University of Alberta

An Assessment of the State of Measurement Science Underpinning Research Utilization in Nursing

by

Janet Elaine Squires

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This thesis is dedicated to my parents, Melville and Florence Squires, who taught me that even the largest task can be accomplished if you believe in yourself and if it is done one day at a time.

Without their ongoing support and belief in me, I would not have been able to realize this goal.

Abstract

Background: Nurses' use of research findings is essential to the provision of quality patient care. As a result, a need to better understand how to implement research into nursing practice has emerged, triggering requirements for its measurement.

Purpose: The purpose of this thesis was to provide an assessment of the state of measurement science underpinning research utilization in nursing.

Methods: The thesis consisted of four inter-related studies: (1) a systematic review of the psychometric properties of instruments used to measure research utilization in healthcare, (2) a systematic review update of individual factors that are associated research utilization by nurses, (3) an item response theory assessment of the precision of a newly developed research utilization scale (the *Conceptual Research Utilization Scale*) when completed by unregulated nursing care providers in long-term care (nursing home) settings, and (4) a traditional psychometric assessment (reliability, validity, acceptability) using classical test score theory of the *Conceptual Research Utilization Scale* when completed by unregulated nursing care providers in long-term care settings. A unitary approach to validity was undertaken following the Standards for Educational and Psychological Testing (the *Standards*) whereby evidence is accumulated from four sources to build a construct validity argument: (1) content, (2) response processes, (3) internal structure, and (4) relations to other variables.

Findings and Conclusions: Findings revealed that there is significant under development in the measurement of research utilization in nursing and that

substantial methodological advances focusing on construct clarity, use of measurement theory, and conducting standard and advanced psychometric assessments is needed. Findings also suggest that: (1) adopting a unitary perspective of validity results in a substantially more comprehensive and accurate validity assessment compared to a traditional perspective of validity (which states that validity exists or not); (2) the *Standards* provides a useful framework for grouping instruments according to established validity sources, as well as for conducting and reporting findings from an instrument validation study; and, (3) item response theory is an appropriate method for evaluating precision of research utilization instruments, which can provide additional psychometric information that is not provided in traditional classical test score theory assessments.

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The second acknowledgement goes to my supervisory committee for their support, patience, supervision, and guidance over the past four years. Additionally, I would also like to thank Dr Christine NewBurn-Cook for her editorial guidance in pursuit of helping me develop my scientific writing skills and for her multiple discussions with me on professional issues and career development. I would like to thank Dr Leslie Hayduk, who with great patience, challenged me to think theoretically and ‘outside the box’, and for always encouraging me to look for connections between empirics and theory. Finally, I would like to thank Dr Mark Gierl for introducing me to the world of measurement theory (item response theory in particular) and for always being willing to answer my questions and for encouraging me to think beyond theory.

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Chapter 1: Introduction and Overview

This thesis represents the output of a comprehensive doctoral program of education and research (thesis). The overall aim of my thesis was to assess the state of measurement science underpinning research utilization in nursing. It represents the first phase of a planned long-term investigation into the science of research utilization. In subsequent phases of my research program, I will: (1) continue my pursuit towards better research utilization measures for nurses specifically and extend this to other groups of healthcare providers as well as care units/organizations; (2) evaluate whether patient outcomes are sensitive to varying levels of research utilization; (3) continue systematic investigation into the identification of factors that are important to research utilization (to inform intervention design); (4) explore the causal pathways between individual and organizational factors, research utilization, and patient outcomes (to inform intervention design), and (5) design and evaluate the effectiveness of theory-based interventions to improve patient outcomes by increasing research utilization.

In this chapter, I begin with an overview of research utilization in nursing and its measurement. I then introduce my thesis research. The thesis is comprised of four individual studies, each of which resulted in a paper for publication. Chapters 2 through 5 each contain one of the four papers. The final chapter of this thesis (Chapter 6) contains: (1) a summary of the findings from each of the four studies, (2) the main conclusions drawn from each study, (3) a summary of study limitations, (4) a description of the contributions this research makes methodologically and to research utilization in nursing knowledge, and (5) the next steps in my program advancing the science of research utilization.

Research Utilization in Nursing

What is Research Utilization?

Knowledge translation, in its most basic form, refers to the movement of knowledge into practice. The Canadian Institutes for Health Research (CIHR) further define knowledge translation as a dynamic and iterative process that involves the application of knowledge to improve the health of individuals, provide effective health services, and strengthen the healthcare system [1]. Research utilization is a specialized form of knowledge translation. Specifically, it refers to the "process by which specific research-based knowledge (science) is implemented in practice" [2] (pp. 4-5).

Research utilization is a complex and multi-facetted construct. This is evidenced by the multiple and diverse conceptualizations of research utilization that abound the nursing and social science literatures. For example, some researchers define research utilization in terms of a general or omnibus construct (e.g., Champion and Leach [3]) while others describe it as the use of specific research-based findings or practices (e.g., Brett [4]). Two dominant approaches to conceptualizing research utilization are also evident: (1) a variance approach (i.e., viewing research utilization as a variable or discrete event [5-7]) and (2) a process approach (i.e., viewing research utilization as consisting of a number of consecutive steps or stages [4, 8]). Process theories such as Rogers' [9, 10] *Innovation-Decision Process Theory* have influenced process oriented nursing studies of research utilization. Other scholars in the field, in addition to using a variance approach, also propose several different kinds of research utilization (i.e., a typology of research utilization) (e.g., Stetler [5] Estabrooks [6]). Those adhering to this latter 'typology' conceptualization frequently describe either two (instrumental and conceptual) or three (instrumental, conceptual, and symbolic [also called persuasive]) kinds of research utilization. *Instrumental* utilization refers to the concrete application of specific knowledge to practice; *conceptual* utilization refers to knowledge that influences an individual's thinking about an issue without putting information to any specific, documental use (i.e., a change in thinking, but not necessarily behavior, in response to research findings); and *symbolic* utilization refers to the use of knowledge as a political tool in order to influence or legitimate policies and decisions (i.e., use of research to persuade others regarding a predetermined position) [2, 11, 12]. Currently, there is little consensus as to which of these conceptualizations *best* represents research utilization and even whether a single conceptualization is appropriate for such a complex construct.

Why is Research Utilization in Nursing Important?

Nursing care providers constitute the largest group of healthcare providers in Canada. The most recent statistics estimate that 325,299 regulated individuals delivered nursing care in 2006, including: 252,948 (77.8%) registered nurses; 67,300 (20.7%) licensed practical nurses; and, 5,051 (1.5%) registered psychiatric nurses. In addition, there were many thousands of unregulated workers (e.g., healthcare aides, personal care attendants) delivering nursing care [13, 14]. There is reasonable evidence to demonstrate that the delivery of inpatient nursing care influences patient outcomes. For example, lower rates of in-patient mortality, shorter hospital stays, and reduced numbers of complications among patients in acute care settings have been documented [15-18]. Within nursing homes, decreased restraint use, falls, contractures, and pressure ulcers have also been documented [19, 20]. Although these findings clearly link the delivery of nursing care to better patient outcomes, what are less obvious are the mechanisms by which this occurs. To date, research conducted in this area has focused on determining which nursing care delivery factors (individual and organizational) have *direct* and *independent* statistical associations with outcomes (patient, staff, and system level) and, as a result, has largely ignored this gap. This model of research (nursing care delivery factors $\rightarrow$ outcomes) ignores the role that research utilization may play in the causal chain. I believe research utilization is one means through which the delivery of nursing services leads to better outcomes. If we can improve our understanding of how to increase the use of research by nursing care providers, then we will be able to improve outcomes at all levels – patient, staff, and system.

Why Focus on the Measurement of Research Utilization?

Research findings are not automatically translated into nursing practice. Complex processes and deliberate efforts are necessary to achieve research utilization. Our knowledge of what constitutes successful research utilization strategies or interventions in nursing practice is sparse. I believe this is due to: (1) lack of attention to the measurement of research utilization, (2) a preponderance of cross-sectional studies and bivariate statistical analyses in research utilization studies, (3) a limited number of intervention studies that attempt to link research utilization to outcomes (at any level), and (4) limited systematic and programmatic research in research utilization in nursing. I have chosen to focus my PhD thesis on the first limitation – lack of attention to the measurement of research utilization. Robust measures of research utilization are necessary to move the field forward; without these measures, the remaining limitations listed above cannot be effectively addressed.

Research utilization is commonly assumed to have a positive impact on patient outcomes by assisting with eliminating ineffective and potentially harmful practices, and implementing more effective (research-based) practices. However, we can only determine if patient outcomes are truly sensitive to varying levels of research utilization if we can first reliably and validly measure research utilization. If patient outcomes are sensitive to nurses' use of research as hypothesized and we do not measure it, we essentially ignore a 'black box' of casual mechanisms that may influence research utilization and by association, improve patient and other outcomes. These casual mechanisms, once identified, can and should be used to develop theoretically based research utilization interventions that have a better then random chance of improving patient and other outcomes.

Literature explicitly addressing research utilization measurement generally, and within nursing specifically, is limited. Four published articles were located. All four articles were published in the social sciences. Three of these articles [21-23] discussed knowledge utilization measurement generally while the fourth article [24] was comprised of an integrative review of research utilization instruments in professions allied to medicine (predominantly nurses). The four papers collectively identified three central methodological gaps in the measurement of knowledge (research) utilization supporting the need for methodological advances in the field. The three gaps identified were: (1) lack of conceptual clarity, (2) lack of pluralism (multiple methods) in measurement, and (3) lack of reliability and validity assessment of knowledge (research) utilization instruments. This PhD thesis has taken the beginning steps to addresses the third need – lack of reliability and validity assessment of research utilization (in nursing) instruments.

Research Utilization and Measurement Theory

Research Utilization Theory

Research utilization theory plays a key role in how one conceptualizes the construct of research utilization and thus, any measurement issues in the field. A variety of theoretical perspectives useful to the study of research utilization exist. It is essential for researchers in the field not only be aware of these perspectives but also be mindful of how they influence their understanding of research utilization. This understanding will subsequently influence how one measures research utilization and more importantly, the interpretations that one draws from the scores obtained in the measurement process. Knowledge of research utilization and related theory, therefore, is an important factor in unraveling its measurement.

A wide variety of theoretical perspectives useful to the study of research utilization exist. These perspectives span multiple disciplines and often, as a result, use different terminology making them difficult to locate and use [25]. Examples of some of these theoretical perspectives include: (1) change models and theories, (2) cognitive psychology theories, (3) research utilization typology models, (4) Weiss' models of research utilization, (5) organizational innovation models, and (6) educational theories. Each of these perspectives contains multiple models or theories, all attempting to explain how knowledge (research) is moved into practice. Change models and theories and cognitive psychology theories are the most commonly used theoretical perspectives in research utilization studies conducted in healthcare.

Change models and theories fall into two basic kinds: classical and planned. Classical change perspectives are passive; they describe *how* change occurs. This type of theoretical perspective describes change but it is not intended to guide or cause change in practice *per se*. It is useful for identifying determinants of change and consequently, for designing interventions to promote change. Rogers' classical *Diffusion of Innovations* Theory [9] is an example of a classical change theory. Planned change theoretical perspectives, on the other hand, explain (in a systematic way), the means by which planned change occurs. The goal of these latter theories is to alter ways of doing things in social systems. The vast majority of nursing research utilization models falls into this category. For example, The *Stetler Model of Research Utilization* [26, 27], the *Iowa Model of Evidence-Based Practice* [28] and the *Promoting Action on Research Implementation in Health Services (PARiHS) framework* are planned action models.

Cognitive psychology theories are commonly used in studies examining research utilization behaviours of physicians, and to a lesser extent, of professions allied to medicine (including nursing). These theories were designed to provide a framework for examining the determinants of health-related behaviors (e.g., smoking) of individuals, in particular the cognitive predictors of behavior. However, like health-related behaviours, research utilization is, in part at least, within the control of the individual. Additionally, cognitive factors (e.g., attitudes) are amendable to change. As a result, cognitive psychology theories are sometimes used to guide knowledge (research) utilization studies. Examples of cognitive psychology theories frequently used in research utilization studies include: (1) theories related to motivation (e.g., *Theory of Planned Behavior* [29]); (2) theories related to action (e.g., *Theory of Operant Conditioning* [30]); (3) theories related to stages of change (e.g., *Transtheoretical Model of Change* [31]); and (4) theories related to decision making (e.g., *Cognitive Continuum Theory* [32]). Each of these theories offers useful frameworks for examining and understanding the determinants of research utilization. However, it is important to keep in mind that they are not inclusive of all determinants. They do not consider external (contextual or environmental) factors, which also influence research utilization.

Research utilization typologies present yet another theoretical approach to understanding research utilization. Caplan and Rich [33], Weiss [34], and Larsen [35] were among the first scholars to discuss *kinds* of knowledge (research) utilization. Each of these scholars referred to the existence of two dominant forms of knowledge utilization: instrumental and conceptual. In 1982, social scientists Beyer and Trice [12] added a third type, symbolic (or persuasive) knowledge utilization, to the mix. Building on this typology, Larsen [35] further contended that knowledge utilization could also be grouped as complete use, partial use, modified use, or no use. *Complete knowledge utilization* refers to the use of an entire set of recommendations as specified by the researcher. This type of utilization within healthcare, Larsen argued, is the exception rather then the rule. More common in healthcare, Larsen suggested, is *partial knowledge utilization* where some aspects of the new knowledge is used but not others, and *modified knowledge utilization* where knowledge is changed to meet the circumstances of the user. A final form of knowledge utilization described by Larsen is *no use*, which may be intentional or non-intentional. Empirical verification of Larsen's [35] model, however, has not been conducted. Within nursing, Estabrooks [36] developed a theory of research utilization (although not labeled as 'theory' by Estabrooks) based on kinds of research utilization. She proposed (and empirically verified with a sample of registered nurses) the existence of instrumental, conceptual and symbolic research utilization and demonstrated that a fourth kind of research utilization – *overall* – could also be conceptualized and added to the typology. This theory proposes that instrumental research utilization, conceptual research utilization, and persuasive research utilization covary with each other and are each a source of overall research utilization.

Other theoretical perspectives relevant to the study of research utilization include: Weiss' models, organizational innovation models, and educational theories. *Weiss' six models of research utilization* represent a theoretical perspective from the social sciences that are commonly used in studies examining research utilization at the policy level. The six models are: (1) a knowledge-driven model, (2) a problem-solving model, (3) an interactive model, (4) a political model, (5) a tactical model, and (6) an enlightenment model [37]. *Organizational innovation models* and educational theories, while relevant, are used to a lesser extent in research utilization studies in healthcare. Examples of organizational innovation models relevant to research utilization include: the model of territorial rights and boundaries [38], the dual core model of innovation [39], the ambidextrous model [40], bandwagon models [41], and the desperation-reaction model [42]. These models focus on explaining organizational innovation and tend to be specific to a particular aspect of innovation adoption. For example, bandwagon models [41] state that organizations adopt innovations through fear that other organizations are benefitting more because of the adoption of the innovation. In this model, adoption occurs regardless of how the innovation is perceived by members of the organization. *Educational theories* are particularly useful for research utilization studies that incorporate an educational intervention, which many do. In these studies, educational theories can provide a useful framework for not only designing the intervention, but also evaluating its effectiveness. Several theoretical approaches exist in the (adult) education field, which attempt to explain how people learn. These approaches can be applied to research utilization educational interventions to understand why, for example, a particular intervention did or did not work. Common educational theoretical approaches are: (1) behaviorist approach; (2) cognitivist approach; (3) constructivist approach; (4) humanist approach; and, (5) social learning approach [43].

My research is framed largely by a well-known classical change theory – Rogers' Diffusion of Innovations Theory [9]. This theory was originally developed in the early 1950's using research in rural sociology on farmers' innovation adoption practices. Rogers' theory describes the spread of new ideas (diffusion) using four main elements: (1) the innovation, (2) communication channels, (3) time, and (4) a social system. That is, according to Rogers' theory, diffusion is the process by which an innovation is communicated through channels over time among the members of a social system. The first element, an *innovation*, according to Rogers' [9], is an idea, thing, procedure, or system that is perceived to be new by whomever is adopting it. The innovation does not need to be new in terms of being recently developed (i.e., a recently published research finding), it only needs to be new to the person (nurse) or organization that is adopting and implementing it. In nursing, we make the assumption that an innovation is equivalent to research findings. However, it is important to take note that this assumption has not been rigorously assessed. The second element of Rogers' Diffusion of Innovations theory is *communication*, or the process by which people develop and share information with each other to achieve common understanding [9]. The communication process requires an innovation (research finding), a unit of adoption (nurse) that knows the innovation and has used it, other units of adoption (other nurses) who have not yet experienced the innovation, and a means or channel of communicating between the two units. *Time* is the third core element of Rogers' theory [9]. There are three components to the time element: the innovation-decision process, adopter categories, and the rate of adoption. The last of the four elements of Rogers' theory [9] is the *social system*. According to Rogers [9], all diffusion occurs within a social system, whose members may be individuals, groups, organizations, or subsystems, but who share a common goal that links them together. The social system, for example, may be all of the nurses in a specific hospital. Opinion leaders, change agents, and champions are examples of individuals within the social system who are believed to have the ability to influence diffusion of innovations in the system [9].

Adoption, in Rogers' theory, is proposed as a linear process whereby individuals progress through five stages: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation. If an individual (a nurse) adopts the innovation (research findings), it is then spread via various communication channels to other members of the group (to other nurses). This process occurs over time and is influenced by the interaction among characteristics of: the innovation (*or research*), the adopter (*or nurse*), and the organization (*or hospital/other facility*). Most nursing scholars using this theory have equated adoption with research utilization and have therefore, conceptualized research utilization as a process (and measured it in this manner). While not explicitly stated, a variance approach can also be extracted from this theory. Implementation (i.e., use of the innovation) is one element (step 4) in the adoption process proposed by Rogers. *Therefore, while Rogers' theory states adoption is a process, use of the innovation (of research findings) is a single discrete event (i.e., a variable or variance conceptualization) in this process.*

In summary, there are many theoretical perspectives available that are relevant to the study of research utilization. However, little direction is provided in any of these theories (with the exception of Rogers' theory [9] and Estabrooks' theory [6]) on how to *best* measure research utilization. Furthermore, the various theories largely ignore the conceptualization of research utilization (i.e., process or variance) and thus provide little or no guidance for research utilization measurement.

Measurement Theory

Just as research utilization theory is foundational to developing instruments in the field, measurement theory is foundational to the psychometric evaluation of these instruments. The two most commonly implemented measurement theories are *classical test score theory* and *item response theory*. The two theories carry their own set of assumptions. Classical test score theory introduces three basic measurement concepts: (1) test score or observed score,

(2) true score, and (3) error score. The theory asserts that an individual's observed score or measurement on a construct is an additive composite of their true score (i.e. their latent unobservable score) and random error [44, 45]. The following assumptions underlie classical test score theory: (1) true scores and error scores are uncorrelated, (2) the average error score in the population of examinees is zero, and (3) error scores on parallel tests are uncorrelated. Classical test analysis uses traditional item and sample dependent statistics and forms the foundation of reliability theory [44, 45]. Generalizability theory [46, 47], an extension of classical test score theory, allows for the estimation of the magnitude of multiple sources of error simultaneously.

The second theory, item response theory [45, 48], is a model-based measurement theory that encompasses any model that relates the probability of an individual's response to a test (or survey) item to an underlying ability (or trait) [45, 49]. In item response theory, the responses to items are used to obtain continuous scaled estimates for the underlying latent trait [called theta (θ)]. Item response theory assumes that an individual's response to an item is functionally related to a latent (unobservable) trait, presumably measured by the item. This theory is capable of providing estimates of item and scale precision at all possible trait levels. Three basic assumptions of item response theory models are: (1) unidimensionality, (2) local independence, and (3) nonspeededness. Item response theory models assume that the latent trait space is dominated by a single dimension (the assumption of unidimensionality). As a consequence of unidimensionality, an individual's response to any one item becomes unrelated to that of the other items when the latent trait is controlled (the assumption of local independence) [45, 50]. The third assumption, nonspeededness, assumes that any items not completed are not due to lack of time.

Both of these dominant measurement theories can provide important information about the robustness of research utilization instruments. Therefore, I used both measurement theories in this thesis. This allowed me to obtain a more comprehensive assessment of the state of measurement science of research utilization in nursing than would have been possible by adhering to one single measurement theory.

My Conceptual Model

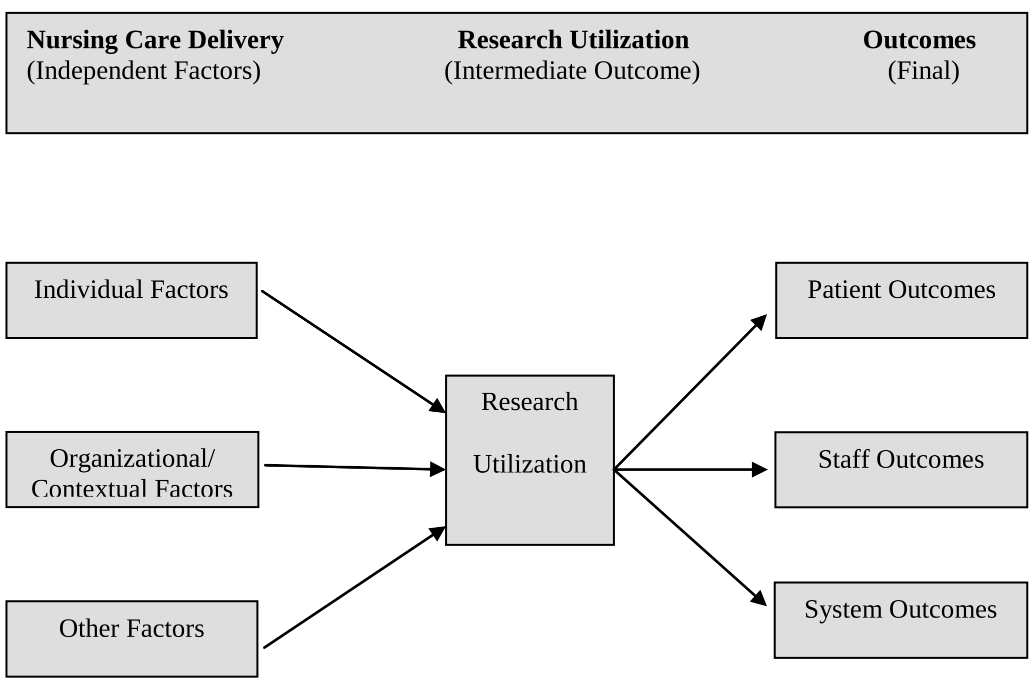
Figure 1-1 displays the conceptual model that guides my overall program of research. In this model, research utilization sits as an intermediate outcome between nursing care delivery factors (individual, organizational, other) and outcomes (patient, staff, and system). The specific nursing care delivery factors are not identified in this model, just the broad categories. They are, however, informed largely by Rogers' *Diffusion of Innovations* theory [9, 10] and other research in the field. As previously identified, Rogers' theory suggests that innovation adoption is influenced by the three key components:

(1) Characteristics of the adopter (represented as individual factors in Figure 1-1, e.g., attitudes),
(2) Characteristics of the organization (represented as organizational and contextual factors in Figure 1-1, e.g., unit culture),
(3) Characteristics of the innovation (represented as ‘other’ factors in Figure 1-1).

Outcomes, in Figure 1-1, are of three types: (1) patient health (e.g., presence of infection, falls), (2) staff (e.g., job satisfaction, burnout), and (3) system (e.g., absenteeism, turnover).

For Phase 1 of my research program (my PhD thesis) I focused on one aspect of the middle box (research utilization) in Figure 1-1, specifically the measurement of research utilization. In the subsequent phases of my program, I will continue my investigation into the science of research utilization by further exploring its measurement as well as exploring the causal chains between nursing care delivery factors, research utilization, and outcomes (specifically, patient outcomes), as depicted in Figure 1-1.

Figure 1-1. Conceptual Model for Research Program



Personal Impetus for this Thesis Research

My motivation for conducting this thesis grew from my experience as a nurse provider and university-based nurse educator and from my knowledge of the research utilization in nursing field. While practicing as a registered nurse, I developed a strong interest in promoting research-based nursing practice and in understanding the challenges involved in changing clinical practice to reflect research evidence. During this time I also began to experience frustration with what I perceived as a lack of research utilization by nurses in the clinical setting and the impact it had on patient care. This resulted in my returning to university to undertake a Master's degree in nursing. The aim of my Master's thesis was to examine the extent to which registered nurses were using research findings in their practice and the role of the organization (through the development and use of policies and procedures) in promoting research utilization in nursing. This research highlighted for me that there are serious limitations with current instruments used to measure research utilization by nurses, and that robust (valid, reliable, and acceptable) measures of research utilization are needed in order for the field to advance, and ultimately, to design and test interventions to improve patient outcomes by increasing research utilization. In my doctoral program, I enrolled in measurement and related courses that would enable me to conduct studies in my thesis focusing on the measurement of research utilization.

The Thesis

Purpose and Objectives

The purpose of this thesis was to assess the state of the measurement science underpinning research utilization in nursing. Four specific objectives guided my research:

1. *To identify and assess the psychometric properties of instruments used to measure research utilization in healthcare (i.e., by healthcare providers, by healthcare decision-makers, and in healthcare units/organizations)*

2. *To identify individual (nurse) factors that are associated with higher research utilization by nurses*

3. *To assess the precision of scores obtained from the Conceptual Research Utilization Scale when completed by unregulated nursing care providers in nursing homes*

4. *To assess the reliability, validity, and acceptability of scores obtained from the Conceptual Research Utilization Scale when completed by unregulated nursing care providers in nursing homes*

With respect to the above objectives, objective #1 (Study #1) was not limited to nursing literature. The reason for this was to allow for the identification of instruments used with other healthcare providers that may be adapted for or inform the development of new instruments for use with nurses in future research.

The findings from Study #1 and Study #2 suggested there has been minimal attention in the field to: (1) assessment of the different *kind*s of research utilization (i.e., instrumental, conceptual, symbolic); (2) assessment of research utilization in long-term care (nursing home) settings; (3) assessment of research utilization by unregulated (healthcare aide) nursing care providers. Based, in part, on these findings, and also on early findings in a related (but non-thesis research project) I co-developed (with my PhD supervisor) a new scale to measure conceptual research utilization by unregulated nursing care providers in nursing homes. The external (non-thesis) research project involved a pilot test with unregulated nursing care providers in nursing homes of an instrument measuring organizational context, research utilization, and staff outcomes. In that project, conceptual research utilization was measured using a single item that had been previously designed for and used with registered nurses. The unregulated nursing care providers in the pilot study, however, experienced difficulty in comprehending this item [30]. As a result, a new multi-item scale (called the *Conceptual Research Utilization Scale*) was developed. The scale items were derived from an 18-item checklist created by Stetler and Caramanica [7] designed to evaluate an evidence-based practice initiative. Six items (later reduced to five items) from the checklist were selected and modified (with permission from the checklist developers) for use with unregulated nursing care providers in facility-based long-term care settings (i.e., nursing homes). The *Conceptual Research Utilization Scale* was embedded into a survey for a larger project (Translating Research in Elder Care, TREC [51, 52], Dr Carole Estabrooks Principal Investigator) for validation. For objectives 3 and 4 of this thesis, I performed a comprehensive psychometric assessment of the measurement properties of the *Conceptual Research Utilization Scale* using the data collected in the TREC study.

Overview

My thesis comprises four studies, each of which led to a manuscript for publication.

Study #1: Systematic Review of Research Utilization Instrument Literature.

Objectives: (1) To identify instruments used to measure research utilization by healthcare providers, healthcare decision-makers, and in healthcare organizations, and (2) to assess the psychometric properties (reliability and validity) of these instruments.

Rationale. Most investigations in research utilization in nursing have described characteristics that facilitate research utilization and modeled these as determinants of research utilization. However, little effort has been expended on identifying and evaluating the reliability and validity of existing research utilization measures. Therefore, a rigorous and systematic review of the literature describing research utilization instruments was necessary to move the field forward and develop and test interventions to increase research utilization by nurses.

Description. The first study of this thesis was a systematic review of literature on research utilization instruments. I assessed the scores reported of all identified instruments for reliability and validity. I undertook a unitary approach to validity assessment (as outlined in the *Standards for Educational and Psychological Testing* (the Standards) [53]) where I classified study findings of all included articles as 'supporting' validity evidence when the study explicitly addressed one or more of the following four evidence sources: (1) content, (2) response processes, (3) internal structure, and (4) relations to other variables.

This project was funded by a grant from the Canadian Institutes of Health Research Knowledge Translation Synthesis Program (KRS 86255).

Study #2: Systematic Review of Individual Factors associated with Research Utilization by Nurses

Objectives: (1) To update the evidence published in a previous systematic review (Estabrooks 2003 [54]) on individual factors that influence nurses' use of research evidence in practice, and (2) to expand on the previous review by: (a) reporting on the magnitude of effect between individual nurse factors and research utilization, and (b) examining literature on *kinds* of research utilization (i.e., instrumental, conceptual, persuasive, overall).

Rationale. In order to conduct a comprehensive validity assessment of instrument scores obtained from nurses in Study #1, I determined that the available synthesis on individual (nurse) factors associated with research utilization first required updating. Conducting this update allowed coding of study findings consistent with the *Standards'* [53] fourth validity source (relations to other variables) reflective of current evidence and thus, a more accurate validity assessment in Study #1.

Description. The second study of this thesis was a systematic review update of the individual (nurse) factors that are associated with research utilization by nurses. The search strategy from Study #1 (systematic review of research utilization instrument literature), with the application of additional inclusion criteria, was used in Study #2 to identify individual factors significantly associated with research utilization by nurses. Findings from Study #2 were then returned to and used in Study #1 to complete a validity assessment on the research utilization instruments used with nurses.

Study #3: Assessment of the Precision of the Conceptual Research Utilization Scale

Objectives: (1) To provide an overview of item response theory; (2) to examine the psychometric properties (using an item response theory framework) of scores obtained with the *Conceptual Research Utilization Scale* when used with unregulated nursing care providers (healthcare aides) in residential long-term care (nursing home) settings; and (3) to discuss how the *Conceptual Research Utilization Scale* can be further developed using item response theory methods.

Rationale. Measurement precision is one component of a psychometric assessment. It is critical to the quality of inferences and the consequent decisions that can be drawn from the scores obtained with an instrument [55]. In the case of research utilization by nurses, these consequences are serious and include the health outcomes of patients and the functioning of a healthcare organization. Precision often is not uniform across an entire range of scale scores; scores at the edges of a scale generally have more error associated with them than those closer to the middle [56]. Assessment of precision within an item response theory framework (using the information function) can overcome this limitation by estimating precision for each item at all possible trait levels.

Description. In the third study of this thesis, I examined a newly developed research utilization instrument, the *Conceptual Research Utilization Scale*, for precision. Using item response theory, I examined the scores obtained from the *Conceptual Research Utilization Scale* when used with unregulated nursing care providers in nursing homes, for item and scale precision. The items were also examined for discrimination and difficulty, and the scale for standard error of measurement, marginal reliability, and scoring implications. The item response theory model used was Samejima’s graded response model (GRM) [57, 58].

Study #4: Assessment of the Psychometric Properties of the Conceptual Research Utilization Scale

Objective: To examine the scores obtained using the *Conceptual Research Utilization Scale* with unregulated nursing care providers (healthcare aides) working in residential long-term care (nursing home) settings for: (a) reliability, (b) validity, and (c) acceptability.

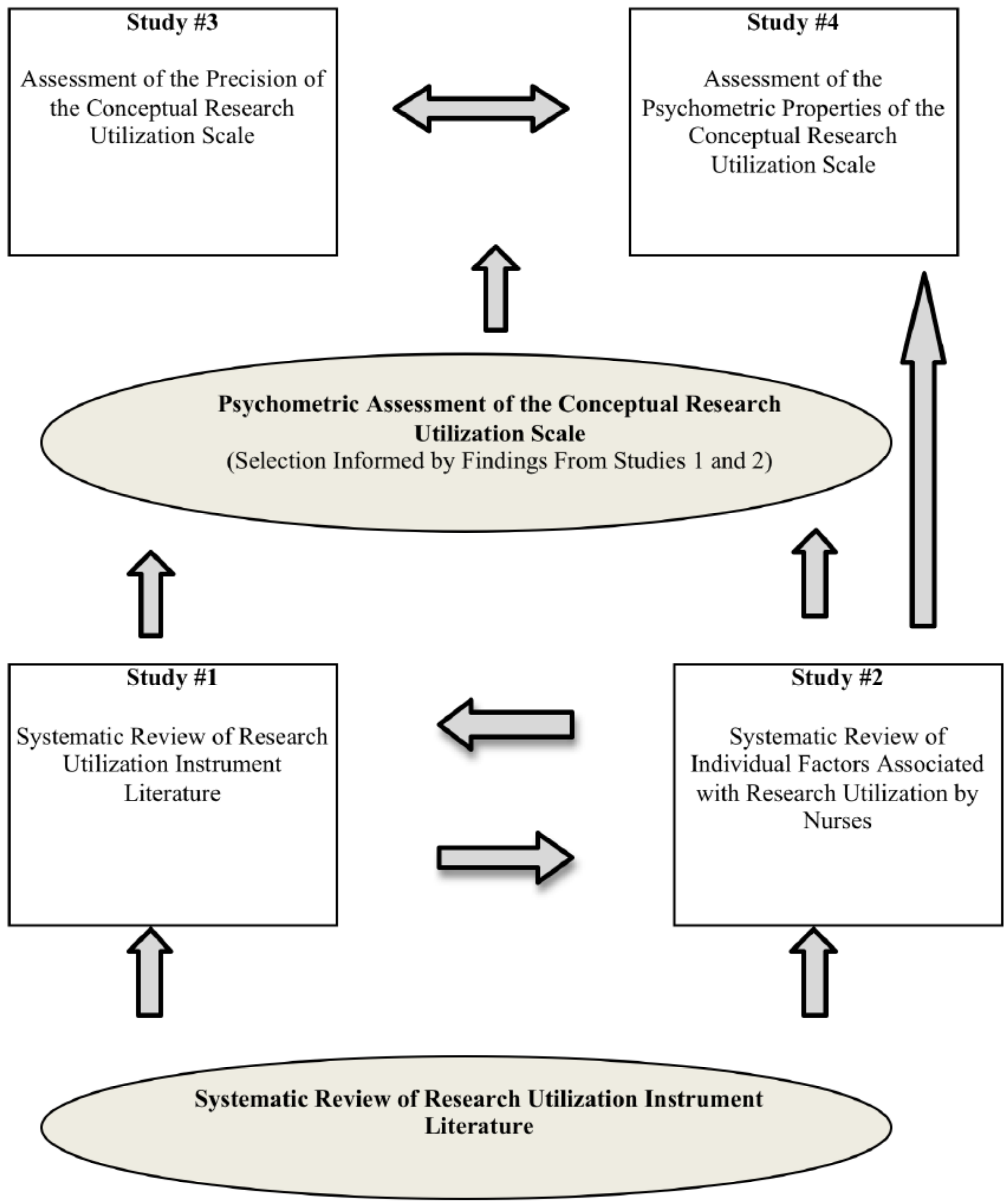
Rationale. Assessment of the psychometric properties of a new instrument involves testing the instrument for: (1) validity, (2) reliability, and (3) acceptability [59-61]. Validity, in nursing, has traditionally been assessed as the existence or not of three types: content, criterion, and construct. Application of a unitary perspective (as seen in the *Standards'* [53] and applied in this study) is limited in healthcare literature and nonexistent in research utilization literature. The *Standards'* [53] approach to validity, however, is best practice in the field of psychometrics [46]. This study was conducted to: (1) demonstrate the extent of validity information that could be obtained using the *Standards* as a guiding framework, and (2) provide a comprehensive psychometric assessment of scores obtained from unregulated nursing care providers in long-term care using the newly developed *Conceptual Research Utilization Scale.*

Description. In the fourth study of this thesis, I continued my psychometric assessment of the *Conceptual Research Utilization Scale* by examining the scores obtained with it from unregulated nursing care providers (healthcare aides) for: (1) reliability, (2) validity, and (3) acceptability. Reliability was assessed using internal consistency coefficients. To assess validity, I followed the *Standards* framework [53]; I specifically sought and assessed validity evidence falling into four domains: (1) content, (2) response processes, (3) internal structure, and (4) relations to other variables. Acceptability was assessed by examining missing-value frequencies and the length of time it took the respondents to complete the scale.

Tying the Four Studies Together

Figure 1-2 illustrates the relationships among the four studies comprising this thesis. The search strategy from Study #1 (systematic review of research utilization instruments) was used in Study #2 (systematic review of individual factors associated with research utilization by nurses) to identify potential articles. Findings from Study #2 were returned to Study #1 in order to complete a comprehensive validity assessment of instrument scores obtained from nurses. Study #1 and Study #2 (along with a related non-thesis project conducted simultaneously to my thesis – see description on page 11) formed the foundation for conducting Study #3 and Study #4. These two studies comprised a psychometric assessment of scores obtained with a new scale measuring *Conceptual Research Utilization* when administered to a sample of unregulated nursing care providers (healthcare aides) in nursing homes. This *kind* of research use (conceptual research utilization), the setting (nursing homes), and provider group (unregulated nursing care providers) were shown in both Study #1 and Study #2 to have received minimal attention in the nursing research utilization literature. Study #3 (assessment of the precision of the *Conceptual Research Utilization Scale*) and Study #4 (assessment of the psychometric properties of the *Conceptual Research Utilization Scale*, using the *Standards*) inform each other by providing a more complete picture, than either alone, of the psychometric properties of the scores obtained with the *Conceptual Research Utilization.* Study #2 was also directly used in Study #4 to inform its validity assessment of 'relations to other variables' evidence. Together, these four studies constitute my thesis and form the basis for what will be one element (measurement of research utilization) of my future research program in research utilization in nursing.

Figure 1-2. Overview of the Four Studies Comprising the Thesis



Ethics

Ethical approval for studies 3 and 4 were obtained from the University of Alberta Health Research Ethics Board. Operational approval was obtained from the TREC Research Management Committee.

Methods

Study #1 and Study #2

The method used in both Study #1 (systematic review of research utilization instruments) and Study #2 (systematic review of individual factors associated with research utilization by nurses) was a systematic review.

In Study #1, I extracted data on: year of publication, study design, setting, sampling, subject characteristics, methods, instrument used to measure research use, substantive theory, measurement theory, reliability, reported statements of traditional validity (e.g., content validity, criterion validity, construct validity), and study findings. My validity assessment was guided by the *Standards* [53]. Using the *Standards*, I classified the results from each individual study included in the review as 'supporting validity evidence' when it explicitly addressed one or more of the following: (1) content, (2) response processes, (3) internal structure, and (4) relations to other variables. A description of these four evidence sources is included in Paper #1 (Chapter 2). Further details on the methods used in Study #1 can be found in Chapter 2.

In Study #2, I used a predominantly vote counting approach to quantify the frequency by which individual (nurse) factors were associated with research utilization by nurses. I extracted data on effect magnitude for all significant associations, but conclusions regarding magnitude were limited due to the wide variety of statistics used and limited reporting of magnitude in the articles. Further details on the methods used in Study #2 can be found in Chapter 3.

Study #3 and Study #4

The approach used in both Study #3 and Study #4 was secondary analysis of survey data collected for the Translating Research in Elder Care (TREC) research program. Permission to use the data for the purpose of this thesis was granted by Dr Carole Estabrooks, principal investigator for TREC and the TREC Research Management Committee. Data came from unregulated nursing care providers (healthcare aides) in 30 urban nursing homes across the three Canadian Prairie Provinces who completed the TREC survey between July 2008 and July 2009. Embedded in the TREC survey is the *Conceptual Research Utilization Scale;* the scale assessed in Study #3 and Study #4.

In Study #3, I used item response theory to assess precision of the scores obtained from the *Conceptual Research Utilization Scale* when used with unregulated nursing care providers (healthcare aides) in nursing homes. I used Samejima's graded response model (GRM) [57, 58] to estimate item characteristics such as item threshold and item discrimination power. Item and scale information functions, scale standard error of measurement, and scale marginal reliability were also examined. Further details on the methods used in Study #3 can be found in Chapter 4.

In Study #4, I continued the psychometric assessment of the scores obtained from the *Conceptual Research Utilization Scale* when used with unregulated nursing care providers (healthcare aides) in nursing homes using classical test score theory approaches. I assessed the scores obtained for reliability, validity, and acceptability. I calculated Cronbach's alpha, Guttman split-half reliability, and Spearman-Brown coefficients to assess reliability. I used the *Standards* [53] as a framework to collect and assess validity data. A secondary analysis of the TREC data provided findings in two of the four *Standards* evidence domains: internal structure (determined with item-total statistics, principal components analysis, and confirmatory factor analysis); and, relations to other variables (determined with bivariate correlations, increasing mean values of conceptual research utilization by other kinds of research utilization [instrumental, symbolic, and overall], and regression analyses). I analyzed field notes collected during development of the *Conceptual Research Utilization Scale* to determine response process validity evidence; and, I developed and analyzed findings from an expert-completed content relevance survey to assess content validity evidence.

Conclusion

In this chapter, I introduced my thesis. Chapters 2-5 contain the four papers that represent the outputs of this thesis, each of which reflect one of the four individual studies described in this chapter. The final chapter of this thesis (Chapter 6) contains: (1) a summary of the findings from each of the four studies, (2) the main conclusions drawn from each study, (3) a summary of study limitations, (4) a description of the contributions this research makes methodologically and to research utilization in nursing theory, and (5) the next steps in my program advancing the science of research utilization.

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Chapter 2: Paper #1

Measuring Research Utilization in Healthcare Organizations: A Systematic Review of Reliability and Validity of Research Utilization Instruments

Janet E. Squires[1,*]
Carole A. Estabrooks[2]
Hannah M. O'Rourke[3]
Petter Gustavsson[4]
Christine V. Newburn-Cook[5]
Lars Wallin[6]

[1] PhD Candidate, Faculty of Nursing, University of Alberta, Edmonton, Alberta, Canada

[2] Professor and Canada Research Chair (in Knowledge Translation), Faculty of Nursing, University of Alberta, Edmonton, Alberta, Canada

[3] MN Student, Faculty of Nursing, University of Alberta, Edmonton, Alberta, Canada

[4] Professor, Department of Clinical Neuroscience, Division of Psychology, Karolinska Institutet, Stockholm, Sweden

[5] Professor and Associate Dean of Research, Faculty of Nursing, University of Alberta, Edmonton, Alberta, Canada

[6] Professor, Department of Neurobiology, Care Sciences and Society, Division of Nursing, Karolinska Institutet, Stockholm, Sweden

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Background

Clinical and health services research produces vast amounts of new (research) knowledge every year. Despite increased access by healthcare providers and decision-makers to this knowledge, uptake into practice is slow [1-13] and has resulted in what we know today in the research utilization field as the 'knowledge (research) – practice gap'.

Measuring Research Utilization

Recognition of, and a desire to narrow, the research-practice gap, has led to the accumulation of a considerable body of knowledge on research utilization and related terms such as knowledge translation, knowledge utilization, innovation adoption, innovation diffusion, and research implementation. In this paper, we use the term *research utilization*, defined as "the process by which specific research-based knowledge (science) is implemented in practice" [14] (pp. 4-5). Despite gains in the understanding of research utilization theoretically [15-17], a large and rapidly expanding literature addressing the individual factors associated with research utilization [18, 19], and the implementation of clinical practice guidelines in various health disciplines [20, 21], little is known about how to robustly measure research utilization.

We located three theoretical papers explicitly addressing the measurement of knowledge utilization (of which research utilization is a component) [22-24] and one integrative review that examined the psychometric properties of research utilization instruments used in professions allied to medicine (predominantly in nursing) [14]. The arguments outlined in these four papers illustrate the complexity and wide range of possibilities that come into play when conceptualizing and, consequently, measuring knowledge (research) utilization. Within each of these papers a need for conceptual clarity and pluralism in measurement was stressed. Individually, in the three theoretical papers, each published in the social sciences, the following was also stressed. Weiss [24] argued for specific foci (i.e., focus on specific studies, people, issues or organizations) when measuring knowledge utilization. Shortly thereafter, Dunn [22], proposed a linear four-step process for measuring knowledge utilization: (1) conceptualization (what is knowledge utilization and how it is defined and classified), (2) methods (given a particular conceptualization, what methods are available to observe the process of knowledge use), (3) measures (what scales are available to measure the process of knowledge use), and (4) reliability and validity. Dunn specifically urged that greater emphasis be placed on step four (reliability and validity). A decade later, Rich [23] provided a comprehensive overview of issues influencing knowledge utilization across many disciplines. He emphasized the complexity of the measurement process, suggesting that knowledge utilization may not always be tied to a specific action and that it may exist as more of an omnibus concept.

The only review of research utilization instruments to date was conducted in 2003 by Estabrooks and colleagues [14]. The review was limited to instruments used within professions allied to medicine (predominantly nursing) and to the specific data on validity that was extracted. That is, only data that was (by the original authors) explicitly interpreted as validity in the study reports was extracted as 'supporting validity evidence'. A total of 43 articles from three online databases (CINAHL, Medline, and Pubmed) comprised the final sample of articles included in the review. Two commonly used multi-item instruments (published in 16 papers) were identified: (1) the Nurses Practice Questionnaire (NPQ) and (2) the Research Utilization Questionnaire (RUQ). An additional 16 published papers were identified that used single-item questions to measure research utilization. Several problems with the research utilization instruments were identified: lack of construct clarity of research utilization, lack of knowledge translation or other appropriate theories in instrument development, lack of measurement theory in instrument development and/or evaluation, and lack of standard psychometric assessment.

The four papers [14, 22-24] discussed above point to a persistent and unresolved problem – an inability to robustly measure research utilization. This presents both an important and a practical challenge to researchers and decision-makers who rely on such measures to evaluate the uptake and effectiveness of research findings to improve patient and organizational outcomes. There are multiple reasons why we believe the measurement of research utilization is important. The most important reason relates to designing and evaluating the effectiveness of interventions to improve patient outcomes. Research utilization is commonly assumed to have a positive impact on patient outcomes by assisting with eliminating ineffective and potentially harmful practices, and implementing more effective (research-based) practices. However, we can only determine if patient outcomes are sensitive to varying levels of research utilization if we can first measure research utilization in a reliable and valid manner. If patient outcomes are sensitive to decision-makers' and care providers' use of research and we do not measure it, we, in essence, do the field more harm than good, by ignoring a 'black box' of casual mechanisms that influence research utilization. The casual mechanisms within this back box can, and should, be used to inform the design of interventions that aim to improve patient outcomes, by increasing research utilization by decision makers and care providers. However, we cannot satisfactorily reach this critical level, of being able to develop and test theory-based interventions, until we first are able to reliably and validly measure research utilization.

Study Purpose and Objectives

The study reported in this paper is a systematic review of the psychometric properties of instruments designed to measure research utilization in healthcare. Specific objectives of this study were to: (1) identify instruments used to measure research utilization by healthcare providers, healthcare decision-makers, and in healthcare organizations, and (2) assess the psychometric properties (reliability and validity) of these instruments. Our assessment of instrument validity was guided by the *Standards for Educational and Psychological Testing* (the *Standards*) [25].

The Standards for Educational and Psychological Testing (the *Standards*)

Validity, in the *Standards*, is defined as "the degree to which evidence and theory support the interpretations of test scores entailed by proposed uses of tests" [25] (p. 9). Thus, it is the scores obtained from an instrument and interpretations made based on these scores that are validated, not an instrument itself. The Standards present a contemporary conceptualization of validity. In this approach, validity is thought of as a unitary concept (not as distinct types) where all evidence sources contribute to construct validity. Therefore, all study results (not just those labeled as validity) are scrutinized in terms of whether or not they add to a construct validity argument. The *Standards* outline four sources of validity evidence where study results may contribute: (1) content, (2) response processes, (3) internal structure, and (4) relations to other variables.

Content evidence refers to the extent to which the items in an instrument adequately represent the content domain of the concept or construct of interest [25, 26]. This validity source is relevant to all measures regardless of content domain (cognitive or affective) and format (paper-and-pencil, online, observation schedule, interview protocol, etc.). Published literature and experts' evaluations are key approaches for obtaining content validity evidence.

Response processes evidence refers to how respondents interpret, process, and elaborate upon item content and whether this behaviour is in accordance with the concept or construct being measured [25]. This validity source can provide evidence on: (1) the fit between the concept or construct of interest and the nature of the response given by the respondents, and (2) any differences in meaning or interpretation of scores across subgroups of respondents. Interviews with, and observation of respondents while engaging in the concept or construct under evaluation, as well as pilot tests and feasibility work, provide data of this type [27].

Internal structure evidence examines the relationships between the items on an instrument to evaluate its dimensionality [25]. This validity source attempts to answer the question, "To what extent do the relationships among instrument items match the concept or construct as operationally defined"? and provide a rationale for combining scores obtained on individual items to produce a derived score. Factor analysis (exploratory and confirmatory) and item-total statistics (e.g., item total correlations, scale alpha when an item is deleted) are commonly used to provide internal structure validity evidence.

Relations to other variables evidence provide the fourth source of validity evidence. External variables may include measures of criteria that the concept or construct of interest is expected to predict, as well as relationships to other scales hypothesized to measure the same concepts or constructs, and variables measuring related or different concepts or constructs [25]. This type of evidence is most often reported using bivariate correlations, predictive statistical models, and multi-group-comparisons.

Methods

Study Selection Criteria

Studies were included in our systematic review if they met the following inclusion criteria: (1) reported on the development or use of an instrument designed to measure research utilization, and (2) the study population comprised one or more of the following groups – healthcare providers, healthcare decision-makers, or healthcare organizations. We defined research utilization as the use of research-based (empirically derived) information. This information could be reported in a primary research article, review/synthesis report, or a protocol. Where the study involved the use of a protocol, we required the research-basis for the protocol to be apparent in the article. We excluded articles that reported on healthcare providers' adherence to clinical practice guidelines, the rationale being that clinical practice guidelines can be based on non-research evidence (e.g., expert opinion). We also excluded articles reporting on the use of one specific-research-based practice if the overall purpose of the study was not to examine *research utilization*.

Search Strategy for Identification of Studies

The search strategy for this review was developed in consultation with a health sciences librarian. We searched the following 12 bibliographic databases: (1) Cochrane Database of Systematic Reviews, (2) Health and Psychosocial Instruments (HAPI), (3) MEDLINE, (4) CINAHL, (5) EMBASE, (6) Web of Science, (7) SCOPUS, (8) OCLC Papers First, (9) OCLC WorldCat, (10) Sociological Abstracts, (11) Proquest Dissertation Abstracts, and (12) Proquest ABI Inform (See Table 2-1 for details on the search terms used to identify potential articles). We also hand searched the journal *Implementation Science* (a specialized journal in the research utilization field) and assessed the reference lists of all retrieved articles. The final set of included articles was restricted to those published in the English, Danish, Swedish, and Norwegian languages (the official languages of the research team). There were no restrictions based on when the study was undertaken, or publication status.

Selection of Studies

Two team members (JES and HMO) independently screened all titles and abstracts (n=42,770). Full text copies were retrieved for 501 titles, which represented all titles identified: (1) as having potential relevance to our objectives or (2) where there was insufficient information to make a decision as to relevance. A total of 108 articles (representing 97 original studies) met our inclusion criteria and, thus, comprised the final sample (See Additional File 2-1 for a list of the 108 included articles). Disagreements were resolved by consensus. When consensus could not be reached, a third senior member of the review team (CAE, LW) acted as an arbitrator and made the final decision (n=9 articles). Figure 2-1 summarizes the results of the screening/selection process. A list of retrieved articles that were excluded can be found in Additional File 2-2.

Data Extraction

Two reviewers (JES and HMO) performed data extraction on all included articles: one reviewer extracted the data, which was then checked for accuracy by a second reviewer. We extracted data on: year of publication, study design, setting, sampling, subject characteristics, methods, research utilization instrument used, substantive theory, measurement theory, reliability, reported statements of traditional validity (content validity, criterion validity, construct validity), and study findings according to the four sources of validity evidence outlined in the *Standards*. All disagreements in data extraction were resolved by consensus.

There are no universal criteria to grade the quality of instruments. Therefore, in line with other recent instrument reviews [28, 29], we did not use restrictive criteria to rate the quality of each study. However, we performed a comprehensive assessment of the psychometric properties of scores obtained using the included instruments. In performing this assessment we adhered to the *Standards*, considered best practice in the field of psychometrics [30], and extracted all study results that could be grouped according to the *Standards'* four evidence sources: (1) content, (2) response processes, (3) internal structure, and (4) relations to other variables. To assess relations to other variables, we *a priori* (based on commonly used research utilization theoretical perspectives [19, 31-37] and systematic reviews [18, 21, 38-43]) identified established relationships between research utilization and other (external) variables (See Tables 2-2 and 2-3 for sample predictions based on theory and systematic reviews respectively). These relationships, when reported in the included articles, were interpreted as *supporting* or *refuting* validity evidence. The relationship was coded as *supporting evidence* if it was in the same direction and had the significance predicted, or as *refuting evidence* if it was in the opposite direction or did not have the significance predicted.

Data Synthesis

The use of many different research utilization instruments and study methods across different healthcare providers and contexts/settings prevented us from performing a meta-analysis. Therefore, the findings from the review are presented in narrative form and focus on findings that could be interpreted as reliability and/or validity evidence. To synthesize further the large volume of data extracted on validity, we developed a 3-level instrument hierarchy based on the number of validity sources reported in 50% or more of the studies for each instrument. In the *Standards*, no one source of validity evidence is considered always superior to the other sources. Therefore, in our hierarchy, Level 1, 2, and 3 instruments provided evidence from any three, two, and one validity sources respectively. In the case of single item (i.e., consisting of one question) measures, only three validity sources are applicable (i.e., internal structure validity evidence is not applicable since it assesses relationships between items). Therefore, a single item measure within Level 1 has evidence from *all* applicable validity sources.

Results

Characteristics of the Research Utilization Instruments

In total, 60 unique research utilization instruments were identified. We grouped the instruments into 10 classes; 7 of the classes each contain one instrument while the 3 remaining classes contain multiple instruments with similar characteristics and/or purposes. The 10 instrument classes are presented below. Table 2-4 provides a description of each instrument class. Additional Files 2-3 and 2-4 provide further details on the individual instruments contained within the *Other Specific Practices Indices* and *Other General Research Utilization Indices* classes.

1. Nurses Practice Questionnaire (n=1 instrument)
2. Research Utilization Survey (n=1 instrument)
3. Edmonton Research Orientation Survey (n=1 instrument)
4. Knott and Wildavsky Standards (n=1 instrument)
5. Other Specific Practices Indices (n=4 instruments)
6. Other General Research Utilization Indices (n=10 instruments)
7. Past, Present, Future Use (n=1 instrument)
8. Parahoo's Measure (n=1 instrument)
9. Estabrooks' Kinds of Research Utilization (n=1 instrument)
10. Other Single-Item Measures (n=39 instruments)

Instruments in classes 1-6 consist of multiple items whereas those in classes 7-10 are single-items; similar proportions of articles reported multi- and single-item measures (n= 51 and n=59 respectively, 2 articles reported both multiand single-item measures). The majority of instruments (n=53, 88%) were assessed in a single study. The seven instruments assessed in multiple studies were: (1) Nurses Practice Questionnaire; (2) Research Utilization Survey; (3) Edmonton Research Orientation Survey; (4) a Specific Practice Index (Tita [44, 45]); (5) Past, Present, Future Use; (6) Parahoo's Measure; and, (7) Estabrooks' Kinds of Research Utilization.

Most studies used the instruments with clinical care providers: professional nurses (n=56 of 97 studies, 58%), allied care professionals (n=25, 26%), physicians (n=7, 7%), multiple clinical staff groups (n=5, 5%), and managers (n= 6, 6%). The unit/organization was the unit of analysis in only 6 (6%) of the studies [46-51]; in all 6 studies a unit-level score for research utilization was calculated by aggregating the mean scores of individuals on the unit. Most studies were conducted in North America (United States: n=43, 44% and Canada: n=22, 23%), followed by Europe (n=22, 23%). Other geographic areas represented included: Australia (n=5, 5%), Iran (n=1, 1%), Africa (n=2, 2%), and Taiwan (n=2, 2%). With respect to date of publication, the first report included in this review was published in 1976 [111]. The majority of reports (n=90, 83%) were published within the last 13 years (See Figure 2-2).

Psychometric Assessment of the Research Utilization Instruments

Acceptability and Feasibility.

Acceptability in terms of time required to complete the research utilization instruments was not reported in any of the studies. Financial costs associated with implementation of the research utilization surveys (feasibility) were also not discussed.

Reliability.

Reliability was reported in 32 (33%) of the studies. Of the 32 studies, 31 described multi-item research utilization instruments and 1 study described a single-item measure (See Table 2-5). Internal consistency (e.g., Cronbach Alpha) was the most commonly reported reliability statistic (n=31 studies). However, this represents only 13 of the 18 multi-item instruments (and n=65, 67% of the included studies) where this type of assessment was appropriate. No reliability evidence was reported for five multi-item instruments [44, 45, 52-55], and for a sixth multi-item instrument, the Edmonton Research Orientation Survey, reliability coefficients were reported in less than 50% of the studies assessing the instrument. Importantly, where reliability (Cronbach Alpha) was reported, it almost always (n=29 of 31 studies, 94%) exceeded the accepted standard (> 0.70) for scales intended to compare groups, as recommended by Nunnally and

Bernstein [56]. The two exceptions were assessments of the Nurses Practice Questionnaire (Rodgers [3, 57] and Berggren [58]). This tendency to only report reliability coefficients that exceed the accepted standard may potentially reflect a reporting bias.

Stability, or test-retest, reliability is conducted when there are multiple administrations of an instrument with the same sample. Thus, test-retest reliability is applicable to all instruments. In this review, however, test-retest reliability was reported for only 3 (3%) of the studies: two studies assessing the Nurses Practice Questionnaire (Brett [59, 60] Thompson [61]) and, one study assessing Stiefel's Research Use Index (Stiefel [62]). All three studies reported Pearson *r* coefficients greater than 0.80 using one-week intervals (See Table 2-5).

One study also assessed inter-rater reliability. Pain and colleagues [63] had trained research staff conduct 1-hour interviews with respondents in which they (the respondents) were asked to describe practice situations where research utilization was most likely. Respondents were also asked to rate their use of research on a 7-point scale. Following the interviews, the research staff also rated the respondents' use of research on the same 7-point scale. Inter-rater reliability among the interviewers was acceptable with pair wise correlations ranging from 0.80 to 0.91 (See Table 2-5).

Validity.

No single instrument had supporting validity evidence from all four evidence sources. For 12 instruments [64-75], each in the 'other single-item' instrument class, there were no reported findings that could be classified as validity evidence. The remaining 48 instruments were classified as Level 1 (n=6), Level 2 (n=16), or Level 3 (n=26) instruments, according to whether the average number of validity sources reported in a majority (50% or more) of the articles describing an assessment of the instrument was 3, 2, or 1 respectively (See Tables 2-6 to 2-8).

Instruments Reporting Three Sources of Validity Evidence (Level 1).

Because no instrument had findings consistent with all four validity evidence sources, a Level 1 instrument was defined as an instrument where the majority (50% or more) of assessments of the instrument reported any three validity sources. A total of six instruments, from three instrument classes, met this criterion: Specific Practices Indices (n=1 instrument, Varcoe [76]), General Research Utilization Indices (n=3 instruments, Reynolds [46], Stiefel [62], Varcoe [76]), and Other-Single Items (n=2 instruments, Dobbins [77], Suter [78]) (See Table 2-6). Each of these instruments, however, was assessed in a single study comprised of one sample. The assessments of five [46, 76-78] of the six instruments displayed content, response process, and relations to other variables evidence while the assessment of one instrument (Stiefel [62]) also provided internal structure validity evidence. A description of the Level 1 instruments and summary of the validity evidence extracted is located in Table 2-9.

Instruments Reporting Two Sources of Validity Evidence (Level 2). A Level 2 instrument is one where the majority of assessments reported, on average, two validity sources. A total of 16 instruments, from 7 instrument classes, met this criterion: (1) Nurses Practice Questionnaire (n=1 instrument); (2) Knott and Wildvasky Standards (n=1 instrument); (3) General Research Utilization Indices (n=4 instruments); (4) Specific Practices Indices (n=2 instruments); (5) Estabrooks' Kinds of Research Utilization (n=1 instrument); (6) Parahoo's Meausre (n=1 instrument); and (7) Other Single-Items (n=6 instruments) (See Table 2-7). Most assessments have occurred with nurses in hospital settings and no single validity source was reported for all Level 2 instruments. For the 16 instruments in Level 2, the most commonly reported evidence source was relations to other variables (reported for 12 (75%) of the instruments), followed by response processes (n=7 (44%) of the instruments), content (n=6 (38%) of the instruments), and lastly, internal structure (n=1 (6%) of the instruments) (See Table 2-7). Four of the instruments were assessed in multiple studies: (1) Nurses Practice Questionnaire, (2) a Specific Practices Index (Tita [44, 45]), (3) Parahoo's Measure, and (4) Estabrooks' Kinds of Research Utilization. Further details can be found in Table 2-7 and Additional File 2-5.

Instruments Reporting One Source of Validity Evidence (Level 3). A Level 3 instrument is one where the majority of assessments reported, on average, one validity source. The majority (n=26) of research utilization instruments identified fell into Level 3. The 26 instruments come from 6 instrument classes: (1) Champion and Leach's Research Utilization Survey (n=1 instrument); (2) Edmonton Research Orientation Survey (n=1 instrument); (3) General Research Utilization Indices (n=3 instruments); (4) Specific Practices Indices (n=1 instrument); (5) Past, Present, Future Use (n=1 instrument); and, (6) Other Single-Item Measures (n=19 instruments) (See Table 2-8). The majority of Level 3 instruments are single-items (n=20) and have been assessed in a single study (n=23). Similar to the Level 2 instruments, there was no single source of validity evidence common across all of the instruments. The most commonly reported validity source was content (reported for 12 (46%) of the instruments), followed by response processes (n=10, 38%), relations to other variables (n=10, 38%), and lastly, internal structure evidence (n=1, 4%) (See Table 2-8). Three Level 3 instruments were assessed in multiple studies: (1) Champion and Leach's Research Utilization Questionnaire; (2) Past, Present, Future Use items; and, (3) the Edmonton Research Orientation Survey. Further details can be found in Table 2-8 and Additional File 2-5.

Discussion

Our discussion is organized around three areas: (1) the state of the science of research utilization measurement, (2) construct validity, and (3) our instrument hierarchy.

State of the Science

In 2003, Estabrooks and colleagues [14] completed a review of research utilization instruments. The review was limited to: (1) articles published prior to the year 2000 that were indexed in three online databases (CINAHL, Medline, and Pubmed), (2) instruments tested with healthcare providers allied to medicine (predominantly nursing), and (3) a traditional validity assessment. That is, in the previous review by Estabrooks and colleagues [14] only the results interpreted (by the original authors of each study) as validity (as content validity, criterion validity [which no studies reported], or construct validity [which only 2 studies reported]) were considered validity evidence. In that review (Estabrooks [14]), 18 instruments were identified (6 multi-item instruments and 12 single-items). By significantly extending the search criteria of that review, we identified 42 additional instruments, a substantial increase in the number of research utilization instruments available. While, on the surface, this gives the impression of an optimistic picture of research utilization measurement, detailed inspection of the 108 articles included in our review revealed several limitations to these instruments and the psychometric testing that has been done on them to date. These limitations seriously constrain our ability, at present, to validly measure research utilization. The limitations center on: (1) ambiguity between different instruments and between studies using the same instrument, and (2) methodological problems with the design and evaluation of the instruments.

Ambiguity in Research Utilization Instruments.

There is ambiguity with respect to the naming of the instruments. For instance, similar instruments had different names. Parahoo's Measure [79] and Pettengil's single item [80], for example, both ask participants one question – whether they have used research findings in their practice in the past two years or three years respectively. Conversely, other instruments that ask substantially different questions are similarly named; for example, Champion and Leach [81], Linde [82], and Tsai [83, 84] all describe a *Research Utilization Questionnaire*. Further ambiguity was seen in the articles that described the modification of a pre-existing instrument (i.e., use of the same instrument in different populations or settings). In most cases, despite making significant modifications to the instrument, the authors retained the original instrument's name and, by doing so (albeit unintentionally), masked the need for additional validity testing. The Nurses Practice Questionnaire (NPQ) is an example of this. Brett [59] originally developed the NPQ, which consisted of 14 research-based practices, to assess research utilization by hospital nurses. The NPQ was subsequently modified (the number of and actual practices assessed, as well as the items that follow each of the practices) and used in eight additional studies [3, 57, 58, 61, 85-89]), but each study retained the NPQ name.

Methodological Problems.

Studies describing the development and/or use of instruments that measure research utilization directly continue to be conducted primarily within nursing. The studies vary significantly in terms of sample composition, sample size, study methods and rigor, and the statistical analyses reported. In the earlier research utilization instrument review, Estabrooks and colleagues [14] identified four core methodological problems, lack of: (1) construct clarity, (2) research utilization theory, (3) measurement theory, and (4) psychometric assessment. In our review, we found that, despite an additional 10 years of research and 65 new reports on research utilization instruments, these problems and others persist.

Lack of Construct Clarity. Research utilization has been, and is likely to remain for some time, a complex and contested construct. What has been cited as lack of construct clarity between researchers with respect to what is research utilization, we believe, is more accurately a lack of clarity with respect to how to best measure research utilization. Issues around clarity of research utilization measurement stems from four areas: (1) a lack of definitional precision of research utilization, (2) confusion around the formal structure of research utilization, (3) lack of substantive theory used in the development and evaluation of research utilization instruments, and (4) confusion between factors associated with research utilization and the use of research *per se*. The above problems were evident in our review.

Lack of definitional precision with respect to research utilization is well documented. In 1991, knowledge utilization scholar Thomas Backer [90] declared lack of definitional precision as part of a serious challenge of fragmentation that was facing researchers in the knowledge (utilization) fields. Since this time, there have been substantial efforts to understand what does and does not make research utilization happen. However, the issue of definitional precision continues to be largely ignored. In our review, definitions of research utilization were infrequently reported in the articles (n=36 studies, 37%) [3, 15, 47, 58, 62, 63, 66, 77, 79, 83, 89, 91-117] and even less frequently incorporated into the administered instruments (n=8 studies, 8%) [15, 94-97, 101, 107, 113, 115]. Where definitions of research utilization were offered, they varied significantly between studies (even studies of the same instrument) with one exception: Estabrooks' Kinds of Research Utilization. In this latter instrument, the definitions offered were consistent in both the study reports and the administered research utilization instrument.

A second reason for the lack of clarity in research utilization measurement is confusion around the formal structure of research utilization. Several different views of how research utilization is structured were evident in the instruments identified for this review. The two predominant views are: (1) as a variable or discrete event (e.g., Parahoo's Measure [5, 79, 118-122]) or (2) as a process that consists of a series of stages (e.g., the Nurses Practice Questionnaire [3, 57-61, 85-89]). Some scholars also prescribe research utilization as typological (i.e., that there are types or kinds of research utilization) in addition to being a variable or a process. For example, Stetler [115]) and Estabrooks [15, 50, 93-97, 101, 107, 113] both have single-items that measure multiple kinds of research utilization, with each kind individually conceptualized as a variable/discrete event. While each of these conceptualizations is valid, there is, to date, no consensus regarding which is best or most valid. Therefore, we recommend that researchers reflect on the structure of research utilization (variable, process, typological) that best matches their study purpose when selecting an instrument to use.

A third reason for the lack of clarity in research utilization measurement is limited use of substantive theory in the development of research utilization instruments. There are numerous theories, frameworks, and models of research utilization and of related constructs, from the fields of nursing (e.g., [32, 33, 123-126]), organizational behaviour (e.g., [127-132]), and the social sciences (e.g., Weiss [133]). However, only 1 of the 60 instruments identified in this review explicitly reported using research utilization theory in its development. Brett's [59] Nurses Practice Questionnaire was developed based of Rogers' Innovation-Decision Process theory (one component of Rogers' larger Diffusion of Innovations theory [134]). The Innovation-Decision Process theory describes five stages to the adoption of an innovation (research): awareness, persuasion, decision, implementation, and confirmation.

A fourth and final reason that we identified for the lack of clarity in research utilization measurement is confusion between factors associated with research utilization and the use of research *per se*. In several of the instruments identified for this review, we saw confusion between research utilization itself and the factors related to it. For example, Brett's Nurses Practice Questionnaire [59] and all of the General Research Utilization Indices (Champion and Leach's Research Utilization Questionnaire [81], the Edmonton Research Orientation Survey [135], and the Other General Research Utilization Indices (n=10) [46, 54, 55, 62, 76, 100, 111, 136-138]) claim to directly measure research utilization. However, their items, which while compatible with a process view of research utilization, do not measure research utilization. For example, *reading research* is an individual factor that fits into the awareness stage of Rogers' Innovation Decision-Process theory. Brett's Nurses Practice Questionnaire uses this item to create an overall *adoption* score, which they equate with 'use', but it is not just ‘use’. A majority of the General Research Utilization Indices also includes *reading research* as an item. In these instruments, such individual factors are treated as proxies for research utilization. We caution researchers that while many individual factors like *reading research* may be a desirable quality for making research utilization happen, they are not research utilization. When selecting which research utilization instrument to use, the goal of the investigation is paramount; this in turn, is intimately linked to the definition and structure of research utilization to which one adheres. For example, if the goal is to examine research utilization as an event, then instruments that incorporate proxies of the construct such as the examples above should be avoided.

Lack of Measurement Theory. Foundational to the development of any instrument is measurement theory. The two most commonly used measurement theories are *classical test score* theory, and *modern measurement (or item response)* theory. Classical test score theory proposes that an individual’s observed score (e.g., value obtained with a self-report instrument) on a construct (e.g., research utilization) is the additive composite of their true score and random error. This theory forms the basis for traditional reliability theory (Cronbach Alpha) [139, 140]. Item response theory, on the other hand, is a model-based measurement theory that encompasses any model that relates the probability of an individual’s response to an item on an underlying trait (e.g., research utilization) and is thus a mathematical function of person (individual) and item (discrimination, difficulty) parameters. This theory proposes that, as an individual’s level of a trait (research utilization) increases, the probability of a correct (or in the case of research utilization, a more positive) response also increases [141, 142].

Similar to the previous review by Estabrooks and colleagues [14], none of the reports in our review explicitly stated that consideration of any kind was given to measurement theory in either the development or assessment of the respective instruments. However, in our review, for 14 (23%) of the instruments, there was reliability evidence consistent with the adoption of a classical test score theory approach. For example: (1) Cronbach alpha coefficients were reported on 13 (22%) instruments (See Table 2-5); and, (2) principal components (factor) analysis and item total correlations were reported on 2 (3%) instruments (Forbes [136] and Stiefel [62]).

Lack of Psychometric Assessment. In the previous review, Estabrooks and colleagues [14] concluded, “All of the current studies lack significant psychometric assessment of used instruments” (p. 23). They further stated that over half of the studies in their review did not mention validity, and that only two instruments (Pain [135], Estabrooks [15]) displayed evidence of construct validity. This latter finding, we argue, may be attributed to the adoption of a traditional conceptualization of validity where only evidence labeled as validity (i.e., as content validity, criterion validity, or construct validity) by the original study authors are considered validity evidence. In our review, a more positive picture was displayed, with only 12 (20%) of the instruments identified showing no evidence of construct validity. We attribute this, in part, to our implementation of the *Standards* as a framework for validity. Using this framework, we scrutinized all results (not just those labeled as validity), in terms of whether or not they added to overall construct validity.

Additional Limitations to the Field. Several additional limitations in research utilization measurement were also noted as a result of this review. They include: (1) limited reporting of findings reflective of validity; (2) limited assessments of the same instrument in multiple (>1) studies; (3) lack of assessment of: (a) acceptability and feasibility and (b) responsiveness (the extent to which the instrument can measure change over time); (4) over-reliance on the assessment made in the index (original) study of an instrument; and, (5) failure to re-establish validity when modifications are made and/or the instrument is assessed in a new population or context.

Construct Validity (the *Standards*)

Traditionally, validity has been conceptualized according to three distinct types: (1) content, (2) criterion, and, (3) construct. While this way of thinking about validity has been useful, it has also caused problems. For example, it has led to compartmentalized thinking about validity, making it 'easier' to overlook the fact that construct validity is really the whole of validity theory. It has also led to the incorrect view of validity as a property of instruments rather than as a property of the scores (and resulting interpretations) obtained from an instrument. A more contemporary conceptualization of validity (seen in the *Standards*) was taken in this review. Using this approach, validity was conceptualized as a unitary concept with multiple sources of evidence, each contributing to overall (construct) validity [25].We believe this conceptualization is both more relevant and more applicable to the study of research utilization and to health services research generally than is the traditional conceptualization that dominates the literature [30, 143].

All instruments require validity assessments. Without such assessments little to no intrinsic value can be placed on findings obtained with the instrument. Validity is associated with the interpretations assigned to instrument scores, and thus is intended to be hypothesis-based [143, 144]. Hence, to establish validity, desired score interpretations are first hypothesized to allow for the deliberate collection of data to support or refute the hypothesis [145]. In line with this thinking, data collected using a research utilization (or any) instrument will always be more or less valid depending on the purpose of the assessment (study), the population and setting, and timing of the assessment (e.g., before or after an intervention). As a result, we are not able to declare any of the instruments we identified in our review as valid or invalid, but only as more or less valid for selected populations, settings, and situations. This deviates substantially from traditional thinking on construct validity, which suggests that validity either exists or does not.

According to Cronbach and Meehl [146], construct validity rests in a nomological network that generates testable propositions which relate instrument scores (as representations of a construct) to other constructs, in order to better understand the nature of the construct being measured [146]. This view is comparable to the traditional conceptualization of construct validity as existing or not, and is also in line with the views of philosophers of science from the first half of the 20th century (e.g., Duhem [147] and Lakatos [148]). Duhem and Lakatos both contended that any theory could be fully justified or falsified based on empirical evidence (i.e., based on data collected with an instrument). From this perspective, construct validity exists or does not. In the second half of the 20th century, however, movement away from justification to what was described by Feyerabend [149] and Kuhn [150] as 'nonjustificationism' occurred. In nonjustificationism, a theory is never *fully* justified or falsified. Instead, at any given time, it is a closer or further approximation of the truth than another (competing) theory. From this perspective, construct validity is a matter of degree (i.e., more or less valid) and can change with the sample, setting, and situation being assessed. This is in line with a more contemporary (the *Standards*) conceptualization of validity.

Instrument Hierarchy

The *Standards* [25] also provided us with a framework to synthesize the large volume of data extracted on the 60 research utilization instruments. Using the *Standards'* four sources of evidence, we created a three-level instrument hierarchy. The average number of validity sources reported in the majority (50% or more) of articles for each instrument determined the level (1, 2, or 3) assigned.

In the *Standards*, no single source of validity evidence is always superior. This will appear, on the surface, to contradict the commonly accepted view that 'construct validity' (defined as relationship testing in the traditional conceptualization of validity) is superior. However, this view (of construct validity determined by relationship testing) ignores the fact that construct validity is the whole of validity theory, and thus, validity equals construct validity. Construct validity does not exist or not based on relationships to other variables, but rather the scores obtained with an instrument will be more or less valid based on accumulated data from all evidential sources (of which relationship testing is only one source). Therefore, relationship testing does not carry more weight than the other validity sources in our instrument hierarchy (or in the *Standards*).

The sources of validity evidence sought are determined by the interpretation(s) based on instrument scores desired [143, 145]. Not all interpretations require all sources of evidence. For example, some instruments (e.g., an achievement test) require straightforward evidence such as content data on the adequacy of the items and statistical evidence of score reproducibility [144]. Other instruments, however, require multiple and complex sources of evidence. We believe research utilization instruments fall into the latter category. Valid research utilization scores require theoretical and empirical evidence demonstrating: (1) content relevance (content evidence); (2) how respondents interpret, process, and elaborate upon item content and whether this behaviour is in accordance with research utilization (response processes evidence); (3) that statistical relationships exist between items where a multi-item instrument is used (internal structure evidence); and, (4) that statistical relationships exist between research utilization scores obtained with the instrument and other variables with which it is (and is not) expected to be related (relations to other variables evidence). As a result, our instrument hierarchy utilized all four evidential sources equally.

Articles identified in this review were scrutinized for all four evidence sources. However, reporting of findings consistent with the four sources of evidence was limited in many of the articles. Additionally, few instruments were tested in multiple studies. Combined, these two factors presented a major challenge to completing an overall validity assessment. While we were able to categorize 48 of the 60 instruments identified into the instrument hierarchy (the remaining 12 instruments had no reported validity evidence), we recommend the following be considered when using this hierarchy to select a research utilization instrument for use. First, the levels in the hierarchy are based only on the number of validity sources, and not on the actual source of evidence or extent and content of the evidence within each source. For instance, if one desires an instrument that has a known relationship to a specific external variable, then higher weight should be placed on instruments demonstrating that relationship when selecting an instrument for use. Secondly, some instruments in our hierarchy may appear to have strong validity only because they have been subjected to limited testing. For example, the six Level 1 instruments identified have each been tested in only a single study. Several Level 2 instruments (e.g., Parahoo's measure and Estabrooks' kinds of Research Utilization), on the other hand, have displayed on average fewer validity sources overall, but have been tested in multiple studies with consistent findings across studies. As a result, at this time, we do *not* recommend using a Level 1 instrument over a Level 2 instrument until additional validity testing has been conducted. Thirdly, the hierarchy included all 48 instruments that displayed any validity evidence. Some of these instruments, however, do not measure research utilization directly but rather are proxies of the construct. This must be considered, alongside the conceptualization of research utilization being adhered to, when selecting an instrument for use.

The hierarchy in this review presents a summary of the validity testing to date on existing research utilization instruments and is meant to inform researchers regarding what testing has been done, with which populations and settings, and where additional testing is needed. The hierarchy should not be relied upon in isolation when selecting a research utilization instrument for use. Details of the validity evidence (Additional File 2-5), reliability (Table 2-5), conceptualization of research utilization measurement that fits with the instrument, and, how the instrument was developed (i.e., use of substantive and measurement theory), are examples of other elements that need to be considered.

Limitations

Although rigorous and comprehensive methods were used for this review, there were two study limitations. First, while we reviewed dissertation databases, we did not search all grey literature sources; consequently, this review may not be representative of all relevant work in the field. Second, due to limited reporting of findings consistent with the four sources of validity evidence in the *Standards*, we may have concluded lower levels of validity for some instruments than actually exist. In the latter case, our findings may reflect poor reporting rather than less validity.

Conclusions

In this review, we identified 60 unique research utilization instruments used in healthcare. While this appears to be a large and definite set of instruments, our assessment of the instruments paints a rather discouraging picture of research utilization measurement. Several instruments, which were labeled research utilization measures, did not measure research utilization *per se*. Additionally, there are substantial methodological gaps in the instruments identified that are designed to measure the phenomenon directly (i.e., not a proxy measure). Substantial methodological advances in the research utilization field, focusing in the area of measurement (in particular with respect to construct clarity, use of measurement theory, and psychometric assessment) are urgently needed. These advances are foundational to ensuring the availability of defensible measures of research utilization. Also needed are improved reporting practices and the adoption of a more contemporary view of validity (the *Standards*) in future research utilization measurement studies.

Figure 2-1. Article Screening and Selection

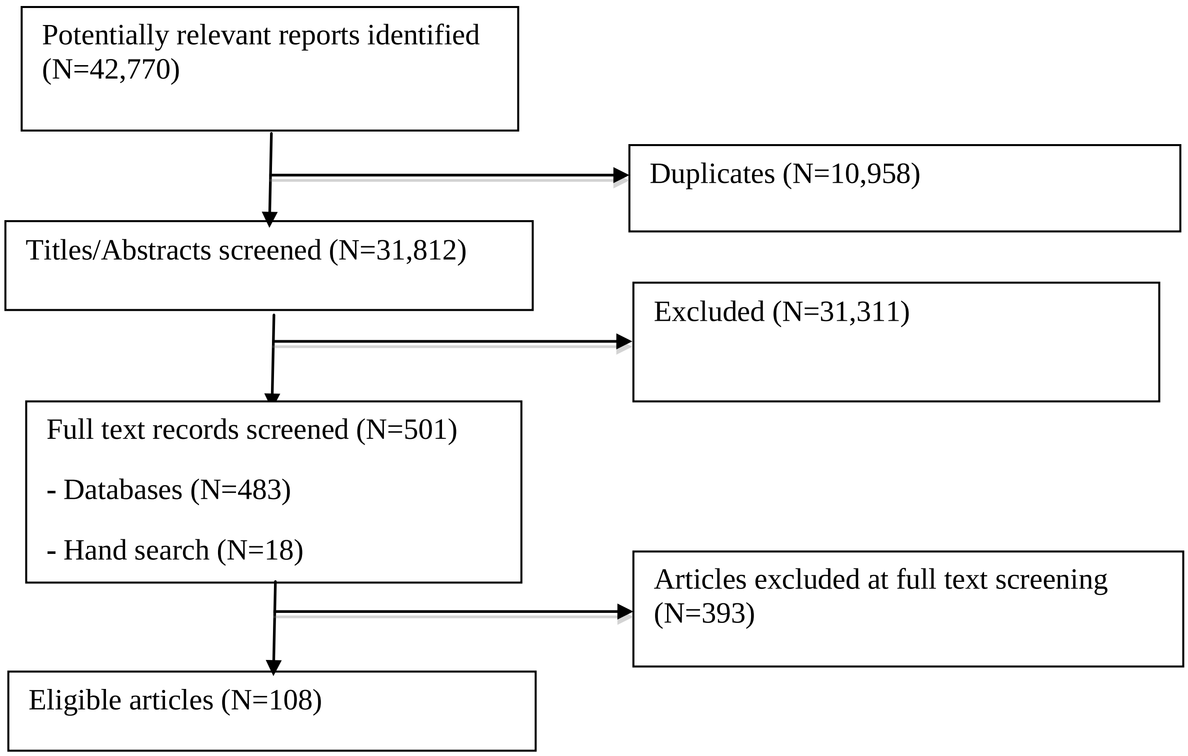

Figure 2-2. Publication Timeline

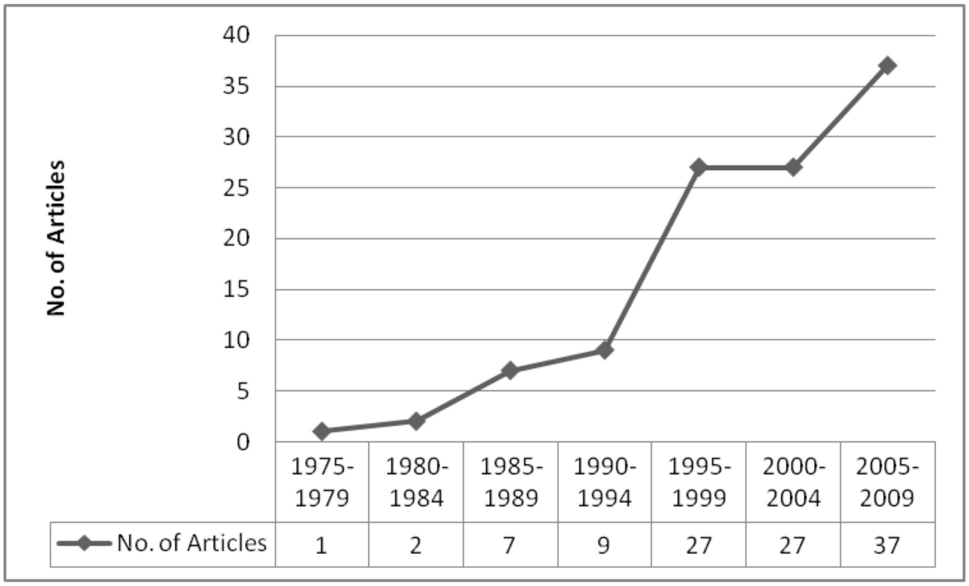

Table 2-1. Search Strategy

Data Base	Edition	Search Terms	No. Articles
Cochrane Database of Systematic Reviews (CDSR)	Through to 4th quarter, 2008	"nursing practice questionnaire" or "edmonton research orientation survey" or (technolog* W diffus*) or (chnolog* W transfer*) or (technolog* W translat*) or (technolog* W adopt*) or "diffusion of innovation" or "diffusion of innovations" or "innovation diffusion" or "dissemination of innovation" or "dissemination of innovations" or (innovation* W/1 adopt*) or "adoption of innovation" or "adoption of innovations" or "dissemination of evidence" or "implementation of evidence" or "adoption of evidence" or "uptake of evidence" or "use of evidence" or "utilization of evidence" or "utilisation of evidence" or "diffusion of evidence" or "translation of knowledge" or "transfer of knowledge" or "implementation of knowledge" or "adoption of knowledge" or "uptake of knowledge" or "utilization of knowledge" or "utilisation of knowledge" or "dissemination of knowledge" or "diffusion of knowledge" or "implementation of technologies" or "adoption of technologies" or "uptake of technologies" or "dissemination of technologies" or "diffusion of technologies" or "translation of technologies" or "transfer of technologies" or "implementation of technology" or "adoption of technology" or "uptake of technology" or "dissemination of technology" or "diffusion of technology" or "translation of technology" or "transfer of technology" or "translation of research" or "transfer of research" or "implementation of research" or "adoption of research" or "uptake of research" or "use of research" or "utilization of research" or "utilisation of research" or "dissemination of research" or "diffusion of research" or "evidence uptake" or "evidence use" or "evidence diffusion" or "evidence dissemination" or "evidence utilization" or "evidence utilisation" or "evidence transfer" or "evidence translation" or "evidence implementation" or "evidence adoption" or "knowledge uptake" or "knowledge use" or "knowledge diffusion “or "knowledge dissemination" or "knowledge utilization" or "knowledge utilisation" or "knowledge transfer" or "knowledge translation" or “knowledge implementation" or "knowledge adoption" or “research uptake" or "research use" or "research diffusion" or "research dissemination" or "research utilization" or "research utilisation" or "research transfer" or "research translation" or "research implementation" or "research adoption" **AND** survey* or questionnaire* or inventor* or	0
Health and Psychosocial Instruments (HAPI)	Through to October 14, 2008		74
MEDLINE	Through to October 11, 2008		7064
CINAHL	Through to October 11, 2008		4939
EMBASE	Through to October 13, 2008		4684
Web of Science	Through to October 13, 2008		6692
SCOPUS	Through to November 17, 2008		8080
OCLC Papers First	Through to October 13, 2008		806
OCLC WorldCat	Through to October 13, 2008		2012
Sociological Abstracts	Through to October 13, 2008		2266
Proquest: Dissertation Abstracts, ABI Inform	Through to October 14, 2008		6135

Data Base	Edition	Search Terms	No. Articles
		instrument* or scale* or assess* or evaluat* or measur* or tool* or reliability or validity or validation or reproducib* or benchmark* or psychometric*	
Manual Search			18
TOTAL			42,770

Table 2-2. Sample Predictions Based on Research Utilization Theory

Author [Citation Number]	Theory	Assumptions	Comments
Rogers EM. 1983/2005 Diffusion of Innovations. [134, 151]	Diffusion of Innovation	• **Innovation-decision process: the stages of the innovation-adoption process include knowledge (or awareness), persuasion, decision, use (or implementation), and confirmation. These stages may progress in a linear manner, but not always.** Other assumptions that may come into play in articles utilizing Rogers' framework are: • Individual innovativeness: A bell shaped curve illustrates the percentage of who (innovators, early adopters, early majority, late majority, laggards) adopts the innovation in relation to a given time frame. • Rate of Adoption: An s-curve on a graph best represents the rate of adoption of innovations, occurring slowly at first, followed by a period of rapid growth that will taper off, stabilize, and eventually decline. • Perceived attributes of the innovation contributing to adoption include: relative advantage over the status quo, compatibility with values/current practices, complexity, trialability, and observability of results. (Rogers discusses the following characteristics thought to influence innovation diffusion and adoption. NOTE: remember this theory was developed in the context of agriculture innovation diffusion). <u>Innovation</u> • Complexity – the degree to which an innovation is perceived as	Theory has been applied and tested repeatedly both within and outside of nursing Has demonstrated longevity, within a number of disciplines Has not been proven that innovation = research

Author [Citation Number]	Theory	Assumptions	Comments
		relatively difficult to understand and use (higher complexity is associated with lower utilization) • Relative advantage/research relevance – the degree to which an innovation is perceived as being better then what it replaces (more relative advantage, the more utilization) • Compatibility – the degree to which an innovation is perceived as consistent with values, experiences, and need (more compatible, the more utilization) • Trialability – the degree to which an innovation may be experimented with on a limited basis (more triable an innovation, the more utilization) • Observability – the degree to which the results of implementing an innovation are visible (more observable, the more utilization) • Additional factors that influence innovation behaviour include: support for innovation; mass media; people/co-worker support Individual • Socioeconomic characteristics: more education, income/social status, income, literacy, age (findings are inconclusive on this point) • Adoptiveness • Personality variables (empathy, dogmatism, ability to deal with abstractions, rationality, intelligence, positive change attitude,	

Author [Citation Number]	Theory	Assumptions	Comments
		ability to cope with uncertainty, favourable attitude towards education, optimism, high levels of achievement motivation) • Communication behaviour (social participation, interconnected social systems, cosmopoliteness, change agent contact, contact with interpersonal communication channels, knowledge of innovations, high levels of opinion leadership, part of highly interconnected systems, localite)	
Logan J, Graham I. 1998 Toward a comprehensive interdisciplinary model of health care research use. [32]	Ottawa Model of Research Use	• There are three sources for the barriers and supports to research use. These relate to the practice environment (consisting of structural factors, social factors, and patients), the potential adopters, and the evidence-based innovation. • Viewing the proposed change from the perspective of the adopters and understanding scientific and extra-scientific considerations may influence adoption • The attributes of an innovation interact with potential adopters. Those thought to positively influence adoption include credible developers and involvement of potential adopters in the process, clear translation processes (i.e. rigorous literature searching and incorporation of objective methods to synthesize the evidence), compatibility, relative advantage, low complexity, and high trialability • This model suggests that tailoring strategies to the barriers/supports of the particular setting may enhance implementation of research.	Model refined through discussions with participants Constructs are supported by evidence **(where available)** **Authors state that the model is based on the literature, but method for identifying literature in this area is not discussed.** **Report study findings to support model components but quality assessment of studies was not undertaken**

Author [Citation Number]	Theory	Assumptions	Comments
Kitson et al., 1998. Enabling the implementation of evidence based practice: A conceptual framework. [33] Rycroft-Malone, J (2004). The PARIHS framework—A framework for guiding the implementation of evidence-based practice. [34]	PARiHS Promoting Action on Research in Health Services	**2 key assumptions** 1. research implementation is not a linear process 2. implementation of quality research will result in improved patient outcomes Successful research implementation is the result of interplay between: 1. evidence (research, clinical experience, patient preferences) 2. context [culture, leadership, and evaluation, and (resources)] 3. facilitation (process of enabling). Briefly refer to presence of structural resources as a facilitator. Structural resources include things like access to nursing journals and libraries	While this is a fairly new framework, there have been some empirical reports supporting its propositions
Godin G et al., 2008. Healthcare professionals' intentions and behaviours: A systematic review of studies based on social cognitive theories. [19] Sheeran P 2002. Intention-behavior relations: a conceptual and empirical review. [35]	TPB Theory of Planned Behavior (Ajzen [152])	TPB posits that individual behaviour (use of research) is driven by behavioural intentions where behavioural intentions are a function of: (1) Behavioural Beliefs, i.e., beliefs about the likely outcomes of the behaviour and the evaluations of these outcomes → Behavioural beliefs produce a favourable or unfavourable ***attitude*** toward the behaviour (2) Normative Beliefs, i.e., beliefs about the normative expectations of others and motivation to comply with these expectations → Normative beliefs result in perceived social pressure or ***subjective norm***	This theory is used largely (in KT) to study physicians (e.g., prescribing) behaviours. However, one of the main premises is that the greatest predictor of behaviour is intention and in recent reviews, on average, approximately only 30% of the variance in behaviour is accounted

Author [Citation Number]	Theory	Assumptions	Comments
		(3) Control Beliefs, i.e., beliefs about the presence of factors that may facilitate or impede performance of the behaviour → Control beliefs give rise to ***perceived behavioural control***	for by intentions
Grol R, et al., 2007. Planning and studying improvement in patient care: the use of theoretical perspectives. [37]	Multiple Theories	• There is a list of 'innovation characteristics that may promote or hinder their implementation' p. 100) - the scientific basis for these principles, they state though, lies in organizational research with little investigation in healthcare: 1. relative advantage or utility 2. compatibility 3. complexity 4. costs 5. risks 6. flexibility, adaptability 7. involvement 8. divisibility 9. trialability, reversibility 10. visibility, observability 11. centrality	**Predictions are based on commonalities between a variety of theories** **Note: Factors hypothesized to affect 'implementation of change'** Combined search methods (databases, hand-searching, and expert review). Database search from 2000-2002.

Author [Citation Number]	Theory	Assumptions	Comments
		12. pervasiveness, scope, impact 13. magnitude, disruptiveness, radicalness 14. duration 15. form, physical properties 16. collective action 17. presentation	

Table 2-3. Sample Predictions Based on Empirical Evidence (Reviews)

Author [Citation Number]	Dependent Variable	Unit of Analysis	Significant Independent Variable(s)	Direction of Effect	Quality Rating Assessed using the Oxman quality assessment checklist
Estabrooks CA, et al. 2003. Individual determinants of research utilization: A systematic review. [18]	**Research Utilization** *Not defined*	**Individual** *Nurses*	• Attitude towards research	Positive	6/7 'Minimal Flaws'
Squires JE et al. (2010, Forthcoming). Individual determinants of research utilization: A systematic review update. [38]	**Research Utilization** *"that process by which specific research-based knowledge (science) is implemented in practice"* **Kinds of research Utilization** "*Instrumental research utilization* refers to the concrete application of research findings in clinical practice." "*Conceptual research utilization refers to the cognitive use of research where the*		• Attitude towards research • Attending in-services/conference • Role (leadership/ advanced practice compared to staff nurse) • Education (graduate degree compared to bachelors/ diploma) • Clinical specialty (specialty unit compared to general hospital ward) • Job satisfaction		No QA - this review is forthcoming by this team

Author [Citation Number]	Dependent Variable	Unit of Analysis	Significant Independent Variable(s)	Direction of Effect	Quality Rating Assessed using the Oxman quality assessment checklist
	research may be used to change one's thinking about a specific practice, but may or may not result in a change in action." "*Symbolic research* utilization is the use of research as a persuasive or political tool to legitimate a position or influence the practice of others." "Overall research utilization refers to the use of any kind of research in any way in practice."				
Meijers JMM, et al. 2006. Assessing the relationships between contextual factors and research utilization in nursing: A systematic literature review. [39]	**Research Utilization** *"Indirect (using research to influence thinking at a general level) and direct (the application of research in clinical practice)"*	**Individual** *Nurses working in clinical practice*	• Role (sustained participation in QI work; 1 study)	Positive	5/7 'Minor Flaws'

Author [Citation Number]	Dependent Variable	Unit of Analysis	Significant Independent Variable(s)	Direction of Effect	**Quality Rating** Assessed using the Oxman quality assessment checklist
Thompson DS, et al. 2007.Interventions aimed at increasing research use in nursing: A systematic review. [40]	**Research Use** *Instrumental: "the concrete application of research to practice"* *Conceptual: "use of research to change one's thinking but not necessarily one's action"* *Symbolic:" use of research to influence policies or decisions"*	**Individual and Unit** *Nurses*	• Multidisciplinary committees (1 study; low quality) • Local opinion leaders (1 study; low quality)	Positive	7/7 'Minimal Flaws'
Grimshaw JM, et al. 2004. Effectiveness and efficiency of guideline dissemination and implementation strategies. [21]	**Guideline Adherence** *Guideline: "systematically developed statements to assist practitioner decisions about appropriate health care for specific clinical circumstances"*	**Individual** *Medically qualified healthcare professionals*	Median absolute improvement in performance for clustered randomized comparisons of the following interventions: • Reminders (14 comparisons) = 14.1% • Educational materials (4 comparisons) = 8.1% • Audit and feedback (5 comparisons) = 7.0%	Median absolute improvement in performance	6/7 'Minimal Flaws'

Author [Citation Number]	Dependent Variable	Unit of Analysis	Significant Independent Variable(s)	Direction of Effect	Quality Rating Assessed using the Oxman quality assessment checklist
			• Multifaceted interventions involving educational outreach (13 comparisons) = 6.0%		
Grol R, et al. 1999. Evidence-based implementation of evidence-based medicine. [41]	**Guideline Adherence** *Improvement in performance related to guideline implementation.*	**Individual** *Health care professionals; not specified*	• Reminders (unless they are used for routine items of care or if too many prompts are presented at the same time) • Introduction of other computer information systems • Educational outreach or academic detailing for prescribing decisions • Tailored interventions based on assessment of barriers • Multifaceted interventions	Reported as 'generally effective'	3/7 'Major flaws'
Greenhalgh T, et al ., 2004. Diffusion of innovations in service organizations: Systematic	**Innovation Adoption** *Innovation in service*	**Organization** *Service sector,*	• Size (larger) • Maturity • Organizational complexity	Positive (Strong-direct; Consistent findings	5/7 'Minor Flaws'

Author [Citation Number]	Dependent Variable	Unit of Analysis	Significant Independent Variable(s)	Direction of Effect	**Quality Rating** Assessed using the Oxman quality assessment checklist
review and recommendations. [42]	*delivery and organization: "a novel set of behaviours, routines, and ways of working that are directed at improving health outcomes, administrative efficiency, cost effectiveness, or users' experience and that are implemented by planned and coordinated actions".*	*focused on health care*	---Functionally differentiated: presence of semi-autonomous departments/units --- Specialized: foci of professional knowledge • Organizational slack: access to and amount of resources, slack resources to channel into new projects • Centralization: De-centralized decision making structures, professional *autonomy* • Absorptive capacity for new knowledge: Encompasses the organizations existing knowledge and skills, pre-existing related technologies, a 'learning organization' culture, and proactive leadership toward sharing knowledge	in two or more empirical studies of appropriate design and high scientific quality undertaken in health service organizations)	

Table 2-4. Description of Instrument Classes

Instrument Class	Index Citation	Description	Response scale	Number of articles [citation number] (number of studies)
MULTI-ITEM				
Nurses Practice Questionnaire (NPQ)	Brett, 1987 [59]	Developed for nurses. The NPQ consists of brief descriptions of 14 specific nursing practice innovations. Seven questions measuring the nurse's stage of innovation adoption are posed for each of the nursing practice innovations. The first six questions measure the nurse's adoption of the practice according to Roger's [134] Innovation-Decision Process Theory while the seventh question measures their perception of policy existence with respect to the practice.	Items are scored dichotomously yes/no for all questions except for question of 'use', which is scored as never, sometimes, or always.	11 articles [3, 57-61, 85-89] (9 studies)
Research Utilization Questionnaire (RUQ)	Champion and Leach [81]	Developed for nurses. The RUQ consists of 42 self-descriptive statements comprising four subscales of which research use is one. The research use subscale contains 10 items, which measure the degree to which an individual feels they incorporate research findings into their daily practice.	Items are scored on a 5-point Likert scale from strongly disagree to strongly agree	16 articles [81, 98, 99, 102, 106, 108, 109, 153-159] (14 studies)

Instrument Class	Index Citation	Description	Response scale	Number of articles [citation number] (number of studies)
Edmonton Research Orientation Survey (EROS)	Pain, Hagler, and Warren [116, 135]	Developed in the context of rehabilitation medicine specialties (e.g., physiotherapy). The EROS has four subscales of which 'Using Research/Evidence-Based Practice' is one subscale. This subscale is composed of 10 items measuring general research use.	Items scored on a 5-point Likert scale from strongly disagree to strongly agree.	8 articles [63, 103-105, 135, 160-162] (7 studies)
Knott and Wildavsky Standards	Belkhodja and colleagues [91]	Developed for leaders based on Knott and Wildavsky's [163] *Standards of Research Use*. Consists of 7 items to measure each of the 7 standards of research use: (1) reception (the research has been received by an individual); (2) cognition (research is both read and understood); (3) reference (research changes ways of thinking); (4) effort (research shapes action – some effort, even if unsuccessful, has been made to get the findings used); (5) adoption (research has had a direct influence on the policy or practice itself); (6) implementation (research is being used), and finally, (7) impact (benefits to citizens, or in the case of clinicians, to patients and residents).	Items scored on a 5-point frequency scale from never to very often.	1 article [91] (1 study)
Other Specific Practices Indices **See Additional File 2-3 for a description of each instrument in this class**	NA Each study serves as the index study for the instrument assessed	Ask respondents to report on their use of a range of specific research-based practices. The number and kind of practices vary by the study.	The scales used to measure use of the practices vary by study with some studies measuring use on frequency scales and others dichotomously as use or nonuse	5 articles [44, 45, 52, 53, 76] (4 studies)

Instrument Class	Index Citation	Description	Response scale	Number of articles [citation number] (number of studies)
Other General Research Use Indices **See Additional File 2-4 for a description of each instrument in this class**	NA Each study serves as the index study for the instrument assessed	Each of these indices combines several items on respondents' general use of research (i.e., not use of specific practices) to derive an index (or overall score) representing their use of research.		10 articles [46, 54, 55, 62, 76, 100, 111, 136-138] (10 studies)
SINGLE-ITEM				
Past/Present/Future Use	NA Each study serves as the index study for the instrument assessed	Developed for nurses. Asks respondents to indicate their participation in one or more research activities in the past (>6 months ago), present (most recent 6 months), and intention to use research in the future (within the next year).	Responses are scored in a dichotomous yes/no format. Each item is considered individually, that is, items are not combined to form an index score.	3 articles [92, 117, 164] (3 studies)
Parahoo Measure	Parahoo [79]	Developed for nurses. Measure research use with three single items. The three items are: (1) frequency of use of research in clinical practice; (2) implementation of new research findings in one's own practice in the last two years; and (3) list up to three research findings that they have implemented in the last two years.	Item 1: scored on a 5-point frequency scale from never to all the time) Item 2: scored dichotomously as yes/no Item 3: open-ended	7 articles [5, 79, 118-122] (3 studies)

Instrument Class	Index Citation	Description	Response scale	Number of articles [citation number] (number of studies)
Estabrooks' Kinds of Research Use	Estabrooks [15]	Developed for nurses. Measures research use with single items that tap four kinds of research use: instrumental (or direct), conceptual (or indirect), persuasive, and overall. Each item is preceded by a definition of the kind of research use and examples of that kind of research use. For each kind of research use, respondents are asked to indicate, over the past year, how often they have used research in this way. The items are treated individually (i.e., they are not combined to form an index)	Items are scored on a 7-point (from never to nearly every shift with 5=on about half of the shifts) or 4-point (from never to nearly every work day with 3 = on about half of my work days) scale depending on the study.	10 articles [15, 50, 93-97, 101, 107, 113] (8 studies)
Other Single Item Measures	NA	Developed for different types of healthcare professionals (depending on the target population of the study). Measures research use with a single-item developed for that study, and not used by others in subsequent studies.	A variety of scoring methods are used depending on the study ranging from different frequency scales, likert agreement scales, dichotomous yes/no scales, and open-ended responses.	39 articles [47-49, 51, 63-75, 77, 78, 80, 83, 84, 110, 114, 115, 165-178] (39 studies)

Table 2-5. Reliability of Research Utilization Instruments (N=14 of 60 instruments)

Instrument Class	Source (First author, year)	Reliability		
		Internal consistency	Stability	Inter-rater
Nurses Practice Questionnaire	Brett, 1987; Brett, 1989	α=0.95	r=0.83	
	Barta, 1995	α=0.74		
	Berggren, 1996	α=0.68		
	Coyle, 1990	α=0.91		
	Michel, 1995	α=0.85		
	Rodgers, 2000; Rodgers, 2000	α=0.63		
	Rutledge, 1996	α=0.75		
	Squires, 2007	α=0.82		
	Thompson, 1997	α=0.89	r=0.99	
Specific Practices Indices	Varcoe, 1995	α=0.87		
Research Utilization Questionnaire	Champion, 1989	α=0.92		
	Bostrom, 2006; Bostrom, 2007	α=0.88		
	Bostrom, 2008	α=0.84		
	Hansen, 1999	α≥0.79		
	McCloskey, 2005; McCloskey, 2008	α=0.93		
	Nash, 2005	α=0.92		
	Ohrn, 2005	α=0.86		
	Prin, 1997	α=0.94		
	Tranmer, 2002	α=0.93		
Edmonton Research Orientation Survey	Henderson, 2006	α=0.89		
	McCleary, 2002; McCleary, 2003	α=0.87		
	McCleary, 2002	α=0.83		
Knott and Wildvasky	Belkhodja, 2007	α=0.87		
General Research Utilization Indices (Each study represents a separate	Forbes, 1997	α=0.78		
	Kamwendo, 2002	α=0.73		
	Karlsson, 2007	α=0.80		

Instrument Class	Source (First author, year)	Reliability		
		Internal consistency	Stability	Inter-rater
instrument)	Morrow, 1986	α=0.73		
	Pelz, 1981	α=0.87		
	Reynolds, 1981	α=0.86		
	Stiefel, 1996	α=0.94	r=0.88	
	Varcoe, 1995	α=0.87		
Other Single Items	Pain, 2004			r=0.80 – 0.91

Table 2-6. Level 1 Instruments (3 validity sources), N=6 instruments

Instrument Class	Source (First author, year)	Participants/ Setting/ Country	Validity			
			Content	Response processes	Internal structure	Relations
Specific Practices Indices	Varcoe, 1995	Nurses/Hospitals/Canada	√	√		√
General Research Utilization Indices (Each represents a separate instrument)	Reynolds, 1981	Nurses/Hospitals/USA	√	√		√
	Stiefel, 1996	Nurses/Hospitals/USA	√		√	√
	Varcoe, 1995	Nurses/Hospitals/Canada	√	√		√
Other Single Items (Each represents a separate instrument)	Dobbins, 2001	Leaders/ Community/ Canada	√	√	NA	√
	Suter et al., 2007	Allied/Variety/Canada	√	√	NA	√

Table 2-7. Level 2 Instruments (2 validity sources), N=16 instruments

Instrument Class	Source (First author, year)	Participants/ Setting/ Country	Validity			
			Content	Response processes	Internal structure	Relations
Nurses Practice Questionnaire	Brett, 1987 Brett, 1989	Nurses/ Hospitals/ USA	√			√
	Barta, 1995	Nurses/ Education/USA	√			
	Berggren, 1996	Nurses/Variety/Sweden	√			√
	Coyle, 1990	Nurses/Hospitals/USA	√			√
	Michel, 1995	Nurses/Hospitals/USA	√			√
	Rodgers, 2000 Rodgers, 2000	Nurses/Hospitals/UK	√	√		√
	Rutledge, 1996	Nurses/Variety/USA	√			√
	Squires, 2007	Nurses/Hospitals/Canada	√			√
	Thompson, 1997	Nurses/Hospitals/USA	√			
Knott and Wildvasky	Belkhodja, 2007	Leaders/Variety/Canada	√			√
General Research Utilization Indices (Each represents a separate instrument)	Forbes, 1997	Nurses/Hospitals/USA			√	√
	Grasso, 1989	Allied/Community/USA	√			√
	Kamwendo, 2002	Allied/Variety/Sweden		√		√
	Rardin, 1986	Allied/Not Reported/USA		√		√
Specific Practices Indices (Each represents a separate instrument)	Knudsen, 2004	Leaders/Community/USA	√			√
	Tita, 2005 Tita, 2006	Multiple Clinical Staff/ Hospitals/ Africa		√		√
Estabrooks	Estabrooks, 1999a Estabrooks, 1999b	Nurses/Variety/Canada	√	√	NA	√
	Kenny, 2005	Nurses/Hospitals/USA			NA	√
	Estabrooks, 2007	Nurses/Hospitals/USA, Canada			NA	√
	Estabrooks, 2008 Profetto-McGrath, 2003	Nurses/Hospitals/Canada		√	NA	

Instrument Class	Source (First author, year)	Participants/ Setting/ Country	Validity			
			Content	Response processes	Internal structure	Relations
	Cobban, 2008	Allied/Variety/Canada		√	NA	
	Connor, 2006	Nurses/Long-term Care/USA		√	NA	√
	Milner, 2005	Nurses/Variety/Canada			NA	√
	Profetto-McGrath, 2008	Nurse Educators/ Variety/ Canada			NA	
Parahoo	Parahoo, 1998 Parahoo, 1999a Parahoo, 1999b Parahoo, 2000 Parahoo, 2001	Nurses/Hospitals/UK	√	√	NA	
	Valizadeh, 2003	Nurses/Hospitals/Iran			NA	
	Veeramah, 2004	Nurses/Variety/UK	√	√	NA	
Other Single Items (Each represents a separate instrument)	Elliott, 2008	Allied/Variety/UK	√		NA	√
	Ofi, 2008	Nurses/Hospitals/Nigeria	√		NA	√
	Olade, 2004	Nurses/Variety/USA	√	√	NA	
	Pepler, 2005	Nurses/Hospitals/Canada		√	NA	√
	Stetler, 1991	Nurses/Hospitals/USA	√	√	NA	
	Tsai, 2000	Nurses/Hospitals/Taiwan	√	√	NA	

Table 2-8. Level 3 Instruments (1 validity source), N=26 instruments

Instrument Class	Source (First author, year)	Participants/ Setting/ Country	Validity			
			Content	Response processes	Internal structure	Relations with other variables
Research Utilization Questionnaire	Champion, 1989	Nurses/Hospitals/USA	√			√
	Bostrom, 2006 Bostrom, 2007	Multiple Clinical Staff/ Long-Term Care/ Sweden				√
	Bostrom, 2008	Nurses/ Long-Term Care/ Sweden				√
	Hansen, 1999	Multiple Clinical Staff/ Variety/ USA				√
	Hatcher, 1997	Nurses/Hospitals/Canada				√
	Humphris, 1999	Nurses/Hospitals/UK				√
	Humphris, 2000	Nurses/Hospitals/UK				
	Lacey, 1994	Nurses/Hospitals/UK		√		
	McCloskey, 2005 McCloskey, 2008	Nurses/Hospitals/USA				√
	Nash, 2005	Nurses/Variety/USA				√
	Ohrn, 2005	Allied/Variety/Sweden				√
	Prin, 1997	Nurses/Hospitals/USA	√			√
	Tranmer, 2002	Nurses/Hospitals/Canada				√
	Wallin, 2003	Nurses/Variety/Sweden				
Edmonton Research Orientation Survey	Pain, 1996	Allied/Hospitals/Canada	√			
	Bonner, 2008	Nurses/Variety/Australia			√	√
	Henderson, 2006	Multiple Clinical Staff/ Hospitals/ Australia				
	McCleary, 2002 McCleary, 2003	Nurses/Hospitals/Canada				√
	McCleary, 2002	Allied/Hospitals/Canada				

Instrument Class	Source (First author, year)	Participants/ Setting/ Country	Validity			
			Content	Response processes	Internal structure	Relations with other variables
	Pain et al., 2004	Allied/Variety/Canada		√		
	Waine et al., 1997	Allied/Variety/Canada				
General Research Utilization Indices (Each represents a separate instrument)	Karlsson, 2007	Allied/Variety/Sweden				√
	Morrow, 1986	Allied/Variety/USA				√
	Pelz, 1981	Nurses/Hospitals/USA				√
Specific Practices Indices (Each represents a separate instrument)	Aron, 1990	Allied/Variety/USA	√			
Past, Present, Future Use	Brown, 1997	Nurses/Variety/USA			NA	√
	Butler, 1995	Nurses/Hospitals/Canada			NA	√
	Wells, 1994	Nurses/Hospitals/USA			NA	√
Other Single Items (Each represents a separate instrument)	Barwick, 2008	Leaders/ Community/ Canada	√		NA	
	Callen, 2006	Physicians/Variety/ Australia	√		NA	
	Cameron, 2005	Allied/Variety/USA	√		NA	
	Erler, 2000	Nurses/Flight Team/USA			NA	√
	Kirk, 1976	Allied/Variety/USA			NA	√
	Logsdon, 1998	Nurses/Variety/USA	√		NA	
	Meehan, 1988	Leaders/ Variety/ USA		√	NA	
	Miller, 2007	Allied/Community/USA	√		NA	
	Molassiotis, 1997	Allied/Hospitals/Europe		√	NA	
	Nelson, 2007	Multiple Clinical Staff/ Variety/ USA			NA	√
	Oliveri, 2004	Physicians/Hospitals/ Denmark			NA	√
	Pain, 2004	Allied/Variety/Canada		√	NA	

Instrument Class	Source (First author, year)	Participants/ Setting/ Country	Validity			
			Content	Response processes	Internal structure	Relations with other variables
	Pettengill, 1994	Nurses/Hospitals/USA	√		NA	
	Sekerak, 1992	Allied/Variety/USA	√		NA	
	Sweetland, 2001	Allied/Variety/UK	√		NA	
	Tsai, 2003	Nurses/Hospitals/Taiwan		√	NA	
	Veeramah, 1995	Nurses/Variety/UK		√	NA	
	Wood, 1996	Physicians/Variety/USA		√	NA	
	Wright, 1996	Nurses/Variety/Australia	√		NA	

Table 2-9. Level 1 Summary

Author, Year	Instrument Class	Instrument Details	Sample and Setting	Validity Assessment	
				Supporting Evidence	Comments
Varcoe and Hilton [76]	Specific Practice Indices	Use of 10 specific research practices. Sample practices include: • IM injection • Catheter removal • Sensory information/ diagnostic Each practice was scored on a 3 pt scale: never (1), sometimes (2), always (3) or 'not applicable'. A mean score based on the ten practices was then calculated.	Population: Nurses Country: Canada Setting: Hospitals	Content: Instrument assessed by an expert panel Response processes: a pilot test was conducted with the larger survey (of which the research utilization index was one component). Relations to other variables: correlations with other variables were reported that support theory and prior empirical research (e.g., with supportive climate and infrastructure)	Content: Unknown whether content assessment was on the specific research-based practices, the question pertaining to use that followed each practice, or both. A high quality assessment of content would include both.
Varcoe and Hilton [76]	General Research Utilization	Research use index contains 10 general statements on research use. Sample items include:	Population: Nurses Country: Canada	Content: Instrument assessed by a peer panel Response processes: a pilot	Content: Process or findings of the content assessment not reported.

Author, Year	Instrument Class	Instrument Details	Sample and Setting	Validity Assessment	
				Supporting Evidence	Comments
	Indices	• Communicating concerns about the effectiveness of practices to colleagues • Use of research articles to support questioning practice • Identification of hospital policies based on research Each item is scored on a 4-point scale from not at all to always. Item scores are then summed for an index score (10-40).	Setting: Hospitals	test was conducted with the larger survey (of which the research utilization index was one component). Relations to other variables: Nonsignificant correlations (as predicted) with other variables (education and valuing research), which support past empirical reviews.	
Reynolds [46]	General Research Utilization Indices	Research use index consists of 5 items focusing on the extent to which respondents participate in research activities. Sample items include: • Reviewed research literature in an effort to identify new knowledge for use in your practice • Evaluated a research study to determine its value for practice Each item is asked with respect to	Population: Nurses Country: USA Setting: Hospitals	Content: Development of the research utilization index was based on a set of five rules (See Additional File 2-4). Response processes: a small pretest was conducted with the larger survey (of which the research utilization index was one component). Relations to other variables: Covariance analysis reported. Several variables were shown to be nonsignificant	

Author, Year	Instrument Class	Instrument Details	Sample and Setting	Validity Assessment	
				Supporting Evidence	**Comments**
		the past year and is scored on a 4-point scale: 0, 1, 2-4, 5 or more times**.** Mean of the items are then taken as a measure of research utilization.		as predicted, for example, professionalism.	
Stiefel [62]	General Research Utilization Indices	Research use index consists of 18 items measuring respondents' reported participation in nursing research utilization activities. Sample items include: • I read nursing research articles and learn about research-based nursing interventions. • I attend conferences/ educational programs and learn about research-based nursing interventions Each item is scored on a 5-point scale from never to always. Item scores are then summed for an index score (18-90).	Population: Nurses Country: USA Setting: Hospitals	Content: A panel of four experts on research use by nurses assessed the index. Reasons for selecting each panel member were reported, illustrating the appropriateness of the selection. Internal structure: Factor analysis was conducted; findings revealed a 3-factor solution. Relations to other variables: A significant association between specialty (working in critical care settings) and research use was reported (as predicted).	Content: Findings from the content assessment were not reported. Internal structure: The 18 items were combined to compute one derived research utilization score (but factor analysis revealed 3 factors and thus supported three scores).
Dobbins' [77]	Other Single-	5 single items asking respondents (decision-makers) whether they have used 5 specific systematic	Population: Decision-Makers	Content: The research utilization item, which was a component of a larger	All applicable sources of validity evidence reported

Author, Year	Instrument Class	Instrument Details	Sample and Setting	Validity Assessment	
				Supporting Evidence	**Comments**
	Items	reviews in the past two years to make a program-related decision. All 5 items are scored as yes or no. Each item is analyzed separately.	Country: Canada Setting: Community	survey, was developed based on a review of research utilization literature, suggesting content validity evidence. Response processes: a pilot test was conducted with the larger survey (of which the research utilization item was one component). Relations to other variables: correlations with other variables, for example, perception that the systematic reviews are easy to use.	
Suter [78]	Other Single-Items	A single item asking respondents whether they have applied research to their practice. Scored on a 4-point Likert scale: never, rarely, sometimes, always	Population: Allied Health Professionals Country: Canada Setting: Variety of settings	Content: An expert panel assessed the research utilization item, which was a component of a larger survey. Response processes: A pilot test was conducted with the larger survey (of which the research utilization item was	All applicable sources of validity evidence reported. Content: The composition of the panel, process undertaken, or related findings were not reported.

Author, Year	Instrument Class	Instrument Details	Sample and Setting	Validity Assessment	
				Supporting Evidence	**Comments**
				one component). Relations to other variables: a significant association with attitude towards research (as predicted).	

Additional File 2-1. **Included Articles (N=108)**

Included Articles
Aron, J. (1990). The utilization of psychotherapy research on depression by clinical psychologists. Dissertation. Faculty of Auburn University, Alabama.
Barta, K. M. (1995). Information-seeking, research utilization, and barriers to research utilization of pediatric nurse educators. *Journal of Professional Nursing*, 11(1), 49-57.
Barwick, M. A., et al. (2008). Research utilization among children's mental health providers. *Implementation Science, 3*, 19.
Belkhodja, O., et al. (2007). The extent and organizational determinants of research utilization in Canadian health services organizations. *Science Communication, 28*(3), 377-417.
Berggren, A. (1996). Swedish midwives' awareness of, attitudes to and use of selected research findings. *Journal of Advanced Nursing*, 23(3), 462-470
Bjorkenheim, J. (2007). Knowledge and social work in health care - the case of Finland. *Social Work in Health Care, 44*(3), 261-278.
Bonner, A., & Sando, J. (2008). Examining the knowledge, attitude and use of research by nurses. *Journal of Nursing Management, 16*(3), 334-343.
Bostrom, A. M., Kajermo, K. N., Nordstrom, G., & Wallin, L. (2008). Barriers to research utilization and research use among registered nurses working in the care of older people: Does the BARRIERS Scale discriminate between research users and non-research users on perceptions of barriers? *Implementation Science, 3*(1).
Bostrom, A. M., Wallin, L., & Nordstrom, G. (2007). Evidence-based practice and determinants of research use in elderly care in Sweden. *Journal of Evaluation in Clinical Practice, 13*(4), 665-673.
Bostrom, A., Wallin, L., & Nordstrom, G. (2006). Research use in the care of older people: a survey among healthcare staff. *International Journal of Older People Nursing*, 1(3), 131-140.
Brett, J. L. L. 1989. Organizational integrative mechanisms and adoption of innovations by nurses. *Nursing Research*, 38(2): 105-110.
Brett, J.L.L. 1987. Use of nursing practice research findings. *Nursing Research*, 36(6): 344-349.
Brown, D. S. (1997). Nursing education and nursing research utilization: is there a connection in clinical settings? *Journal of Continuing Education in Nursing*, 28(6), 258-62, 284-5.
Butler, L. (1995). Valuing research in clinical practice: A basis for developing a strategic plan for nursing research. *The Canadian Journal of Nursing Research*, 27(4), 33-49.
Callen, J. L., Fennell, K., & McIntosh, J. H. (2006). Attitudes to, and use of, evidence-based medicine in two Sydney divisions of general practice. *Australian Journal of Primary Health, 12*(1), 40-46.
Cameron, K. A. V., Ballantyne, S., Kulbitsky, A., Margolis-Gal, M., Daugherty, T., & Ludwig, F. (2005). Utilization of evidence-based practice by registered occupational therapists. *Occupational Therapy International, 12*(3), 123-136.

Included Articles
Champion, V. L., & Leach, A. (1989). Variables related to research utilization in nursing: An empirical investigation. *Journal of Advanced Nursing*, 14(9), 705-710.
Cobban, S. J., & Profetto-McGrath, J. (2008). A pilot study of research utilization practices and critical thinking dispositions of Alberta dental hygienists. *International Journal of Dental Hygiene*, *6*(3), 229-237.
Connor, N. (2007). The relationship between organizational culture and research utilization practices among nursing home departmental staff. Masters thesis. Dalhousie University.
Coyle, L. A., & Sokop, A. G. (1990). Innovation adoption behavior among nurses. *Nursing Research*, 39(3), 176-180.
Dobbins, M., Cockerill, R., & Barnsley, J. (2001). Factors affecting the utilization of systematic reviews - A study of public health decision makers. *International Journal of Technology Assessment in Health Care*, 17(2), 203-214.
Dysart, A. M., & Tomlin, G. S. (2002). Factors related to evidence-based practice among US occupational therapy clinicians. *American Journal of Occupational Therapy*, 56(3), 275-284.
Elliott, V., Wilson, S. E., Svensson, J., & Brennan, P. (2008). Research utilisation in sonographic practice: Attitudes and barriers. *Radiography*. doi:10.1016/j.radi.2008.06.003
Erler, C. J., Fiege, A. B., & Thompson, C. B. (2000). Flight nurse research activities. *Air Medical Journal*, *19*(1), 13-18.
Ersser, S. J., Plauntz, L., Sibley, A., Ersser, S. J., Plauntz, L., & Sibley, A. (2008). Research activity and evidence-based practice within DNA: a survey. *Dermatology Nursing, 20*(3), 189-194.
Estabrooks CA, Kenny DJ, Adewale AJ, Cummings GG & Mallidou AA. (2007). A comparison of research utilization among nurses working in Canadian civilian and United States army healthcare settings. *Research in Nursing & Health*, 30, 282-296.
Estabrooks, C. A. (1999a). The conceptual structure of research utilization. *Research in Nursing & Health*, 22(3), 203-216.
Estabrooks, C. A. (1999b). Modeling the individual determinants of research utilization. *Western Journal of Nursing Research*, 21(6), 758-772.
Estabrooks, C.A., Et al. (2008). Patterns of research utilization on patient care units. *Implementation Science*, *3*:31.
Forbes, S. A., Bott, M. J., & Taunton, R. L. (1997). Control over nursing practice: A construct coming of age. *Journal of Nursing Measurement*, 5(2), 179-190
Grasso, A. J., Epstein, I., & Tripodi, T. (1988). Agency-based research utilization in a residential child-care setting. *Administration in Social Work*, 12(4), 61-80.
Hansen, H. E., Biros, M. H., Delaney, N. M., & Schug, V. L. (1999). Research utilization and interdisciplinary collaboration in emergency care. *Academic Emergency Medicine*, 6(4), 271-279.
Hatcher, S., & Tranmer, J. (1997). A survey of variables related to research utilization in nursing practice in the acute care setting. *Canadian Journal of Nursing Administration*, 10(3), 31-53.

Included Articles
Heathfield, A. D. M. (2000). Research utilization in hand therapy practice using a world wide web survey design. Masters thesis. Grand Valley State University.
Henderson, A., Winch, S., Holzhauser, K., & De Vries, S. (2006). The motivation of health professionals to explore research evidence in their practice: an intervention study. *Journal of Clinical Nursing, 15*(12), 1559-1564.
Humphris, D., Hamilton, S., O'Halloran, P., Fisher, S., & Littlejohns, P. 1999. Do diabetes nurse specialists utilize research evidence? *Practical Diabetes International* 16(2): 47-50.
Humphris, D., Littlejohns, P., Victor, C., O'Halloran, P., & Peacock, J. (2000). Implementing evidence-based practice: factors that influence the use of research evidence by occupational therapists. *British Journal of Occupational Therapy, 63*(11), 516-222.
Kamwendo, K. (2002). What do Swedish physiotherapists feel about research? A survey of perceptions, attitudes, intentions and engagement. *Physiotherapy Research International, 7*(1), 23-34.
Karlsson, U., & Tornquist, K. (2007). What do Swedish occupational therapists feel about research? A survey of perceptions, attitudes, intentions, and engagement. *Scandinavian Journal of Occupational Therapy, 14*(4), 221-229.
Kelly, K. A. (2008). Translating research into practice: The physicians' perspective. Unpublished Ph.D., State University of New York at Albany, United States -- New York.
Kenny, D. J. (2005). Nurses' use of research in practice at three US army hospitals. *Canadian Journal of Nursing Leadership*, 18(3), 45-67.
Kirk, S.A., Osmalov, M.J., & Fischer, J. (1976). Social workers involvement in research. *Social Work*, 21, 121-124.
Knudsen, H. K., & Roman, P. M. (2004). Modeling the use of innovations in private treatment organizations: The role of absorptive capacity. *Journal of Substance Abuse Treatment, 26*(1), 353-361.
Lacey, E. A. (1994). Research utilization in nursing practice - a pilot-study. *Journal of Advanced Nursing*, 19(5), 987-995.
Logsdon, C., Davis, D. W., Hawkins, B., Parker, B., & Peden, A. (1998). Factors related to research utilization by registered nurses in Kentucky. *Kentucky Nurse*, 46(1), 23-26.
McCleary, L., & Brown, G. T. (2002). Research utilization among pediatric health professionals. *Nursing & Health Sciences,* 4(4), 163-171
McCleary, L., & Brown, G. T. (2002). Use of the Edmonton research orientation scale with nurses. *Journal of Nursing Measurement*, 10(3), 263-275.
McCleary, L., & Brown, G. T. (2003). Association between nurses' education about research and their research use. *Nurse Education Today*, 23(8), 556-565.
McCloskey, D. J. (2005). The relationship between organizational factors and nurse factors affecting the conduct and utilization of nursing research. (Ph.D thesis, George Mason University).

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McCloskey, D. J., (2008). Nurses' perceptions of research utilization in a corporate health care system.*Journal of Nursing Scholarship, 40*(1), 39-45.
Meehan, S. M. S. (1988). An exploratory study of research management programs: Enhancing use of health services research results in health care organizations. (Volumes I and II). (Ph.D. thesis, The George Washington University).
Michel, Y., & Sneed, N. V. (1995). Dissemination and use of research findings in nursing practice. *Journal of Professional Nursing*, 11(5), 306-311.
Miller, J. P. (2007). Speech-language pathologists' use of evidence-based practice in assessing children and adolescents with cognitive-communicative disabilities: a survey.Masters Thesis. Eastern Washington University.
Milner, F. M., Estabrooks, C. A., & Humphrey, C. (2005). Clinical nurse educators as agents for change: Increasing research utilization. *International Journal of Nursing Studies*, 42(8), 899-914.
Molassiotis, A. (1997). Nursing research within bone marrow transplantation in Europe: an evaluation. *European Journal of Cancer Care*, 6(4), 257-261.
Morrow-Bradley, C. et al. (1986). Utilization of psychotherapy research by practicing psychotherapists. *American Psychologist*, 41(2), 188-197.
Mukohara, K. (2005). Electronic delivery of research summaries for academic generalist doctors: A randomised trial of an educational intervention, *Medical Education*, *39*(4), 402-409.
Nash, M. A. (2005). Research utilization among Idaho nurses (MN thesis, Department of Nursing of Gonzaga University).
Nelson, T. D., & Steele, R. G. (2007). Predictors of practitioner self-reported use of evidence-based practices: Practitioner training, clinical setting, and attitudes toward research. *Administration and Policy in Mental Health and Mental Health Services Research*, *34*(4), 319-330.
Niederhauser, V. P., & Kohr, L. (2005). Research endeavors among pediatric nurse practitioners (REAP) study. *Journal of Pediatric Health Care*, 19(2), 80-89.
Ofi, B., Sowunmi, L., Edet, D., Anarado, N., Ofi, B., Sowunmi, L., et al. (2008). Professional nurses' opinion on research and research utilization for promoting quality nursing care in selected teaching hospitals in Nigeria. *International Journal of Nursing Practice*, *14*(3), 243-255.
Ohrn, K., Olsson, C., & Wallin, L. (2005). Research utilization among dental hygienists in Sweden--a national survey. *International Journal of Dental Hygiene*, 3(3), 104-111.
Olade, R. A. (2004). Evidence-based practice and research utilization activities among rural nurses. *Journal of Nursing Scholarship*, 36(3), 220-225.
Oliveri, R. S., Gluud, C., Wille-Jorgensen, P. A., Oliveri, R. S., Gluud, C., & Wille-Jorgensen, P. A. (2004). Hospital doctors' self-rated skills in and use of evidence-based medicine - a questionnaire survey. *Journal of Evaluation in Clinical Practice*, *10*(2), 219-226.
Olympia, R. P., Khine, H., & Avner, J. R. (2005). The use of evidence-based medicine in the management of acutely ill children. *Pediatric Emergency Care*, 21(8), 518-522.

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Pain, K., Hagler, P., & Warren, S. (1996). Development of an instrument to evaluate the research orientation of clinical professionals. *Canadian Journal of Rehabilitation*, 9(2), 93-100.
Pain, K., Magill-Evans, J., Darrah, J., Hagler, P., & Warren, S. (2004). Effects of profession and facility type on research utilization by rehabilitation professionals. *Journal of Allied Health*, 33(1), 3-9.
Parahoo, K. (1998). Research utilization and research related activities of nurses in northern Ireland. *International Journal of Nursing Studies,* 35(5), 283-291.
Parahoo, K. (1999). A comparison of pre-project 2000 and project 2000 nurses' perceptions of their research training, research needs and of their use of research in clinical areas. *Journal of Advanced Nursing*, 29(1), 237-245.
Parahoo, K. (1999). Research utilization and attitudes towards research among psychiatric nurses in northern Ireland. *Journal of Psychiatric and Mental Health Nursing,* 6(2), 125-135.
Parahoo, K., & Mccaughan, E. M. (2001). Research utilization among medical and surgical nurses: A comparison of their self reports and perceptions of barriers and facilitators. *Journal of Nursing Management*, 9(1), 21-30.
Parahoo, K., Barr, O., & McCaughan, E. (2000). Research utilization and attitudes towards research among learning disability nurses in northern Ireland. *Journal of Advanced Nursing*, 31(3), 607-613.
Pelz, D.C., & Horsley, J.A. 1981. Measuring utilization of nursing research. In J. A. Ciarlo Editor, Utilizing evaluation: Concepts and measurement techniques. (pp. 125-49). Beverly Hills, CA: Sage.
Pepler, C. J., Edgar, L., Frisch, S., Rennick, J., Swidzinski, M., White, C., et al. (2005). Unit culture and research-based nursing practice in acute care. *Canadian Journal of Nursing Research*, 37(3), 66-85.
Pettengill MM, Gillies DA. Clark CC. (1994) Factors Encouraging and Discouraging the Use of Nursing Research Findings. *IMAGE: Journal of Nursing Scholarship*, 26, 2, 143-147.
Prin, P. L., & Mills, M. E. (1997). Nurses' MEDLINE usage and research utilization. *Studies in Health Technology & Informatics*, 46, 451-456.
Profetto-McGrath, J., Hesketh, K. L., Lang, S., & Estabrooks, C. A. (2003). A study of critical thinking and research utilization among nurses. *Western Journal of Nursing Research*, 25(3), 322-337.
Profetto-McGrath, J., Smith, K. B., Hugo, K., Patel, A., & Dussault, B. (2009). Nurse educators' critical thinking dispositions and research utilization. *Nurse Education in Practice*. doi:10.1016/j.nepr.2008.06.003
Rardin, D. K. (1986). The mesh of research and practice: the effect of cognitive style on the use of research in the practice of psychotherapy. Unpublished Ph.D. thesis, University of Maryland College Park, United States -- Maryland.
Reynolds, m. I. A. (1981). An investigation of organizational factors affecting research utilization in nursing organizations (PhD Dissertation, University of Michigan)

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Rodgers, S. E. (2000). A study of utilization of research in practice and the influence of education. *Nurse Education Today*, 20(4), 279-287
Rodgers, S. E. (2000). The extent of nursing research utilization in general medical and surgical wards. *Journal of Advanced Nursing*, 32(1), 182-193.
Rutledge, D. N., Greene, P., Mooney, K., Nail, L. M., & Ropka, M. (1996). Use of research-based practices by oncology staff nurses. *Oncology Nursing Forum*, 23(8), 1235-1244.
Scott, I., Heyworth, R., & Fairweather, P. (2000). The use of evidence-based medicine in the practice of consultant physicians: Results of a questionnaire survey. *Australian and New Zealand Journal of Medicine, 30*(3), 319-326.
Sekerak, D. K. (1992). Characteristics of physical therapists and their work environments which foster the application of research in clinical practice. (Ph.D., The University of North Carolina at Chapel Hill).
Squires, J. E., Moralejo, D., Lefort, S. M. (2007). Exploring the role of organizational policies and procedures in promoting research utilization in registered nurses. *Implementation Science, 2*, 17.
Stetler, C. B., & DiMaggio, G. (1991). Research utilization among clinical nurse specialists. *Clinical Nurse Specialist*, 5(3), 151-155.
Stiefel, K. A. (1996). Career commitment, nursing unit culture, and nursing research utilization. (PH.D., University of South Carolina), 135. (UMI Order #PUZ9623126.)
Suter, E., Vanderheyden, L. C., Trojan, L. S., Verhoef, M. J., & Armitage, G. D. (2007). How important is research-based practice to chiropractors and massage therapists? *Journal of Manipulative and Physiological Therapeutics*, 30(2), 109-115.
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Thompson, C. J. (1997). Extent and factors related to research utilization among critical care nurses. *Critical Care Medicine*, 27(12 SUPPL.).
Tita, A. T. N., Selwyn, B. J., Waller, D. K., Kapadia, A. S., & Dongmo, S. (2005). Evidence-based reproductive health care in Cameroon: population-based study of awareness, use and barriers. *Bulletin of the World Health Organization, 83*(12), 895-903.
Tita, A. T., Selwyn, B. J., Waller, D. K., Kapadia, A. S., Dongmo, S., & Tita, A. T. N. (2006). Factors associated with the awareness and practice of evidence-based obstetric care in an African setting. *BJOG: An International Journal of Obstetrics & Gynaecology, 113*(9), 1060-1066.
Tranmer, J. E., Lochhaus-Gerlach, J., & Lam, M. (2002). The effect of staff nurse participation in a clinical nursing research project on attitude towards, access to, support of and use of research in the acute care setting. *Canadian Journal of Nursing Leadership*, 15(1), 18-26.
Tsai, S. L. (2000). Nurses' participation and utilization of research in the republic of China. *International Journal of Nursing Studies*, 37(5), 435-444.
Tsai, S. L. (2003). The effects of a research utilization in-service program on nurses. *International Journal of Nursing Studies*, 40(2), 105-113.

Included Articles
Upton, D. (1999). Clinical effectiveness and EBP 3: application by health-care professionals. *British Journal of Therapy & Rehabilitation, 6*(2), 86-90.
Valizadeh, L., & Zamanzadeh, V. (2003). Research utilization and research attitudes among nurses working in teaching hospitals in Tabriz, Iran. *Journal of Clinical Nursing*, 12(6), 928-930.
Varcoe, C., & Hilton, A. (1995). Factors affecting acute-care nurses' use of research findings. *Canadian Journal of Nursing Research*, 27(4), 51-71
Veeramah, V. (1995). A study to identify the attitudes and needs of qualified staff concerning the use of research findings in clinical practice within mental health care settings. *Journal of Advanced Nursing*, 22(5), 855-861.
Veeramah, V. (2004). Utilization of research findings by graduate nurses and midwives. *Journal of Advanced Nursing*, 47(2), 183-191.
Veeramah, V. (2007). The use of research findings in nursing practice. *Nursing Times*, *103*(1), 32-33.
Waine, M., Magill-Evans, J., & Pain, K. 1997 Alberta occupational therapists' perspectives on and participation in research. *Canadian Journal of Occupational Therapy 64(2):* 82-88.
Walczak, J. R., McGuire, D. B., Haisfield, M. E., & Beezley, A. (1994). A survey of research-related activities and perceived barriers to research utilization among professional oncology nurses. *Oncology Nursing Forum*, 21(4), 710-715.
Wallin, L., Bostrom, A. M., Wikblad, K., & Ewald, U. (2003). Sustainability in changing clinical practice promotes evidence-based nursing care. *Journal of Advanced Nursing*, 41(5), 509-518.
Wells, N., & Baggs, J. G. (1994). A survey of practicing nurses' research interests and activities. *Clinical Nurse Specialist: The Journal for Advanced Nursing Practice, 8*(3), 145-151.
Wood, C. K. (1996). *Adoption of innovations in a medical community: The case of evidence-based medicine.* Unpublished PhD thesis. University of Hawaii, United States
Wright, A., Brown, P., & Sloman, R. (1996). Nurses' perceptions of the value of nursing research for practice. *Australian Journal of Advanced Nursing*, 13(4), 15-18.

Additional File 2-2. Exclusion List by Reason (N=393)

Citation	Exclusion reason
Steenrod, S. A. (2004). The use of evidence-based practices in substance abuse treatment programs. *Journal of Evidence-Based Social Work, 1*(4), 33-51.	Guideline adherence
Crane, J. (1989). Factors associated with the use of research-based knowledge in nursing (Dissertation)	Guideline adherence (use of CURN protocols)
Kreuger J. C. (1982). A survey of research utilization in community health nursing... using research in practice. Western journal of nursing research, 4, 244-248.	Guideline adherence (use of CURN protocols)
LoftusHills, A., & Duff, L. (1997). Implementation of nutrition standards for older adults. Nursing Standard, 11(44), 33-37.	Guideline adherence
Alerany, C., Campany, D., Monterde, J., & Semeraro, C. (2005). Impact of local guidelines and an integrated dispensing system on antibiotic prophylaxis quality in a surgical centre. Journal of Hospital Infection, 60(2), 111-117.	Guideline adherence
Bradley, et al. (2006). Implementation of evidence-based alcohol screening in the VHA. *The American Journal of Managed Care, 12*(10), 597-606.	Guideline adherence
Brehaut, J. C., Stiell, I. G., & Graham, I. D. (2006). Will a new clinical decision research rule be widely used? The case of the Canadian c-spine research rule. Academic Emergency Medicine, 13(4), 413-420.	Guideline adherence
Burkoski, V. (2002). Infant sleep position: Nurses' awareness and practice of the Canadian joint statement recommendation. (M.Sc., University of Windsor (Canada).	Guideline adherence
Crawford, V. L., McPeake, B., & Stout, R. W. (1995). Diagnostic regimes for urinary tract infection--are research results applied to practice? Ulster Medical Journal, 64(2), 131-136.	Guideline adherence
Delnevo, C. D. et al. (2000). Injury-prevention counseling among residents of internal medicine. *American Journal of Preventive Medicine*, 19(1), 63-65.	Guideline adherence
Friedman, J.R. (1984). The acceptance of national dietary recommendations by nutrition educators as related to their use of professional sources of information and to their professional and personal characteristics (diffusion innovations), New York: New York University (Thesis)	Guideline adherence
Graham, I. D., Stiell, I. G., Laupacis, A., McAuley, L., Howell, M., Clancy, M., et al. (2001). Awareness and use of the Ottawa Ankle and Knee Research Rules in 5 countries: can publication alone be enough to change practice? Annals of Emergency Medicine, 37(3), 259-266.	Guideline adherence
Hill, M.N (1986). Diffusion of 1984 hypertension consensus recommendations among clinicians, Maryland: the John Hopkins	Guideline adherence

Citation	Exclusion reason
University (Thesis).	
Johnson, F. E., & Maikler, V. E. (2001). Nurses' adoption of the AWHONN/NANN neonatal skin care project. Newborn and Infant Nursing Reviews, 1(1), 59-67.	Guideline adherence
Kinsman, L., & James, E. L. (2001). Evidence-based practice needs evidence-based implementation. Lippincott's Case Management, 6(5), 208-216.	Guideline adherence
Knaus, R., Ramsden, V. R., Reeder, Shuaib, A., Pancyr, G., Ding, Y., et al. (1996). Innovations in continuing education. We audit our own charts, thank you! Journal of Continuing Education in the Health Professions, 16(2), 117-124.	Guideline adherence
Kothari, A., Birch, S., & Charles, C. (2005). "Interaction" and research utilisation in health policies and programs: Does it work? Health Policy, 71(1), 117-125.	Guideline adherence
Lia-Hoagberg, B., Schaffer, M., & Strohschein, S. (1999). Public health nursing practice guidelines: An evaluation of dissemination and use. Public Health Nursing, 16(6), 397-404.	Guideline adherence
Manes, G., Mosca, S., Balzano, A., Amitrano, L., Bove, A., de Nucci, C., et al. (2001). Diffusion of knowledge about Helicobacter pylori as assessed in an open-access endoscopy system: a prospective observational study based on the Maastricht guidelines. Digestive Diseases, 19(2), 158-163.	Guideline adherence
McGlynn, E. A., Asch, S. M., Adams, J., Keesey, J., Hicks, J., DeCristofaro, A., & Kerr, E. A. (2003). The quality of health care delivered to adults in the United States. The New England Journal of Medicine, 348(26), 2635-2645.	Guideline adherence
McPhee, S. J., & Bird, J. A. (1990). Implementation of cancer prevention guidelines in clinical practice. Journal of General Internal Medicine, 5(5 Suppl), S116-22.	Guideline adherence
Mehta, R. R. (2002). The implementation of new treatment guidelines in asthma in a social system by health care providers: An application of the diffusion theory, Idaho State University (Thesis).	Guideline adherence
Mesters, I., & Meertens, R. M. (1999). Monitoring the dissemination of an educational protocol on pediatric asthma in family practice: A test of associations between dissemination variables. Health Education & Behavior, 26(1), 103-120.	Guideline adherence
Miller, E. H., Belgrade, M. J., Cook, M., Portu, J. B., Shepherd, M., Sierzant, T., et al. (1999). Institution-wide pain management improvement through the use of evidence-based content, strategies, resources, and outcomes. Quality Management in Healthcare, 7(2), 28-40.	Guideline adherence
Montgomery, L. A., Hanrahan, K., Kottman, K., Otto, A., Barrett, T., & Hermiston, B. (1999). Guideline for i.v. infiltrations in pediatric	Guideline adherence

Citation	Exclusion reason
patients. Pediatric nursing, 25(2), 167-169.	
O'Connor et al. (1999) Geographic variation in the treatment of acute myocardial infarction. Jama, 281(7), 627-633.	Guideline adherence
Pratt, C. N. U., Paone, D., Carter, R. J., & Layton, M. C. (2002). Hepatitis C screening and management practices: a survey of research use treatment and syringe exchange programs in New York City. American Journal of Public Health, 92(8), 1254-1256.	Guideline adherence
Rahimian, A., Driscoll, M., & Taylor, D. (1998). The maternal and child health sites' practices regarding HIV education, counseling, and testing of women of reproductive age in Chicago: barriers to universal implementation. Maternal and child health journal, 2(1), 35-44.	Guideline adherence
Redfern et al. 2000. Evaluation of change in practice: South Thames Evidence-based Practice Project (STEP). Executive summary. ***Referenced by Titler 2004***	Guideline adherence
Ring, N., Coull, A., Howie, C., Murphy-Black, T., & Watterson, A. (2006). Analysis of the impact of a national initiative to promote evidence-based nursing practice. International journal of nursing practice, 12(4), 232-240.	Guideline adherence
Ring, N., Malcolm, C., Coull, A., Murphy-Black, T., & Watterson, A. (2005). Nursing best practice statements: an exploration of their implementation in clinical practice. Journal of clinical nursing, 14(9), 1048-1058.	Guideline adherence
Roghmann, M., Perdue, B. E., & Polish, L. (1999). Concise communications. Vancomycin use in a hospital with vancomycin restriction. Infection Control and Hospital Epidemiology, 20(1), 60-63.	Guideline adherence
Roila, F. (2004). Transferring scientific evidence to oncological practice: a trial on the impact of three different implementation strategies on antiemetic prescriptions. Supportive Care in Cancer, 12(6), 446-453.	Guideline adherence
Rosenthal, V. D., Guzman, S., & Safdar, N. (2004). Effect of education and performance feedback on rates of catheter-associated urinary tract infection in intensive care units in Argentina. Infection Control and Hospital Epidemiology, 25(1), 47-50.	Guideline adherence
Rof, J., Mittendorf, T., Pirk, O., & Graf Von Der Schulenburg, J.M. (2002). Diffusion of innovations: Treatment of Alzheimer's disease in Germany. Health Policy, 60(1), 59-66.	Guideline adherence
Shah, S. S., Sinkowitz-Cochran, R. L., Keyserling, H. L., & Jarvis, W. R. (1999). Vancomycin use in pediatric neurosurgery patients. American Journal of Infection Control, 27(6), 482-487.	Guideline adherence

Citation	Exclusion reason
Sheehan, A. K., Walrath, C. M., & Holden, E. W. (2007). Evidence-based practice use, training and implementation in the community-based service setting: A survey of children's mental health service providers. *Journal of Child and Family Studies*, *16*(2), 169-182.	Guideline adherence
Specht, J. P., Bergquist, S., & Frantz, R. A. (1995). Adoption of a research-based practice for treatment of pressure ulcers. Nursing Clinics of North America, 30(3), 553.	Guideline adherence
Sproat, L. J., & Inglis, T. J. (1994). A multicentre survey of hand hygiene practice in intensive care units. Journal of Hospital Infection, 26(2), 137-148.	Guideline adherence
Valenstein, M., McCarthy, J. F., Austin, K. L., Greden, J. F., Young, E. A., & Blow, F. C. (2006). What happened to lithium? Antidepressant augmentation in clinical settings. American Journal of Psychiatry, 163(7), 1219-1225.	Guideline adherence
Valente, S. M. (2005). Evaluation of innovative research-based fact sheets. Journal for Nurses in Staff Development, 21(4), 171-176.	Guideline adherence
Wakefield, B., Johnson, J. A., Kron-Chalupa, J., & Paulsen, L. (1998). A research-based guideline for appropriate use of transdermal fentanyl to treat chronic pain. Oncology nursing forum, 25(9), 1505-1513.	Guideline adherence
Weilburg, J. B., O'Leary, K. M., Meigs, J. B., Hennen, J., & Stafford, R. S. (2003). Evaluation of the adequacy of outpatient antidepressant treatment. Psychiatric Services, 54(9), 1233-1239.	Guideline adherence
Williams. A lack of motivation... infection control measures. Source: Nursing times [0954-7762] yr:1988 vol:84 iss:22 pg:60 -64	Guideline adherence
Won, S., Chou, H., Hsieh, W., Chen, C., Huang, S., Tsou, K., et al. (2004). Handwashing program for the prevention of nosocomial infections in a neonatal intensive care unit. Infection Control and Hospital Epidemiology, 25(9), 742-746.	Guideline adherence
Madhok, R., Thomson, R. G., Mordue, A., Mendelow, A. D., & Barker, J. (1993). An audit of distribution and use of guidelines for management of head injury. Quality in Health Care, 2(1), 27-30.	Guideline adherence
Bahtsevani, C., Khalaf, A., Willman, A., Bahtsevani, C., Khalaf, A., & Willman, A. (2005). Evaluating psychiatric nurses' awareness of evidence-based nursing publications. [Clinical Trial Research Support, Non-U.S. Gov't]. Worldviews on Evidence-Based Nursing, 2(4), 196-206.	Guideline adherence
Bahtsevani, C., Willman, A., Khalaf, A., & OÌˆstman, M. (Writer) (2008). Developing an instrument for evaluating implementation of clinical practice guidelines: A test-retest study, *Journal of Evaluation in Clinical Practice*.	Guideline adherence

Citation	Exclusion reason
Hosoglu, S., Sunbul, M., Erol, S., Altinidis, M., Caylan, R., Demirdag, K., et al. (2003). A national survey of surgical antibiotic prophylaxis in Turkey. Infection Control and Hospital Epidemiology, 24(10), 758-761.	Guideline adherence
Chen, J., & Zhou, L. P. (2006). A survey of the application of evidence-based medicine in medical postgraduates. *Chinese Journal of Evidence-Based Medicine, 6*(8), 596-599.	Language: Chinese
Zhou, L. P., Chen, J., Ai, C. L., Liu, G. J., Li, J., Kang, D. Y., et al. (2007). Can training courses improve medical postgraduates' knowledge, skill, attitude and behavior related to evidence-based medicine? A before-and-after study. *Chinese Journal of Evidence-Based Medicine, 7*(5), 337-343.	Language: Chinese
Kalliomaki, T. (2002). Midwives as users of research-based knowledge in childbirth nursing Finnish. Sairaanhoitaja, 75(4), 14-17.	Language: Finnish
Perleth, M., Jakubowski, E., & Busse, R. (2000). ["Best practice" in health care--or why we need evidence-based medicine, guidelines and health technology assessment]. [English Abstract]. *Zeitschrift fur Arztliche Fortbildung und Qualitatssicheresearch useng, 94*(9), 741-744.	Language: German
Puschner, B., Vauth, R., Jacobi, F., & Becker, T. (2006). Evidence basis of psychotherapy for schizophrenia patients in Germany. [Review]. *Nervenarzt, 77*(11), 1301-+.	Language: German
Veith, A., Buchbinder, C., & Beelmann, A. (1998). Research orientation in psychotherapeutic postgraduate training programs and psychotherapeutic practice. Verhaltenstherapie, 8(4), 263-269.	Language: German
Oh, E. G., Oh, H. J., & Lee, Y. J. (2004). Nurses' research activities and barriers of research utilization. Taehan Kanho Hakhoe chi, 34(5), 838-848.	Language: Korean.
Bostrom A-M, Wallin L & Nordstrom G (2006) Research use in the care of older people: a survey among healthcare staff. International Journal of Older People Nursing 1, 131-140 (2006). International Journal of Older People Nursing, 1(4), 252-252. Erratum...	Not an instrument to measure research use. Not on development or use.
Youngstrom, L. H. (1996). Nursing staff development educators and research utilization. (D.N.SC., Widener University School of Nursing). (UMI Order #PUZ9709112.)	Not an instrument to measure research use. Not on development or use.
Barg, F. K., McCorkle, R., Robinson, K., Yasko, J. M., Jepson, C., & McKeehan, K. M. (1992). Gaps and contract - evaluating the diffusion of new information. Cancer nursing, 15(6), 401-405.	Not an instrument to measure research use. Not on development or use.
Bjorkstrom, M. E., & Hamrin, E. K. F. (2001). Swedish nurses' attitudes towards research and development within nursing. *Journal of Advanced Nursing, 34*(5), 706-714.	Not an instrument to measure research use. Not on development or

Citation	Exclusion reason
	use.
Ehrenfeld, M., & Eckerling, S. (1991). Perceptions and attitudes of registered nurses to research: a comparison with a previous study. *Journal of Advanced Nursing16,* 224-232.	Not an instrument to measure research use. Not on development or use.
Eckerling, S., Bergman, R., Bar-Tal, Y (1998). Perceptions and attitudes of academic nursing students to research. *Journal of Advanced Nursing, 13,* 759-767.	Not an instrument to measure research use. Not on development or use.
Eller, L. S., Kleber, E., & Wang, S. L. (2003). Research knowledge, attitudes and practices of health professionals. Nursing outlook, 51(4), 165-170.	Not an instrument to measure research use. Not on development or use.
Reed, J. H., & Jordan, G. (2007). Using systems theory and logic models to define integrated outcomes and performance measures in multi-program settings. *Research Evaluation, 16*(3), 169-181.	Not an instrument to measure research use. Not on development or use.
Richey Blythe and Berlin. 1987. Do social workers evaluate their practice? Social Work Research & Abstracts, 23, 14-20.	Not an instrument to measure research use. Not on development or use.
Welch 1983. Will graduates use single-case design to evaluate their casework practice? Journal of Education for Social Work, 19, 42-47.	Not an instrument to measure research use. Not on development or use.
Rangeley, H., & Arthurs, J. (2004). The long-term effects of undertaking a research course on clinical practice. Nurse Education in Practice, 4(1), 12-19.	Not an instrument to measure research use. Not on development or use.
Carlson, C. L., Plonczynski, D. J., Carlson, C. L., & Plonczynski, D. J. (2008). Has the BARRIERS Scale changed nursing practice? An integrative review. *Journal of Advanced Nursing, 63*(4), 322-333.	Not an instrument to measure research use. Not on development or use.
Craik, J., & Rappolt, S. (2006). Enhancing research utilization capacity through multifaceted professional development. American Journal of Occupational Therapy, 60(2), 155-164.	Not an instrument to measure research use. Not on development or use.
Hoffart, N., & Cobb, A. K. (2002). Assessing clinical pathways use in a community hospital: It depends on what "use" means. The Joint Commission journal on quality improvement, 28(4), 167-179.	Not an instrument to measure research use. Not on development or use.

Citation	Exclusion reason
Howell, S. L., Foster, R. L., Hester, N. O., Vojir, C. P., & Miller, K. L. (1996). Evaluating a pediatric pain management research utilization program. Canadian Journal of Nursing Research, 28(2), 37-57.	Not an instrument to measure research use. Not on development or use.
Schreiber, J., & Stern, P. (2005). A review of the literature on evidence-based practice in physical therapy. *Internet Journal of Allied Health Sciences & Practice, 3*(4), 17p.	Not an instrument to measure research use. Not on development or use.
Linde, B. J. (1989). The effectiveness of three interventions to increase research utilization among practicing nurses, The University of Michigan (Thesis).	Not an instrument to measure research use. Not on development or use.
Midodzi, W. K., Hayduk, L., Cummings, G. G., Estabrooks, C. A., & Wallin, L. (2007). An alternative approach to addressing missing indicators in parallel datasets: Research utilization as a phantom latent variable. *Nursing Research, 56*(4 SUPPL. 1).	Not an instrument to measure research use. Not on development or use of research.
Panagiotopoulou, K., & Kerr, S. M. (2002). Pressure area care: An exploration of Greek nurses' knowledge and practice. Journal of advanced nursing, 40(3), 285-296.	Not an instrument to measure research use. Not on development or use of research.
Peach, H. (2003). Should Australia's hospitals be reviewing the use of research in patient care by nurses, managers and allied health professionals? -- A systematic review of recent evidence. *Australian Health Review, 26*(2), 49-62.	Not an instrument to measure research use. Not on development or use of research.
Pennington, L. (2001). Attitudes to and use of research in speech and language therapy. British Journal of Therapy & Rehabilitation, 8(10), 375-6, 378-9.	Not an instrument to measure research use. Not on development or use of research.
Research utilization (2000). *Kentucky Nurse, 48*(3), 30-30.	Not an instrument to measure research use. Not on development or use of research.
Smith, T. J. (1997). An examination of the direct consequences and the individual characteristics influencing physician adoption of a practice guideline innovation. (D.B.A., Nova Southeastern University).	Not an instrument to measure research use. Not on development or use of research.
Thompson, C., McCaughan, D., Cullum, N., Sheldon, T., & Raynor, P. (2004). International research reviews. The potential for evidence based primary care nursing: clinical decisions and research information use by UK primary care nurses. *Hypothesis: Journal of the Research Section of MLA, 18*(1), 7-8.	Not an instrument to measure research use. Not on development or use of research.

Citation	Exclusion reason
Walker, A. E., Grimshaw, J., Johnston, M., Pitts, N., Steen, N., & Eccles, M. (2003). PRIME--Process modeling in Implementation research: selecting a theoretical basis for interventions to change clinical practice. BMC Health Services Research, 3(1), 22.	Not an instrument to measure research use. Not on development or use of research.
Farbstein, K., & Clough, J. (2001). Improving medication safety across a multihospital system. Joint Commission Journal on Quality Improvement, 27(3), 123-137. (245)	Not an instrument to measure research use. Not on development or use of research. Is about adherence to 16 selected practices to reduce medication errors but the research basis for these are not discussed.
Dorsey, M., Overman, P., Hayden, W. J., Mayberry, W., Requa-Clark, B., & Krust, K. (1991). Relationships among and demographic predictors of dentists' self-reported adherence to national guidelines. Social Science and Medicine, 32(11), 1263-1268.	Not an instrument to measure research use. Not on development or use of research. Is about adherence to national guidelines but the research basis for these guidelines are not discussed.
Hart, G. M. (1988). Change theory and the impact of an educational program on the case-finding activities of registered nurses in the early identification of alcohol-related problems. Rutgers the State University of New Jersey-New Brunswick. Dissertation	Not an instrument to measure research use. Not on development or use of research. Is about the effects of an educational program on nurses' behaviour but research use is not discussed.
McCleary, L., & Brown, G. T. (2003). Barriers to paediatric nurses' research utilization. Journal of advanced nursing, 42(4), 364-372.	Not an instrument to measure research use. Not on development or use of research.
Kirk and Fisher 1976. Do social workers understand research? Journal of Education for Social Work, 12, 63-70.	Not an instrument to measure research use. Not on development or use of research. Potential for use measured, not actual use.

Citation	Exclusion reason
Fattal, J., Lehoux, P., Fattal, J., & Lehoux, P. (2008). Health technology assessment use and dissemination by patient and consumer groups: Why and how? *International Journal of Technology Assessment in Health Care, 24*(4), 473-480.	Not an instrument to measure research use. Not on development or use of research. Purpose is not to measure the amount of HTA/research use but rather to examine *how* HTA reports were used by organizations in relation to four cases.
Van Mullem, C., Burke, L. J., Dohmeyer, K., Farrell, M., Harvey, S., John, L., et al. (1999). Strategic planning for research use in nursing practice. Journal of Nursing Administration, 29(12), 38-45.	Not an instrument to measure research use. Not on development or use of research. The Kap survey measures willingness but not actual research use
Stock, J. L., Waud, C. E., Coderre, J. A., Overdorf, J. H., Janikas, J. S., Heiniluoma, K. M., et al. (1998). Clinical reporting to primary care physicians leads to increased use and understanding of bone densitometry and affects the management of osteoporosis, Annals of Internal Medicine, 128(12 part 1), 996-999.	Not an instrument to measure research use. Not on development or use of research. The outcome (management of osteoporosis) is not necessarily research based.
Adamsen, L., Larsen, K., Bjerregaard, L., & Madsen, J. K. (2003). Danish research-active clinical nurses overcome barriers in research utilization. Scandinavian journal of caring sciences, 17(1), 57-65.	Not an instrument to measure research use. Not on development or use of research.
Taylor, G., Herrick, T., & Mah, M. (1998). Wound infections after hysterectomy: opportunities for practice improvement. American Journal of Infection Control, 26(3), 254-257.	Not an instrument to measure research use. Not on development or use of research.
Schmader, K., Hanlon, J. T., Weinberger, M., Landsman, P. B., Samsa, G. P., Lewis, I., et al. (1994). Appropriateness of medication prescribing in ambulatory elderly patients. Journal of the American Geriatrics Society, 42(12), 1241-1247.	Not an instrument to measure research use. Not on development or use of research.
Klabunde, C.N. (1997). Physicians' reactions to change in recommendations for mammography screening, American Journal of Preventive Medicine, 13(6), 432-438.	Not an instrument to measure research use. Not on development or use of research. Evidence is inconclusive, measures use of the 'Statement of Evidence"

Citation	Exclusion reason
Lacey, E. A. (1996). Facilitating research-based practice by educational intervention. Nurse education today, 16(4), 296-301.	Not an instrument to measure research use. Not on development or use of research. Evaluation of the extent to which an educational intervention can influence practice.
Nelson, A., & Weaver, F. M. (2004). Promoting evidence-based practice in spinal cord injury/disorders health care. Sci Nursing, 21(3), 129-135.	Not an instrument to measure research use. Not on development or use of research.
Miller, L. M., & Nugent, K. P. (2003). Surgical integrated care pathway development: compliance and staff satisfaction. Journal of Integrated Care Pathways, 7(1), 36-46.	Not an instrument to measure research use. Not on development or use of research. Measures compliance with an integrated care pathway. Research basis for this pathway is not clearly identified.
Weyts, A., Morpeth, L., & Bullock, R. (1999). Department of Health research overviews -- past, present and future: an evaluation of the dissemination of the Blue Book, Child Protection: Messages from Research. Child and Family Social Work, 5(3), 215-223.	Not an instrument to measure research use. Not on development or use of research. Measures use of exercises in a research-based report, but, from what is described, these exercises are for the physicians to evaluate their practice and attitudes, not to change them.
Lombarts, M. J. M. H., Klazinga, N. S., & Redekop, K. (2005). Measuring the perceived impact of facilitation on implementing recommendations from external assessment: Lessons from the Dutch visitatie programme for medical specialists. Journal of Evaluation in Clinical Practice, 11(6), 587-597.	Not an instrument to measure research use. Not on development or use of research.

Citation	Exclusion reason
Landon, B. E., Wilson, I. B., Cohn, S. E., Fichtenbaum, C. J., Wong, M. D., Wenger, N. S., et al. (2003). Physician specialization and antiretroviral therapy for HIV - adoption and use in a national probability sample of persons infected with HIV. Journal of General Internal Medicine, 18(4)	Not an instrument to measure research use. Not on development or use of research. Physician characteristics are the independent variables here (for pt use of HAART meds); their prescribing practice is not asked.
Melzer, B. A., Hubbard, S. M., & Huang, J. Y. (2003). TIPs evaluation project prospective study. Evaluation and program planning, 26(1), 81-89.	Not an instrument to measure research use. Not on development or use of research. Research basis for the Treatment Improvement Protocol (TIP) is not discussed.
Vaidyanathan, V. T. (2004). Looking beyond the adoption decision in innovation research investigating innovation, Ohio: The Ohio State University (Thesis).	Not an instrument to measure research use. Not on development or use of research. State that the EBPs chosen have variable scientific support.
Wenghofer, E. F., Way, D., Moxam, R. S., Wu, H., Faulkner, D., & Klass, D. J. (2006). Effectiveness of an enhanced peer assessment program: Introducing education into regulatory assessment. Journal of Continuing Education in the Health Professions, 26(3), 199-208.	Not an instrument to measure research use. Not on development or use of research. States that physician change practice based on assessor's recommendations but does not state what the basis is (research or otherwise) for these recommendations.
Whellan, D. J., Cohen, E. J., Matchar, D. B., & Califf, R. M. (2002). Disease management in healthcare organizations: results of in-depth interviews with disease management decision makers. American Journal of Managed Care, 8(7), 633-641.	Not an instrument to measure research use. Not on development or use of research.
Mutschler, E. (1984). Evaluating practice - a study of research utilization by practitioners. Social work, 29(4), 332-337.	Not an instrument to measure research use. Not on development or use of research. Use of research methods, not of research information.

Citation	Exclusion reason
Camiletti, Y. A., & Huffman, M. C. (1998). Research utilization: Evaluation of initiatives in a public health nursing division. Canadian journal of nursing administration, 11(2), 59-77.	Not an instrument to measure research use. Not on development or use of research. Valuing research.
Ferlie, E., Fitzgerald, L., & Wood, M. (2000). Getting evidence into clinical practice: an organisational behaviour perspective. Journal of Health Services & Research Policy, 5(2), 96-102.	Not an instrument to measure research use. Not on development or use of research. Case study of change issues.
Jacobson, A. F., Warner, A. M., Fleming, E., Schmidt, B., Jacobson, A. F., Warner, A. M., et al. (2008). Factors influencing nurses' participation in clinical research. Gastroenterology Nursing, 31(3), 198-208.	Not an instrument to measure research use. Not on development or use of research.
Murtaugh, C. M., Pezzin, L. E., McDonald, M. V., Feldman, P. H., & Peng, T. R. (2005). Just-in-time evidence-based e-mail "reminders" in home health care: impact on nurse practices. Health services research, 40(3), 849-864.	Not an instrument to measure research use. Not on development or use of research. About cost.
McCleary, L., Ellis, J. A., & Rowley, B. (2004). Evaluation of the pain resource nurse role: a resource for improving pediatric pain management. Pain Management Nursing, 5(1), 29-36.	Not an instrument to measure research use. Not on development or use of research. About how a program influenced a specialists' role.
Michie, S., & Johnston, M. (2004). Improving health care delivery: Making psychological theory useful. *Psychology and Health, 19*(SUPPL. 1), 113-114.	Not an instrument to measure research use. Not on development or use of research.
Crowe, 1996. Making best use of research evidence -- a course for MSLC members (1996). *Changing Childbirth Update*(5), 8-8.	Not an instrument to measure research use. Not on development or use of research. Advertisement for a workshop.
Forsetlund, L., & Bjorndal, A. (2001). The potential for research-based information in public health: identifying unrecognised information needs. *BMC Public Health, 1*, 1.	Not an instrument to measure research use. Not on development or use of research. Assesses information needs.

Citation	Exclusion reason
Cuddihy, J. T. (1979). Clinical research: translation into nursing practice. *International Journal of Nursing Studies, 16*(1), 65-72.	Not an instrument to measure research use. Not on development or use of research. Assesses nursing process.
Di Pietro, T., Coburn, G., Dharamshi, N., Doran, D., Mylopoulos, J., Kushniruk, A., et al. (2008). What nurses want: diffusion of an innovation. *Journal of Nursing Care Quality, 23*(2), 140-146.	Not an instrument to measure research use. Not on development or use of research. Assesses what nurses want to make decisions.
Clifford, C. M., Murray, S., & Kelly, S. M. (2001). A multiprofessional perspective of the role and training needs for research utilisation in healthcare. *Journal of Clinical Excellence, 3*(4), 175-182.	Not an instrument to measure research use. Not on development or use of research. Assesses attitudes.
Gray, M. J., Elhai, J. D., & Schmidt, L. O. (2007). Trauma professionals' attitudes toward and utilization of evidence-based practices. *Behavior Modification, 31*(6), 732-748.	Not an instrument to measure research use. Not on development or use of research. Assesses attitudes.
Larrabee, J. H., Sions, J., Fanning, M., Withrow, M. L., Ferretti, A., Larrabee, J. H., et al. (2007). Evaluation of a program to increase evidence-based practice change. Journal of Nursing Administration, 37(6), 302-310.	Not an instrument to measure research use. Not on development or use of research. Assesses attitudes.
Mehrdad, N., Salsali, M., & Kazemnejad, A. (2008). Iranian nurses' attitudes toward research utilisation. *Journal of Research in Nursing, 13*(1), 53-65.	Not an instrument to measure research use. Not on development or use of research. Assesses attitudes.
Mildon, D., Courtright, P., Rollins, D., Blicker, J., & Law, F. (2001). Knowledge, attitudes and practices regarding evidence-based medicine and outcome assessment: a survey of British Columbia cataract surgeons. [Article]. *Canadian Journal of Ophthalmology-Journal Canadien D Ophtalmologie, 36*(6), 323-331.	Not an instrument to measure research use. Not on development or use of research. Assesses attitudes.
Moledor, H. (1999). *Conduction and Utilization of Research: The Relationship Between Air Force Nurses' Attitudes, Levels of Education, and Rank*. Uniformed Services University of the Health Sciences (Thesis).	Not an instrument to measure research use. Not on development or use of research. Assesses attitudes.

Citation	Exclusion reason
Thibodeau, J. A., & Hawkins, J. W. (1994). Moving toward a nursing model in advanced practice. *Western Journal of Nursing Research, 16*(2), 205-218.	Not an instrument to measure research use. Not on development or use of research. Assesses attitudes.
McClarey, M. (2008). Iranian nurses' attitudes toward research utilisation. *Journal of Research in Nursing, 13*(1), 66-67.	Not an instrument to measure research use. Not on development or use of research. Assesses attitudes.
Metcalfe, C., Lewin, R., Wisher, S., Perry, S., Bannigan, K., & Moffett, J. K. (2001). Barriers to implementing the evidence base in four NHS therapies: dietitians, occupational therapists, physiotherapists, speech and language therapists. *Physiotherapy, 87*(8), 433-441.	Not an instrument to measure research use. Not on development or use of research. Assesses barriers.
Parahoo, K. (2000). Barriers to, and facilitators of, research utilization among nurses in Northern Ireland. *Journal of Advanced Nursing, 31*(1), 89-98.	Not an instrument to measure research use. Not on development or use of research. Assesses barriers.
Mitton, C., & Patten, S. (2004). Evidence-based priority-setting: What do the decision-makers think? *Journal of Health Services Research and Policy, 9*(3), 146-152.	Not an instrument to measure research use. Not on development or use of research. Assesses barriers.
Michie, S., Hendy, J., Smith, J., & Adshead, F. (2004). Evidence into practice: a theory based study of achieving national health targets in primary care. *Journal of Evaluation in Clinical Practice, 10*(3), 447-456.	Not an instrument to measure research use. Not on development or use of research.
Chummun, H., Tiran, D.(2008). Increasing research evidence in practice: a possible role for the consultant nurse. *Journal of Nursing Management, 16*(3), 327-333.	Not an instrument to measure research use. Not on development or use of research. Commentary
Gawlinski, A., & Gawlinski, A. (2007). Evidence-based practice changes: measuring the outcome. *AACN Advanced Critical Care, 18*(3), 320-322.	Not an instrument to measure research use. Not on development or use of research. Commentary
Sisson, J. (2002). Evidence based practice. *Journal of Community Nursing, 16*(5).	Not an instrument to measure research use. Not on development or use of research. Commentary.

Citation	Exclusion reason
Treasure, T. (2006). The evidence on which to base practice: different tools for different times. *European Journal of Cardio-Thoracic Surgery, 30*(6), 819-824.	Not an instrument to measure research use. Not on development or use of research. Commentary.
Meijers, J. M. M., Janssen, M. A. P., Cummings, G. G., Wallin, L., Estabrooks, C. A., & Halfens, R. Y. G. (2006). Assessing the relationships between contextual factors and research utilization in nursing: systematic literature review. *Journal of Advanced Nursing, 55*(5), 622-635.	Not an instrument to measure research use. Not on development or use of research. Assesses context.
Block, A. E. (2007). *The diffusion of medical information in hospitals, patients and physicians.* Unpublished Ph.D., Harvard University, United States -- Massachusetts.	Not an instrument to measure research use. Not on development or use of research. Cost benefit analysis.
Shortell, S. M., Zazzali, J. L., Burns, L. R., Alexander, J. A., Gillies, R. R., Budetti, P. P., et al. (2001). Implementing evidence-based medicine: The role of market pressures, compensation incentives, and culture in physician organizations. *Medical Care, 39*(7 SUPPL.).	Not an instrument to measure research use. Not on development or use of research. Assesses culture, compensation measures.
Bostrom, J., & Wise, L. (1994). Closing the gap between research and practice... "Retrieval and Application of Research in Nursing". *Journal of Nursing Administration, 24*(5), 22-27.	Not an instrument to measure research use. Not on development or use of research. Describes a program.
Weiss, A. (1994). Adoption Of Innovation And Policy-Making In Organizations Questionnaire Identifying sources of error in informant reports: A confirmatory measurement model approach. Evaluation Review, 18, 592-612.	Not an instrument to measure research use. Not on development or use of research. Describes how to do confirmatory factor analysis.
Greer, A. L. (1977). Advances in the Study of Diffusion of Innovation in Health Care Organizations. *Milbank Memorial Fund Quarterly/Health and Society, 55*(4), 505-532.	Not an instrument to measure research use. Not on development or use of research. Assesses diffusion factors.
Upton, J. (2007). Part 42: research evidence: finding it and using it. *Practice Nurse*, *34*(4), 43-48.	Not an instrument to measure research use. Not on development or use of research. Discussed how to do a literature search.

Citation	Exclusion reason
Pearson, B. (1994). Translating research into practice. *Journal of Urological Nursing, 13*(3), 838-842. PAL-12008050	Not an instrument to measure research use. Not on development or use of research.
Simpson, D. D. (2002). A conceptual framework for transferring research to practice. *Journal of Substance Abuse Treatment, 22*(4), 171-182.	Not an instrument to measure research use. Not on development or use of research.
Hart, P., Eaton, L., Buckner, M., Morrow, B. N., Barrett, D. T., Fraser, D. D., et al. (2008). Effectiveness of a computer-based educational program on nurses' knowledge, attitude, and skill level related to evidence-based practice. *Worldviews on Evidence-Based Nursing, 5*(2), 75-84.	Not an instrument to measure research use. Not on development or use of research. Assesses EBP Skills.
Haines, A., & Donald, A. (1998). Getting research findings into practice. Making better use of research findings. *British Medical Journal, 317*(7150), 72-75.	Not an instrument to measure research use. Not on development or use of research. Editorial.
Pipe, T. B., Cisar, N. S., Caruseso, E., Wellik, K. E., Pipe, T. B., Cisar, N. S., et al. (2008). Leadership strategies: inspiring evidence-based practice at the individual, unit, and organizational levels. *Journal of Nursing Care Quality, 23*(3), 265-271.	Not an instrument to measure research use. Not on development or use of research. Education interventions for leadership.
Melnyk, B. M. (2007). Enhancing research utilization capacity through multifaceted professional development. [Note]. *Worldviews on Evidence-Based Nursing, 4*(3), 172-173.	Not an instrument to measure research use. Not on development or use of research. Evidence Digest.
Sheehan, A., Walrath-Greene, C., Fisher, S., Crossbear, S., & Walker, J. (2007). Evidence-based practice knowledge, use, and factors that influence decisions: Results from an evidence-based practice survey of providers in American Indian/ Alaska Native communities. *American Indian and Alaska Native Mental Health Research, 14*(2), 29-48.	Not an instrument to measure research use. Not on development or use of research. Evidence/knowledge use in native communities.
Regan, J. A. (1998). Will current clinical effectiveness initiatives encourage and facilitate practitioners to use evidence-based practice for the benefit of their clients? *Journal of Clinical Nursing, 7*(3), 244-250.	Not an instrument to measure research use. Not on development or use of research. Facilitators of change.
Dobbins, M., Cockerill, R., Barnsley, J., & Ciliska, D. (2001). Factors of the innovation, organization, environment, and individual that predict the influence five systematic reviews had on public health decisions. International Journal of Technology Assessment in Health Care, 17(4), 467-478.	Not an instrument to measure research use. Not on development or use of research.

Citation	Exclusion reason
Sredl, D., & Sredl, D. (2008). Evidence-based nursing practice: what US nurse executives really think. *Nurse Researcher, 15*(4), 51-67.	Not an instrument to measure research use. Not on development or use of research. Factors related to EBP.
Redfern, S., & Murrells, T. (1998). Occasional paper. Research, audit and networking: who's in the lead? *Nursing Times, 94*(28), 57-60.	Not an instrument to measure research use. Not on development or use of research. Factors to build a research culture.
Kenrick, M., & Luker, K. A. (1996). An exploration of the influence of managerial factors on research utilization in district nursing practice. Journal of advanced nursing, 23(4), 697-704.	Not an instrument to measure research use. Not on development or use of research.
Guenter, D., Majumdar, B., Willms, D., Travers, R., Browne, G., Robinson, G., et al. (2005). Community-based HIV education and prevention workers respond to a changing environment. *Journal of the Association of Nurses in AIDS Care, 16*(1), 29-36.	Not an instrument to measure research use. Not on development or use of research. HIV Prevention Program.
Oermann, M. H., Roop, J. C., Nordstrom, C. K., Galvin, E. A., & Floyd, J. A. (2007). Effectiveness of an intervention for disseminating Cochrane reviews to nurses. *MEDSURG Nursing, 16*(6), 373-377.	Not an instrument to measure research use. Not on development or use of research.
Mulhall, A., le May, A., & Alexander, C. (1996). The utilization of research in nursing: a report of a study involving nurses and managers. *Professional Update, 4*(7), 50-51.	Not an instrument to measure research use. Not on development or use of research. Interview uncovering factors related to research utilization.
Luker, K. A., & Kenrick, M. (1995). Towards knowledge-based practice - an evaluation of a method of dissemination. International journal of nursing studies, 32(1), 59-67.	Not an instrument to measure research use. Not on development or use of research. Items measure change to knowledge, not practice.
Munroe, D., Duffy, P., & Fisher, C. (2008). Nurse knowledge, skills, and attitudes related to evidence-based practice: before and after organizational supports. *Medsurg nursing: official journal of the Academy of Medical-Surgical Nurses, 17*(1), 55-60.	Not an instrument to measure research use. Not on development or use of research.

Citation	Exclusion reason
Daigle-LeBlanc, M. B. (2002). *Measuring knowledge use in organizations.* Unpublished M.Sc., Saint Mary's University (Canada), Canada.	Not an instrument to measure research use. Not on development or use of research. Knowledge not required to be research based.
Black, S. D. (1975). The use of research. *Journal of the Royal College of Surgeons of Edinburgh*, *20*(6), 355-364.	Not an instrument to measure research use. Not on development or use of research. Lecture to physicians.
Clifford, C., & Murray, S. (2001). Pre- and post-test evaluation of a project to facilitate research development in practice in a hospital setting. Journal of advanced nursing, 36(5), 685-695.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Cheatham 1987 the empirical evaluation of clinical practice: A survey of four groups of practitioners. Journal of Social Service Research, 10, 163-177.	Not an instrument to measure research use. Not on development or use of research. Measures level of integration of research procedures into practice (self-evaluation), not research use.
Pronovost, P., Holzmueller, C. G., Needham, D. M., Sexton, J. B., Miller, M., Berenholtz, S., et al. (2006). How will we know patients are safer? An organization-wide approach to measuring and improving safety. *Critical Care Medicine*, *34*(7), 1988-1995.	Not an instrument to measure research use. Not on development or use of research. Measures of safety
Holden, J. (2002). St. Helens and Knowsley MAAG 1991-2001: Were we effective? Journal of Clinical Governance, 10(3), 139-149.	Not an instrument to measure research use. Not on development or use of research. Measures the effectiveness of audit and feedback program.
Eldridge 1983. Practitioners and self-evaluation. Social Casework, 64, 426-430.	Not an instrument to measure research use. Not on development or use of research. Measures use of research for self-evaluation, not for practice.

Citation	Exclusion reason
Hayashi, S. W., Suzuki, M., Hubbard, S. M., Huang, J. Y., & Cobb, A. M. (2003). A qualitative study of the treatment improvement protocols (TIPS): A qualitative study of the use of TIPs by individuals affiliated with the addiction technology transfer centres (ATTCs). Evaluation and Program Planning, 26(1), 69-79.	Not an instrument to measure research use. Not on development or use of research. Measures use of tips (treatment improvement protocols) but does not present it as a research use measure.
Cobban, S. J., Edgington, E. M., Clovis, J. B.(2008). Moving research knowledge into dental hygiene practice. *Journal of Dental Hygiene, 82*(2), 21.	Not an instrument to measure research use. Not on development or use of research, report on related factors but not on measure of research use (complexity of research use).
Kiresuk (1993). Nonspecific Knowledge Transfer And Utilization Intervention Scale. The evaluation of knowledge utilization: Placebo and nonspecific effects, dynamical systems, and chaos theory. Journal of the American Society for Information Science, 44, 235-241.	Not an instrument to measure research use. Not on development or use of research.
Manion (1993). Retrieved from this ref: Drury, T. (1993). Commentary on Chaos or transformation? Managing innovation [original article by Manion J appears in JONA 1993;23(5):41-8]. ENA'S Nursing Scan in Emergency Care, 3(6), 16-16.	Not an instrument to measure research use. Not on development or use of research.
Matejko, A. J. (1983). Utilization of Social Research. The Alberta Case. *Sociologia Internationalis, 21*(1 - 2), 117-144.	Not an instrument to measure research use. Not on development or use of research.
Wimpenny, P., Johnson, N., Walter, I., Wilkinson, J. E., et al. (2008). Tracing and identifying the impact of evidence-use of a modified pipeline model. *Worldviews on Evidence-Based Nursing, 5*(1), 3-12.	Not an instrument to measure research use. Not on development or use of research, is a model.
Gartenberg, M. J. (2007). *A study of the role of psychologists practicing in long-term care.* Unpublished Psy.D., Rutgers The State University of New Jersey, Graduate School of Applied and Professional Psychology, United States -- New Jersey.	Not an instrument to measure research use. Not on development or use of research.
Sales, A. E. (2007). A view from health services research and outcomes measurement. [Comment]. [Comment Review]. Nursing Research, 56(4 Suppl), S67-71.	Not an instrument to measure research use. Not on development or use of research. A Critique.

Citation	Exclusion reason
Jbilou, J., Amara, N., Landry, R.(2007). Research-based-decision-making in Canadian health organizations: a behavioural approach. *Journal of Medical Systems, 31*(3), 185-196.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Koehn, M. L., Lehman, K., Koehn, M. L., & Lehman, K. (2008). Nurses' perceptions of evidence-based nursing practice. *Journal of Advanced Nursing, 62*(2), 209-215.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Kuuppelomaki, M., & Tuomi, J. (2005). Finnish nurses' attitudes towards nursing research and related factors. *International Journal of Nursing Studies*, *42*(2), 187-196.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Nursing Standard (2005) Using research in practice. 19(26), 30-31.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Thompson, D. S., Estabrooks, C. A., Scott-Findlay, S., Moore, K., Wallin, L., et al. (2007). Interventions aimed at increasing research use in nursing: a systematic review. *Implementation Science, 2*, 15.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Rodgers, S. (1994). An exploratory study of research utilization by nurses in general medical and surgical wards. JAN, 20, 904-911.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.

Citation	Exclusion reason
Thompson, C. (2002). Nurses' use of research information in clinical decision making a descriptive and analytical study: final report, from http://www.york.ac.uk/healthsciences/centres/evidence/decrpt.pdf	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Pearcey (1995). Research Skills Questionnaire "Nurses And Tutors" (1995). Achieving research-based nursing practice. Journal of Advanced Nursing, 22, 33-39.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Robinson et al. (2000). Attitudes Toward Research Questionnaire What are the attitudes of general practitioners towards research? British Journal of General Practice, 50, 390-392.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Upton, D., & Upton, P. (2005). Professional issues. Nurses' attitudes to evidence-based practice: impact of a national policy. *British Journal of Nursing (BJN), 14*(5), 284-288.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
McWilliam, C. L., Kothari, A., Leipert, B., Ward-Griffin, C., Forbes, D., King, M. L., et al. (2008). Accelerating client-driven care: Pilot study for a social interaction approach to knowledge translation. *Canadian Journal of Nursing Research, 40*(2), 58-74.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Thompson, C., McCaughan, D., Cullum, N., Sheldon, T., & Raynor, P. (2005). Barriers to evidence-based practice in primary care nursing -- viewing decision-making as context is helpful. *Journal of Advanced Nursing, 52*(4), 432-444.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.

Citation	Exclusion reason
Thompson, D. R., Chau, J. P. C., & Lopez, V. (2006). Barriers to, and facilitators of, research utilisation: a survey of Hong Kong registered nurses. *International Journal of Evidence-Based Healthcare, 4*(2), 77-82.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Pepler, C. J., Edgar, L., Frisch, S., Rennick, J., Swidzinski, M., White, C., et al. (2006). Strategies to increase research-based practice: interplay with unit culture. *Clinical Nurse Specialist: The Journal for Advanced Nursing Practice, 20*(1), 23-33.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Scott, S. D., Pollock, C., Scott, S. D., & Pollock, C. (2008). The role of nursing unit culture in shaping research utilization behaviors. *Research in Nursing & Health, 31*(4), 298-309.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Titler, M., & Titler, M. (2007). Translating research into practice. *American Journal of Nursing, 107*(6 Suppl), 26-33; quiz 33.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Titler, M. G., Kleiber, C., Steelman, V. J., Rakel, B. A., Budreau, G., Everett, L. Q., et al. (2001). The Iowa Model of Evidence-Based Practice to Promote Quality Care. *Critical Care Nursing Clinics of North America, 13*(4), 497-509.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Thomas, D. E., Kukuruzovic, R., Martino, B., Chauhan, S. S., & Elliott, E. J. (2003). Knowledge and use of evidence-based nutrition: A survey of paediatric dietitians. *Journal of Human Nutrition and Dietetics, 16*(5), 315-322.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.

Citation	Exclusion reason
Stetler, C. B., Caramanica, L., Stetler, C. B., & Caramanica, L. (2007). Evaluation of an evidence-based practice initiative: outcomes, strengths and limitations of a retrospective, conceptually based approach. *Worldviews on Evidence-Based Nursing, 4*(4), 187-199.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Veeramah, V. (2008). Exploring strategies for promoting the use of research findings in practice. *British journal of nursing (Mark Allen Publishing), 17*(7), 466-471.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Upton, D. (1999b). Clinical effectiveness: how much do radiographers know about it and what do they think of the concept? *Radiography, 5*(2), 79-87.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Upton, D., & Upton, P. (2006a). Knowledge and use of evidence-based practice by allied health and health science professionals in the United Kingdom. *Journal of Allied Health, 35*(3), 127-133.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Upton, D., & Upton, P. (2006b). Knowledge and use of evidence-based practice of GPs and hospital doctors. *Journal of Evaluation in Clinical Practice, 12*(3), 376-384.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Sargent, M. M. C. (1984). Influence of psychotherapy research on clinical practice. Unpublished Ph.D., University of Delaware, United States -- Delaware.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.

Citation	Exclusion reason
Schreiber, J. M. (2007). *Pediatric physical therapists and evidence-based practice: a participatory action research project.* Unpublished Ph.D., Duquesne University.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Stetler, C. B., Ritchie, J., Rycroft-Malone, J., Schultz, A., Charns, M., Stetler, C. B., et al. (2007). Improving quality of care through routine, successful implementation of evidence-based practice at the bedside: an organizational case study protocol using the Pettigrew and Whipp model of strategic change. *Implementation Science, 2*, 3.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Rye, C. B., & Kimberly, J. R. (2007). Review: The adoption of innovations by provider organizations in health care. *Medical Care Research and Review, 64*(3), 235-278.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
McQueen, J. (2008). Practice development: bridging the research-practice divide through the appointment of a research lead. *British Journal of Occupational Therapy, 71*(3), 112-118.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Johnson, L. N., Sandberg, J. G., & Miller, R. B. (2000). Research practices of marriage and family therapists. *American Journal of Family Therapy*, *28*(5), 239-249.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Qian, X., Smith, H., Liang, H., Liang, J., Garner, P., Qian, X., et al. (2006). Evidence-informed obstetric practice during normal birth in China: trends and influences in four hospitals. BMC Health Services Research, 6, 29.	Not an instrument to measure research use. Not on development or use of research, but reports on patient outcomes.

Citation	Exclusion reason
Zwarenstein, M., & Reeves, S. (2006). Knowledge translation and interprofessional collaboration: Where the rubber of evidence-based care hits the road of teamwork. *Journal of Continuing Education in the Health Professions, 26*(1), 46-54.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Wickham, S. (1999). Evidence-informed midwifery 2: using research in midwifery practice. *Midwifery Today* (52), 39-41.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Zafar, I., Michael, C., & David, J. T. (1998). Clinical effectiveness: The potential for change in maternity care. *Journal of Clinical Effectiveness, 3*(2), 67.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Van Caulil, G. F., Mombers, C. A. M., & Van Den Beemt, F. C. H. D. (1996). Quantifying the utilization of research: The difficulties and two models to evaluate the utilization of research results. *Scientometrics, 37*(3), 433-444.	No instrument to measure research use. Not a development or use of research use measure. Discussion of what research use means.
Low, L. K., Miller, J., Low, L. K., & Miller, J. (2006). A clinical evaluation of evidence-based maternity care using the Optimality Index. *JOGNN - Journal of Obstetric, Gynecologic, & Neonatal Nursing, 35*(6), 786-793.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Hakkennes, S., Green, S., Hakkennes, S., & Green, S. (2006). Measures for assessing practice change in medical practitioners. *Implementation Science, 1*, 29.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.

Citation	Exclusion reason
Hannes, K., Leys, M., Vermeire, E., Aertgeerts, B., Buntinx, F., & Depoorter, A. (2005). Implementing evidence-based medicine in general practice: a focus group based study. *BMC Family Practice, 6*, 13p.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Forbes, D., & Phillipchuk, D. (2001). The dissemination and use of nursing research. *Canadian Nurse, 97*(7), 18-22.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Funk, S. G., Tornquist, E. M., & Champagne, M. T. (1989). Application and evaluation of the dissemination model. *Western Journal of Nursing Research, 11*(4), 486-491.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Gifford, W., Davies, B., Edwards, N., Griffin, P., Lybanon, V.,et al. (2007). Managerial leadership for nurses' use of research evidence: an integrative review of the literature. *Worldviews on Evidence-Based Nursing, 4*(3), 126-145.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Gira, E. C., Kessler, M. L., & Poertner, J. (2004). Influencing social workers to use research evidence in practice: Lessons from medicine and the allied health professions. *Research on Social Work Practice, 14*(2), 68-79.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Hefferin, E. A., Horsley, J. A., & Ventura, M. R. (1982). Promoting research-based nursing: the nurse administrator's role. *Journal of Nursing Administration, 12*(5), 34-41.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.

Citation	Exclusion reason
Haug, N. A., Shopshire, M., Tajima, B., Gruber, V., Guydish, J., Haug, N. A., et al. (2008). Adoption of evidence-based practices among substance abuse treatment providers. *Journal of Drug Education, 38*(2), 181-192.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Gervasini, A. (1999). The research process -- part II. *Journal of Trauma Nursing, 6*(4), 88-97.	Not an instrument to measure research use. Not on development or use of research, is a report on factors related to research use without measuring research use.
Rutledge, D. N., Bookbinder, M.(2002). Processes and outcomes of evidence-based practice. *Seminars in Oncology Nursing, 18*(1), 3-10.	Not an instrument to measure research use. Not on development or use of research.
Russell, M. N. (1990). Clinical social work: Research and practice. Newbury Park, Calif: Sage Publications.	Not an instrument to measure research use. Not on development or use of research. Not a primary study.
Scheirer, M.-A. R. E. L. (1982). *Measuring the implementation of innovations final report to the National Science Foundation from grant no. PRA-8022612*. Annandale, Va.: American Research Institute. *Author referred us to a 1983 article, which reports the main findings from this report.*	Not an instrument to measure research use. Not on development or use of research but is a review that reports on implementation of specific practices.
Hivon, M., Lehoux, P., Denis, J. L., & Tailliez, S. (2005). Use of health technology assessment in decision-making: Coresponsibility of users and producers? International Journal of Technology Assessment in Health Care, 21(2), 268-275.	Not an instrument to measure research use. Not on development or use of research.
Happell, B., & Martin, T. (2004). Exploring the impact of the implementation of a nursing clinical development unit program: What outcomes are evident? International Journal of Mental Health Nursing, 13(3), 177-184.	Not an instrument to measure research use. Not on development or use of research.
Peterson, J. C., Rogers, E. M., Cunningham-Sabo, L., Davis, S. M., Peterson, J. C., Rogers, E. M., et al. (2007). A framework for research utilization applied to seven case studies. *American Journal of Preventive Medicine, 33*(1 Suppl), S21-34.	Not an instrument to measure research use. Not on development or use of research. Instrument's purpose to measure the adoption of a single research-based practice.

Citation	Exclusion reason
Sea-Orchid Group. (2008). Use of evidence-based practices in pregnancy and childbirth: South East Asia Optimising Reproductive and Child Health in Developing countries project. PLoS ONE 3(7)(e2646).	Not an instrument to measure research use. Not on development or use of research. Is a review/synthesis report. Is a report on factors related to research use without measuring research use.
Estabrooks, C. A., Floyd, J. A., Scott-Findlay, S., O'Leary, K. A., & Gushta, M. (2003). Individual determinants of research utilization: a systematic review. *Journal of Advanced Nursing, 43*(5), 506-520.	Not an instrument to measure research use. Not on development or use of research. Is a review/synthesis report. Is a report on factors related to research use without measuring research use.
Lavis, J., Ross, S., McLeod, C., Gildiner, A., Lavis, J., Ross, S., et al. (2003). Measuring the impact of health research. *Journal of Health Services & Research Policy, 8*(3), 165-170.	Not an instrument to measure research use. Not on development or use of research. Is a review/synthesis report. Is a report on factors related to research use without measuring research use.
Lerner, E. B., Mosesso, V., Jr., Zak, C., Lerner, E. B., Mosesso, V., Jr., & Zak, C. (2002). Implementation of research in the out-of-hospital setting. *Prehospital Emergency Care, 6*(2 Suppl), S24-27.	Not an instrument to measure research use. Not on development or use of research.
Ashford, J. B., & Lecroy, C. W. (1991). Problem-solving in social-work-practice - implications for knowledge utilization. *Research on Social Work Practice, 1*(3), 306-318.	Not an instrument to measure research use. Not on development or use of research
Beyer, J. M., & Trice, H. M. (1982). The Utilization Process: A Conceptual Framework and Synthesis of Empirical Findings. *Administrative Science Quarterly, 27*(4), 591-622.	Not an instrument to measure research use. Not on development or use of research, Is a conceptual paper.
Bircumshaw, D. (1990). The utilization of research findings in clinical nursing practice. *Journal of Advanced Nursing, 15*(11), 1272-1280.	Not an instrument to measure research use. Not on development or use of research, Is a review or synthesis report.

Citation	Exclusion reason
Adily, A., & Ward, J. (2004). Evidence based practice in population health: a regional survey to inform workforce development and organisational change. *Journal of Epidemiology & Community Health, 58*(6), 455-460.	Not an instrument to measure research use. Not on development or use of research, report on related factors but not on measure of research use.
Andersson, N., Cederfjall, C., Jylli, L., Nilsson Kajermo, K., & Klang, B. (2007). Professional roles and research utilization in paediatric care: newly graduated nurses experiences. *Scandinavian Journal of Caring Sciences, 21*(1), 91-97.	Not an instrument to measure research use. Not on development or use of research, report on related factors but not on measure of research use.
Armitage, S. (1990). Research utilisation in practice. *Nurse Education Today, 10*(1), 10-15.	Not an instrument to measure research use. Not on development or use of research, report on related factors but not on measure of research use.
Armstrong, R., Waters, E., Crockett, B., Keleher, H., Armstrong, R., Waters, E., et al. (2007). The nature of evidence resources and knowledge translation for health promotion practitioners. *Health Promotion International, 22*(3), 254-260.	Not an instrument to measure research use. Not on development or use of research, report on related factors but not on measure of research use.
Bradbury, L., Clipsham, K., & Kitson, A. (2005). Developing nursing research. *Journal of Orthopaedic Nursing, 9*(4), 199-204.	Not an instrument to measure research use. Not on development or use of research, report on related factors but not on measure of research use.
Conklin, J., Stolee, P., Conklin, J., & Stolee, P. (2008). A model for evaluating knowledge exchange in a network context. *Canadian Journal of Nursing Research, 40*(2), 116-124.	Not an instrument to measure research use. Not on development or use of research, report on related factors but not on measure of research use.

Citation	Exclusion reason
Conway, P. H., Edwards, S., Stucky, E. R., Chiang, V. W., Ottolini, M. C., & Landrigan, C. P. (2006). Variations in management of common inpatient pediatric illnesses: hospitalists and community pediatricians. *Pediatrics, 118*(2), 441-447.	Not an instrument to measure research use. Not on development or use of research, report on related factors but not on measure of research use.
Danielson, E., & Berntsson, L. (2007). Registered nurses' perceptions of educational preparation for professional work and development in their profession. *Nurse Education Today, 27*(8), 900-908.	Not an instrument to measure research use. Not on development or use of research, report on related factors but not on measure of research use.
Brenner, M. (2005). Children's nursing in Ireland: barriers to, and facilitators of, research utilisation. *Paediatric Nursing, 17*(4), 40-45.	Not an instrument to measure research use. Not on development or use of research, report on related factors but not on measure of research use.
Buxton, V., James, T., & Harding, W. (1998). Occasional paper. Using research in community nursing. *Nursing Times*, *94*(35), 57-60.	Not an instrument to measure research use. Not on development or use of research, report on related factors but not on measure of research use.
Aarons, G. A. (2004). Mental health provider attitudes toward adoption of evidence-based practice: The evidence-based practice attitude scale (EBPAS). *Mental Health Services Research*, *6*(2), 61-74.	Not an instrument to measure research use. Not on development or use of research, report on related factors but not on measure of research use.
Aarons, G. A. (2005). Measuring provider attitudes toward evidence-based practice: Consideration of organizational context and individual differences. *Child and Adolescent Psychiatric Clinics of North America, 14*(2), 255-271.	Not an instrument to measure research use. Not on development or use of research, report on related factors but not on measure of research use.

Citation	Exclusion reason
Aarons, G. A. (2006). Transformational and transactional leadership: association with attitudes toward evidence-based practice. *Psychiatric Services, 57*(8), 1162-1169.	Not an instrument to measure research use. Not on development or use of research, report on related factors but not on measure of research use.
Adams, F., & Cooke, M. (1998). Evidence-based practice. Implementing evidence-based practice for urinary catheterization. *British Journal of Nursing (BJN), 7*(22), 1393.	Not an instrument to measure research use. Not on development or use of research, purpose is to examine use of specific practice, not to measure research use.
Rabin, B. A., Brownson, R. C., Haire-Joshu, D., Kreuter, M. W., Weaver, N. L., Rabin, B. A., et al. (2008). A glossary for dissemination and implementation research in health. *Journal of Public Health Management & Practice, 14*(2), 117-123.	Not an instrument to measure research use. Not primary study: a glossary
Camiah, S. (1997). Utilization of nursing research in practice and application strategies to raise research awareness amongst nurse practitioners: A model for success. Journal of advanced nursing, 26(6), 1193-1202.	Not an instrument to measure research use. One qualitative question in focus groups with aim of measuring research use.
Roberts, K. L. (1998). Evidence-based practice: an idea whose time has come. *Collegian, 5*(3), 24-27.	Not an instrument to measure research use. Opinion article
Boissel, J. P., Nony, P., Amsallem, E., Mercier, C., Esteve, J., Cucherat, M., et al. (2005). How to measure non-consistency of medical practices with available evidence in therapeutics: a methodological framework. Fundamental & Clinical Pharmacology, 19(5), 591-596.	Not an instrument to measure research use. Opinion piece.
Bond, M. P. (2000). Information use: appreciating the subtleties. *British Journal of Therapy & Rehabilitation, 7*(5), 241-245.	Not an instrument to measure research use. Opinion piece.
Merrin, J. B. (2008). *Program evaluation of clinical services at a community-based behavioral health clinic: An action research approach.* Unpublished PhD thesis., Alliant International University, Fresno, United States -- California.	Not an instrument to measure research use. Assesses organizational factors.
Pfouts and McDaniels. 1977. Medical handmaidens or professional colleagues: A survey of social work practice in the pediatrics departments of twenty-eight teaching hospitals. Social Work in health Care, 2I, 275-283.	Not an instrument to measure research use. Participation in research is measured but no clear measure of use.

Citation	Exclusion reason
Redfern, S., Normand, C., Christian, S., Gilmore, A., Murrells, T., Norman, I., et al. (1997). An evaluation of nursing development units... including commentary by Bond S. *NT Research, 2*(4), 292-304.	Not an instrument to measure research use. Measures predictors.
Nicklin, W., & Stipich, N. (2005). Enhancing skills for evidence-based healthcare leadership: the Executive Training for Research Application (EXTRA) program. Canadian journal of nursing leadership, 18(3), 35-44.	Not an instrument to measure research use. Program evaluation.
Bridges, P. H., Bierema, L. L., Valentine, T., Bridges, P. H., Bierema, L. L., & Valentine, T. (2007). The propensity to adopt evidence-based practice among physical therapists. *BMC Health Services Research, 7*, 103.	Not an instrument to measure research use. Propensity for EBP
Kelly, J. A., Somlai, A. M., DiFranceisco, W. J., Otto-Salaj, L. L., McAuliffe, T. L., Hackl, K. L., et al. (2000). Bridging the gap between the science and service of HIV prevention: Transferring effective research-based HIV prevention interventions to community AIDS service providers. American Journal of Public Health, 90(7), 1082-1088.	Not an instrument to measure research use. Purpose is to measure model adoption.
Gingerich 1984. Generalizing single-case evaluation from classroom to practice setting. Journal of Education for Social Work., 20, 74-82.	Not an instrument to measure research use. Purpose is to measure use of single-case evaluation, not research use.
Richens, Y. (2002). Are midwives using research evidence in practice? *British Journal of Midwifery, 10*(1), 11-16.	Not an instrument to measure research use. Qualitative comments r/elated to research use.
Mueller, C., Degenholtz, H., & Kane, R. (2004). Do evidence-based clinical and administrative policies/practices in nursing homes influence quality? *Nursing & Health Policy Review, 3*(1), 35-47.	Not an instrument to measure research use. Report on patient outcomes.
Rutledge, D. N., & Donaldson, N. E. (1995). Building organizational capacity to engage in research utilization. Journal of Nursing Administration, 25(10), 12-16.	Not an instrument to measure research use. Reports on factors related to research use in health care organizations.
Paukert, J. L., Chumley-Jones, H. S., & Littlefield, J. H. (2003). Do peer chart audits improve residents' performance in providing preventive care? Academic Medicine, 78(10), S39-S41.	Not an instrument to measure research use. Research basis for the 12 preventative practices is not discussed.

Citation	Exclusion reason
Cummings, G. G., Estabrooks, C. A., Midodzi, W. K., Wallin, L., Hayduk, L.,., et al. (2007). Influence of organizational characteristics and context on research utilization. Nursing Research, 56(4 Suppl), S24-39.	Not an instrument to measure research use. Research use variable is derived.
Sprang, G., Craig, C., Clark, J., Sprang, G., Craig, C., & Clark, J. (2008). Factors impacting trauma treatment practice patterns: the convergence/divergence of science and practice. *Journal of Anxiety Disorders*, *22*(2), 162-174.	Not an instrument to measure research use. Used combination of tested and untested practices.
Ricketts, T., Saul, C., Newton, P., & Brooker, C. (2003). Evaluating the development, implementation and impact of protocols between primary care and specialist mental health services. Journal of Mental Health, 12(4), 369-383.	Not an instrument to measure research use.
Kovach, A. C. (1997). Hospital breastfeeding policies in the Philadelphia area: a comparison with the ten steps to successful breastfeeding. Birth, 24(1), 41-48.	Not an instrument to measure research use. Compares hospital breastfeeding practices to WHO/UNIICEF recommendations, which were developed by government ministers from 32 countries. Does not mention research-base.
Thompson, D. S. (2006). Research utilization interventions in nursing. (M.N. thesis, University of Alberta (Canada).	Not an instrument to measure research use. Content analysis of the process of use but level of use is not measured.
Michie, S., Johnston, M., Abraham, C., Lawton, R., Parker, D., Walker, A., et al. (2005). Making psychological theory useful for implementing evidence based practice: a consensus approach. Quality & Safety in Health Care, 14(1), 26-33.	Not an instrument to measure research use. Is a report on factors related to research use without measuring research use.
Dubouloz, C., Egan, M., Vallerand, J., & von Zweck, C. (1999). Occupational therapists' perceptions of evidence-based practice... an earlier version of this paper was presented at the World Federation of Occupational Therapists Conference in Montreal, July 1998. *American Journal of Occupational Therapy, 53*(5), 445-453.	Not an instrument to measure research use. Assesses perceptions of EBP.
Nelson, D. (1995). Research into research practice. Accident and emergency nursing, 3(4), 184-189.	Not an instrument to measure research use. Evaluates whether action plans are being implemented.

Citation	Exclusion reason
Gagnon, M. P., Sanchez, E., & Pons, J. M. (2006). Integration of health technology assessment recommendations into organizational and clinical practice: A case study in Catalonia. International Journal of Technology Assessment in Health Care, 22(2), 169-1	Not an instrument to measure research use. Focus on factors related to use of HTA.
Rizzuto, C, et al. 1994. Predictors of nurses' involvement in research activities. Western Journal of Nursing Research 16(2): 193-204.	Not an instrument to measure research use. Focus on research involvement.
Bostrom, J., & Suter, W. N. (1993). Research utilization: making the link to practice. Journal of Nursing Staff Development, 9(1), 28-34.	Not an instrument to measure research use. Focus on research involvement.
Parkin, C., & Bullock, I. (2005). Evidence-based health care: Development and audit of a clinical standard for research and its impact on an NHS trust. Journal of clinical nursing, 14(4), 418-425. (490) (633)	Not an instrument to measure research use. Lacks clarity in reporting. Asks about use of 'best evidence' for practice change.
Ornstein, S., Meiert, P. J., Jenkins, R. G., Wessell, A. M., Nemeth, L. S., & Rose, H. L. (Writer) (2008). Improving the translation of research into primary care practice: Results of a national quality improvement demonstration project, *Joint Commission Journal on Quality and Patient Safety*.	Not an instrument to measure research use. Assesses quality outcomes.
Shaffer (1996). Support for Research in Hospitals Questionnaire (1996). Hospital research programs and barriers to research utilization. IMAGE: Journal of Nursing Scholarship, 28, 278.e.	Not an instrument to measure research use. Measures research activities not research use.
Shaffer, C. M. (1994). *Staff nurse perceptions of barriers to research utilization and administrative supports for research in hospitals.* Unpublished PH.D. Thesis, George Mason University.	Not an instrument to measure research use. Measures research activities not research use.
Stomski, N., Grimmer-Somers, K., & Petkov, J. (2008). A survey of the uptake and implementation of research evidence by South Australian acupuncturists in clinical practice: attitudes and associated predictive factors. *Complementary Therapies in Medicine, 16*(4), 199-205.	Not an instrument to measure research use. Measures research importance and barriers.
Kimberly, J., Cook, J. M., Kimberly, J., & Cook, J. M. (2008). Organizational measurement and the implementation of innovations in mental health services. *Administration & Policy in Mental Health, 35*(1-2), 11-20.	Not an instrument to measure research use. Review/synthesis report. Is a report on factors related to research use without measuring research use.

Citation	Exclusion reason
Drury, T. (1993). Commentary on chaos or transformation? Managing Innovation, JONA, 23(5), 41-48.	Not an instrument to measure research use. Commentary
Muthard, J. E. F. K. A., & joint, a. (1978). *Measuring and improving research utilization practices in rehabilitation*. Gainesville: Rehabilitation Research Institute, College of Health Related Professions, University of Florida.	Not an instrument to measure research use. Generic tool for evaluation of effects of a program.
Schlamp, F. T. (1975). *Researching the use of using research: Final report of the Research Utilization Project in California*. Sacramento: California Dept. of Rehabilitation.	Not an instrument to measure research use.
Pettengill (1994). Factors encouraging and discouraging the use of nursing research findings. IMAGE: Journal of Nursing Scholarship, 26, 143-147.	Not an instrument to measure research use. Measures predictors.
Wallin, L., Estabrooks, C. A., Midodzi, W. K., & Cummings, G. G. (2006). Development and validation of a derived measure of research utilization by nurses. Nursing research, 55(3), 149-160.	No instrument to measure research use. Research use variable is derived.
Cole, N., Tucker, L. J., & Foxcroft, D. R. (2000). Benchmarking evidence-based nursing... including commentary by Thompson C. *NT Research, 5*(5), 336-345.	Not an instrument to measure research use. Not on development or use of research, report on related factors but not on measure of research use. Assesses aspects of EBP.
Measuring organizational implementation status: CII knowledge implementation index (CKII) (2004). [Austin, Tex.]: Construction Industry Institute.	Not healthcare.
Costa-Mitrano, L. R. (2001). *Research and school psychologists: Training, consumption, application, perceptions, and attitudes.* Unpublished Psy.D., Alfred University, United States -- New York.	Not healthcare.
Landry, R., Amara, N., & Lamari, M. (2001). Utilization of social science research knowledge in Canada. Research Policy, 30(2), 333-349.	Not healthcare. Also, are asking a different question about researchers' perspective on the respondents' use of research.
Standefer, R. L. Research utilization and the development of research utilization systems (pp. 3, [5] leaves; 28 cm.).	Not healthcare. No research use measure.
Research utilization and the social indicators project (1975). Denver: The Center.	Not healthcare. Research use not measured.

Citation	Exclusion reason
Smith, H., Brown, H., Hofmeyr, G. J., & Garner, P. (2004). Evidence-based obstetric care in South Africa--influencing practice through the 'Better Births Initiative'. South African Medical Journal.Suid-Afrikaanse Tydskrif Vir Geneeskunde, 94(2), 117-120.	Purpose is to measure use of specific practice, not to measure research use.
Abouzelof, R. H. (1999). Diffusion of innovations: Describing the perceptions of the stages in the innovation-decision process for handwashing and alcohol hand rubs. (M.S.N., University of Utah College of Nursing).	Purpose is to measure use of specific practice, not to measure research use.
Amsallem, E., Kasparian, C., Cucherat, M., Chabaud, S., Haugh, M. C., Boissel, J. P., et al. (2007). Evaluation of two evidence-based knowledge transfer interventions for physicians. A cluster randomized controlled factorial design trial: The CardioDAS study	Purpose is to measure use of specific practice, not to measure research use.
Andrzejewski, M. E., Kirby, K. C., Morral, A. R., & Iguchi, M. Y. (2001). Technology transfer through performance management: the effects of graphical feedback and positive reinforcement on drug treatment counselors' behavior. Drug & Alcohol Dependence, 6	Purpose is to measure use of specific practice, not to measure research use.
Bjornson, D.C. (1990). Impact of a drug-use review program intervention on prescribing after publication of a randomized clinical trial, American Journal of Hospital Pharmacy, 47(7), 1541-154.	Purpose is to measure use of specific practice, not to measure research use.
Bookbinder, M. I. (1992). Nurse linkage agents' efforts to facilitate the use of a research-based innovation. (PH.D., New York University). , 207. (UMI Order #PUZ9237737.)*(92)*	Purpose is to measure use of specific practice, not to measure research use.
Cantor, M. N., Lavarias, V., Lam, S., Mount, L., Laskova, V., Nakhamiyayev, V., et al. (2005). Barriers to implementing a surgical beta-blocker protocol. Joint Commission journal on quality and patient safety / Joint Commission Resources., 31(11), 640-648	Purpose is to measure use of specific practice, not to measure research use.
Capra,. (1992). RNs utilization of research findings. *The American Journal of Advanced Nursing, 10*(1), 21-25.	Purpose is to measure use of specific practice, not to measure research use.
Carlson, C. L. (2006). Prior conditions influencing nurses' decisions to adopt evidence-based postoperative pain assessment practices. (Ph.D., Indiana University).	Purpose is to measure use of specific practice, not to measure research use.
Chien, C. R., & Lai, M. S. (2006). Trends in the pattern of care for lung cancer and their correlation with new clinical evidence: experiences in a university-affiliated medical center. American Journal of Medical Quality, 21(6), 408-414.	Purpose is to measure use of specific practice, not to measure research use.

Citation	Exclusion reason
ColonEmeric, C., Schenck, A., Gorospe, J., McArdle, J., Dobson, L., DePorter, C., et al. (2006). Translating evidence-based falls prevention into clinical practice in nursing facilities: results and lessons from a quality improvement collaborative, Journal of the American Geriatrics Society, 54(9), 1414-1418.	Purpose is to measure use of specific practice, not to measure research use.
Davies, B. L. (1999). Evaluation of two strategies for the transfer of research results about labour support and electronic fetal monitoring into practice. (Ph.D., University of Toronto (Canada).	Purpose is to measure use of specific practice, not to measure research use.
Dennis, A. R., Leeson-Payne, C. G., Langham, B. T., & Aitkenhead, A. R. (1995). Local anaesthesia for cannulation. Has practice changed? see comment. Anaesthesia, 50(5), 400-402. *(198)*	Purpose is to measure use of specific practice, not to measure research use.
Doerflinger, D. M. (2004). The relationship between acute care nurse administrators' knowledge and attitudes and restraint reduction. (Ph.D., George Mason University).	Purpose is to measure use of specific practice, not to measure research use.
Dopson, S., Mant, J., & Hicks, N. (1994). Getting research into practice: facing the issues. Journal of management in medicine, 8(6), 4-12.	Purpose is to measure use of specific practice, not to measure research use.
Drenning, C. (2006). Collaboration among nurses, advanced practice nurses, and nurse researchers to achieve evidence-based practice change. Journal of nursing care quality, 21(4), 298-301.	Purpose is to measure use of specific practice, not to measure research use.
Fineberg, H. V., Gabel, R. A., & Sosman, M. B. (1978). Acquisition and application of new medical knowledge by anesthesiologists: Three recent examples. Anesthesiology, 48(6), 430-436.	Purpose is to measure use of specific practice, not to measure research use.
Frantz, R. A., Gardner, S., Harvey, P., & Specht, J. (1992). Adoption of research-based practice for treatment of pressure ulcers in long-term care. Decubitus, 5(1), 44-5, 48-50, 52.	Purpose is to measure use of specific practice, not to measure research use.
Freeman, C. K. et al. (1993). Breastfeeding care in Ohio hospitals…	Purpose is to measure use of specific practice, not to measure research use.
Ghali, W. A., & Cornuz, J. (2000). Early uptake of research findings after fast-track publication. Lancet, 355(9203), 579-580.	Purpose is to measure use of specific practice, not to measure research use.

Citation	Exclusion reason
Gordon, M., & Montgomery, L. A. (1996). Minimizing epidermal stripping in the very low birth weight infant: Integrating research and practice to affect infant outcome. Neonatal network: NN, 15(1), 37-44.	Purpose is to measure use of specific practice, not to measure research use.
Grap, M. J., Pettrey, L., & Thornby, D. (1997). Hemodynamic monitoring: a comparison of research and practice. American Journal of Critical Care, 6(6), 452-456.	Purpose is to measure use of specific practice, not to measure research use.
Hammond, A., & Klompenhouwer, P. (2005). Getting evidence into practice: implementing a behavioural joint protection education programme for people with rheumatoid arthritis. British Journal of Occupational Therapy, 68(1), 25-33.	Purpose is to measure use of specific practice, not to measure research use.
Harris, M. (1992). The impact of research findings on current practice in relieving postpartum perineal pain in a large district general hospital. Midwifery, 8(3), 125-131.	Purpose is to measure use of specific practice, not to measure research use.
Helberg, D., Mertens, E., Halfens, R. J., & Dassen, T. (2006). Treatment of pressure ulcers: results of a study comparing evidence and practice. Ostomy Wound Management, 52(8), 60-72.	Purpose is to measure use of specific practice, not to measure research use.
Henderson, J. L., MacKay, S., & Peterson-Badali, M. (2006). Closing the research-practice gap: factors affecting adoption and implementation of a children's mental health program. Journal of Clinical Child & Adolescent Psychology, 35(1), 2-12.	Purpose is to measure use of specific practice, not to measure research use.
Hermann, R. C., Ettner, S. L., Dorwart, R. A., LangmanDorwart, N., & Kleinman, S. (1999). Diagnoses of patients treated with ECT: a comparison of evidence-based standards with reported use. Psychiatric Services, 50(8), 1059-1065.	Purpose is to measure use of specific practice, not to measure research use.
Jordan, H. S., Burke, J. F., Fineberg, H., & Hanley, J. A. (1983). Diffusion of innovations in burn care: Selected findings. Burns, 9(4), 271-279.	Purpose is to measure use of specific practice, not to measure research use
Kaner, E. F. S., Lock, C. A., McAvoy, B. R., Heather, N., & Gilvarry, E. (1999). A RCT of three training and support strategies to encourage implementation of screening and brief alcohol intervention by general practitioners. British Journal of General Practice, 49(446), 699-703.	Purpose is to measure use of specific practice, not to measure research use.
Kirchhoff, K. T. (1982). A diffusion survey of coronary precautions. Nursing Research, 31(4), 196-201.	Purpose is to measure use of specific practice, not to measure research use.
LaVela, S. L., Legro, Weaver, & Smith. (2004). Staff influenza vaccination: Lessons learned. *SCI Nursing, 21*(3), 153-157. ***Taken from SCI table of contents after review of Nelson 2004***	Purpose is to measure use of specific practice, not to measure research use.

Citation	Exclusion reason
Lock, C. A., & Kaner, E. F. S. (2000). Use of marketing to disseminate brief alcohol intervention to general practitioners: Promoting health care interventions to health promoters. Journal of evaluation in clinical practice, 6(4), 345-357**.**	Purpose is to measure use of specific practice, not to measure research use.
Mant, J., Hicks, N. R., Dopson, S., & Hurley, P. (1999). Uptake of research findings into clinical practice: A controlled study of the impact of a brief external intervention on the use of corticosteroids in preterm delivery.	Purpose is to measure use of specific practice, not to measure research use.
Martin, P., Thomsen, A. S., Rautanen, K., Hjalt, C. A., Jonsson, A., & Lofroth, G. (1999). Diffusion of knowledge of Helicobacter pylori and its practical application by Nordic clinicians. Scandinavian journal of gastroenterology, 34(10), 974-980.	Purpose is to measure use of specific practice, not to measure research use.
McGovern, M. P., Fox, T. S., Xie, H., & Drake, R. E. (2004). A survey of clinical practices and readiness to adopt evidence-based practices: Dissemination research in an addiction treatment system. Journal of Substance Abuse Treatment, 26(4), 305-312.	Purpose is to measure use of specific practice, not to measure research use.
McMenamin, S. B. et al. (2002) Support for smoking cessation interventions in physician organizations: Institutional and resource dependence perspectives, California: University of California (Thesis).	Purpose is to measure use of specific practice, not to measure research use.
Morse, B. A., Idelson, R. K., Sachs, W. H., Weiner, L., & Kaplan, L. C. (1992). Pediatricians' perspectives on fetal alcohol syndrome. Journal of substance abuse, 4(2), 187-195.	Purpose is to measure use of specific practice, not to measure research use.
Mullen, P. D., Ito, J. R., Carbonari, J. P., & DiClemente, C. C. (1991). Assessing the congruence between physician behavior and expert opinion in smoking cessation counseling. Addictive Behaviors, 16(5), 203-210. *(583)*	Purpose is to measure use of specific practice, not to measure research use.
Mullenbach, D. M. (1997). Pédiatrie Endotracheal Suctioning: Practice and Complications [Master's Thesis]. Winona, Minn: Winona State University.	Purpose is to measure use of specific practice, not to measure research use.
Munschauer, F. E., Priore, R. L., Hens, M., & Castilone, A. (1997). Thromboembolism prophylaxis in chronic atrial fibrillation: practice patterns in community and tertiary-care hospitals. Stroke, 28(1), 72-76.	Purpose is to measure use of specific practice, not to measure research use.
Obyrne, K. K., Peterson, L., & Saldana, L. (1997). Survey of pediatric hospitals' preparation programs: Evidence of the impact of health psychology research. Health Psychology, 16(2), 147-154.	Purpose is to measure use of specific practice, not to measure research use.
Rappolt, S., Mitra, A. L., Murphy, E., Rappolt, S., Mitra, A. L., & Murphy, E. (2002). Professional accountability in restructured contexts of occupational therapy practice. Canadian Journal of Occupational Therapy - Revue Canadienne d Ergotherapie, 69(5), 293-302.	Purpose is to measure use of specific practice, not to measure research use.

Citation	Exclusion reason
Rappolt, S., Pearce, K., McEwen, S., & Polatajko, H. J. (2005). Exploring organizational characteristics associated with practice changes following a mentored online educational module. Journal of Continuing Education in the Health Professions, 25(2), 116	Purpose is to measure use of specific practice, not to measure research use.
Riegel, B., Thomason, T., Carlson, B., & Gocka, I. (1996). Are nurses still practicing coronary precautions? A national survey of nursing care of acute myocardial infarction patients. American Journal of Critical Care, 5(2), 91-98.	Purpose is to measure use of specific practice, not to measure research use.
Scorpiglione, N., Nicolucci, A., Grilli, R., Angiolini, C., Belfiglio, M., Carinci, F., et al. (1995). Appropriateness and variation of surgical treatment of breast cancer in Italy: when excellence in clinical research does not match with generalized good Clin Epidemiol. 1995 Mar;48(3):345–352.	Purpose is to measure use of specific practice, not to measure research use.
Scott, W., & Marfell-Jones, M. (2004). Evidence alone is not enough to bring about practice change. Nursing New Zealand (Wellington), 10(1), 14-16.	Purpose is to measure use of specific practice, not to measure research use.
Stetler, C. B., Corrigan, B., SanderBuscemi, K., & Burns, M. (1999). Integration of evidence into practice and the change process: fall prevention program as a model. Outcomes management for nursing practice, 3(3), 102-111.	Purpose is to measure use of specific practice, not to measure research use.
Stevenson, K., Lewis, M., & Hay, E. (2006). Does physiotherapy management of low back pain change as a result of an evidence-based educational programme? Journal of evaluation in clinical practice, 12(3), 365-375.	Purpose is to measure use of specific practice, not to measure research use.
Valanis, B., Labuhn, K. T., Stevens, N. H., Lichtenstein, E., & Brody, K. K. (2003). Integrating prenatal-postnatal smoking interventions into usual care in a health maintenance organization. Health Promotion Practice, 4(3), 236-248.	Purpose is to measure use of specific practice, not to measure research use.
Varney, Carolynne. Tu, Jack V., Institute for Clinical Evaluative Sciences in Ontario, & Canadian Cardiovascular Outcomes Research Team. (2004). Quality of cardiac care in Ontario : EFFECT (enhanced feedback for effective cardiac treatment). phase 1, report	Purpose is to measure use of specific practice, not to measure research use.
Watters, C. A. (2007). Nutrition evidence in practice: How heart health promotion and guidelines are used by dietitians and regional health authorities. (Ph.D., University of Alberta (Canada).	Purpose is to measure use of specific practice, not to measure research use.
White, C. L. (1999). Changing pain management practice and impacting on patient outcomes. Clinical Nurse Specialist, 13(4), 166-172.	Purpose is to measure use of specific practice, not to measure research use.

Citation	Exclusion reason
Winter, J. C. (1990). Relationship between sources of knowledge and use of research findings. Journal of continuing education in nursing, 21(3), 138-140. *(898)*	Purpose is to measure use of specific practice, not to measure research use.
Wolanczyk, T., Moskwa, M., Gniadek, E., & Komender, J. (1999). Psychopharmacological preferences of Polish child and adolescent psychiatrists. European child & adolescent psychiatry, 8(4), 320-324.	Purpose is to measure use of specific practice, not to measure research use.
Wygnanski-Jaffe, T. (2005). The effect on pediatric ophthalmologists of the randomized trial of patching regimens for treatment of moderate amblyopia. Journal of Aapos: American Association for Pediatric Ophthalmology & Strabismus, 9(3), 208-211.	Purpose is to measure use of specific practice, not to measure research use.
Young, W. W., Marks, S. M., Kohler, S. A., & Hsu, A. Y. (1996). Dissemination of clinical results. Mastectomy versus lumpectomy and radiation therapy. Medical care, 34(10), 1003-1017.	Purpose is to measure use of specific practice, not to measure research use.
Zwart-van Rijkom, Leufkens, H. G. M., Simoons, M. L., & Broekmans, A. W. (2002). Variability in abciximab (ReoPro (R)) prescribing: Evidence based or budget driven? Pharmacoepidemiology and drug safety, 11(2), 135-141.	Purpose is to measure use of specific practice, not to measure research use.
Goode, C. J., Lovett, M. K., Hayes, J. E., & Butcher, L. A. (1987). Use of research based knowledge in clinical practice. Journal of Nursing Administration, 17(12), 11-18.	Purpose is to measure use of specific practice, not to measure research use.
Heiberger, G. L. (2002). *Factors affecting the health care beliefs, attitudes and caregiving behaviors of pediatric nurse practitioners: a case study of change.* Unpublished Ed.D., Rutgers The State University of New Jersey - New Brunswick.	Purpose is to measure use of specific practice, not to measure research use. Is a report on factors related to research use without measuring research use.
Davies, S. (1999). Occasional paper: Practice nurses' use of evidence-based research. *Nursing Times*, 95*(4), 57-60.*	Purpose is to measure use of specific practice, not to measure research use.
Ketefian, S. (1975) Application of selected nursing research findings into nursing practice: A pilot study. *Nursing Research, 24*(2) 89-92.	Purpose is to measure use of specific practice, not to measure research use.
Farr uggia, M. (2003). *A case study of the "Gourmet Education" situated learning model for teaching and learning research in the nursing profession.* Unpublished Ph.D., University of Idaho.	Purpose is to measure use of specific practice, not to measure research use.

Citation	Exclusion reason
Shibata, M. C., Soneff, C. M., Tsuyuki, R. T., Shibata, M. C., Soneff, C. M., & Tsuyuki, R. T. (2005). Utilization of evidence-based therapies for heart failure in the institutionalized elderly. *European Journal of Heart Failure, 7*(7), 1122-1125.	Purpose is to measure use of specific practice, not to measure research use.
Wolgin (1996). Perspectives on research. Practice changes through research utilization. Journal of Nursing Staff Development, 12(4), 219-220.	Purpose is to measure use of specific practice, not to measure research use.
Williamson, J. W. et al. (1989) Health science information management and continuing education of physicians. Annals of Internal Medicin, 110, 151-160. ***Cited by Weiss 1990***	Sources of knowledge. Not an instrument to measure research use.
Winters, C. A., Besel, J., Dea, J. E., III, Jorgensen, K. P., & Lee, H. J. (2006). Understanding health research utilization in rural settings: research use & access: interviews with practicing rural nurses in Montana. *Communicating Nursing Research, 39*, 167-167.	Sources of knowledge. Not an instrument to measure research use.
Glover, P. (2000). The journal has something for everyone -- journal reading habits of midwives who are members of the Australian College of Midwives -- a national survey. *Australian College of Midwives Journal*, *13*(3), 26-30.	Sources of knowledge. Not an instrument to measure research use. Not a development or use of research use report. Is a report on factors related to research use without measuring research use.
Amin, M., Saunders, J. A., & Fenton, J. E. (2007). Pilot study of the knowledge and attitude towards evidence based medicine of otolaryngology higher surgical trainees [6]. *Clinical Otolaryngology, 32*(2), 133-135.	Sources of knowledge. Report on related factors but not on measure of research use.
Akindipe, T. A., & Guidon, M. (2008). Evidence based practice: attitudes, use, and knowledge of physiotherapists in the Republic of Ireland... Rehabilitation and Therapy Research Society Fourth Annual Conference. Physical Therapy Reviews, 13(3), 198-199.	Sources of knowledge. No research use Measure. Assesses sources and attitudes.
Amin, F. A., Fedorowicz, Z., Montgomery, A. J.(2006). A study of knowledge and attitudes towards the use of evidence-based medicine among primary health care physicians in Bahrain. *Saudi Medical Journal*, *27*(9), 1394-1396.	Sources of knowledge. Not on development or use of research, report on related factors but not on measure of research use.
Baessler, C. A., Blumberg, M., Cunningham, J. S., Curran, J. A., Fennessey, A. G., Jacobs, J. M., et al. (1994). Medical-surgical nurses' utilization of research methods and products. Medsurg nursing : official journal of the Academy of Medical-Surgical Nurses, 3(2), 113-117, 120.	Sources of knowledge.

Citation	Exclusion reason
Erickson, B. A. (1988). *Method for incorporating nursing research findings into critical care nursing practice.* Unpublished PH.D, union for experimenting colleges and universities.	Sources of knowledge.
Estabooks (1998). Research Utilization Questionnaire--"modified" (1998). Will evidence-based nursing practice make practice perfect? Canadian Journal of Nursing Research, 30, 15-36.	Sources of Knowledge.
Glenton, C., Oxman, A. D., & Oxman, A. (1998). The use of evidence by health care user organizations. *Health Expectations, 1*(1), 14-22.	Sources of knowledge.
O'Donnell, C. A. (2004). Attitudes and knowledge of primary care professionals towards evidence-based practice: A postal survey. *Journal of Evaluation in Clinical Practice, 10*(2), 197-205.	Sources of knowledge.
Profetto-McGrath, J., Smith, K. B., Hugo, K., Taylor, M., El-Hajj, H., Profetto-McGrath, J., et al. (2007). Clinical nurse specialists' use of evidence in practice: a pilot study. *Worldviews on Evidence-Based Nursing, 4*(2), 86-96.	Sources of knowledge.
Sackett, D. L., Straus, S. E., & Firm, A. N. D. M. (1998). Finding and applying evidence during clinical rounds - The "evidence cart". [Article]. *Jama-Journal of the American Medical Association, 280*(15), 1336-1338.	Sources of knowledge.
Salisbury, C., Bosanquet, N., Wilkinson, E., Bosanquet, A., & Hasler, J. (1998). The implementation of evidence-based medicine in general practice prescribing. *British Journal of General Practice, 48*(437), 1849-1852.	Sources of knowledge.
Turner, P. (2001). Evidence-based practice and physiotherapy in the 1990s. *Physiotherapy Theory and Practice, 17*(2), 107-121.	Sources of knowledge.
Gerrish, K., & Clayton, J. (2004). Promoting evidence-based practice: an organizational approach. *Journal of Nursing Management, 12*(2), 114-123.	Sources of knowledge & barriers.
An investigation of the attitudes towards, and implementation of evidence based practice in physiotherapy in Ireland (2006). *Physiotherapy Ireland, 27*(2), 33-34.	Sources of knowledge (see Jette 2003). Not a research report; is an outline of a student project.
Schaafsma, F., Hugenholtz, N., de Boer, A., Smits, P., Hulshof, C., van Dijk, F., et al. (2007). Enhancing evidence-based advice of occupational health physicians. *Scandinavian Journal of Work, Environment & Health, 33*(5), 368-378.	Sources of knowledge and search skills.
Caldwell, K., Coleman, K., Copp, G., Bell, L., Ghazi, F., et al. (2007). Preparing for professional practice: how well does professional training equip health and social care practitioners to engage in evidence-based practice? *Nurse Education Today, 27*(6), 518-528.	Sources of knowledge. Not on development or use of research, report on related factors but not on measure of research use.

Citation	Exclusion reason
Nieri, M., & Mauro, S. (2008). Continuing professional development of dental practitioners in Prato, Italy. *Journal of Dental Education, 72*(5), 616-625.	Sources of knowledge.
Barnieh, L., & Edge, D. S. (2006). Understanding health research utilization in rural settings: cross-border collaborative research: pilot questionnaire results from Montana. *Communicating Nursing Research, 39,* 168-168. **Published abstract for Winters 2007 study**	Sources of knowledge.
Gerrish, K., Ashworth, P., Lacey, A., & Bailey, J. (2008). Developing evidence-based practice: experiences of senior and junior clinical nurses. *Journal of Advanced Nursing, 62*(1), 62-73.	Sources of knowledge.
Weiss, R., Charney, E., Baumgardner, R. A., German, P. S., Mellits, E. D., Skinner, E. A., et al. (1990). Changing patient management: what influences the practicing pediatrician? Pediatrics, 85(5), 791-795.	Sources of knowledge. No instrument to measure research use.
Turner, P., & Whitfield, T. W. A. (1997). Physiotherapists' use of evidence based practice: a cross-national study. *Physiotherapy Research International, 2*(1), 17-29.	Sources of knowledge. Not an instrument to measure research use. Not a development or use of research use measure. Reports on factors related to research use without reporting on measure of research use.
Winters, C. A., Lee, H. J., Besel, J., Strand, A., Echeverri, R., Jorgensen, K. P., et al. (2007). Access to and use of research by rural nurses. *Rural & Remote Health, 7*(3), 758.	Sources of knowledge. Not an instrument to measure research use. Not a development or use of research use measure. Reports on factors related to research use without reporting on measure of research use.
Stross, J. K. (1987). Information sources and clinical decisions. Journal of General Internal Medicine, 2(3), 155-159.	Sources of knowledge. Not research use measure. Criteria for appropriate use (of diagnostic/ therapeutic modalities) were based on expert opinion. Remainder of data is about sources of knowledge.
Estabrooks, C. A., Chong, H., Brigidear, K., & Profetto-McGrath, J. (2005). Profiling Canadian nurses' preferred knowledge sources for clinical practice. Canadian Journal of Nursing Research, 37(2), 118-140.	Sources of knowledge. No research use measure.

Citation	Exclusion reason
Hickie, S., Ross, S., & Bond, C. (1998). A survey of the management of leg ulcers in primary care settings in Scotland. Journal of clinical nursing, 7(1), 45-50. (362)	Sources of knowledge. Not research use measure. Instrument measures current practice.
Bogdan-Lovis, E. A., & Sousa, A. (2006). The contextual influence of professional culture: certified nurse-midwives' knowledge of and reliance on evidence-based practice. *Social Science & Medicine, 62*(11), 2681-2693.	Sources of knowledge. Not on development or use of research, report on related factors but not on measure of research use.
Burkiewicz, J. S., Zgarrick, D. P., Burkiewicz, J. S., & Zgarrick, D. P. (2005). Evidence-based practice by pharmacists: utilization and barriers. *Annals of Pharmacotherapy, 39*(7-8), 1214-1219.	Sources of knowledge. Not on development or use of research, report on related factors but not on measure of research use.
James, E. L., Fraser, C., Anderson, K., Judd, F., James, E. L., Fraser, C., et al. (2007). Use of research by the Australian health promotion workforce. *Health Education Research*, *22*(4), 576-587.	Sources of knowledge. Not on development or use of research use. Reports on factors related to research use without reporting on measure of research use.
Forsetlund, L., Bradley, P., Forsen, L., Nordheim, L., Jamtvedt, G., & Bjørndal, A. (2003). Randomised controlled trial of a theoretically grounded tailored intervention to diffuse evidence-based public health practice [ISRCTN23257060]. *BMC Medical Education*, *3*, 1-12.	Sources of knowledge. Not on development or use of research use. Reports on factors related to research use without reporting on measure of research use.
Coleman, P., & Nicholl, J. (2001). Influence of evidence-based guidance on health policy and clinical practice in England. *Quality in Health Care, 10*(4), 229-237.	Sources of knowledge. Not on development or use of research, report on related factors but not on measure of research use.
Mattila, L. M., Koivisto, V., & Haggman-Laitila, A. (2005). Evaluation of learning outcomes in a research process and the utilization of research knowledge from the viewpoint of nursing students. *Nurse Education Today*, *25*(6), 487-495.	Sources of knowledge. Reports on factors related to research use (with nursing students) without reporting on measure of research use.

Citation	Exclusion reason
Philibert, D. B., Snyder, P., Judd, D., Windsor, M. M.,et al. (2003). Practitioners' reading patterns, attitudes, and use of research reported in occupational therapy journals. *American Journal of Occupational Therapy, 57*(4), 450-458.	Sources of knowledge. Operationalized more as use of a source of knowledge.
Banning, M. (2005). Conceptions of evidence, evidence-based medicine, evidence-based practice and their use in nursing: independent nurse prescribers' views. *Journal of Clinical Nursing, 14*(4), 411-417.	Sources of knowledge. Reports on EBP terms.
Jette, D. U., Bacon, K., Batty, C., Carlson, M., Ferland, A., Hemingway, R. D., et al. (2003). Evidence-based practice: beliefs, attitudes, knowledge, and behaviors of physical therapists. *Physical Therapy, 83*(9), 786-805.	Sources of knowledge. Reports on factors related to research use without reporting on measure of research use.
Zipoli, R. P., Jr. (2004). *Evidence-based practice among speech-language pathologists: Attitudes, utilization, and barriers.* Unpublished M.S., Southern Connecticut State University, United States -- Connecticut.	Sources of knowledge. Research use defined as use of sources; barriers to EBP.
Pierce, S. T. (2000). *Readiness for evidence-based practice: information literacy needs of nursing faculty and students in a Southern United States state.* Unpublished Ed.D., Northwestern State University of Louisiana.	Sources of knowledge; EBP Process.
Zipoli, R. P., Jr., Kennedy, M., Zipoli, R. P., Jr., & Kennedy, M. (2005). Evidence-based practice among speech-language pathologists: attitudes, utilization, and barriers. *American Journal of Speech-Language Pathology, 14*(3), 208-220.	Sources of knowledge; research use defined as use of sources. Barriers to EBP.
Bauer, I., Lechner, S., & Wojciech, J. (2007). Evidence-based practice in physiotherapy: the current situation in Germany as compared to England (part 2) [German]. *Zeitschrift fuer Physiotherapeuten, 59*(2), 122-137.	Sources of knowledge; research use defined as use of sources. Barriers to EBP.
Egerod, I. (2004). Survey of evidence-based practice among critical care nurses in Denmark. *CONNECT: The World of Critical Care Nursing, 3*(2), 38-42.	Sources of knowledge; research use defined as use of sources. Barriers to EBP.
Estabrooks CA. Translating research into practice: implications for organizations and administrators. Can J Nurs Res. 2003 Sep;35(3):53-68.	Sources of knowledge; research use defined as use of sources. Barriers to EBP.

Additional File 2-3. Description of Other Specific Practices Indices

Author, Year [Citation No.]	Description of research use measure
Aron, 1990 [52]	20 items relating to the use of specific therapeutic techniques for depression. Sample items include: • Establish and maintain rapport • Be sincere and genuine • Convey a warm and interested attitude Scored on a 7-point Likert scale from 1=do not use at all to 7=use all the time. For analysis, scale points were combined to produce 3 separate categories: 1-2 (do not use) 3-5 (use sometimes) 6-7 (use all the time)
Knudsen, 2004 [53]	Dependant variable was the organizational use of treatment innovations. Sample treatment innovations assessed include: • Disulfiram • Naltrexone • Rapid opiate detoxification Each item was scored dichotomously as yes/no. An aggregate measure of innovation adoption based on an additive index of the 15 innovative substance abuse treatment techniques was calculated.
Tita, 2005 [44] Tita, 2006 [45] [1 study, 2 articles]	Questionnaire designed to estimate awareness and use of 13 obstetrical interventions. Sample interventions include: • Antenatal corticosteroids for impending prematurity • Antiretrovirals to prevent mother-to-child transmission of HIV/AIDS • Uterotonics to prevent postpartum hemorrhage Each item was scored dichotomously as yes/no for awareness and use. An additive composite score based on the 13 interventions was then calculated.
Varcoe, 1995 [76]	Use of 10 specific research practices. Sample practices include: • IM injection • Catheter removal • Sensory information/ diagnostic Each practice was scored on a 3 pt scale: never (1), sometimes (2), always (3) or ‘not applicable’. A mean score based on the ten practices was then calculated.

Additional File 2-4. Description of Other General Research Use Indices

Author, Year [Citation No.]	**Description of research use measure**
Forbes et al., 1997 [136]	Research use index reflects the frequency with which staff nurses engaged in 5 research activities during the past year. Sample items include: • Reviewing research literature applicable to their practice • Rejecting or implementing a practice activity based on the results of a research study Scored using the following four response options: 0, 1, 2-4, 5 or more times. Research use index score obtained by taking a sum of the 5 items.
Grasso et al., 1989 [54]	Research use index composed of 9 items, which ask respondents how often they use research information in 9 different ways. Sample items include: • Discussion with coworkers • Discussion with students • Assessing individual client change Scored using a 4-point scale from never to frequently. Research use index score obtained by taking the sum of the 9 items.
Kamwendo 2002 [138]	Research use index composed of 4 statements measuring present engagement in research use. A sample item is: • Apply research findings to improve physiotherapy practice Each item is scored on a 5-point Likert scale from 'I do not agree at all' to 'I very much agree'. Item scores are then summed for an index score (4-20).
Karlsson & Tornquist, 2007 [100]	Same index used as above (Kamwendo, 2002)
Morrow-Bradley et al., 1986 [137]	Research use index composed of 6 items (called a 'research utility index'). Sample items include: • Rate the degree to which the results from psychotherapy research have influenced the way you do psychotherapy • Use of psychotherapy research in dealing with difficult treatment cases in the last year • Practice changed by conferences in the last year One item (rate the degree) scored using a 6-point scale from not at all to more than any other factor. Remainder of items scored dichotomously as yes/no. Method for combining items to form the index is not reported.
Pelz et al., 1981 [111]	Research use index consisting of 10 items that measure the extent of research use. Directly or indirectly.

Author, Year [Citation No.]	Description of research use measure
	Direct Measures of Research Use sample items: • Reviewed research literature in an effort to identify new knowledge for use in your practice • Evaluated a research study to determine its value for practice Scored using a 4-point scale from 0 to 5 or more times in the past year. *Indirect Measures of Research Use* sample item: • Extent to which several possible types of committees 'influence nursing practice in your hospital' Scored using a 5-point scale from none to complete OR no extent to very great (depending on the item). Research use index scores obtained by taking a mean of the 10 items.
Rardin, 1986 [55]	Research use index measuring impact of psychotherapy research on practice with 3 items (this is within the section on research attitudes in the survey). Items are: • Please estimate how much impact research in psychotherapy has on your actual practice of psychotherapy. • Please estimate how much impact research in psychotherapy has on your thinking about the process of psychotherapy • Please estimate how much impact research in psychotherapy has on your conceptualizations of clients/patients in psychotherapy Scored on a 5-point Likert scale from very to very high. Results from these items are then summed for an *Impact on Practice* rating ranging from 3-15.
Reynolds, 1981 [46]	Research use index consists of 5 items focusing on the extent to which respondents participate in research activities. Sample items include: • Reviewed research literature in an effort to identify new knowledge for use in your practice • Evaluated a research study to determine its value for practice Each item is asked with respect to the past year and is scored on a 4-point scale: 0, 1, 2-4, 5 or more times**.** Mean of the items are then taken as a measure of research utilization.
Stiefel, 1996 [62]	Research use index consists of 18 items measuring respondents' reported participation in nursing research utilization activities. Sample items include: • I read nursing research articles and learn about research-based nursing interventions. • I attend conferences/educational programs and learn about research-based nursing interventions

Author, Year [Citation No.]	**Description of research use measure**
	• I think about ways of using a research-based nursing intervention in my nursing practice when I become aware of it Each item is scored on a 5-point scale from never to always. Item scores are then summed for an index score (18-90).
Varcoe & Hilton, 1995 [76]	Research use index contains 10 general statements on research use. Sample items include: • Communicating concerns about the effectiveness of practices to colleagues • Use of research articles to support questioning practice • Identification of hospital policies based on research Each item is scored on a 4-point scale from not at all to always. Item scores are then summed for an index score (10-40).

Additional File 2-5: Supporting Validity Evidence by Instrument (See instrument hierarchy for population and setting)

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
NPQ n=11 articles (n=9 studies)				
Brett 1987 **Index Study**	"Assumed" as practices were derived from published research using specific criteria developed by Haller et al. 1979	No evidence	Not reported	**Significant** ($p<0.05$) • Nurses' perception about the existence of organizational policy and procedure (r=.626) • Percentage of nurses with non-nursing master's degree • (r=.133) **Non-significant** • Type or number of degrees [BN vs. diploma]
Brett 1989 *A report of Brett 1987*	"Assumed" as the practices were derived from published research reports using specific criteria developed by Haller et al. 1979	No evidence	Not reported	None reported
Barta 1995	Expert panel of 3 pediatric nurses active in paediatric pain assessment and management reviewed the research base for each practice	No evidence	Not reported	None reported
Berggren 1996	Midwifery practices taken from doctoral dissertations and articles published in the journal of the Swedish Midwives' Association	No evidence	Not reported	**Non-significant** • Experience • Education [degree vs. diploma]
Coyle 1990	Appropriateness of the nursing practices; practices replicated in 1 study	No evidence	Not reported	**Significant** ($p<0.05$) • Attendance at conferences (X^2=5.179, df=1) • Policy perception: significant for 5/14 practices (Range r=0.50 to r=0.70) and significant overall (r=0.58)

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
				Non-significant • Level of education • Years experience in nursing
Michel 1995	"Assumed" as research findings derived from published nursing literature using specific criteria; replicated in at least 1 study	No evidence	Not reported	**Significant** ($p<0.05$) • Educational level [bachelors vs masters, Mann-Whitney U test] • Awareness of agency policy and educational level (R^2=.18, F=16.26, linear regression) **Non-significant** • Years of work experience
Rodgers 2000a 'a study…'	Panel of nurse researchers and educators. *(Unclear if practice only evaluated or if items were evaluated as well.)* 14 practices and influencing factors were identified in the earlier exploratory study.	Validity of self-reporting levels of research utilization confirmed in pilot with 20 nurses. Process and details of this are not reported.	Not reported	**Significant** ($p<0.05$) • Whether ward gets nursing journals (z= -2.68, Mann-Whitney U test) **Non-significant** • Time qualified • Age
Rodgers 2000b 'the extent..' *A report of Rodgers 2000a*	Panel of nurse researchers and educators. *(Unclear if practice only or if items were evaluated as well.)* 14 practices and influencing factors were identified in the earlier exploratory study	Ability of nurses to self-report open and honestly on their level of research utilization confirmed in pilot with 20 nurses. Option of 'not able to use' was added to survey but was coded as 'not using' for purpose of analysis.	Not reported	Progression through the stages of adoption was linear for the vast majority of nurses. Non-linear progression did occur for a small percentage.

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
Rutledge 1996	Expert panel: RU subcommittee and the clinical practice committee. *(Unclear if practice only or if items were evaluated as well.)*	No evidence	Not reported	Progression through the stages of adoption was linear for the vast majority of nurses. Non-linear progression (i.e., persuasion or implementation without awareness) did occur for small percentage (<1%). **Significant** (p<0.05) • Conferences attended in last year (r=0.1168)
Squires 2007	"Assumed" as the research-based practices selected were identified from existing research literature (systematic reviews and clinical practice guidelines) using specific criteria.	No evidence Use Brett's scoring to allow for comparability but notes that averaging the 8 practices for a final TIAB may not be appropriate.	Not reported	Logistic regression with classification as a 'User' *(i.e., nurse who reported any use for at least 4 of the 6 practices)* **Significant** (p<0.05) (β; 95% CI) • Aware overall (β=2.52; 0.98, 4.06) • Aware by regular use (β=3.49; 2.47, 4.50) • Persuaded of the appropriateness of the practice (β=2.11; 0.40, 3.83) Logistic regression with classification as a 'Consistent User' *(i.e., nurse who reported that they 'always use' 4 of the 6 practices)* **Significant** (p<0.05) (β; 95% CI) • Perception of existence of policy/procedure (β=0.58; 0.09, 1.07) • Work in critical care unit (CCU as reference group) (β= -0.42; -0.72, -0.12)
Thompson 1997	By expert panel of five doctoral-prepared nurses. *(Unclear if practice only or if items were evaluated as well.)* Content validity index (pilot) = .94	No evidence	Not reported	None reported

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
RUQ n= 16 articles (14 studies)				
Champion 1989 Index	Expert panel	No evidence	Not reported	**Significant** ($p<0.05$) • Attitude ($r=0.55$) • Availability ($r=0.52$) • Multiple $R=0.65$ (accounts 42% of the variance) **Non-significant** • Age • Years employed
Bostrom 2006	Not reported	No evidence	Not reported	None reported
Bostrom 2007 *A report of Bostrom 2006*	State that the RUQ is valid Details not provided Cite: Champion & Leach (1989) Pettengill et al. (1994) Humphris et al. (1999)	No evidence	Not reported	*Single item "*I use research findings in my daily practice*" from the RUQ used as the dependant variable for this study* *Likert scale dichotomized into *agree* versus *do not know/disagree* to divide into research user vs. non-user groups for analysis* **Significant** ($p<0.05$) • Attitudes toward research ($\beta=1.71$; OR=5.52) • Access to research findings at work place ($\beta=1.90$; OR=6.65) • Support from unit manager ($\beta=1.40$; OR=4.03) **Non-significant** • Years of employment • Age
Bostrom	Not reported	No evidence	Not reported	**Significant** ($p<0.05$)

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
2008				• Presentation subscale (i.e., RNs reporting more RU are less likely to perceive presentation of research as a barrier to RU) (r= -0.289)
Hansen 1999	Content & Predictive (Champion & Leach)	No evidence	Not reported	**Significant** ($p<0.05$) (β coefficients are not reported) **Physicians** (All are measures of collaboration) • Communication timeliness • Within-unit coordination • Communication openness between groups (47% of variance) **Nurses** • Communication openness within group (9.3% of variance)
Hatcher 1997	Not reported	No evidence	Not reported	**Significant** ($p<0.05$) • Support (27% of variance when entered alone, regression) • Attitude (52% of variance when entered alone, regression) • Availability (value not reported) • Significant difference between Nursing Advisory Committee (NAC) members (RU=4.03) & Staff Nurses (RU=3.27) (t=5.57, df=155).
Humphris 1999	Not reported	No evidence	Not reported	**Significant** ($p<0.05$) (X^2 analysis; test statistic value not reported) • Greater number of Diabetes Nurse Specialist (DNS) implement specific findings into practice as compared to the Non-Nurse Specialist (NNS) group (74% vs. 62%).
Humphris 2000	Judged by professional opinion. *(Not clear as to whether this is*	No evidence	Not reported	None reported

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
	for the new measures or for RU.) Although not reported as content validity, the authors developed the items for the questionnaire based on qualitative analysis from phase one of the study and from an extensive literature review.			
Lacey 1994	Not reported	**Follow-up interviews** Validity of self-reports in the questionnaire assessed by follow-up interviews. Respondents asked how they defined research utilization, to give examples of research-based practice in their own clinical area and about difficulties in implementing research findings. Nurses were able to provide appropriate examples of research utilization and to interpret the term	Not reported	**Significant** ($p<0.05$) (β coefficients are not reported) • Attitude • Availability • Support (Combined to account for 35.4% explained variance)

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
		‘research’ correctly (although they were unable to define the term ‘research’, could use the concept knowledgeably). Many examples of research use given, indicating that it was likely that the respondents were accurately reporting their research use behaviour in the questionnaire.		
McCloskey 2005	Cite Champion & Leach, 1989-panel of experts	No evidence	Refer to Champion and Leach, 1989–factor analysis. But no report of factor analysis in this reference.	**Significant** ($p<0.05$) • Salary ($\beta=0.003$; $R^2=.115$) • Direct ($\beta=0.098$; $R^2=.164$) • Assets ($\beta=0.113$; $R^2=.174$) **Variable details:** ***Salary*** : degree to which the nurse has paid work time to engage in research utilization activities ***Direct:*** support through direct consultation with mentors, statisticians, budgeted money, grants, and support for writing reports ***Assets:*** degree to which the respondent is able to use hospital resources such as supplies, services, equipment, and computers
McCloskey 2008	Champion and Leach, 1989-panel of experts	No evidence	Refer to Champion and Leach, 1989–	**Significant** ($p<0.05$) • Masters degree [vs. baccalaureate or associate/diploma]

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
A report of McCloskey 2005			factor analysis. But no report of factor analysis in this reference.	(F=11.34, df=2) • Management position or advanced practice nurses [vs. staff nurses] (F=7.901, df=2) **Non-significant** • Years of nursing experience
Nash 2005	Not reported	No evidence	Not reported	**Significant** ($p<0.05$) • Primary population (Mean RU score highest to lowest): critical (i.e., ICU, ER, surgery, or recovery), ambulatory, intermediate, long term, other (F=2.43)
Ohrn 2005	Not reported	No evidence	Not reported	**Significant** ($p<0.05$) (t-test; test statistic value not reported) • Education
Prin 1997	By three nursing informatics experts (process unclear)	No evidence	Not reported	**Significant** ($p<0.05$) • Attitudes (r=.5793)
Tranmer 2002	Not reported	No evidence	Not reported	**Significant** ($p<0.05$) **<u>All respondents (i.e., pretest + post test):</u>** • Attitude (β=0.63) • Support (β=0.20) • Access (β=0.20) **Non-significant** • Work experience • Highest level of education [diploma vs. baccalaureate]
Wallin 2003	Not reported	No evidence	Not reported	None reported
EROS n= 8 articles (7 studies)				
Pain 1996 **Index**	Instrument developed based on focus groups. 4 sections of the EROS based	No evidence	Not reported for use subscale	None reported

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
Study	on 90-minute focus group findings with representatives (4 clinicians, 4 clinician-researchers, and 3 administrators) from 7 institutions. Informal discussions based on 4 questions; of which two ask about use. 1) In what ways (if any) have research findings influenced your own practice and that of others? 2) In the ideal world, how should research be integrated into clinical practice? Findings, based on content analysis, from this stage demonstrated that the concept of 'research orientation' went beyond specific changes in clinical procedures to include the four subcomponents.			
Bonner 2008	Not reported Authors state that the EROS does not clearly define what research is and that this may limit validity	No evidence	Factor analysis with three retained components (45.1% explained variance in total): 1) Attitude (18.0%)	**Significant** ($p<0.05$) Kruskal–Wallis • Nurse unit managers and CN consultants as compared to nurses in other positions (H=12.67) • Completion of a masters degree (H=11.16)

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
			2) Use of Research (15.6%) 3) Knowledge of Research (11.4%) But the analysis does not indicate which items are included in this scale. Further, there are four subscales in the original EROS.	
Henderson 2006	Not reported Refer to Pain et al. 1996	No evidence	Not reported	None reported
McCleary 2002a 'Use of the EROS...'	Not reported Refer to Pain et al.1996	No evidence	Not reported for use subscale	**Significant** ($p<0.05$) • Graduate [vs. baccalaureate or community college] (F=8.8, df=2172) **Non-significant** • Age • Work experience
McCleary 2002b 'Research utilization among...' *A report of McCleary 2002a*	Not reported Refer to Pain et al. 1996	No evidence	Not reported	None reported
McCleary	Not reported	No evidence	Not reported	None reported

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
2003 *A report of McCleary 2002a*	Refer to Pain 1996			
Pain 2004	Not reported	Utilize two methods to gain information about research utilization behaviours but the authors do NOT compare/contrast the findings from each of these methods as a way to assess the validity of the survey measure.	Not reported	None reported
Waine 1997	Not reported	No evidence	Not reported	None reported
Specific practices n=5 articles (4 studies)				
Aron 1990	Not reported Therapeutic techniques based on empirical research	No evidence	Not reported	None reported
Varcoe 1995	Total instrument- peer review *(Unclear if practice only or if items were evaluated as well.)*	Pilot testing with revision (whole instrument; nothing specific to the research use items).	Not reported	**Significant** ($p<0.05$) • Climate ($r=.33$) • Supportive infrastructures for research (e.g. libraries) ($r=.31$) **Non-significant** Education
Knudsen 2004	Not reported The authors do report that the innovations were selected based on the literature, although	No evidence	Not reported	**Significant** ($p<0.05$) (Structural equation model coefficients) • Large size (0.290)

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
	research on acupuncture has mixed results, and were chosen to represent a wide range of approaches.			• Environmental scanning (information seeking in the external environment 4 items) (0.289) • Collection of satisfaction data (from referral sources and third party payers 2 items) (0.140)
Tita 2005	Not reported	Respondents encouraged to add clarifying comments which enhanced validity for 3% of the sample (32.9% wrote in comments) Debriefing allowed for adjustment of prevalence ratios for 17 responses (3 for folic acid question which was misinterpreted and 14 for planned use of caesarean section which was likely over-reported).	Not reported	None reported
Tita 2006 *A report of Tita 2005*	Not reported	Refer to Tita 2005	Not reported	*Associated with at least 50% variation in awareness of practice* **Significant** (p<0.05) • Awareness is associated with a 15-fold increase in practice (PR prevalence ratio=15.4; 95% CI: 4.3-55**)** • Have internet access (aPOR=prevalence odds ratio adjusted for other confounders retained in the logistic regression model=3.4)

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
General Research Utilization Indices n=10 articles (10 studies)				
Forbes 1997	Not reported	No evidence	Factor Loadings for RU subscale: Item29=.68 Item30=.80 Item31=.82 Item32=.72 Item33=.66	**Significant** (p<0.05) • Group cohesion (r=.07) **Significant** (p<0.05) (post-hoc Duncan test; test statistic value not provided). • Difference between groups for critical care nurses (M=9.2, SD 3.1) as compared to medical/surgical (M=8.2, SD 3.0) or obstetrical/gynecological (M=8.7, SD 3.0)
Grasso 1988	Index score results from sum of first 9 items; One item omitted from index score based on content analysis that it is different from the remaining items.	No evidence	Not reported	**Significant** (p<0.05) • Perception of facilitators=27.7% (r=.51) • Pro-research attitudes= 3.5% (r=.39)
Kamwendo 2002	Eckerling et al. 1988—four dimensions and the four research activities chosen based on an extensive literature review	Trialed the instrument with 30 physiotherapy colleagues and students resulting in minor changes	Not reported	*Correlations to engagement dimension for 'apply research findings' activity* **Significant** (p<0.05) (Spearman coefficient) • The following are work-related factors: I have set time aside to read (0.14) or to execute research (0.24) • Research activities are encouraged by physiotherapist colleagues (0.15), by other colleagues (0.22), by nearest superior (0.12), by management (0.19)
Karlsson 2007	Eckerling et al. 1988—four dimensions and the four research activities chosen based on an extensive literature review	No evidence	Not reported	*Correlations to engagement dimension for 'apply research findings' activity* **Significant** (p<0.05) (Spearman coefficient 1997; 2003)

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
				The following are work-related factors: I have set time aside to read (0.21; 0.13) or to execute (0.24; 0.11) Research activities are encouraged by OT colleagues (0.27; 0.18), by other colleagues (0.24; 0.14), by nearest superior (0.24; 0.10), by management (0.21; 0.10)
Morrow-Bradley 1986	Not reported	No evidence	Not reported	*Correlations to the utility index* **Significant** ($p<0.05$) (Kendel tau) Agree that: • Clinically meaningful questions are not studied (-0.15); • Criteria are either too global or too specific (-0.13); • Research procedures distort therapeutic process (-0.21); • Studies ignore complexities of therapy (-0.14); • Therapeutic relationship is ignored (-0.13); • Total # criticisms endorsed (-0.19)
Pelz 1981	Not Reported	No evidence	Not reported	**Significant** ($p<0.05$) (Paired t-tests; test statistic value not reported) • Experimental IT members (in intervention hospitals) increased significantly in direct measures of RU from year 1 to year 2 (i.e. post-intervention) • Experimental ITs significantly higher than experimental non-IT counterparts on 5 of 6 direct RU measures (includes RU index score) in year 2 and on 4 of the 6 RU scores in year 3. In both cases, changes to mean RU index was significant.
Rardin 1986	Not reported	Pre-tested by 3 graduate students in counseling psychology to ensure clarity and to	Not reported	None reported

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
		refine the layout		
Reynolds 1981	Not reported *Reviewer note:* The following general rules for constructing the indices from the survey items to represent the concepts in the study were used: 1) Constituent items must be conceptually related 2) Constituent items must be statistically related 3) That statistical relationships must be stable within each of the nursing roles 4) The final result was to be a 4-6 category variable with each category typically containing 20-25 percent of the cases 5) For respondents with missing data on a constituent item, an index value was constructed using the available data if at least half of the data were available.	Pre-tested on a group of nurses employed in a non-participating hospital. Changes made in format and wording.	Not reported	**Non-significant** (Covariance analysis) • Professionalism (total standardized coefficient=0.498 NS; individual component=0.456 NS; organizational component=0.042 NS) • Decentralization (total standardized coefficient=0.333 NS; individual component=0.079 NS; organizational component=0.254 NS) • Communication (total standardized coefficient= -0.090 NS; individual component=0.209 NS; organizational component= - 0.299 NS) • Size Note: Size does demonstrate significant effects with communication and decentralization (total standardized coefficient= -0.042 NS; individual component=none; organizational component= - 0.042 NS) • Interorganizational relationships (total standardized coefficient= - 0.045 NS; individual component=none; organizational component= - 0.0.045 NS)
Stiefel 1996	Pilot—by 4 NRU experts (2 members of the CURN project, 1 developer of the Iowa model, and 1 who works actively with nurses on NRU projects)	No evidence	**Below are from the pilot** Factor analysis (n=202 RNs) Loading of 3	**Significant** ($p<0.05$) • Critical care (vs. other settings) (Wilk's lambda=0.76, F=2.23, df=1246)

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
	Current study—Clinical nurse researcher at the Midwest site Process for the expert review unclear in both cases		factors 1) Literature factor (7 items): 0.56-0.88 2) Intervention factor (8 items): 0.43-0.74 3) Outcomes factor (3 items): 0.57-0.65 2 items were deleted from the original 20 item survey No discussion as to why did not use the findings from the factor analysis in the derivation of the final score-FA showed 3 factors but they presented 1 derived score.	
Varcoe 1995	Total instrument- peer review *(Unclear if practice only or if items were evaluated as well.)*	Pilot testing with revision (whole instrument; nothing specific to the RU items)	Not reported	**Non-significant** • Education [diploma vs. degree] • Value research
Knott & Wildavsky Standards n=1 article (1 study)				
Belkhodja 2007	Not reported Based on the utilization scales developed by Knott &	No evidence	Not reported	**Significant** ($p< 0.05$) • Research relevance (t-ratio=3.668) • Organizational culture (research as a preferred source [i.e., research culture] (t-ratio=3.621); intensity of

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
	Wildavsky (1980)			research source use (t-ratio=3.506) • Formal linkage mechanisms (t-ratio=7.142) and informal linkage mechanisms (t-ratio=3.251)
Past/ Present/ Future Utilization n= 3 (3 studies)				
Brown 1997	Not reported	No evidence	N/A	*Correlations to interest in future participation: *Applying research findings to practice** **Significant** ($p<0.05$) • Higher education [without bachelor's vs. with bachelors vs. graduate degree] (X^2=36.1, V=0.14)
Butler 1995	Not reported	No evidence	N/A	**Significant** ($p<0.05$) Staff group: • Perceived support within the system for research activity (X^2=4.88, OR=2.0) • Nurses in the leadership group are five times more likely than staff nurses to use research (OR=5.01) **Non-significant** Staff group • Age • Experience as RN Leadership group: • Age • Experience as RN • Education
Wells 1994	Not reported	No evidence	N/A	**Significant** ($p<0.05$) • Higher research value (β=1.62)
Parahoo n= 7 articles (3 studies)				
Parahoo 1998	Panel of three experts Questionnaire developed after a	Reports a pilot with 20 nurses--changes were made mostly to	N/A	None reported

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
Index Study	review of the literature on research utilization and research activities No details provided.	wording. Not clear as to whether this was for research use items or not.		
Parahoo 1999a 'A comparison …' *A report of Parahoo, 1998*	Panel of three experts Questionnaire developed after a review of the literature on research utilization and research activities No details provided.	No evidence	N/A	None reported
Parahoo, 1999b 'Research utilization... ' *A report of Parahoo, 1998*	Panel of three experts Questionnaire developed after a review of the literature on research utilization and research activities No details provided.	Reports a pilot with 20 nurses--changes were made mostly to wording.	N/A	None reported
Parahoo 2000 *A report of Parahoo, 1998*	Panel of three experts Questionnaire developed after a review of the literature on research utilization and research activities. No details provided.	Reports a pilot with 20 nurses--changes were made mostly to wording.	N/A	None reported
Parahoo	Panel of three experts	Reports a pilot with 20	N/A	None reported

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
2001 *A report of Parahoo, 1998*	Questionnaire developed after a review of the literature on research utilization and research activities No details provided.	nurses--changes were made mostly to wording.		
Valizadeh 2003	Survey was translated into Persian and back-translated into English for analysis but no report on whether content validity was re-established during this process Parahoo 1999-expert panel	Not reported. Refer to Parahoo 1999-pilot study	N/A	None reported
Veeramah 2004	Questionnaire developed following a review of the literature Reviewed by a panel of five nurse or midwifery teachers with expertise in research methods	Piloted with 12 graduates similar to the intended sample. Changes made mostly to wording	N/A	None reported

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
Estabrooks' Kinds of Research Utilization n= 10 articles (8 studies)				
Estabrooks 1999a 'The conceptual …'	Reviewed by two researchers with expertise in the field. Careful attention paid to theoretical conceptualizations of research utilization in the literature, questioning approaches of previous investigators, theoretical needs of the study, and the investigator's clinical experience. Participants were deliberately coached with definitions and examples. Participants' responses to the question on general research use should have reflected the acquisition of new knowledge about the concept of 'research utilization' as they progressed through the	Pilot testing on a convenience sample (n=23) of post-basic baccalaureate nursing students and master's nursing students. The labeling convention was chosen as pilot testing suggested that concrete labels were required to make explicit that the numerical scale was a relative scale.	N/A	Significant (Variables retained in final model structural equation model fit using LISREL; X^2=55.91, p=0.263, AGF=0.956) (Coefficients are not reported) • Attitude towards research • Attending in-services

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
	questionnaire.			
Estabrooks 1999b ‘Modeling …’ *A report of Estabrooks 1999a*	See report 1999a	See report 1999a	N/A	**Significant** (Variables retained in final model structural equation model fit using LISREL; X^2=55.91, p=0.263, AGF=0.956) (Coefficients are not reported) • In-services attended in the past year • Attitude towards research
Kenny 2005	Not reported	No evidence	N/A	**Regression models** (p<0.10) (β Coefficients are not reported) *Direct Research Use* • Attitude • Access • Organizational support

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
				Persuasive Research Use • Access *Overall Research Use* • Organizational innovativeness
Estabrooks 2007	Not reported	No evidence	N/A	**Significant** ($p<0.05$) (Cumulative logit modeling) **Canadian Civilian Sample** (OR; 95% CI) *Overall Research Use:* • Presence of a research champion (1.47; 1.03, 2.10) • Number of in-services (1.03; 1.01,1.06) • Attitude (1.21; 1.13,1.30) *Instrumental Research Use:* • Library access (0.95; 0.90,1.00) • Attitude (1.17; 1.09,1.25) **US Army Sample** (OR; 95% CI) *Overall Research Use:* • Attitude (1.16; 1.06, 1.14)
Estabrooks 2008 *A report of Profetto-McGrath 2003*	Not reported	'Overall research utilization' is the only *Research Use* question reported. It was asked three times. The scores increased significantly between the first and second and the second and third repetition.	N/A	None reported

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
		Adjusted overall RU scores were obtained by taking a weighted average of the score obtained from the three repetitions: time one (1/6), time 2 (2/6), time 3 (3/6). Higher weights assigned as participants learned more about research utilization over the course of questionnaire completion and authors reasoned that latter responses are more representative of the true 'overall RU' score.		
Profetto-McGrath 2003	Refers to Estabrooks 1997: appraised by experts in the field	No evidence	N/A	Report construct validity by Estabrooks 1999: development of a model explaining the conceptual structure of RU using these measures
Cobban 2008	Not reported	Pre-tested with a convenience sample of dental hygiene clinical instructors re: clarity and ease of completion This was reported as content validity in the article.	N/A	None reported

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
Connor 2006	Not reported	Pilot study with 6 individuals from each of the three groups. Found no problem with design. Used to refine data collection procedures; 2 questions were clarified but not RU questions.	N/A	**Significant** (p<0.05) **<u>RN</u>** *Overall Research Use* • Access (to sources within the organization) (β=0.054) • Attitude (β=0.117) **<u>LPN</u>** *Indirect Research Use* • # of in-services (only factor in the model) (R^2=0.237) *Persuasive RU* • Access (β=0.122) *Overall RU* • Support (only factor in the model) (R^2=0.194) **<u>PCW/CCA</u>** *Direct Research Use* • Attitude (only factor in the model) (R^2=0.070) *Indirect Research Use* • Attitude (β=0.114) *Persuasive Research Use* • Access (β=0.059) *Overall Research Use* • Attitude (only factor in the model) (R^2=0.224)
Milner 2005	Not reported	No evidence	N/A	**Significant difference between groups** (p<0.05) (One-way ANOVA; test statistic value not reported) • Clinical nurse educators > staff nurses for all measures

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
				of research utilization **Significant coefficients** ($p<0.05$) (Regression model; R^2=39%) *Overall Research Utilization* • Attitude (β=0.098) • Awareness (β= 0.063) *Conceptual Research Utilization* • Localite (use of local sources of information in clinical practice (e.g., colleagues) (β= 0.031) *Symbolic Research Utilization* • Mass media (use of mass media sources of information in clinical practice) (β= 0.194)
Profetto-McGrath 2008	State that validity has been reported elsewhere (Estabrooks 1999a, 1999b)	No evidence	N/A	None reported
Other Single-Item Measures n= 39 articles (39 studies)				
Barwick 2008	Not reported Based on the Canadian Health Services Research Foundation's Four-A's approach: access, assess, adapt, apply but no panel review	No evidence	N/A	None reported
Bjorken-heim 2007	Not reported	No evidence	N/A	None reported
Callen 2005	Not reported	Pilot with 7 medical practitioners and 5	N/A	None reported

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
		Sydney university academics; modifications made.		
Cameron 2005	Based on design used by Humphris et al. (2000) and evaluated by 3 expert reviewers. Process unclear. They took items from the RUQ but have broken up the scale and have used single items.	No evidence	N/A	None reported
Dobbins 2001	Modified from previous diffusion of innovation and research utilization studies	Face validity-established during pre-test at 1 Public Health Unit	N/A	**Significant** ($p<0.05$) • Perception that the systematic reviews (SRs) could overcome the barrier of limited critical appraisal skills ($r=0.23$) • Perception of SRs as easy to use ($r=0.14$)
Dysart 2002	Not reported	No evidence	N/A	None reported
Elliott 2008	Not reported *Reviewer note*: data available from previous studies and focus-group interviews with sonographers informed the composition of the questionnaire. Nothing specific to RU questions and no expert panel.	No evidence	N/A	*Item=*Utilize research findings as a result of having a research paper published** **Significant** ($p<0.05$) (X^2 test; test statistic value not reported) • Master degree versus diploma
Erler 2000	Not reported	No evidence	N/A	*Item: =*Performing literature searches**

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
				Significant ($p<0.05$) • Chief flight nurse or research nurse (X^2=15.7) *Item=*Translating research findings into policies and procedures** **Significant** ($p<0.05$) • Role (X^2=25.0)
Ersser 2008	Not reported	No evidence	N/A	None reported
Heathfield 2000	Not reported	No evidence	N/A	None reported
Kelly 2008	Not reported	No evidence	N/A	None reported
Kirk 1976	Not reported	No evidence	N/A	**Significant** ($p<0.05$) • Attitude (Index composed of 5 items) (r=0.25)
Logsdon 1998	Based on the literature and the investigators experience with research use in the clinical setting.	No evidence	N/A	None reported
Meehan 1988	Not reported	Self-report measure was supplemented by: 1) Asking all respondents to identify and describe how studies they believed had a major impact had been used 2) Asking selected respondents how specifically selected	N/A	None reported

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
		studies had been used Interview guides (logic, flow, timing, economy, and rationale for each question) were pretested with simulated sessions with 4 individuals (2 of these for the client set of questions, 2 for researcher/manager set) Similar questions included within the 'General HSR results use' section to check consistency of responses.		
Miller 2007	Not reported	Draft version reviewed by 2 professors within the University clinic regarding ambiguity and organization. Revisions were made.	N/A	None reported
Molassiotis 1997	Not reported	Those who report that they incorporated research findings into practice also provided specific examples of the research subject matter that they were	N/A	None reported

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
		using, including using research about *clostridium difficile*, pain relief, oral assessment guides, treatments for oral mucositis, and findings about primary care nursing systems.		
Mukohara 2005	Not reported	No evidence	N/A	None reported
Nelson 2007	Not reported	No evidence	N/A	**Significant** ($p<0.05$) • Openness of clinical setting (β=0.21) • Positive attitudes (β=0.28) • Negative attitudes (β= -0.19)
Nieder-hauser 2005	Not reported	No evidence	N/A	None reported
Ofi 2008	Content—experts in the field	No evidence	N/A	**Non-significant** • Education [diploma vs. degree]
Olade 2004	Verified by two doctoral nurses, two RNs and a sociologist	Respondents added comments. These give the reader some indication as to what respondents interpret as 'research utilization': "What we do is the result of some kind of research" "Most of the findings that I have used, I found experimentally	N/A	None reported

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
		works" "Common sense tells me that the findings in medical research are used daily, but I have not directly taken part in any research" "Our nursing policies are research-based and updated yearly with current literature".		
Oliveri 2004	Not reported	No evidence	N/A	**Non-significant** • Academic degree
Olympia 2005	Not reported	No evidence	N/A	None reported
Pain 2004 *Interview results*	Not reported	Utilize two methods to gain information about research utilization behaviours but the authors do NOT compare/contrast the findings from each of these methods as a way to assess the validity of the survey measure.	N/A	None reported
Pettengill 1994	Not reported	Pilot with nurse educators and 2 nurse administrators (authors report this as content validity).	N/A	None reported
Pepler 2005	Not reported	Data from multiple sources were used to	N/A	*Principal factor (unit culture) was linked to high research use*

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
		illustrate the presence or absence of research use. For example, in addition to interviews, field notes (based on direct observation) were kept in relation to ongoing practices observed on each unit. Issues such as how nurses dealt with the situations when they needed information or how new ideas evolved were pursued. Data also collected on resources and their use.		Unit culture (as consisting of harmony of research perspective, motivation to learn, goal orientation, creativity, critical inquiry, mutual respect, maximization of resources)
Scott 2000	Not reported	No evidence	N/A	None reported
Sekerak 1992	Not reported Although not discussed in the context of validity, questionnaire was developed with input from expert reviewers.	Questionnaire was developed with input from pilot subjects (n=5)	N/A	None reported
Stetler 1991	Interview schedule developed based on literature review.	Small pilot with 4 masters prepared nurses to critique the tools. Changes made based on consistent feedback.	N/A	None reported

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
		Post-hoc analysis of reported sources of research-based information to determine whether they were actually research-based. Could document at least one source by 71% of the CNSs; of these, 79.5% could be categorized as research-related To guard against the related problems of memory and social desirability the following precautions were taken: ---Subjects given the opportunity to process their research use through a specific case prior to completing scales on routine use ---Scale had an acceptable non-use option (i.e., considered but rejected) ---Post-hoc validation of actual citations.		

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
Suter 2007	Informed by in-depth interviews with 8 complementary and alternative medicine (CAM) practitioners Face-assessed by an expert in CAM research literacy.	Pilot tested by 5 CAM and conventional practitioners	N/A	* Item =*I apply research findings in my practice** **Significant** ($p<0.05$) (Logistic regression) • Research adds credibility to my discipline (OR 1.6)
Sweetland 2001	Based on the literature and two exploratory interviews with expert occupational therapists in the field of stroke rehabilitation	No evidence	N/A	None reported
Tsai 2000	Expert panel of 8 nurses prepared at masters' and doctoral levels	Pilot test to ensure the tool content was associated with other data reported in the literature and was sensitive to the symbolic meanings relevant in Taiwan's nursing community.	N/A	None reported
Tsai 2003	Refer to Tsai 2000	Tool checked and confirmed by five clinical nurses.	N/A	None reported
Upton 1999	Not reported	No evidence	N/A	None reported
Veeramah 1995	Not reported	Pilot tested with Research Interest Group Nurses –Don't report number or whether they evaluated the content.	N/A	None reported

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
Veeramah 2007	Not reported	No evidence	N/A	None reported
Walczak 1994	Research activities scale-documented by Stetler (1983, 1985), other research related literature (American Nurses Association Commission on Nursing Research 1981), and the investigators' experiences Authors report that items measuring ‘using research’ may not have been specific enough. They suggest revising items in future to ask more specifically about how research is used (e.g., As a foundation for assessing a problem, to develop assessment tool, as a basis for nursing standard and protocols)	No evidence	N/A	None reported
Wood 1996	Not reported	2 internists reviewed and critiqued the questionnaire throughout its development Pre-tested by 5 members of the ACP. Provided few substantive comments	N/A	*Item=*Over the past month, to about how many patients have you applied EBM to answer a clinical question*?* None reported

Study	Content	Response Processes	Internal Structure	Relations with Other Variables
		on content and items were found to be clear.		
Wright 1996	Not reported	Consultation with 3 clinical nurse consultants.	N/A	None reported

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Chapter 3: Paper #2

Individual Determinants of Research Utilization by Nurses:
A Systematic Review Update

Janet E. Squires[1,*]
Carole A. Estabrooks[2]
Petter Gustavsson[3]
Lars Wallin[4]

[1] PhD Candidate, Faculty of Nursing, University of Alberta, Edmonton, Alberta, Canada

[2] Professor and Canada Research Chair (in Knowledge Translation), Faculty of Nursing, University of Alberta, Edmonton, Alberta, Canada

[3] Professor, Department of Clinical Neuroscience, Division of Psychology, Karolinska Institutet, Stockholm, Sweden

[4] Professor, Department of Neurobiology, Care Sciences and Society, Division of Nursing, Karolinska Institutet, Stockholm, Sweden

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Background

In this paper, we update the evidence published in a previous systematic review on individual characteristics that influence nurses' use of research evidence in clinical practice. Research utilization refers to "that process by which specific research-based knowledge (science) is implemented in practice" [1]. In recent years, research utilization by nurses has received increased attention in the literature and has been conceptualized and measured in terms of four *kinds or types* of research use: (1) instrumental, (2) conceptual, (3) persuasive (or symbolic), and (4) overall [1-3]. *Instrumental research utilization* refers to the concrete application of research findings in clinical practice. These research findings are normally translated into a useable form, such as a guideline, a protocol, or a policy. C*onceptual research utilization* refers to the cognitive use of research where the research may be used to change one's thinking about a specific practice, but may or may not result in a change in action. *Persuasive or symbolic research utilization* is the use of research as a persuasive or political tool to legitimate a position or influence the practice of others. The final kind of research utilization, o*verall research utilization*, is an omnibus construct and refers to the use of any kind of research in any way in practice [1, 4].

Research utilization scholars continuously express concern about whether nurses use the best available scientific (i.e., research) evidence to guide their clinical practice [4-7]. This disparity between the availability of research evidence and its use in practice is often referred to as the 'research-practice gap'. The nature of this gap has been the subject of much debate in the nursing literature. Larsen and colleagues [8], for example, have argued that there is no theory-practice gap; that the knowledge forms at issue in theory-practice gap discourse are radically different in kind. This stands in contrast to the views of other well-respected theorists (e.g., Allmark [9] and Fealy [10]) who go to some lengths to articulate the nature of the gap, its origins, and in some cases, solutions to it. While, several examples of the research-practice gap have been highlighted in the nursing literature, most of the evidence is anecdotal due to difficulties surrounding attempts to measure whether or not nursing practice is based on research [11]. It remains generally accepted however that a research-practice gap does exist.

Despite increased knowledge of the benefits of adopting a research-based approach to providing nursing care and of increased availability of research findings for nurses, the use of research findings in nursing practice remains, at best, slow and haphazard [12-14]. As a result, patients frequently do not receive best (or even optimal) nursing care. In response, there is an accelerated research agenda calling for the implementation of interventions to increase research use by nurses. However, relatively few reports of interventions to increase research use within nursing exist and more importantly, where they do exist, positive findings are generally not reported [15]. To date, one review examining interventions to increase research utilization by nurses has been published. Thompson and colleagues [16] concluded findings on the effectiveness of interventions to increase research use in nursing are equivocal and at best, a combination of educational interventions and local opinion leaders or multidisciplinary teamwork *may* be effective. One reason for this relative lack of knowledge on successful interventions to increase research utilization by nurses, we argue, is the lack of systematic identification and evaluation of the factors (individual, contextual, and organizational) that are associated with and predict research utilization by nurses.

In a previous systematic review of individual characteristics related to research utilization by nurses, Estabrooks and colleagues [17] identified 95 characteristics which they grouped into six core categories: (1) beliefs and attitudes, (2) involvement in research activities, (3) information seeking, (4) education, (5) professional characteristics, (6) other socio-economic factors. The six categories were not predetermined but rather emerged from the data extraction, meaning after reviewing and extracting data, they decided that the individual characteristics relevant to the objectives of their review could be grouped in these six categories. By using a vote-counting approach to synthesis, Estabrooks and colleagues [17] concluded the most frequently studied individual determinant and the only one with a consistently positive effect was 'attitude towards research', which is part of the larger category of determinants called 'beliefs and attitudes'. Findings for other individual determinants were highly equivocal and were characterized by serious study design and methodological flaws. In this paper, we update the evidence on individual determinants of research utilization by searching additional electronic databases and by adding the results of studies published between 2001 and 2008 to the evidence reported in the previous systematic review. We also expand on the previous review by reporting on the magnitude of effect between individual nurse characteristics and research utilization and by searching for and examining literature on kinds of research utilization (i.e., instrumental, conceptual, persuasive, overall) with respect to individual characteristics important to research utilization in nursing.

Methods

Selection Criteria for Studies

Types of Study.

Randomized controlled trials, clinical trials, and observational (i.e., quasi-experimental, cohort, case-control, cross-sectional) designs that examined the association between individual characteristics and nurses' use of research in practice were eligible for inclusion. Case reports and editorials were excluded. Studies were further limited to those published in the English, Danish, Swedish, and Norwegian languages (the official languages of the research team). There were no restrictions on the basis of country of origin, when the study was undertaken, or publication status.

Type of Participant, Determinant, and Outcome.

We considered studies that examined relationships between individual characteristics and nurses' use of research in practice. A nurse was defined as a professional who provides care in a clinical setting; this definition includes registered nurses, licensed practical nurses, nurse leaders, and clinical nurse educators. All individual characteristics, modifiable and non-modifiable, were eligible for inclusion. The outcome of interest was research utilization. We defined research utilization as the use of research-based information – that is, information that is empirically derived. This information could be reported in a primary research article, review/synthesis report, or protocol. If the study involved the use of a protocol, the authors were required to make the research-basis for the protocol apparent in the report. We excluded articles that reported on: (1) the adherence to clinical practice guidelines, rationale being that clinical practice guidelines can be based on non-research evidence (e.g., expert opinion), and (2) the use of one specific-research-based practice if the purpose was not to examine nurses' use of research in practice generally. We did however include nurses' use of protocols where the research-base of the protocol was made explicit in the research report. We also required the relationship between the individual nurse characteristic(s) and research utilization to be expressed quantitatively (and tested statistically).

Search Strategy for Identification of Studies

This review was conducted as part of a larger review on research utilization instruments used in healthcare [18]. The objectives of the larger review are: (1) to identify instruments used to measure research utilization: (a) among healthcare providers, (b) among healthcare decision makers, and (c) in healthcare organizations; and (2) to assess the psychometric properties (reliability and validity) of these instruments. Research utilization instruments refer to self-report measures that assess healthcare providers' and decision makers' use of research-based knowledge in their daily practice. The search strategy for the larger review was designed in consultation with a health sciences librarian. We searched the following 12 online bibliographic databases: (1) Cochrane Database of Systematic Reviews (CDSR), (2) Health and Psychosocial Instruments (HAPI), (3) MEDLINE, (4) CINAHL, (5) EMBASE, (6) Web of Science, (7) SCOPUS, (8) OCLC Papers First, (9) OCLC WorldCat, (10) Sociological Abstracts, (11) Proquest Dissertation Abstracts, and (12) Proquest ABI Inform. Key words and medical subject headings related to research utilization were identified prior to initiating the search. Figure 3-1 displays a summary of the search strategy used in the larger review. We also hand searched the journal *Implementation Science* (a specialized journal in the research utilization field) as well as the bibliographies of articles identified for inclusion in the review.

Study Identification and Quality Assessment

One investigator (JES) and a research assistant screened the titles and abstracts of the articles identified by the search strategy. Articles that potentially met our inclusion criteria, or where there was insufficient information to make a decision re inclusion, were retrieved and assessed for relevance by one investigator (JES) and a research assistant. Disagreements throughout the selection process were resolved by consensus. To assess methodological quality of the final set of articles, we adapted two previously used tools: (1) *Estabrooks' Quality Assessment and Validity Tool for Cross-Sectional Studies*, and (2) the *Quality Assessment Tool for Quantitative Studies*. Each article had a quality appraisal performed by two reviewers. Articles were classified as weak, moderate-weak, moderate-strong, or strong using a system developed based on work by De Vet and colleagues [19] which has been used in other published systematic reviews [17, 20, 21]. All discrepancies in quality assessment were resolved through consensus.

Estabrooks' Quality Assessment and Validity Tool was developed based on the Cochrane Collaboration guidelines (in existence in 2001) and medical literature [22, 23]. The tool contains a maximum of 16 total points covering three core domains: (1) sample, (2) measurement, and (3) statistical analysis (See Table 3-1). In order to derive a final score for each of the included articles (that used a cross-sectional study design), the total number of points obtained with this tool was divided by the total number of possible points, allowing for a score between 0 and 1 for each article. The articles were then classified as weak, moderate-weak, moderate-strong, or strong as follows: < 0.50: weak article; 0.51 - 0.65: moderate-weak article; 0.66 - 0.79: moderate-strong article; and 0.80 – 1.00: strong article.

The *Quality Assessment Tool for Quantitative Studies* tool, originally developed for the Canadian Effective Public Health Practice Project, has been judged suitable to be used in systematic reviews of interventions [24, 25]. The tool contains a maximum of 18 total points covering 6 content areas: (1) selection bias (is the study sample representative of the target population), (2) allocation bias (extent that assessments of exposure and outcome are likely to be independent), (3) confounders (were important confounders reported and appropriately managed), (4) blinding (were the outcome assessor(s) blinded to the intervention or exposure status of participants), (5) data collection methods (reliability and validity of data collection methods and instruments), and (6) withdrawals and dropouts (percentage of participants completing the study) (See Table 3-2). Each article is scored as weak, moderate, strong, or not applicable in each of these 6 areas according to preset criteria that accompany the tool. The tool developers do not provide a means for calculating an overall quality score. However, in order to compare the quality scores for each included article that used an intervention design (assessed with this tool) to the included articles that used cross-sectional designs (assessed with *Estabrooks' Quality Assessment and Validity Tool* described above), we derived an overall quality score for each article. To derive this score, we assigned values of 1, 2, and 3 to the categorizations of weak, moderate, and strong in each content area respectively obtained with this tool. A final quality score for each article was then obtained using the same method as for the cross-sectional studies, by dividing the summative score obtained by the total amount of points possible. The articles were then classified as weak, moderate-weak, moderate-strong, or strong as follows: 1.0 – 2.0: weak article; 2.1 – 2.34: moderate-weak article; 2.35 – 2.66: moderate-strong article; and 2.67 – 3.0: strong article.

Data Extraction and Analysis

One reviewer (JES) extracted data from all articles included in this review. Extracted data was then double checked by a research assistant for accuracy. Data were extracted on: study design, objectives, sample and subject characteristics, theoretical framework, instruments used, reliability, validity, and key findings with respect to relationships between individual characteristics and nurses' research utilization (See Tables 3-3 to 3-5). All discrepancies in data extraction were resolved through consensus.

We present the findings from this review update descriptively according to: (1) the individual characteristics assessed, and (2) whether research utilization was assessed as a general phenomenon or as specific kinds. We used the same six broad categories of individual nurse characteristics suggested in the earlier review by Estabrooks and colleagues [17]: (1) beliefs and attitudes, (2) involvement on research activities, (3) information seeking, (4) education, (5) professional characteristics, and (6) other socioeconomic factors. A seventh category, critical thinking, emerged and is reported on in this review with respect to kinds of research utilization. Examples of the characteristics that fall within each of these categories can be seen in Tables 3-3 and 3-4.

We were forced to use a vote-counting approach to data synthesis. That is, the overall assessment of evidence for the association between an individual characteristic and research utilization was based on the relative number of studies demonstrating and failing to demonstrate statistically significant associations. For all cases, where available, we extracted details on the magnitude of the effect between the individual characteristics and nurses' research utilization. These details are presented in Tables 3-3 and 3-4. However, because of large inconsistencies in how the associations were evaluated between studies, limited conclusions on to the magnitude of the association between research utilization and specific individual characteristics could be drawn.

A priori we developed the following set of rules to guide our synthesis:

1. In order to reach a conclusion as to whether or not an individual characteristic was associated with research utilization by nurses, it had to be assessed in a minimum of four articles. Characteristics assessed in less then four articles were coded as inconsistent (i.e., insufficient evidence to reach a conclusion).

   There is no agreed benchmark with respect to the number of studies required to reach a conclusion concerning the relationship between two or more variables when conducting a systematic review. Within the Cochrane Collaboration, where higher levels of evidence (e.g., randomized controlled trials, pseudo-randomized controlled trials) are routinely utilized, one study is deemed sufficient. When only lower levels of evidence (e.g., non-randomised studies, observational studies) are available, no direction with respect to the number of studies required is offered [26]. A recent review (utilizing observational studies) that examined the extent to which social cognitive theories (which are comprised of individual characteristics) explain healthcare professionals' intention to adopt clinical behavior used a cut-off of three studies [27]. In this review, we set our cut-off slightly higher, at 4 studies, to ensure we did not draw conclusions based on occasional/random findings.

2. Characteristics that were assessed in four or more articles were coded as significant, not significant, or equivocal, depending on which of these three categories 60% or more of the articles fell within. For example, if four articles existed and two of these articles found the characteristic to be significant and two articles, not significant, the characteristic was coded as equivocal.

3. Where bivariate and multivariate statistics were both offered in an article as evidence, we used the more robust multivariate findings in our synthesis to reach a conclusion as to whether or not a relationship existed between the individual characteristic(s) and research utilization.

Results

Description of Studies

Figure 3-2 summarizes article selection for this review. The database and hand searches yielded 42,770 titles and abstracts. Of these 42,770 articles, 501 were identified as being potentially relevant after a title and abstract review. A total of 456 articles were excluded for not meeting our inclusion criteria, leaving 45 articles for inclusion in this review (31 [69%] of these articles are additions to the previous review). The 45 articles represent 41 original studies; four studies have two reports each: (1) McCleary and Brown [28, 29]; (2) Estabrooks [30, 31]; (3) McCloskey [32, 33]; and (4) Parahoo [34, 35]. A list of all (n=45) included articles can be found in Table 3-5. The original review [17] included 22 articles. The review update, presented in this paper, excluded 8 of these articles leaving 14 of the original articles in the update. The 8 articles were excluded for one of three reasons: (1) they did not include a measure of research utilization as we defined it for this review update (n=5) [36-40], (2) they did not report on individual characteristics (n=2, these two articles represented a second report of a study that did not report individual characteristics – the first report of each study, which did report on individual characteristics were included) [2, 41], or (3) did not provide a quantitative (statistical) test of the significance between the individual determinant(s) and research utilization (n=1) [42].

A variety of self-report instruments, multi-item and single item, were used to measure research utilization in the 45 include articles. Multi-item instruments used included: the Nurses Practice Questionnaire (n=8 articles) [12, 14, 43-48]; the Research Utilization Questionnaire (n=11 articles) [32, 33, 49-57]; the Edmonton Research Orientation Survey (n=3 articles) [28, 29, 58]; and three research utilization indexes, each used in a single study [59-61]. Single- item instruments used included: Estabrooks Kinds of Research Utilization Items (n=9 articles) [30, 31, 62-68]; Parahoo's Item (n=2 articles) [34, 35]; Past, Present, and Future Use Items (n=3 articles) [69-71]; and Other Single Items, each used in a single study (n=6 articles) [72-77]. The majority of articles examined research utilization by nurses in the United States (n=18, 40%) followed by Canada (n=14, 31%), Europe (n=8, 18%), Australia (n=2, 4.5%), China (n=2, 4.5%), and Africa (n=1, 2%). The most common setting reported was hospitals (n=28 articles, 62%) followed by a mixture of settings, e.g., sampling from a provincial or state nursing roster (n=13 articles, 29%), nursing homes (n=2 articles, 4.5%), an educational setting (n=1, 2%), and a flight team setting (n=1, 2%). With respect to year of publication, the vast majority of articles were published since 1995 (n=40 articles, 89%). Further detail on the characteristics of each of the 45 included articles can be found in Table 3-5.

Methodological Quality of Included Studies

Methodological quality of the articles included in this review is reported in Tables 3-1 and 3-2. All articles used an observational design: the majority (n=43, 96%) used a cross-sectional design while 2 articles (4%) used a quasi-experimental design. Of the 45 included articles, 1 (2%) was rated as strong, 13 (29%) as moderate-strong, 18 (40%) as moderate-weak, and 13 (29%) as weak. Discrepancies in quality assessment related mainly to sample representativeness, treatment of missing data, and appropriateness of the statistical test(s) used.

The Outcome: Individual Characteristics and Research Utilization

Data on individual characteristics were extracted into the same six categories as the previous review [17]: (1) beliefs and attitudes, (2) involvement on research activities, (3) information seeking, (4) education, (5) professional characteristics, (6) socio-demographic and socio-economic factors (relabeled from other socio-economic factors), and one additional category, (7) critical thinking. Relationships between these characteristics and: (1) research utilization in general and (2) kinds of research utilization, are summarized next with additional details presented in Tables 3-3 and 3-4 respectively.

Research Utilization in General

A total of 39 (87%) of the 45 included articles examined relationships between individual characteristics and nurses' research utilization in general (See Table 3-3).

Beliefs and Attitudes.

Fourteen articles assessed one or more individual characteristic in the beliefs and attitudes category. Of these 14 articles, 6 were rated as weak methodologically, 5 were rated as moderate-weak, and 3 were rated as moderate-strong (Tables 3-1 and 3-2). Sample sizes varied from a low of 20 participants [53] to a high of 1,117 participants [61] (Table 3-5). The most frequently assessed characteristic in the beliefs and attitudes category was attitude towards research, assessed in eight articles. The majority of articles were rated as weak (n=3) or moderate weak (n=4) methodologically while one article received a quality rating of moderate-strong (Tables 3-1 and 3-2). In all eight articles, attitude towards research was measured using multi-item summated scales. A 21-item scale developed by Champion and Leach [49] with items assessing nurses' feelings about incorporating research into practice was used in four of the eight articles [49, 51, 55, 56]. Similar multi-item measures, with six [30, 60], 12 [53] and 15 items [71] were used in the remaining four studies. A positive association with research utilization, at statistically significant levels, was found in all eight articles. The magnitude of effect, on average, was high moderate, with correlation coefficients ranging from .41 - .82. Other belief and attitudinal characteristics were assessed in less then four articles and therefore their results cannot be considered with any confidence.

Involvement in Research Activities.

Thirteen articles assessed one or more individual characteristic related to nurses' involvement in research activities. Of these articles, 3 were rated as weak methodologically, 8 were rated as moderate-weak, and 2 were rated as moderate-strong (Tables 3-1 and 3-2). Sample sizes also varied from a low of 82 participants [54] to a high of 1,100 participants [48] (Table 3-5). Examples of activities assessed that were reflective of involvement in research activities included: participation in a research study [43, 54], participation in quality improvement initiatives [78], participation in quality management [28], and data collection for others conducting research [70]. Additional examples can be found in Table 3-3. A total of 13 individual characteristics were identified in this category overall. However, each characteristic was assessed in less then four articles, precluding us from drawing conclusions on the relationships between individual characteristics characteristic of involvement in research activities and nurses' use of research findings in practice.

Information-Seeking.

A total of 15 articles reported individual characteristics consistent with information-seeking behavior. Two articles were rated as weak methodologically, 5 articles as moderate-weak, and the remaining 8 articles as moderate-strong (Tables 3-1 and 3-2). Sample sizes varied largely from a low of 92 participants [56] to a high of 5,948 participants [68] (Table 3-5). Several articles examined the relationships between different reading practices and research utilization. For example, reading professional journals [45]; hours spent reading professional journals [43, 46, 47]; the number of journals read [48, 71, 79]; and reading specific journals such as *Heart and Lung* [46, 47], *Nursing Research* [43, 47], and *RN* [43], were studied. Different combinations of these six reading characteristics were tested a total of 12 times (some articles assessed more then one of the reading practices simultaneously). Findings from these investigations were equivocal with seven articles (58%) reporting statistically significant findings and five articles (42%) not finding statistically significant findings. Thus, no conclusion can be drawn as to the effect of reading practices on nurses' use of research in practice.

The second most commonly studied information-seeking characteristic was attendance at conferences and/or attendance at in-services, examined in five articles [30, 46-48, 80]. Four of these articles [30, 46-48], all rated moderate-strong with respect to methodological quality, found positive relationships, at statistically significant levels, between conference and/or in-service attendance and research utilization. The overall magnitude of this effect, however, is not computable since each article used a different test of statistical association. The remainder of individual characteristics falling within the category of information seeking was only investigated in one or two articles, precluding us from considering their findings (Table 3-3).

Education.

Education was the most commonly studied individual characteristic with 28 of the 39 articles examining the effect of education on research utilization. Of these articles, 10 were rated as weak methodologically, 9 were rated as moderate-weak, and 9 were rated as moderate-strong (Tables 3-1 and 3-2). Sample sizes varied from a low of 20 participants [53] to a high of 5,948 participants [68] (Table 3-5). Twenty-five of the articles in this category examined the impact of increasing levels of education (i.e., diploma, bachelors degree, graduate degree – masters or PhD). Significant findings were found in half (n=13) of these articles, making the characteristic *level of education/ type of degree* appear equivocal. Of the 13 articles, 2 were rated as weak methodologically, 7 as moderate-weak, and 4 as moderate strong. The vast majority (n=12 of 13, 92%) of the articles describing statistically significant findings between education levels and research utilization revealed a positive relationship (i.e., higher levels of education were associated with higher frequencies of research use) while one article showed both significant and not significant findings depending on the education level(s) assessed [43]. When the findings from these articles are broken down by the specific level(s) of education assessed, they are not equivocal and conclusions based on type of degree can be drawn. Three of the 13 articles describing statistically significant findings did not specify the education levels studied, but stated higher levels were related to higher research utilization scores [53, 76, 79]. Two articles found higher research utilization scores among nurses baccalaureate-prepared compared to those diploma-prepared [68, 80]. The vast majority of the articles (n=7 of 13), however, found nurses who have graduate degrees (masters or PhD) had significantly higher research utilization scores compared to nurses whose highest level of education was an undergraduate (bachelors) degree [28, 32, 33, 43, 47, 58, 69]. Only one article [48] examining education level showed a significant negative association with research utilization; the negative relationship was likely spurious due of the use of multiple comparison tests to determine the effect of education on research utilization.

An additional 13 articles (4 rated as weak methodologically, 3 as moderate-weak, and 6 as moderate-strong, see Tables 3-1 and 3-2) did not find a significant relationship between nurses' levels of education and research utilization. Of these 13 articles, almost half (n= 6 articles) did not have graduate-level prepared nurses in their sample and thus were only able to compare nurses with baccalaureate (undergraduate) to nurses with diplomas; findings in all six articles were not statistically significant. Overall, findings from all 28 articles examining nurses' education levels indicate that a positive effect exists for level of education, when a nurse holds a graduate degree compared to a baccalaureate degree or a diploma but not when a nurse holds a baccalaureate degree compared to a diploma.

Completion of research classes was the second most commonly assessed educational characteristic, assessed in five articles [29, 43, 46, 54, 79]. Findings show completion of research classes is not significantly related to research utilization. Two articles [29, 79], rated as weak and moderate-strong methodologically respectively, found a positive relationship, at statistically significant levels, while three articles (60%) [43, 46, 54], one rated as weak methodologically and two rated as moderate-strong, did not find evidence of a statistically significant relationship. The remaining individual characteristics related to education (e.g., well prepared in education process, working towards a degree, number of degrees, see Table 3-3) were assessed in less then four studies and therefore, were not considered.

Professional Characteristics.

The second most commonly studied category of individual characteristics, assessed in 27 of the 39 included articles, was professional characteristics. Of these articles, 12 were rated as weak methodologically, 8 as moderate-weak, and 8 as moderate-strong (Tables 3-1 and 3-2). Sample sizes varied from a low of 20 participants [53] to a high of 5,948 participants [68] (Table 3-5).The most commonly reported characteristics in this category were: (1) experience (i.e., years employed as a nurse) (n=12 articles), (2) current role (e.g., leadership compared to staff nurse) (n=8 articles), (3) clinical specialty (e.g., critical care compared to medical/surgical (n=9 articles) and (4) job satisfaction (n=5 articles) (Table 3-3). Of these characteristics, consistent statistically significant relationships with research utilization were found for current role, specialty, and job satisfaction. Experience was not related to research utilization.

Eight articles examined the impact of current role on research utilization. Six (75%) of these articles (three rated as weak methodologically, two as moderate-weak, and one as moderate strong, see Tables 3-1 and 3-2) found that nurses practicing in advanced practice or leadership roles had significantly higher research utilization scores compared to staff nurses [32, 33, 51, 58, 68, 80]. However, nurses in such advanced practice and leadership roles generally have higher levels of education levels, which may have confounded this finding. Nine articles examined the impact of clinical specialty on research utilization. Six (67%) of these articles (two rated as weak, as moderate-weak, and as moderate strong respectively, see Table 3-1) found a significant relationship between specialty and research utilization; nurses who worked on specialty wards (e.g., critical care, diabetes care) reported higher frequencies of research utilization in comparison to nurses who worked in more generalized units (e.g., medical or surgical floors) [14, 35, 52, 54, 59, 61]. Five articles examined the impact of job satisfaction on research utilization. Three (60%) of these articles (one rated as moderate-weak methodologically and two as moderate-strong, see Table 3-1) found a statistically significant relationship between job satisfaction and research utilization [46, 61, 68]. Experience, assessed in 12 articles, was not related to research utilization at statistically significant levels in the majority (n=10 of 12, 83%) of these articles (See Table 3-3).

Socio-Demographic and Socio-Economic Factors.

Of the ten articles reporting other socio-demographic and socio-economic nurse characteristics (four rated as weak methodologically, three as moderate-weak, and three as moderate-strong, see Table 3-1), none reported a significant association with research utilization. Further, with the exception of age, which was assessed in nine studies, the characteristics were assessed in less then four studies, precluding the drawing of conclusions.

Kinds of Research Utilization

While the majority of articles identified in this review update assessed associations between individual characteristics and nurses' use of research in general, there is also a beginning trend in the literature to examine kinds of research utilization. A total of six articles (one rated as weak methodologically, two as moderate-weak, two as moderate-strong, and one as strong, see Table 3-1) were identified that explicitly examined the relationship between individual characteristics and nurses' use of one or more kinds of research utilization. The following section presents a brief summary of the findings from these six articles. More details on these findings can be found in Table 3-4.

The only individual characteristic assessed in a sufficient number of articles (i.e., in four or more articles) was a nurse's attitude towards research. All four articles reported a positive relationship, at statistically significant levels, between a nurse's attitude towards research and at least one kind of research utilization [31, 62, 65, 66]. Only instrumental and overall kinds of research utilization were assessed in four articles. A positive relationship was found in three articles (75%) for both of these kinds of research utilization: instrumental [31, 62, 66] and overall [31, 65, 66]. All remaining individual characteristics were assessed in less then four articles, precluding conclusions.

One individual characteristic, *critical thinking dispositions*, was assessed in two articles examining kinds of research utilization. Critical thinking dispositions refers to a "set of attitudes that define a personal disposition to prize and to use critical thinking in one's personal, professional, and civic affairs" [81]. Both articles assessed critical thinking dispositions using the California Critical Thinking Disposition Inventory which measures seven dispositional components: truth-seeking, open-mindedness, analyticity, systematicity, self-confidence, inquisitiveness, and maturity [81]. Both identified studies found a positive relationship, at statistically significant levels, between nurses' ability to think critically (as measured by an average of all seven dispositions) and each of the four kinds of research utilization [63, 64]. The magnitude of this effect was small to moderate with correlation coefficients ranging from .15 to .35, depending on the kind of research utilization (See Table 3-4).

Discussion

Comparison with Previous Review

This systematic review update focused on individual nurse characteristics that have been studied empirically with respect to nurses' use of research in practice. By extending the search criteria of the previous review, 31 additional studies were identified for inclusion in this update. This more then doubles the evidence available for review specifically examining the relationships between individual characteristics and research utilization by nurses. Unfortunately, studies continue to vary greatly in terms of sample selection (source of participants), sample size, study methods and rigor, statistical tests used, and the instrument (items) used to measure the outcome variable – research utilization. Promisingly, though, a trend in the most recent included studies for more robust analyses (i.e., multivariate regression versus bivariate correlations and/or tests of difference) and less variability in choice of outcome measures is evident. Nevertheless, given the continuing heterogeneity between studies, only general statements can be made regarding the relationships between individual characteristics and research utilization by nurses at this time. That is, we can only say which characteristics are associated with research utilization and not which characteristics *predict* research utilization by nurses, at this point in time.

Taken collectively, the now significantly larger body of evidence suggests promise for the following individual characteristics as being important to (i.e., related to an increase in) nurses' use of research in their practice: (1) positive attitude towards research, (2) attending conferences and/or in-services, (3) have a graduate degree (compared to a baccalaureate degree or diploma), (4) current role (i.e., leadership and/or advanced practice compared to staff nurse), (5) clinical specialty (working in critical care areas compared to general hospital units), and (6) job satisfaction. An additional three characteristics were shown not to be important to research utilization by nurses: (1) completion of research classes, (2) experience, and (3) age. While, overall, the extent to which many individual characteristics influence research utilization remains largely unknown, there is support for the above-mentioned characteristics. This represents a significant increase in knowledge over the previous review. Table 3-6 compares conclusions made in our review update with the original review.

Kinds of Research Utilization

In addition to examining the relationships between individual characteristics and research utilization generally, we also looked for relationships between individual characteristics and kinds (i.e., instrumental, conceptual, persuasive, and overall) of research utilization. Estabrooks [2] confirmed the existence of the four kinds of research utilization in a study of Canadian registered nurses, and additional studies since then have shown significant relationships between individual and/or contextual characteristics and nurses' reported use of the different kinds of research utilization [31, 62, 65, 66]. Therefore, we elected to report on these articles separately and not combine them with the articles that report research utilization in general. While few articles were identified that have assessed relationships between individual characteristics and kinds of research utilization, some promising findings did emerge in those that were identified. For example, critical thinking, which was assessed in two articles showed positive, statistically significant, correlations with *each* kind of research utilization in both articles [63, 64]. These two articles were moderate-weak and moderate-high in methodological quality and had relatively small sample sizes of 143 and 287 nurses respectively (Tables 3-1 and 3-5), which combined with the limited number of studies conducted, precluded us from drawing a conclusion. While there is insufficient evidence at this time to conclude that a relationship does exist (and that nurses' critical thinking dispositions could be a target of future intervention studies), it may be a fruitful avenue for future research.

Despite a limited number of articles addressing kinds of research utilization, one characteristic - attitude towards research - was assessed in a sufficient number of articles (i.e., four articles) to be able to conclude a positive relationship between attitude towards research and nurses' instrumental and overall use of research exists. This relationship was also found in all eight articles examining attitude towards research on research utilization in general. This finding is consistent with known theories of human behavior. For example, the *Theory of Planned Behavior*, which is frequently used in psychological research, states human behavior (such as research utilization) is guided by three kinds of considerations: (1) behavioral beliefs (i.e., beliefs about the likely outcomes of a behavior), (2) normative beliefs (i.e., beliefs about the normative expectations of others and motivation to comply with these expectations), and (3) control beliefs (i.e., beliefs about the presence of factors that may facilitate or impede performing the behavior) [82]. Behavioral beliefs are further known to produce a favorable or unfavorable *attitude toward the behavior* [82], supporting our findings.

Godin and colleagues [27], in a systematic review of healthcare professionals' (which included nurses) intentions and clinical behaviors, found the Theory of Planned Behavior to be an appropriate theory for examining attitudes and beliefs in relation to specific actions or behaviors. Specifically, they found healthcare professionals' beliefs about their own capabilities and the consequences of their behavior to be consistently and positively associated, at statistically significant levels, with predicting their clinical behavior. Beliefs were also positively and significantly associated with healthcare professionals' intention to change their behavior. These findings illustrate the potential benefit that using this theory, beyond the measurement of nurses' attitudes in general towards research utilization, may have in research utilization studies. For example, added value could be obtained by measuring nurses' beliefs and attitudes in relation to specific behaviors (i.e., their use of specific research-based findings in practice). Future research should also focus on determining what causes nurses to form favorable (positive) attitudes towards the use of research, both of research utilization in general and of its kinds, as well as of the use of specific research-based findings in practice.

Methodological Implications for Future Research

Systematic reviews typically identify and comment on problems with internal validity of the research under scrutiny, and this review update is no exception. Future studies examining individual characteristics related to research utilization need to attend to methodological quality to reduce bias and to increase confidence in this growing body of knowledge. This will allow for the design of theory-based research utilization interventions with the intention of improving the quality of patient care.

Four important limitations of studies conducted to date on individual characteristics and research utilization by nurses are: (1) methodological quality, (2) statistical rigor, (3) inconsistency in measurement of the outcome measure (research utilization), and (4) limited use of research utilization or other related theory. First, few studies examining the relationship between individual characteristics and research utilization in this review were of moderate-strong or strong methodological quality, illustrating a clear need for well-designed, robust studies that examine the association between different individual characteristics and research utilization by nurses. Second, in order to effectively design research utilization interventions tailored for individual nurse characteristics, we need to know which characteristics predict (not just which ones are related to) research utilization. This will require multivariate statistical assessments. There is no need for continued bivariate assessments, especially given the clear evidence of inter-correlations among different individual characteristics [83]. Third, there is inconsistency in the measures being used for the outcome of interest, research utilization. By this we mean that we observed a lack of standard measures of research utilization across studies. While a few instruments that measure research use by nurses have been used in multiple studies (e.g., Nurses Practice Questionnaire [12, 14, 43-48], Research utilization Questionnaire [32, 33, 49-57]), Edmonton Research Orientation Survey [28, 29, 58], Estabrooks Kinds of Research Utilization Items [30, 31, 62-68]), by far, the most common approach to measuring research utilization has been the use of an index or a single-item developed for an individual study. This absence of commonly used measures across studies makes it difficult, if not impossible, to build a consistent body of knowledge on which individual characteristics influence research utilization by nurses. Finally, only 1/3 (n=14) of the articles identified in this review reported their investigation was based on research utilization or other appropriate theory (Table 3-5). For the vast majority of these articles, Rogers Diffusion of Innovations theory was used to guide the development of a measure of and/or calculation of a research utilization score, but not variable selection or the design and evaluation of the study. Future research utilization investigations should utilize appropriate theory in both instrument and study design/evaluation.

Limitations

While rigorous methods were used for this review, there were limitations. First, while an attempt was made to review grey literature (e.g., searching dissertation databases) we did not search all grey literature databases, and, as such, this review update may not be representative of all relevant work in the field. Second, where details of study methods were not clear, we did not attempt to clarify these details by contacting the article authors. This may have resulted in aspects of methods being scored low in the quality assessment phase, possibly reflecting quality of the reporting rather than the actual methods used. Third, studies published in languages other than those of the research team were excluded. Finally, because of the inconsistency in how associations between individual characteristics and research utilization were determined and reported in the included studies, we were forced to use a predominantly vote-counting approach to data synthesis.

Conclusions

This review update has pointed to an increased body of research on the study of individual characteristics and research utilization by nurses. However, methodological problems inherent in many of the studies included in the review update mean that robust evidence to support individual characteristics that *predict* research utilization is scarce. Current evidence suggests that a nurse's attitude towards research is the only individual characteristic that is consistently (with a positive effect) related to research utilization in general and the different kinds of research utilization. Other individual characteristics with evidence for a positive association with research utilization (in general) include: attending conferences and/or in-services, having a graduate degree, current role, clinical specialty, and job satisfaction. These characteristics may hold promise as targets of future research utilization interventions. While all of these characteristics are potentially modifiable, some can be more easily manipulated and thus incorporated into interventions to increase research utilization. For example, attitude towards research and attendance at conferences and/or in-services, are two characteristics that we believe can and should be the focus of future research utilization interventions. The remaining characteristics identified in this review as having a positive statistically significant association with research utilization, while modifiable, would require substantial effort and time, for example, increasing the number of nurses employed within a clinical setting that hold a graduate degree.

We also recommend that programmatic research in the area of research utilization in nursing be undertaken. Programmatic research differs from conducting a research study in that it seeks to break a large research topic into smaller, more manageable pieces, allowing for more detailed analyses. Importantly, programmatic research addresses each piece sequentially in an effort to build a coherent picture from the smaller studies' findings, and allows investigators to build upon their own and others' research. Such programs in research utilization in nursing would have several concurrent streams examining, for example, different settings (acute care adults, acute care pediatrics, long-term care, community/home healthcare), different classes of determinants (individual characteristics, contextual factors, and organizational factors), and interventions to increase research use and subsequently patient outcomes. Without such programmatic research, we believe substantial advances in understanding how to increase the use of research by nurses and thereby improve patient care will be difficult, if not impossible, to achieve.

Figure 3-1. Search Strategy

The following bibliographic databases were searched: Cochrane Database of Systematic Reviews (through to 4th Quarter 2008), Cochrane Central Register of Controlled Trials (CENTRAL) (through to 4th Quarter 2008); Health and Psychosocial Instruments (HAPI) (through to October 14, 2008), MEDLINE (through to October 11, 2008), CINAHL (through to October 11, 2008), EMBASE (through to October 13, 200), Web of Science (through to October 13, 2008), SCOPUS (through to November 17, 2008), OCLC Papers First (through to October 13, 2008), OCLC WorldCat (through to October 13, 2008), Sociological Abstracts (through to October 13, 2008), Proquest Dissertation Abstracts (through to October 14, 2008), and Proquest ABI Inform (through to October 14, 2008).

The search terms used were as follows:
"nursing practice questionnaire" or "edmonton research orientation survey" or (technolog* W diffus*) or (chnolog* W transfer*) or (technolog* W translat*) or (technolog* W adopt*) or "diffusion of innovation" or "diffusion of innovations" or "innovation diffusion" or "dissemination of innovation" or "dissemination of innovations" or (innovation* W/1 adopt*) or "adoption of innovation" or "adoption of innovations" or "dissemination of evidence" or "implementation of evidence" or "adoption of evidence" or "uptake of evidence" or "use of evidence" or "utilization of evidence" or "utilisation of evidence" or "diffusion of evidence” or "translation of knowledge" or "transfer of knowledge" or "implementation of knowledge" or "adoption of knowledge" or "uptake of knowledge" or "utilization of knowledge" or "utilisation of knowledge" or "dissemination of knowledge" or "diffusion of knowledge" or "implementation of technologies" or "adoption of technologies" or "uptake of technologies" or "dissemination of technologies" or "diffusion of technologies" or "translation of technologies" or "transfer of technologies" or "implementation of technology" or "adoption of technology" or "uptake of technology" or "dissemination of technology" or "diffusion of technology" or "translation of technology" or "transfer of technology" or "translation of research" or "transfer of research" or "implementation of research" or "adoption of research" or "uptake of research" or "use of research" or "utilization of research" or "utilisation of research" or "dissemination of research" or "diffusion of research" or "evidence uptake" or "evidence use" or "evidence diffusion" or "evidence dissemination" or "evidence utilization" or "evidence utilisation" or "evidence transfer" or "evidence translation" or "evidence implementation" or "evidence adoption" or "knowledge uptake" or "knowledge use" or "knowledge diffusion” or "knowledge dissemination" or "knowledge utilization" or "knowledge utilisation" or "knowledge transfer" or "knowledge translation" or “knowledge implementation" or "knowledge adoption" or “research uptake" or "research use" or "research diffusion" or "research dissemination" or "research utilization" or "research utilisation" or "research transfer" or "research translation" or "research implementation" or "research adoption" **AND** survey* or questionnaire* or inventor* or instrument* or scale* or assess* or evaluat* or measur* or tool* or reliability or validity or validation or reproducib* or benchmark* or psychometric*

Figure 3-2. Selection of Articles for Review

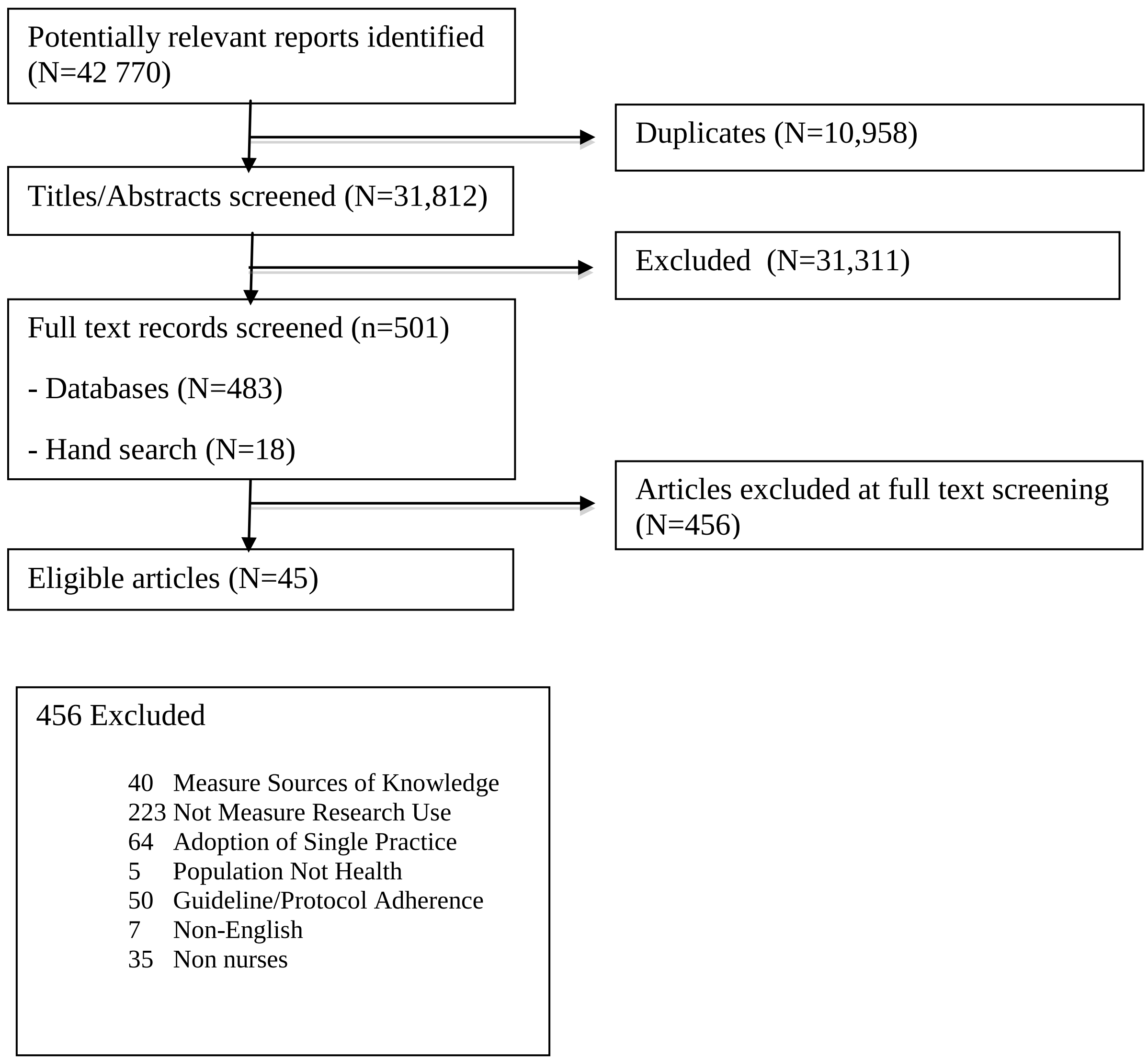

Table 3-1: Quality Assessment for Included Cross Sectional Articles (N=43)

First Author, Year	Sample							Measurement			Statistical Analysis				Total Points[1]	Score	Quality
	Probabilistic sample used	Representative	Sample size appropriate for power	Sample drawn > 1 site	Matching design	Statistically adjusted	Response rate > 50%	DV directly measured/ administrative	DV reliability	DV validity	Appropriate tests used	p values reported	CI reported	Missing data managed appropriately			
Milner, 2005	1	2	1	1	2	N/A	1	0	1	1	1	1	0	1	13/15	0.87	Strong
Rodgers, 2000	1	2	1	1	N/A	N/A	1	0	1	1	1	1	0	1	11/13	0.85	Moderate-Strong
Squires, 2007	0	1	1	1	N/A	N/A	1	0	1	1	1	1	1	1	10/13	0.77	Moderate-Strong
Coyle, 1990	1	2	1	1	N/A	N/A	1	0	1	1	1	1	0	0	10/13	0.77	Moderate-Strong
Brett, 1987	1	2	1	1	N/A	N/A	1	0	1	1	1	1	0	0	10/13	0.77	Moderate-Strong
Barta, 1995	0	1	1	1	N/A	N/A	1	0	1	1	1	1	N/A	1	9/12	0.75	Moderate-Strong
Tsai, 2000	1	2	1	0	N/A	N/A	1	0	1	1	1	1	N/A	0	9/12	0.75	Moderate-Strong
Estabrooks, 2007	1	2	1	1	0	1	0	0	1	1	1	1	1	1	12/16	0.75	Moderate-Strong
Profetto-McGrath, 2009	1	2	1	1	N/A	N/A	1	0	0	1	1	1	N/A	0	9/12	0.75	Moderate-Strong
Estabrooks, 1999	1	2	1	1	N/A	N/A	0	0	0	1	1	1	0	1	9/13	0.69	Moderate-Strong
Michel, 1995	1	1	1	1	N/A	N/A	1	0	1	1	1	1	0	0	9/13	0.69	Moderate-Strong
Forbes, 1997	0	1	1	1	N/A	N/A	0	0	1	1	1	1	N/A	1	8/12	0.67	Moderate-Strong
Cummings, 2007	1	1	1	1	N/A	N/A	0	0	0	1	1	1	N/A	1	8/12	0.67	Moderate-Strong
Bonner, 2008	0	1	1	1	N/A	N/A	0	0	1	1	1	1	N/A	1	8/12	0.67	Moderate-Strong
Berggren, 1996	0	1	1	1	N/A	N/A	1	0	1	1	1	N/A	N/A	0	7/11	0.64	Moderate-Weak
Ofi, 2008	0	1	1	1	N/A	N/A	1	0	0	1	1	1	1	0	8/13	0.62	Moderate-Weak
Hatcher, 1997	1	2	1	0	N/A	N/A	0	0	1	1	1	1	0	0	8/13	0.62	Moderate-Weak

First Author, Year	Sample							Measurement			Statistical Analysis				Total Points[1]	Score	Quality
	Probabilistic sample used	Representative	Sample size appropriate for power	Sample drawn > 1 site	Matching design	Statistically adjusted	Response rate > 50%	DV directly measured/ administrative	DV reliability	DV validity	Appropriate tests used	p values reported	CI reported	Missing data managed appropriately			
Prin, 1997	0	1	1	0	N/A	N/A	0	0	1	1	1	1	0	1	8/13	0.62	Moderate-Weak
Kenny, 2005	0	1	1	1	N/A	N/A	0	0	1	1	1	1	0	1	8/13	0.62	Moderate-Weak
Varcoe, 1995	1	1	1	1	N/A	N/A	0	0	1	1	1	1	0	0	8/13	0.62	Moderate-Weak
Logsdon, 1998	1	1	1	1	N/A	N/A	0	0	0	1	1	1	N/A	0	7/12	0.58	Moderate-Weak
Bostrom, 2008	0	1	1	1	N/A	N/A	1	0	1	0	1	1	N/A	0	7/12	0.58	Moderate-Weak
Humphris, 1999	1	2	1	1	0	0	1	0	0	1	1	1	0	0	9/16	0.57	Moderate-Weak
Brown, 1997	0	1	1	1	N/A	N/A	1	0	0	1	1	1	0	0	7/13	0.54	Moderate-Weak
McCleary, 2002	0	1	1	0	N/A	N/A	0	0	1	1	1	1	0	1	7/13	0.54	Moderate-Weak
Parahoo,1999 A comparison	0	1	1	1	N/A	N/A	1	0	0	1	1	1	0	0	7/13	0.54	Moderate-Weak
Parahoo, 2001	0	1	1	1	N/A	N/A	1	0	0	1	1	1	0	0	7/13	0.54	Moderate-Weak
Rutledge, 1996	0	1	1	1	N/A	N/A	0	0	1	1	1	1	0	0	7/13	0.54	Moderate-Weak
Wallin, 2003	0	2	0	0	N/A	N/A	1	0	1	1	1	1	0	0	7/13	0.54	Moderate-Weak
Wallin, 2006	0	1	1	1	N/A	N/A	1	0	0	1	1	1	0	0	7/13	0.54	Moderate-Weak
Profetto-McGrath, 2003	0	1	1	1	N/A	N/A	0	0	1	1	1	1	0	0	7/13	0.54	Moderate-Weak
McCleary, 2003	0	1	1	0	N/A	N/A	0	0	1	1	1	1	0	N/A	6/12	0.5	Weak
Erler, 2000	1	1	1	1	N/A	N/A	0	0	0	0	1	1	N/A	0	6/12	0.50	Weak
Stiefel, 1996	1	1	1	1	0	0	0	0	1	1	1	1	0	0	8/16	0.5	Weak
Champion, 1989	0	1	1	0	N/A	N/A	0	0	1	1	1	1	0	0	6/13	0.46	Weak

First Author, Year	Sample							Measurement			Statistical Analysis				Total Points[1]	Score	Quality
	Probabilistic sample used	Representative	Sample size appropriate for power	Sample drawn > 1 site	Matching design	Statistically adjusted	Response rate > 50%	DV directly measured/ administrative	DV reliability	DV validity	Appropriate tests used	p values reported	CI reported	Missing data managed appropriately			
Lacey, 1994	1	1	0	1	N/A	N/A	0	0	0	1	1	1	0	0	6/13	0.46	Weak
Nash, 2005	1	0	1	1	N/A	N/A	0	0	1	1	1	0	0	0	6/13	0.46	Weak
Wells, 1994	1	2	1	0	N/A	N/A	0	0	0	0	1	1	0	0	6/13	0.46	Weak
McCloskey, 2005	0	0	1	1	N/A	N/A	0	0	1	1	1	1	0	0	6/13	0.46	Weak
Butler, 1995	0	1	1	0	0	0	1	0	1	0	1	1	0	1	7/16	0.44	Weak
Wright, 1996	0	1	1	1	0	0	1	0	0	1	1	1	0	0	7/16	0.44	Weak
McCloskey, 2008	0	0	0	1	N/A	N/A	0	0	1	1	1	1	N/A	0	5/12	0.42	Weak
Connor, 2006	0	1	0	1	0	0	0	0	0	1	1	1	0	1	6/16	0.38	Weak

[1] **Total Points:** No. of points possible= (16 – N/A)

Key:

< 0.50= weak; 0.51-0.65= moderate-weak; 0.66-0.79= moderate-strong; > 0.80= strong

DV=Dependent Variable; CI=Confidence Interval

Table 3-2: Quality Assessment for the Included Quasi-Experimental Articles (N=2)

First Author, Year	Selection Bias	Allocation Bias	Confounders	Blinding	Data Collection Methods	Withdrawals and Drop-Outs	Total Points[1]	Score	Quality
Tranmer, 2002	Moderate	Moderate	Strong	Not applicable	Strong	Weak	11/5	2.2	Moderate-Weak
Tsai, 2003	Weak	Moderate	Weak	Not applicable	Moderate	Strong	9/5	1.8	Weak

[1] **Total Points:** 6 – the number of points not applicable for the article

Key:

Weak (1.0-2.0), moderate-weak (2.10-2.34), moderate-strong (2.35-2.66), or strong (2.67-3.00)

Table 3-3. Summary of Findings for Studies Reporting Research Utilization in General (N=39)

Individual Determinant	First Author, Year	Significance*	Direction and Magnitude	Comment
1. BELIEFS AND ATTITUDES				
Perceived support for research	Butler (1995)	NS		
Attitude toward research	Champion (1989)	S	+ (r=.55)	
	Estabrooks (1999)	S	+ LISREL	Chi square = 55.91 p=.263 for model with attitude, belief suspension and in-services
	Hatcher (1997)	S	+ (r=.65 - .82)	
	Lacey (1994)	S	+ (r=.674)	
	Prin (1997)	S	+ (r=.58)	
	Tranmer (2002)	S	+ (β =.64)	
	Varcoe (1995)	S	+ (r=.41)	S for general research use (RUQ); NS for specific practices
	Wells (1994)	S	+ (β=1.62)	
Expectation of self to use research	Varcoe (1995)	S	+ (r=.51)	With general use of research (not specific findings)
Expressed interest in research	Varcoe (1995)	S	+ (r=.50)	With general use of research (not specific findings)
Problem solving ability	Estabrooks (1999)	NS		
Cosmopoliteness	Estabrooks (1999)	NS		
Autonomy	Estabrooks (1999)	NS		

Individual Determinant	First Author, Year	Significance*	Direction and Magnitude	Comment
	Forbes (1997) McCloskey (2005)	S S	+ (r=0.08) + (β= 0.135)	
Dogmatism	Estabrooks (1999)	NS		
Activism	Estabrooks (1999)	NS		
Belief suspension	Estabrooks (1999)	S	+ (LISREL)	Chi square = 55.91 p=.263 for model with attitude, in-services, belief suspension
Theoretical orientation	Estabrooks (1999)	NS		
Trust	Estabrooks (1999)	NS		
Confidence	Wells (1994)	NS		Confidence in research related activities (e.g., reading research, discussing research)
Career commitment	Stiefel (1996)	S	+ (R^2=0.13)	MANOVA
Perception of nurse as a RU barrier	Bostrom (2008)	S	+ (t=2.512)	Research user reports less individual barriers
Awareness (overall) of practice	Squires (2007)	S	+ (β=2.52)	For 'user of research'
Awareness of practice by regular use	Squires (2007)	S	+ (β=3.49)	For 'user of research'
Research awareness	Wells (1994)	NS		
Persuaded (believe in) of the practice	Squires (2007)	S	+ (β=2.11)	For 'user of research'
2. INVOLVEMENT IN RESEARCH ACTIVITIES				
Current data collection for others	Butler (1995)	S	+ (OR=4.04)	
Participation in research-related activities	Berggren (1996)	NS		
	McCleary (2002)	S	+	Test statistic not given
Participation in research as subject	Hatcher (1997)	NS		
Past use of research	Butler (1995)	S	+ OR=20.0	
Job related research activities	Rutledge (1996)	S	+ (r=.0673 to .1272)	S for 3 of 8 practices
Participation in research study	Brett (1987) Nash (2005)	NS NS		
Education for research participation	Logsdon (1998)	S	+ (r=.32)	
Research participation	Tsai (2000)	S	+ (r=.3268)	
Involvement in research	Tranmer (2002)	NS		

Individual Determinant	First Author, Year	Significance*	Direction and Magnitude	Comment
projects				
Research experience	Varcoe (1995)	S	+ (r=.37)	With general use of research (not specific findings)
Participation in quality management	McCleary (2002)	S	+	Test statistic not given
Participation in quality improvement	Wallin (2003)	S	+ (X^2=11.1)	
Completion of the research study	Tsai (2003)	NS		
3. INFORMATION SEEKING				
Nursing texts as information	Barta (1995)	NS		
Nursing journals as information	Barta (1995)	S	+ (t= -2.36)	
Education by specialty groups	Barta (1995)	NS		
Personal experience as information	Squires (2007)	S	+ (β=0.55)	For 'consistent research user'
P&P manual as information	Squires (2007)	NS		
In-services as a source of knowledge	Squires (2007)	NS		
Attended education program	Berggren (1996)	NS		
Critical reading skills	Tranmer (2002)	S	+ (β=0.19)	Pre-test & Post-test respondents combined
Use computer	Wallin (2006)	S	+ (β=0.142)	
Time per week on the internet	Wallin (2006)	NS		
Internet use	Cummings (2007)	NS		
Have a personal computer	Wallin (2006)	NS		
Reading activities Read journals	 Berggren (1996)	 NS		
Hours reading journals	Brett (1987) Coyle (1990) Michel (1995)	S NS NS	+ (r=.163)	
Number of journals	Rodgers (2000)	S	+ (Z=2.98)	

Individual Determinant	First Author, Year	Significance*	Direction and Magnitude	Comment
read	Rutledge (1996) Wells (1994)	S NS	+ (r=.0901)	1 of 8 practices
Reads *Heart & Lung*	Coyle (1990) Michel (1995)	S S	+ (X^2= 3.795) + Mann Whitney U = 1422.0	
Reads *Nursing Research*	Brett (1987) Michel (1995)	S NS	+ (X^2 = 12.422)	
Reads *RN*	Brett (1987)	S	+ (X^2=8.925)	
Attendance at conferences/in-services	Butler Coyle (1990) Estabrooks (1999)	NS S S	 + (X^2=5.179) + (LISREL)	 To total TIAB score Chi square = 55.91 p=.263 for model with attitude, belief suspension and in-services
	Michel (1995) Rutledge (1996)	S S	+ Mann Whitney U = 1291.5 + (r=.1168)	 All 8 practices combined
Hours of continuing education	Brett (1987) Coyle (1990)	NS NS		
Number of study days attended	Rodgers (2000)	S	+ (r=.095)	
Time spent studying (on duty)	Rodgers (2000)	NS		
Time spent studying (off duty)	Rodgers (2000)	S	+ (r=.1)	
MEDLINE usage	Prin (1997)	S	+ (r=.2526)	
4. EDUCATION				
Increasing levels	Coyle (1990) Lacey (1994) Logsdon (1998) Nash (2005) Rodgers (2000)	NS S S NS S	 + (r=.554) + (X^2=7.99) + (rho=.12)	 Willingness to use research to change practice
Type of degree	Berggren (1996) Brown (1997) Bonner (2008)	NS S S	 + (X^2=36.1) + (H=11.16) Kruskal wallis	Diploma, Degree Without bachelor's vs. with bachelors vs. graduate degree. Masters degree versus lower

Individual Determinant	First Author, Year	Significance*	Direction and Magnitude	Comment
	Brett (1987)	NS		Diploma, Bachelors, Masters
	Brett (1987)	S	+ % with BN (r=.123) % non-nursing masters (r=.123) - % with MN (r=-.201)	Negative effect for MN but only 2% of sample had MN
	Butler (1995)	S	+ (OR=1.75)	Diploma, Bachelors degree (higher for degree)
	Champion (1989)	NS		Graduate compared to basic education (BN)
	Erler (2000)	NS		For using literature searches in practice and in policies, Diploma versus degree
	Estabrooks (1999)	NS		Diploma, Degree
	Forbes (1997)	NS		Diploma, Degree
	McCleary (2002)	S	+ (*F*=8.8)	Baccalaureate or graduate degree vs. community college
	McCloskey 2005/2008	S	+ (F=11.34)	Diploma, Bachelors, Masters
	Michel (1995)	S	+ (U= 2345.0)	BSN, MSN
	Ofi (2008)	NS		Diploma, Degree
	Rutledge (1996)	S	- All Practices r=-.1205, 3 of 8 practices (r=.0666-.1158)	Diploma/associate, bachelors, masters, doctorate Suggested in article to be spurious due to multiple tests
	Squires (2007)	NS		Diploma, Degree
	Stiefel (1996)	NS		Bachelors, Graduate degree
	Tranmer (2002)	NS		Diploma, Degree
	Varcoe (1995)	NS		Diploma, Degree
	Wallin (2006)	S	+ (r=0.229)	Diploma, Degree
Working toward a degree	Brett (1987)	NS		
	Coyle (1990)	NS		
Current enrolment	Brett (1987)	NS		
Well prepared in education process	Logsdon (1998)	S	+ (r=.32)	With willingness to change ones practice based on research
Number of degrees	Brett (1987)	NS		

Individual Determinant	First Author, Year	Significance*	Direction and Magnitude	Comment
Courses attended	Estabrooks (1999)	NS		
Completion of research class(es)	Brett (1987) Coyle (1990) McCleary (2003) Nash (2005) Rodgers (2000)	NS NS S NS S	 + (t=2.9) + (Mann Whitney U= 4.44)	
Completion of statistics course	Butler (1995)	NS		
Completion of research design course	McCleary (2002)	S	+ (*t*=3.9)	
	McCleary (2003)	S	+ (*t*=3.5)	
Number of statistics courses taken	Wells (1994)	S	+ (β=0.48)	
Years since basic education	Brett (1987)	NS		
Years since last degree	Estabrooks (1999)	NS		
Taught a topic based on research	Rodgers (2000)	S	+ (Mann Whitney U=4.93)	
Having project 2000 training	Parahoo (1999)	NS		
5. PROFESSIONAL CHARACTERISTICS				
Full or part-time status	Butler (1995) Wallin (2006)	NS S	 + (β=0.228)	 For work full time
Years employed as an RN	Butler (1995) Champion (1989) Coyle (1990) Estabrooks (1999) McCleary (2002) McCloskey 2008 Michel (1995) Rodgers (2000) Squires (2007) Stiefel (1996) Tranmer (2002) Wallin (2006)	NS NS NS NS NS NS NS NS S S NS NS	 + (β =0.07) + (r=.22)	 For ‘consistent research user’
Years in post (hospital)	Tranmer (2002)	NS		

Individual Determinant	First Author, Year	Significance*	Direction and Magnitude	Comment
Current role	Berggren (1996)	NS		Staff midwife or midwifery sister
	Bonner (2008)	S	+ Kruskal Wallis (H=12.67)	Nurse unit managers and consultant report more use then staff nurses
	Butler (1995)	S	+ (OR=5.01)	Those in leadership or advanced roles report more use then staff nurses
	Connor (2006)	NS		
	Hatcher (1997)	S	+ (t=5.57)	Those in leadership of advanced roles report more use as compared to staff nurses
	McCloskey (2005/2008)	S	+ (F=7.901)	Management position or advanced practice nurses vs. staff nurses
	Rodgers (2000)	NS		Charge nurse vs. staff nurse
	Wallin (2006)	S	- (β= -0.395)	Staff nurse versus other (staff nurses use less research)
	Wells (1994)	NS		Staff nurse, nurse manager
Clinical specialty	Estabrooks (1999)	NS		
	Michel (1995)	NS		
	Forbes (1997)	S	+ ANOVA (F=5.370	Higher RU for critical care nurses as compared to medical/surgical or obstetrical/gynecological
	Humphris (1999)	S	+ X^2 (test value not reported)	Greater number of diabetic nurse specialists implement specific findings into practice as compared to the non-nurse specialist group
	Nash (2005)	S	+ ANOVA (*F*=2.35)	Area worked (highest RU mean to lowest): Education, other, hospital inpatient, outpatient clinic, office
	Parahoo (2001)	S	+ (X^2= 3.79)	Medical vs. surgical nurses
	Squires (2007)	S	- (β=-0.42)	Med-surg compared to critical care unit (med-surg use less then critical care)
	Stiefel (1996)	S	+ (Wilk's lambda=0.76, F=2.23)	Critical care higher RU then medicine, surgery, oncology
	Wright (1996)	NS		Analyzed groups by practice area (general hospital, psychiatric hospital, or community mental health)
Number of memberships held	Coyle (1990)	NS		
Oncology nursing society status	Rutledge (1996)	S	- 2 of 8 practices (-.068, -.080)	

Individual Determinant	First Author, Year	Significance*	Direction and Magnitude	Comment
Oncology certification	Rutledge (1996)	NS		
CFRN certification	Erler (2000)	S	+ (X^2= 9.6 – use research literature); (x^2=11.2 – translate findings into policies and procedures)	
Job satisfaction	Coyle (1990 Estabrooks (1999) Berggren (1996)	S NS NS	+ (r=.18)	
	Forbes (1997) Wallin (2006)	S S	+ (r=0.13) + (β=0.264)	
Emotional exhaustion	Cummings 2007	S	- (magnitude varied by context)	Coefficients significant but model not. High context estimated effect=-.109; partially high context estimated effect=-.191; partially low context estimated effect=-.334; low context estimated effect=-.251
Stress	Forbes (1997) Forbes (1997)	S S	- (r= -0.13) - (r= -0.08)	Personal job stress: Juggling expectations of other professionals and of clients Situational job stress: Issues such as equipment, time, and staffing
Affiliation	Estabrooks (1999)	NS		
Dependant care hours	Estabrooks (1999)	NS		
Hours/week worked	Estabrooks (1999) Wallin (2006)	NS NS		
Shift usually worked	Estabrooks (1999)	NS		
Shift satisfaction	Estabrooks (1999)	NS		
National certification	Stiefel (1996)	NS		
6. SOCIO-DEMOGRAPHIC AND SOCIO-ECONOMIC FACTORS				
Age	Berggren (1996) Butler (1995) Champion (1989) Cummings (2007) Estabrooks (1999) Lacey (1994)	NS NS NS NS NS NS		

Individual Determinant	First Author, Year	Significance*	Direction and Magnitude	Comment
	McCleary (2002) Rodgers (2000) Wallin (2006)	NS NS NS		
Married or partnered/ Marital status	Estabrooks (1999)	NS		
Family income	Estabrooks (1999)	NS		
Health/lifestyle activity	Estabrooks (1999)	NS		
Gender	Estabrooks (1999) Stiefel (1996) Wallin (2006)	NS NS NS		

*Significance: NS=not significant, S=significant at p<0.05

Table 3-4. Summary of Findings for Studies Reporting *Kinds* of Research Utilization (N=6)

Individual Determinant	First Author, Year	Significance* (Direction and magnitude)			
		Instrumental Research Utilization	**Conceptual Research Utilization**	**Persuasive Research Utilization**	**Overall Research Utilization**
1. BELIEFS AND ATTITUDES					
Attitude toward research	Connor (2006)	NS	NS	NS	S + (β=0.234)
	Estabrooks (2007)	Canadian S + (OR=1.17) US Military NS	**Not assessed**	**Not assessed**	Canadian S + (OR=1.21) US Military S + (OR=1.16)
	Kenny (2005)	S + (β not reported)	NS	NS	NS
	Milner (2005)	S + (β=0.120)	NS	S + (β=0.075)	S + (β=0.098)
Importance of access to research	Kenny (2005)	NS	NS	S + (β not reported)	NS
Cosmopoliteness	Milner (2005)	NS	NS	NS	NS
Localite (orientation within one's immediate social context)	Milner (2005)	NS	S + (β= 0.031)	NS	NS
Interest or organizational groups	Kenny (2005)	NS	NS	NS	S + (β not reported)

Individual Determinant	First Author, Year	Significance* (Direction and magnitude)			
		Instrumental Research Utilization	Conceptual Research Utilization	Persuasive Research Utilization	Overall Research Utilization
belonged to					
Adoptiveness	Milner (2005)	NS	NS	NS	NS
Belief suspension	Estabrooks (2007)	Canadian NS US Military S + (OR=1.11)	**Not assessed**	**Not assessed**	Canadian S + (OR=1.07) US Military S + (OR=1.08)
	Kenny (2005)	S + (β not reported)	NS	NS	NS
Trust	Connor (2006)	NS	NS	NS	NS
	Estabrooks (2007)	NS	**Not assessed**	**Not assessed**	Canadian NS US Military S + (OR=1.12)
	Kenny (2005)	NS	NS	S + (β not reported)	NS
Research awareness	Milner (2005)	S + (β= 0.037)	NS	S + (β= 0.076)	S + (β= 0.063)
Importance of various factors to decision-making	Kenny (2005)	NS	S + (β not reported)	S + (β not reported)	NS
2. INVOLVEMENT IN RESEARCH ACTIVITIES					
Research involvement	Milner (2005)	S + (β= 0.142)	NS	S + (β= 0.170)	S + (β= 0.176)
3. INFORMATION SEEKING					
Number of nursing journals read	Connor (2006)	NS	NS	NS	NS
	Kenny (2005)	NS	NS	NS	NS
Sources of knowledge	Connor (2006)	NS	NS	NS	NS
	Estabrooks (2007)	NS	**Not assessed**	**Not assessed**	NS
	Kenny (2005)	NS	NS	NS	NS
Mass media	Milner (2005)	NS	NS	S + (β=0.194)	NS
Number of journals read	Kenny (2005)	S + (β not reported)	NS	NS	NS
Number of continuing education sessions	Connor (2006)	NS	S + (β not reported)	S + (β not reported)	S + (β not reported)

Individual Determinant	First Author, Year	Significance* (Direction and magnitude)			
		Instrumental Research Utilization	**Conceptual Research Utilization**	**Persuasive Research Utilization**	**Overall Research Utilization**
In-services attended	Connor (2006)	NS	NS	NS	NS
	Estabrooks (2007)	NS	**Not Assessed**	**Not Assessed**	Canadian S + (OR=1.03) US Military NS
4. EDUCATION					
Increasing levels	Kenny (2005)	NS	NS	NS	NS
	Connor (2006)	NS	NS	NS	NS
Type of degree	Estabrooks (2007)	NS	**Not Assessed**	**Not Assessed**	NS
Possessing a degree	Milner (2005)	NS	NS	NS	NS
5. PROFESSIONAL CHARACTERISTICS					
Years employed as an RN	Estabrooks (2007)	Canadian NS US military S + (OR= 0.97)	**Not Assessed**	**Not Assessed**	NS
	Kenny (2005)	NS	NS	NS	NS
Length of time at job title	Connor (2006)	NS	NS	NS	NS
Years in post (hospital)	Kenny (2005)	NS	NS	NS	NS
	Connor (2006)	NS	NS	NS	NS
Current role	Milner (2005) [1]	NS	NS	NS	S - (β = -0.265)
	Milner (2005) [2]	NS	S - (β= -0.382)	S - (β= -0.345)	NS
	Kenny (2005)	NS	NS	NS	NS
	Connor (2006)	NS	NS	NS	NS
	Kenny (2005)	NS	NS	NS	NS
	Connor (2006)	NS	NS	NS	NS
Number of memberships held	Connor (2006)	NS	NS	NS	NS
6. SOCIO-DEMOGRAPHIC AND SOCIO-ECONOMIC FACTORS					
Age	Milner (2005)	NS	NS	NS	S - (β=-0.011)
	Profetto-McGrath (2003)	NS	NS	NS	NS
	Connor (2006)	NS	NS	NS	NS
Gender	Estabrooks (2007)	NS	**Not assessed**	**Not Assessed**	NS

Individual Determinant	First Author, Year	Significance* (Direction and magnitude)			
		Instrumental Research Utilization	Conceptual Research Utilization	Persuasive Research Utilization	Overall Research Utilization
7. CRITICAL THINKING					
Critical thinking skills (total CCTDI score)	Profetto-McGrath (2003)	S + (*r* =.240	S + (*r* =.27)	S + (*r*=.17)	S + (*r* =.35)
	Profetto-McGrath (2009)	S + (*r* =.222)	S + (*r* =.205)	S + (*r*=.237)	S + (*r* =.146)

*Significance: NS=not significant, S=significant at p<0.05
[1]Managers vs educators
[2] RNs vs educators

Table 3-5: Characteristics of the Included Studies (N=45)

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
Berggren, Journal of Advanced Nursing, 1996	Cross-sectional	**Sample size:** **n**=108(returned) **n**=84(completed) **Subjects:** Swedish Midwives	**Setting:** Members of a county division of the Swedish Midwives Association **Country:** Sweden	Roger's (1983) Theory of Diffusion of Innovations	Modified NPQ[1] - The Midwifery Practice Questionnaire (MPQ)	Multiple items. Scored dichotomous yes/no for all questions and sometimes/always for the question on use Total Innovation Adoption Behavior (TIAB) score calculated to categorize participants' stage	α (Pilot, n=25) =0.79 α (current study)=0.68 α(subscales)= 0.59-0.76	**Content:** midwifery practices taken from doctoral dissertations and articles published in the Journal of the Swedish Midwives' Association

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
						of adoption		
Bonner, Journal of Nursing Management, 2008	Cross-sectional	**Sample size:** **n**=347 **Subjects:** Registered and enrolled nurses	**Setting:** Cairns District health Services (CDHS) Includes a regional hospital, 2 rural hospitals, 2 health centres, and community health facilities **Country:** Australia	Not specified	Edmonton Research Orientation Survey (EROS[2]) *Using Research/ Evidence-Based Practice* subscale	10 items scored on a 5-point Likert scale: strongly disagree (1) - strongly agree (5) Overall score = mean of 10 items	α (current study, EROS)=0.95	Construct (current study)-factor analysis - 3 components (45.1% explained variance in total): 1) Attitude (18.0%) 2) Use of Research (15.6%) 3) Know. of Research (11.4%)
Bostrom, Implementation Science, 2008	Cross-sectional	**Sample size:** **n**=140 (descriptive) **n**=134 for correlations (data from 6 respondents could not be used due to >50% missing items in the RU Index) **Subjects:** Registered nurse working in the care of older people	**Setting:** Multiple sites in 8 municipalities for Elder care including nursing homes, rehabilitation units, and group dwellings **Country:** Sweden	Not specified	Research Utilization Questionnaire (RUQ[3]) *Using Research* Subscale	10 items scored on a 5-point Likert scale: strongly disagree (1) - strongly agree (5) Overall score = mean of 10 items	α (current study, RU index)=0.84	Not reported

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
Brett, Journal of Continuing Education in Nursing, 1987	Cross-sectional	**Sample size:** **n**=216 **Subjects:** Registered Nurses	**Setting: 19** Acute care hospitals: medical, surgical, or intensive care units **Country:** United States	Roger's (1983) Theory of Diffusion of Innovations	The Nursing Practice Questionnaire (NPQ[1])	Scored dichotomous yes/no for all questions and sometimes/always for the question on use Total Innovation Adoption Behavior (TIAB) score calculated to categorize participants' stage of adoption	α (pilot)=.82 Test-retest (pilot, one-week interval) r =.83 α (current, NPQ)= .95 α (current, 14 subscales) =.68 to.95	**Content:** Assumed as the innovations were derived from published research reports using specific criteria developed by Haller et al. 1979
Brown, Journal of Continuing Education in Nursing, 1997	Cross-sectional	**Sample size:** **n**=753 **Subjects:** Nurses	**Setting:** 29 health care facility locations **Country:** United States	Not specified	Nursing Research Utilization Survey (developed for this study) Single item	Number of times participated in activity	Not reported	Not reported
Butler, The Canadian Journal of Nursing Research, 1995	Cross-sectional	**Sample size:** **n**=348 **Subjects:** Staff nurses, head nurses, clinical nurse specialists, nurse educators, hospice nurses, expanded-role nurses, and	**Setting:** 1 large tertiary hospital (Victoria General Hospital, Nova Scotia) **Country:** Canada	Not specified	Research Survey (developed for this study) Single item	Scored dichotomous yes/no	Not reported	Not reported

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
		enterostomal therapy nurses						
Champion, Journal of Advanced Nursing, 1989	Cross-sectional	**Sample size:** **n**=59 **Subjects:** Registered nurses (medical, surgical, labour/delivery, postpartum, nursery, ICU, CCU)	**Setting:** 1 community hospital **Country:** United States	Not specified	Research Utilization Questionnaire (RUQ[3]) *Using Research* Subscale	10 items scored on a 5 point Likert scale: strongly disagree (1) - strongly agree (5)	α (sub-scales) = 0.84 - 0.94 α (overall) = 0.92 α (use subscale)= 0.92	**Content**- expert panel
Connor, 2006 (dissertation)	Cross-sectional	**Sample size:** **n**=143 **Subjects:** Registered nurses (n=39), licensed practice nurses (n=31), personal care workers (n=73)	**Setting:** # Sites: 12 (5 urban, 7 rural) nursing home facilities **Country:** Canada	Not specified	Research Utilization Survey (adapted from Estabrooks 1999) Single items for four kinds of research utilization: instrumental, conceptual, persuasive, overall	Scored on a 7-point response scale: 1=never 2=on one or two shifts 3 unlabelled 4 unlabelled 5=on about half of the shifts 6 unlabelled 7=nearly every shift 8=do not know	Not reported	**Content**- pilot study with 6 individuals from each of the three groups
Coyle, Nursing Research, 1990	Cross-sectional	**Sample size:** **n**=113 **Subjects:** Registered nurses, registered practical nurses	**Setting:** 10 acute care hospital **Country:** United States	Roger's (1983) Theory of Diffusion of Innovations	The Nursing Practice Questionnaire (NPQ[1])	Multiple items. Dichotomous yes/no for all questions and sometimes/always for the question on use	α (NPQ) =.91 α (14 subscales) =.79-.90	**Content**- Nursing practices from published literature (replication

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
								of Brett 1987 study)
Cummings, Nursing Research, 2007	Secondary analysis of cross-sectional data	**Sample sizes after listwise deletion** 1998 dataset (**n**=3701) **Used in analysis** (**n**=1200; i.e. 300 cases per context group) **Subjects:** Registered nurses	**Setting:** All RNs in Alberta Canada **Country:** Canada	PARiHS	Questionnaire (same data as Estabrooks 1999) Single item	Scored on a 7-point response scale: 1=never 2=on one or two shifts 3 unlabelled 4 unlabelled 5=on about half of the shifts 6 unlabelled 7=nearly every shift 8=do not know	Not reported	**Content**--Derived measure developed based on predictors of research utilization found in the literature Development of the theoretical model was guided by the PARIHS framework, the literature, previous research, and admin. experience
Erler, Air Medical Journal, 2000	Cross-sectional	**Sample size:** **n**=497 **Subjects:** Nurses (Air and Surface Transport)	**Setting:** Members of the Air & Surface Transport Nurses Association (ASTNA)	Not specified	Questionnaire (developed for this study) Single item	Dichotomous yes/no	Not reported	Not reported

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
			Country: United States					
Estabrooks, Research in Nursing & Health, 2007	Cross-sectional	**Sample size:** **Canadian-N**=600 **US Army-N**=290 **Subjects:** Nurses	**Setting:** Canada: health care settings in Alberta (mainly hospitals) United States: three US Army hospitals in North east **Country:** Canada & US	Not specified	Questionnaire (adapted from Estabrooks, 1999) Single items for two kinds of research utilization: instrumental, overall	Scored on a 7-point response scale: 1=never 2=on one or two shifts 3 unlabelled 4 unlabelled 5=on about half of the shifts 6 unlabelled 7=nearly every shift 8=do not know	Not reported	No new data presented Refers to Estabrooks 1999

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	**Description/ Scoring**	**Reliability**	**Validity**
Estabrooks, Western Journal of Nursing Research, 1999	Cross-sectional	**Sample size:** **n**=600 **Subjects:** Registered nurses-direct patient care	**Setting:** Members of the Alberta Association Registered Nurses **Country:** Canada	Roger's (1983) Theory of Diffusion of Innovations (for overall survey but not RU measure)	Questionnaire (developed for this study) Single item	Scored on a 7-point response scale: 1=never 2=on one or two shifts 3 unlabelled 4 unlabelled 5=on about half of the shifts 6 unlabelled 7=nearly every shift 8=do not know	Not reported	**Content:** --reviewed by two researchers with expertise in the field. --Careful attention paid to theoretical conceptualiz-ations of research utilization in the literature, questioning approaches of previous investigators, theoretical needs of the study, and the investigator's clinical experience. ---Pilot testing on a convenience sample (n=23) of post-basic baccalaureate nursing students and master's nursing students. The labeling convention was chosen

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
Forbes, Journal of Nursing Measurement, 1997	Cross-sectional	**Sample size:** **n**=1117 **Subjects:** Staff RNs (medical/surgical, critical care, operating/ recovery room, obstetrics/ gynecology, and others)	**Setting: 4** acute care hospitals in the Midwest **Country:** United States	Not specified	Control Over Nursing Practice Instrument	Scored on a 4-point scale: 0 1 2-4 5 or more times Does not apply	α (RU subscale)=.78	**Dimensionality** High factor loadings for items in research use subscale: (.66-.82)
Hatcher, Canadian Journal of Nursing Administration, 1997	Cross-sectional	**Sample size:** **n**=174 NAC members (**n**=37) Staff (**n**=137) **Subjects:** Registered nurses, registered practical nurses	**Setting:** acute care hospital **Country:** Canada	Not specified	Research Utilization Questionnaire (RUQ[3]) *Using Research* Subscale	10 Items scored on a 5 point Likert scale: strongly disagree (1) - strongly agree (5)	Not reported	Not reported
Humphris, Practical Diabetes International, 1999	Cross-sectional	**Sample size:** DNS **n**=299 NNS **n**=133 **Subjects:** Registered Nurses-Diabetic Nurse Specialists (DNS) and Non-Nurse specialists (NNS)	**Setting:** acute care trusts **Country:** United Kingdom	Not specified	Questionnaire (developed for this study) Single item	Dichotomous yes/no	Not reported	Not reported

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
Kenny, Canadian Journal of Nursing Leadership, 2005	Cross-sectional	**Sample size:** **n**=290 Military (160) Civilian (130) **Subjects:** Registered nurses (Military and Civilian)	**Setting:** Three hospitals in the North Atlantic Regional Medical Command **Country:** United States	Not specified	Research Utilization Survey (Adapted from Estabrooks, 1999) Single items for four kinds of research utilization: instrumental, conceptual, persuasive, overall	Scored on a 7-point response scale: 1=never 2=on one or two shifts 3 unlabelled 4 unlabelled 5=on about half of the shifts 6 unlabelled 7=nearly every shift 8=do not know	Not reported	Not reported

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
Lacey, Journal of Advanced Nursing, 1994	Cross-sectional Pilot	**Sample size:** **n**=20 **Subjects:** Registered nurses in the United Kingdom	**Setting:** 2 Hospitals; Adult acute areas. Hospital A: district general hospital in an industrial town Hospital B: a high profile teaching hospital in a major city **Country:** United Kingdom	Not specified	Research Utilization Questionnaire (RUQ[3]) *Using Research* Subscale	10 items scored on a 5-point Likert scale: strongly disagree (1) - strongly agree (5)	Not reported	Not reported
Logsdon, Kentucky Nurse, 1998	Cross-sectional	**Sample size:** **n**=196 **Subjects:** Nurses registered with the Kentucky Board of Nursing	**Setting:** Kentucky **Country:** United States	Not specified	Registered Nurses' Views on Research (developed for this study)	Not reported	Not reported	**Content:** based on literature and investigators experience with research use in the clinical setting
McCleary, Nurse Education Today, 2003	Cross-sectional	**Sample size:** **n**=175 **Subjects:** Registered nurses	**Setting:** **1** Paediatric acute care hospital **Country:** Canada	Not specified	Edmonton Research Orientation Survey (EROS[2]) *Using Research/*	10 items scored on a 5-point Likert scale: strongly disagree (1) - strongly agree (5)	Not reported	**Construct-** State that construct validity of the subscales were good

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
					Evidence-Based Practice subscale			
McCleary, Journal of Nursing Measurement, 2002	Cross-sectional	**Sample size:** **n**=185 **Subjects:** Registered Nurses	**Setting:** One Paediatric teaching hospital **Country:** Canada	Not specified	Edmonton Research Orientation Survey (EROS[2]) *Using Research/ Evidence-Based Practice* subscale	10 items scored on a 5-point Likert scale: strongly disagree (1) - strongly agree (5)	α (EROS)= 0.94 α (EBP subscale)= 0.87	Not reported
McCloskey, 2005 (dissertation) McCloskey, Journal of Nursing Scholarship, 2008	Cross-sectional	**Sample size:** **n**=270 **Subjects:** All registered nurses >18 years of age working within the Iowa hospital system	**Setting:** 5 Iowa hospitals **Country:** United States	Not specified	Research Utilization Questionnaire (RUQ[3]) *Using Research* Subscale	10 items scored on a 5 point Likert scale: strongly disagree (1) - strongly agree (5)	α (RU subscale)= 0.93	No new data reported - Refers to Champion and Leach 1989

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
Michel, Journal of Professional Nursing, 1995	Cross-sectional	**Sample size:** **n**=167 (returned) **n**=157 (completed) **Subjects:** Nurses	**Setting:** Members of STTI Honor Society associated with a university in a metropolitan setting **Country:** United States	Roger's (1983) Theory of Diffusion of Innovations	Modified Nursing Practice Questionnaire (NPQ[1])	Multiple items. Dichotomous yes/no for all questions and sometimes/always for the question on use	α (NPQ) = 0.85 α(subscales)= 0.73 - 0.84	**Content-** assumed as research findings derived from published nursing literature using specific criteria
Milner, International Journal of Nursing Studies, 2005	Cross-sectional	**Sample size:** **n=**389 **Subjects:** Staff nurses, educators and managers	**Setting:** Nurses registered with the Alberta Association of registered nurses in Alberta, Canada **Country:** Canada	Not specified	Research Utilization Survey (Adapted from Estabrooks, 1999) Single items for four kinds of research utilization: instrumental, conceptual, persuasive, overall	Modified response scale used. Scored on a 5-point response scale: never (1) to nearly every day (5)	Not reported	Not reported

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
Nash, 2005 (Dissertation)	Cross-sectional	**Sample size:** **n**=82 **Subjects:** Registered Nurses - Nurses registered with the Idaho State Board of Nursing	**Setting:** State of Idaho **Country:** United States	Not specified	Utilities #2 questionnaire	Multiple items. Scored on a 4 point Likert-type scale - Strongly disagree Disagree Agree Strongly agree	α (utilization subscale) = 0.917	Not reported
Ofi, International Journal of Nursing Practice, 2008	Cross-sectional	**Sample size:** **Whole sample n**=500 **By hospital** (**n**=199, 162, & 139) **Subjects:** Nurses in Nigeria	**Setting:** three Tertiary hospitals **Country**: Nigeria	Not specified	Research Conduct and Research Utilization by Nurses Questionnaire (developed for this study) Single item	Scored on a 5 point scale: Never Seldom Sometimes Frequently All the time	Not reported	**Content—** experts in the field
Parahoo, Journal of Advanced Nursing, 1999	Cross-sectional	**Sample size:** **n**=1368 **Subjects:** Hospital nurses in Northern Ireland	**Setting:** 23 Hospitals in 14 Trusts **Country:** United Kingdom (Ireland)	Not specified	Questionnaire (developed for this study) Single item	Scored on a 5 point scale: Never Seldom Sometimes Frequently All the time	States that it was 'piloted for reliability with a group of 20 nurses'	**Content-** panel of three experts **Content-** survey developed after a review of the literature on research utilization

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
								and research activities
Parahoo, Journal of Nursing Management, 2001	Cross-Sectional	**Sample size:** **n**=479 **n**=1368 (total sample) **Subjects:** Medical/ surgical nurses (subset of results from Parahoo 1998)	**Setting:** 10 hospitals **Country:** United Kingdom (Ireland)	Not specified	Questionnaire (developed for this study) Single item	Scored on a 5 point scale: Never Seldom Sometimes Frequently All the time	Not reported	**Content**- panel of three experts **Content**- survey developed after a review of the literature on research utilization and research activities Reports a pilot with 20 nurses
Prin, Studies in Health Technology & Informatics, 1997	Cross-sectional	**Sample size:** **n**=121 **Subjects:** Female clinical nurses	**Setting:** medical-surgical units in 1 large, university medical center **Country:** United States	Not specified	Modified Research Utilization Questionnaire (RUQ[3]) *Using Research* Subscale	10 items scored on a 5 point Likert scale: strongly disagree (1) - strongly agree (5)	α= 0.942 Pilot testing indicated one item contributed to low reliability. This item was removed from the scale	**Content**-by three nursing informatics experts

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
Profetto-McGrath, Western Journal of Nursing Research, 2003	Cross-sectional	**Sample size:** **n**=141(valid responses from a total of 143 returned) **Subjects:** Registered Nurses	**Setting:** 7 hospitals; Adult surgical (n=2) and pediatric units (n=5) **Country:** Canada	Roger's (1983) Theory of Diffusion of Innovations	Research Utilization Survey (shortened version of Estabrooks, 1999) Single items for four kinds of research utilization: instrumental, conceptual, persuasive, overall	Scored on a 7-point response scale: 1=never 2=on one or two shifts 3 unlabelled 4 unlabelled 5=on about half of the shifts 6 unlabelled 7=nearly every shift 8=do not know	Not reported	No new data presented Refers to Estabrooks 1999
Profetto-McGrath, Nurse Education in Practice, 2009	Cross-Sectional	**Sample size:** **n**=287 **Subjects:** Nurse educators	**Setting:** Members of a provincial association of registered nurses in western Canada **Country:** Canada	Not specified	Research Utilization Survey (shortened version of Estabrooks, 1999) Single items for four kinds of research utilization: instrumental, conceptual, persuasive, overall	Modified response scale used. Scored on a 5-point response scale: never (1) to nearly every day (5)	Not reported	No new data presented - Refers to Estabrooks 2008

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
Rodgers, Nurse Education Today, 2000 (a study..)	Cross-sectional	**Sample size:** **n**=680 **Subjects:** Registered nurses-general medical and surgical wards	**Setting:** 25 Hospitals in the Scottish Health Service **Country:** United Kingdom (Scotland)	Roger's (1983) Theory of Diffusion of Innovations	Modified Nursing Practice Questionnaire (NPQ[1])	Multiple items. Dichotomous yes/no for all questions and sometimes/always for the question on use	α (mean research utilization score over all of the 14 practices)= 0.631	**Content-** panel of nurse researchers and educators. **Construct-** authors report that, as the 14 practices and influencing factors were identified in an earlier exploratory study, the survey was felt to have construct validity **Content-** validity of self-reporting levels of research utilization confirmed in pilot with 20 nurses

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
Rutledge, Oncology Nursing Forum, 1996	Cross-sectional	**Sample Size:** **n**=1100 ONS members (**n**=769) Networking (**n**=331) **Subjects:** Staff nurses (oncology)	**Setting:** Oncology settings (hospitals, comprehensive cancer center, outpatient care clinic, hospice, home care, private/group practice, physician's office) **Country:** United States	Roger's (1983) Theory of Diffusion of Innovations	Modified Nursing Practice Questionnaire [1]--- The Oncology Nursing Practice Questionnaire (ONPQ)	Multiple items. Dichotomous yes/no for most questions and sometimes/always for the question on use	α (ONPQ overall)= 0.75	Not reported
Squires, Implementation Science, 2007	Cross-sectional	**Sample size:** **n**=248 **Subjects:** Registered nurses - medical, surgical, and/or critical care nurses	**Setting:** adult acute care hospitals **Country:** Canada	Roger's (1983) Theory of Diffusion of Innovations	Modified Nursing Practice Questionnaire [1]	Multiple items. Dichotomous yes/no for most questions and sometimes/ always for the question on use Total Innovation Adoption Behavior (TIAB) score calculated to categorize participants' stage of adoption and single score to use item used for 'research use'	α (modified NPQ)= 0.82	**Content –** assumed as the research-based practices selected were identified from existing research literature using specific criteria
Stiefel, 1996	Cross-	**Sample size:**	**Setting:** 20	Item	Nursing	Multiple items	Reliability	**Content**

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
(dissertation)	sectional	**n**=100 **Subjects:** Clinical nurses from adult medical, oncology, surgical, and critical care	nursing units in two university-affiliated teaching hospitals **Country:** United States	selection guided by Rogers (1983), CURN (Horseley et al. 1983), and the Iowa Model of Research Use in Practice (Titler et al. 1994)	Research Utilization Survey (NRUS) (developed for this study)	scored on a 5 point Likert scale: Never Seldom Sometimes Frequently Always Scoring range: 18-90	Test-retest of a convenience sample of 257 nurses from 3 hospitals to develop the NRUS. Involved a test-retest of this convenience sample (see below) Test segment: N=211 RNs (RR: 82.1%) Answered all 20 items of the NRUS: n=202, α=0.941 Re-test segment: - n=188 RNs (RR: 89.1%) Answered all 20 items of the NRUS: n=176 α=0.951 - Reliability correlation of the two scores	**(pilot)**-by 4 NRU experts (2 members of the CURN project, 1 developer of the Iowa model, and 1 who works actively with nurses on NRU projects) **Content (current study)**—Clinical nurse researcher at the Midwest site **Construct:-** factor analysis (n=202 RNs) 2 items were deleted from the original 20 item survey based on

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
							r=0.876	factor analysis
Tranmer, Canadian Journal of Nursing Leadership, 2002	Quasi-experimental	**Sample size= All** Nursing Pretest (**n**=92) Post-test (**n**=88) (High, Low, control) Pretest: (**n**=37, **n**=21, **n**=34) Post-test: (n=29, n=39, n=24) Working Group (High, Low) Pre-test (**n**=18, **n**=6) Post-test (**n**=17, **n**=4) **Subjects:** Registered Nurses -high, low, and controlled exposure to research	**Setting: 1** acute care hospital **Country:** Canada	Not specified	Research Utilization Questionnaire (RUQ[3]) *Using Research* Subscale	10 items scored on a 5 point Likert scale: strongly disagree (1) - strongly agree (5)	α (sub-scales) = 0.85 - 0.94 α (use sub-scale)= 0.93	Not reported
Tsai, International Journal of Nursing Studies, 2000	Cross-sectional	**Sample size= Staff** nurses (**n**=271) Managers (**n**=111) **Subjects:** Staff Nurses and Nurse	**Setting:** largest medical center in Taipei **Country:**. Taiwan	Not specified	Research Utilization questionnaire (adapted from Funk et al. 1991 and Pettengill et al. 1994)	Dichotomous- yes/no	Not reported	**Content**- expert panel of 8 nurses prepared at masters and doctoral levels

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	**Description/ Scoring**	**Reliability**	**Validity**
		Managers			Single item			Pilot test to ensure the tool content was associated with other data reported in the literature and was sensitive to the symbolic meanings relevant in Taiwan's nursing community
Tsai, International Journal of Nursing Studies, 2003	Quasi-experimental	**Sample size:** Control group (**n**=42) Experimental group (**n**=47) **Subjects:** Nurses with at least one year of working experience	**Setting:** A medical center **Country:** Taiwan	Not specified	Research Utilization questionnaire (adapted by Tsai 2000 from Funk et al. 1991 and Pettengill et al. 1994) Single item	Dichotomous- yes/no	Not reported	**Content**- tool checked and confirmed by five clinical nurses

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
Varcoe, Canadian Journal of Nursing Research, 1995	Cross-sectional	**Sample size:** **n**=183 **Subjects:** Registered Nurses	**Setting:** medical surgical and critical care areas of acute care hospitals **Country:** Canada	Roger's (1983) Theory of Diffusion of Innovations	The Research Use in Nursing Practice Instrument (Alcock 1990; modified by Clarke 1991) & Nursing Practice Questionnaire (NPQ[1])	General use: 10 items scored on a 4 point scale: Not at all 2=Sometimes 3=Frequently 4=Always Possible score range 10 to 40 NPQ Use of 10 specific findings: 3 point scale: 1=Never 2=Sometimes 3=Always 'Not applicable'	General research use α = 0.87 NPQ α =0.87	**Content** (total instrument)- pilot testing and peer review
Wallin, Journal of Advanced Nursing, 2003	Cross-sectional	**Sample size:** **n**=119 QI+(**n**=46) QI- (**n**=72) **Subjects:** Registered nurses who participated in a QI training course	**Setting:** Various clinical areas (>75) -acute care, psychiatry, primary care, and nursing homes **Country:** Sweden	Not specified	Research Utilization Questionnaire (RUQ) *Using Research* Subscale Additional item (Pettengill 1994)	10 items scored on a 5 point Likert scale: strongly agree (1)-strongly disagree (5) Dichotomous yes/no on additional item	Not reported (for current study)	Not reported

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
Wallin, Nursing Research, 2006	Secondary analysis of cross-sectional data	**Sample sizes:** **Sample sizes after listwise deletion** **1996** (n=504) **1998** (n=5946) **Subjects:** Registered Nurses	**Setting:** Any setting that a registered nurse may work (random sample of all registered nurses in one Canadian province) **Country:** Canada	PARiHS	Questionnaire (same data as Estabrooks 1999) Single item for overall research utilization	Scored on a 7-point response scale: 1=never 2=on one or two shifts 3 unlabelled 4 unlabelled 5=on about half of the shifts 6 unlabelled 7=nearly every shift 8=do not know	Not reported	**Content**--- Derived measure developed based on predictors of research utilization found in the literature
Wells, Clinical Nurse Specialist: The Journal for Advanced Nursing Practice, 1994	Cross-sectional	**Sample sizes:** **Whole sample** (**n**=279) **Staff Nurses** (**n**=156) **Managers** (**n**=37) **Advanced Practice Nurses (CNS & NPs)** (**n**=86) **Subjects:** Nurses working in a large academic medical centre	**Setting:** 1 Large academic medical centre **Country:** United States	Not specified	Questionnaire (developed for this study) Single item	Dichotomous yes/no	Not reported	Not reported

First Author, Journal, Year	Design	Sample/ Subjects	Setting/ Location	Framework	Research Utilization Instrument			
					Name	Description/ Scoring	Reliability	Validity
Wright, Australian Journal of Advanced Nursing, 1996	Cross-sectional	**Sample size:** **n**=410 **Subjects:** Registered nurses-general and psychiatric	**Setting:** General nurses from 3 teaching hospitals in Sydney; psychiatric nurses from a large Sydney hospital, a medium sized private psychiatric hospital, or from community mental health centres in Sydney **Country:** Australia	Not specified	Questionnaire (designed for this study) Single item	Not reported - appears to be dichotomous yes/no	Not reported	**Content**-consultation with 3 clinical nurse consultants

[1]NPQ = Nurses Practice Questionnaire. NPQ consists of a series of questions following each of several research-based innovations. Scores on individual items are combined to obtain an overall Innovation Adoption Score, based on Rogers (1983) Diffusion of Innovations Theory
[2]EROS = Edmonton Research Orientation Survey. EROS consists of four subscales of which 'Using Research/Evidence-Based Practice' is one subscale. This subscale is composed of 10 items measuring general research use.
[3]RUQ = research Utilization Questionnaire. The RUQ consists of 42 self-descriptive statements comprising four subscales of which research use is one. The research use subscale contains 10 items, which measure the degree to which an individual feels they incorporate research findings into their daily practice.

Table 3-6. Comparison of Conclusion Between Previous Review and Review Update

Category	Individual Characteristic	Conclusion	
		Previous Review (Estabrooks et al,, 2003	**Review Update**
Beliefs and Attitudes	Attitude towards research	Positive attitude associated with more research use	Positive attitude associated with more research use (in general **and with instrumental and overall research utilization**)
	All other determinants	No conclusion – Too few studies	No conclusion – Too few studies
Involvement in Research Activities	Variety of determinants	No conclusion – Too few studies	No conclusion – Too few studies
Information Seeking	Reading practices	Equivocal	Equivocal
	Attending conferences/in-services	No conclusion – Too few studies	**Conference and/or in-service attendance associated with more research use**
	All other determinants	No conclusion – Too few studies	No conclusion – Too few studies
Education	Level of education	Equivocal	**Bachelors versus diploma – no effect on research use**
			Graduate versus bachelors/diploma – increased research use for graduate degree
	Completion of research classes	No conclusion – Too few studies	**No association with research use**
	All other determinants	No conclusion – Too few studies	No conclusion – Too few studies
Professional Characteristics	Years as an RN	No association with research use	No association with research use
	Current role	Leadership role associated with more research use	Leadership role associated with more research use
	Clinical specialty	No association with research use	**Working in critical care areas (compared to general wards) associated with more research use**

Category	**Individual Characteristic**	**Conclusion**	
		Previous Review (Estabrooks et al,, 2003	**Review Update**
	Job satisfaction	No conclusion – Too few studies	**Higher levels of job satisfaction associated with more research use**
	All other determinants	No conclusion – Too few studies	No conclusion – Too few studies
Socio-Demographic and Socio-Economic Factors	Age	No association with research use	No association with research use
	All other determinants	No conclusion – Too few studies	No conclusion – Too few studies

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Chapter 4: Paper #3

An Item Response Theory Analysis of the Conceptual Research Utilization Scale

Janet E. Squires[1,*]
Carole A. Estabrooks[2]
Leslie Hayduk[3]
Mark Gierl[4]
Christine V. Newburn-Cook[5]

[1] PhD Candidate, Faculty of Nursing, University of Alberta, Edmonton, Alberta, Canada

[2] Professor and Canada Research Chair (in Knowledge Translation), Faculty of Nursing, University of Alberta, Edmonton, Alberta, Canada

[3] Professor, Department of Sociology, University of Alberta, Edmonton, Alberta, Canada

[4] Professor and Canada Research Chair (in Educational Measurement), Department of Educational Psychology, University of Alberta, Edmonton, Alberta, Canada

[5] Professor and Associate Dean of Research, Faculty of Nursing, University of Alberta, Edmonton, Alberta, Canada

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Psychological Assessment.

Background

Research utilization is one indicator of an optimum practice environment that leads to improved patient and organizational outcomes. In the most general sense, research utilization refers to “that process by which specific research-based knowledge (science) is implemented in practice” [1]. Several investigators have proposed the existence of multiple kinds of research utilization – instrumental, conceptual, symbolic (or persuasive), and overall [2-4]. *Instrumental* use refers to the use of research findings in a specific and concrete way, such as guideline implementation. *Conceptual* use represents a psychological concept. It refers to using research findings more generally; e.g., using the results to develop new insights and/or using concepts or theories in a less specific manner. Thus, this form of research use will lead to a change in thinking, but not necessarily behavior. *Symbolic* use refers to the use of research findings to legitimate, justify or mobilize support for actions or decisions. Overall use refers to the use of any kind of research in anyway in one’s practice [4, 5]. In this paper we report an item response theory (IRT) psychometric evaluation of a newly developed scale (the *Conceptual Research Utilization Scale*) designed to measure specifically one kind of research utilization -- conceptual research utilization (CRU). We also provide an overview of IRT and discuss how the conceptual research utilization scale can be further developed using IRT methods.

The Conceptual Research Utilization Scale (hereafter called the CRU scale) was developed by two members of our research team (JES and CAE) as part of a larger research program -- the Translating Research In Elder Care (TREC) program [6]. Development of the CRU scale was guided by two key principles: (1) brevity – the scale was required to be less than 10 items so that it could be easily administered as part of a larger survey in busy resource-stretched nursing homes; and (2) generality – the scale was intended to capture the concept of CRU generally so that it could be administered in a wide range of settings. Therefore, terminology that is specialty (e.g., dementia) or culture-specific was avoided. The scale items were derived from an 18-item checklist created by Stetler and Caramanica [7] designed to evaluate an evidence-based practice initiative. Evidence-based practice (medicine) refers to the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients [8]. Six items (later reduced to five items) from the checklist were selected and modified (with permission from the checklist developers) for use with nursing care providers in facility-based long-term care settings (i.e., nursing homes). The scale underwent several feasibility iterations with healthcare aides (i.e., unregulated care providers who provide the majority of nursing care in these settings) in two nursing homes in Alberta Canada before being piloted in the TREC program. The final version of the scale contained five items and asked respondents to score how often best practice knowledge (research) lead to the behaviours reflected in each of the items. A 5-point Likert-type frequency scale was used where 1 indicates ‘never’, 2 indicates ‘rarely’, 3 indicates ‘occasionally’, 4 indicates ‘frequently’ and 5 indicates ‘very frequently’. Higher scores imply more CRU. A copy of the CRU scale can be found in Appendix A.

Measurement precision is critical to the quality of inferences and the consequent decisions that can be drawn from an instrument [9]. In the case of research utilization by healthcare providers, these consequences are serious and include the health outcomes of patients and the functioning of a healthcare facility (e.g., hospital or nursing home). Precise measurement of research utilization is also critical to: (1) identifying and understanding relationships between research utilization and other phenomena (e.g., patient and organizational outcomes), (2) developing and testing research utilization theory, and most importantly, (3) evaluating the effectiveness of research utilization interventions. These requirements draw attention to the need to evaluate the precision with which we can measure research utilization.

There are numerous statistical techniques available to assess measurement precision, for example, Cronbach alpha and principal component analyses are two commonly used techniques. Although these techniques, labeled as classical test theory (CTT) psychometric methods, are able to provide valuable insight into the measurement properties of an instrument, they also display certain limitations. For example, item characteristics obtained with CTT methods are dependent on the sample used to generate them and on the number of, and relative difficulty of, the items (questions) posed. These methods also assume that an instrument is equally precise across the full range of possible scores. However precision often is not uniform across the entire range of scale scores; scores at the edges of a scale generally have more error associated with them than those closer to the middle [10]. As a result, an instrument may be precise when assessing individuals with average levels of a trait like CRU, but at the same time, be imprecise when assessing individuals with extremely low or high levels of that same trait [11]. This lack of precision uniformity is not visible using traditional CTT reliability coefficients such as Cronbach alpha. IRT can overcome this and similar limitations and therefore, offers a valuable supplement to CTT psychometric approaches.

Overview of Item Response Theory

Healthcare providers exhibit a wide range of levels of research utilization, from very low to very high. IRT is a strong method for evaluating instruments that assess psychological traits possessing this kind of distribution. IRT is a model-based measurement theory that relates the probability of an individual’s response to an item on an underlying trait (e.g., CRU) and is thus a mathematical function of both person (individual) and item (question) parameters. The person parameter is called a *latent trait* or *ability*; in our case, it represents an individual’s level of CRU. The three basic types of item parameters refer to: (1) *threshold* (also called location or difficulty), (2) *discrimination* (also called slope), and

(3) *pseudoguessing* (also called lower asymptote). The threshold parameter indicates the point along the standardized latent trait continuum (-3 to +3 with 0 = average trait level) where an individual would have a 50% chance of endorsing a particular item (if the item is dichotomous) or a particular response category (if the item has more than 2 response categories). Figure 4-1 displays three hypothetical dichotomous items; item 1 has a threshold of -1 (below average), item 2 has a threshold of 0 (average), and item 3 has a threshold of +1 (above average). As can be seen in Figure 4-1, changes in threshold parameters shift trace lines (which graphically depict the probability that individuals having different values on the latent trait continuum will endorse, or agree with, the item) horizontally, to the left if the threshold value is below average (item 1) and to the right if the value is above the average (item 3). The further right the item threshold is, the less frequently it will be endorsed because fewer people have high enough trait values to permit endorsing the item. The higher the item threshold, the higher an individual must be on the latent trait to have a 50% chance of endorsing that item/response category [12-14].

Figure 4-2 depicts the discrimination parameter, which reports how responsive a particular item is to the latent trait being assessed. The three hypothetical dichotomous items in Figure 4-2 have the same threshold but differ in discrimination (slope). The higher the discrimination value (or slope), the more rapid the change in probability for endorsing the item as the threshold value is passed [14, 15]. Also, the higher the discrimination parameter, the more variability in the item responses that is attributable to differences in the latent trait [13, 14, 16]. Thus, discrimination reports the degree to which an item will differentiate between individuals at different points on the latent trait continuum. More discriminating items (higher discrimination values) are better able to differentiate between individuals in the trait range around the item threshold level than are lower discriminating items [15]. We will not be using a pseudoguessing parameter but should mention that this style of parameter can be calculated for items with multiple choices in an attempt to account for the effects of guessing on the probability of a correct response. It indicates the probability that individuals who are very low on the latent trait will endorse the item/response category by chance. Psuedoguessing is seldom used with psychological scales but is frequently used with educational tests where there is a 'correct' potentially guessable response [14, 17].

IRT models can be represented graphically using what is variously called the *trace line, item characteristic curve (ICC), operator characteristic curve (OCC),* or *item response function (IRF).* Six trace lines, for three hypothetical dichotomous items, are presented in Figures 4-1 and 4-2. For items assessed on rating scales like the CRU scale questions, the trace line describes the relationship between an individual's score on the latent trait continuum and the probability that he or she will chose a particular response category. A trace line is ordinarily an S-shaped curve for dichotomous items (see Figure 4-1) and a peaked curve (that rises and falls) for polytomous (greater than two response options) items (see

Figure 4-4, Column 1). For both types of items, as the level of the latent trait increases (on the x-axis, symbolized by the Greek letter theta, θ), the probability of endorsing the item (or selecting the more demanding response) increases. But when multiple response options are available and the trait value increases further, the person switches to selecting the next higher available option. As a result, the probability of selecting any lower option declines. If there are more than two response options for one item, the trace lines for the various response options can appear peaked if the availability of easier and harder response options results in a specific choice being endorsed only by individuals having a limited range of latent trait values. We will see such trait lines and also, monotonic (decreasing) trace lines for options chosen only by individuals with low trait values in our analysis of the CRU scale (Figure 4-4). The construct is called a *latent trait* because it is assumed to underlie responses to items on a scale designed to measure it [14, 15].

Why use IRT?

IRT surpasses CTT in a variety of ways, but for our purposes IRT's main advantage is its superior ability to assess measurement reliability. Traditionally, reliability refers to the precision of measurement (i.e., the degree to which measurement is stable or replicable) and is measured using an index such as Cronbach's alpha. Indices like alpha presume all values of the latent trait are equally reliably measured. In contrast, the IRT *item information function* indicates how much information an item provides at the various latent trait values – more information means less error of measurement.

In addition to the item information functions, a scale information function can also be calculated (as the sum of the individual item information functions). The scale information function is the reciprocal of the scale standard error of measurement [14], and hence both the scale and item information functions provide assessments of the precision for the instrument (scale) across the full range of latent trait levels [9, 14, 17, 18]. Despite this advantage of IRT, no study to date has attempted to fit and assess research utilization using an IRT framework. In this paper, we examine the psychometric properties of the CRU scale using an IRT framework, specifically Samejima's graded response model (GRM) [19, 20].

Samejima's Graded Response Model (GRM) for Polytomous Data

In conducting IRT analyses, the response format of the items is critical to determining the appropriate IRT model to use. IRT models exist for both dichotomous response items (often correct/incorrect educational items) and rated or graded response items (such as Likert-type scales for psychological constructs). Dichotomous IRT models are classified according to the number of parameters (1, 2, or 3) estimated. The 1-parameter logistic model (1PLM), also known as the Rasch model, allows items to vary in threshold (*b* parameter) while holding discrimination (*a* parameter) constant. The 2-parameter logistic model (2PLM) allows both the item discrimination and thresholds to vary. The 3-parameter logistic model (3PLM) adds a pseudoguessing parameter (*c* parameter), in addition to estimating item discrimination and threshold [12, 13, 15].

To analyze the CRU data, we selected Samejima's graded response model (GRM) [19, 20] because this model is appropriate for items having ordered polytomous response options. The graded response model assumes that the probability of endorsing a higher response category increases as the individual's level of the latent trait increases. If there are *k* response categories, each item has *k*-1 estimated threshold parameters, and the probability of an individual endorsing category *k* on item *j* is expressed as:

$$P\,(x_j = k|\theta) = \frac{1}{1+\exp[-a_j(\theta - b_{kj})]} - \frac{1}{1+\exp[-a_j(\theta - b_{(k+1)j}]}$$ [20].

The probability of someone choosing response *k* on item *j* is therefore a function of: (1) the individual's value on the latent trait variable (theta, θ), (2) the category threshold parameter for category *k* of item *j* (b_{kj}), and (3) the item discrimination parameter (a_j) which is presumed to be the same for all response categories for item *j*. The probability of choosing any response category (*k)* can be thought of as repeatedly using the standard 2PLM for the probability of endorsing an item that is dichotomous. For items with five response categories, such as the CRU scale items, there are four thresholds per item (i.e., *k* - 1 = 5 – 1 = 4), corresponding to four dichotomies as follows:

1. Threshold 1 (b_1) is the threshold for the trace line describing the probability of choosing category 2, 3, 4, or 5 (namely any category above the lowest).

2. Threshold 2 (b_2) is the threshold for the trace line describing the probability of choosing category 3, 4, or 5 (namely any category above the two lowest categories).

3. Threshold 3 (b_3) is the threshold for the trace line describing the probability of choosing category 4 or 5.

4. Threshold 4 (b_4) is the threshold for the trace line describing the probability of choosing category 5 (the highest category).

While it is possible to plot the four 2PLM trace lines described above for each of the five CRU items, it is more useful to plot the response probabilities for the categories for each item. For any one item, the probability of choosing a particular response category, for example category 2, is determined by subtracting the probability from the trace line for the next more difficult category (b_2) from the trace line for the less difficult category 1 (b_1) [21, 22] (see Figure 4-4, column 1). The probability of endorsing the lowest response category drops monotonically as the individuals' latent trait values make choosing a higher category more appropriate. The curve for the highest category rises monotonically because those with the highest latent trait values should find the highest category most appropriate for them. The response probabilities for categories 2, 3, and 4 will appear pointed because they are most appropriate for only a specific range of intermediate latent trait values.

The graded response model assumes the discrimination parameter is the same (equal) for all response categories for a single item (question) but it can differ between items (questions) in a scale. The information function for both the items (questions) and scale provide the clearest assessment of how well the item or scale differentiate between individuals who have low, average, or high levels of the latent trait because these reflect both the item threshold and item discrimination parameters [20, 21].

Methods

Design, Sample, and Data Collection

The data analyzed in this paper come from the *Translating Research in Elder Care* (TREC) Project 1: Building Context – An Organizational Monitoring Program in Long-term Care [6]. TREC is a multi-level longitudinal (5-year) program of research designed to examine the impact of organizational context (i.e., the work environment) on research utilization by care providers, and the subsequent impact of research utilization on resident health (e.g., pain), staff (e.g., burnout), and organizational (e.g., staff turnover) outcomes in nursing homes in three Canadian Provinces. Data in the current study are from healthcare aides in 30 urban nursing homes who completed the TREC survey (which includes the CRU scale) between July 2008 and July 2009. Facility selection in the TREC program was stratified by healthcare region, owner-operational model, and size using random sampling. Healthcare aides within each selected facility were recruited using a volunteer, census-like sampling technique. Inclusion criteria included: (1) ability to identify a unit where they had worked for 3 or more months and were currently working, and (2) having worked a minimum of 6 shifts per month on this unit. Further details on the data collection are reported elsewhere [23]. The questions comprising the CRU scale are provided in Appendix A. Ethical approval for the study was obtained from the University of Alberta Health Research Ethics Board. Operational approval was obtained from the TREC Research Management Committee.

IRT Assumptions

Three basic assumptions of IRT models are: (1) unidimensionality, (2) local independence, and (3) nonspeededness. IRT models assume that the latent trait space is dominated by a single dimension (the assumption of unidimensionality). As a consequence of unidimensionality, an individual's response to any one item becomes unrelated to that of the other items when the latent trait is controlled (the assumption of local independence) [14, 24]. The third assumption, nonspeededness, assumes that any items not completed are not due to lack of time [14].

We assessed the assumptions of unidemsionality and local independence using: (1) principal components analysis (using the PASW Version 18.0 [25]), and (2) confirmatory factor analyses (using LISREL [26]). The scree plot and Kaiser-criterion (Eigenvalue >1) were considered in determining the optimal number of factors for the principal components analysis [27, 28]. Confirmatory factor analyses permits *testing* a hypothesized factor structure. The chi-square statistic, which assesses whether a model-implied covariance matrix is consistent with a sample covariance matrix, is the most stringent test of model-data fit and was therefore used to assess dimensionality of the CRU scale in this study; a non-significant chi-square value implies acceptable fit. We report three fit indices that have been commonly used: (1) the root mean square of approximation (RMSEA), (2) the standardized root mean square residual (SRMSR), and (3) the comparative fit index (CFI). Though a RMSEA < 0.06 and SRMSR < 0.09 [29, 30] and a CFI value $> .90$ [29, 31] have frequently been taken as indicative of a close fit, the trustworthiness of such indices have been questioned [32, 33]. Hence, while we report these statistics for consistency with the literature, we have not depended on these values in our own analysis.

The final assumption of nonspeededness was not formally evaluated. However, the average time for completion of the 5-item CRU scale was low (at 1 minute and 6 seconds), and no time limitation was set, leading us to assume the assumption of nonspeededness was met.

IRT Parameter Estimation and Model-Data Fit

MULTILOG 7.0.3 [34] was used to estimate the parameters in Samejima's GRM [19] version of IRT for the five items (j=5) in the CRU scale. A total of five parameters were estimated for each item: one item-discrimination parameter (a_j) and four item threshold parameters (b_{j1}, b_{j2}, b_{j3}, b_{j4}). For some analyses the values for the four b parameters were averaged to create a relative threshold parameter b_j for each item. MULTILOG uses the item parameter (a's and b's) to compute: item probabilities, item information functions, and marginal reliability. The estimated parameters are transferred to an excel database to compute trace lines for the response categories in each item, item information function curves, and curves for the full scale (the information function and standard error of measurement curves).

For each item, MULTILOG provides the observed and expected proportion of the responses in each category. The expected proportion is predicted from the item parameters (a_j, b_{j1}, b_{j2}, b_{j3}, b_{j4}) and each person's latent trait value. IRT model-data fit was evaluated by examining the difference in these proportions; smaller residuals indicated better model-data fit.

Results

Sample Characteristics

A total of 1367 healthcare aides (73% of those eligible to participate in TREC Project 1) completed the TREC survey. We used listwise deletion to deal with missing data on the CRU scale items, leaving an analytic sample of 1349 (99% of those participating) for the analyses. A summary of the demographic characteristics of the 1349 participants is presented in Table 4-1; all characteristics were within normal ranges.

Assessment of IRT Assumptions

Principal components analysis was used to test the assumptions of unidemsionality and local independence. One dominant factor (eigenvalue =3.489 accounting for 64.98% of variance and covariance in the items) was extracted from the scale items. Visual inspection of the scree plot (figure not shown) was consistent with this finding. The second factor (eigenvalue of 0.646) explained significantly less variance and covariance at 12.93%. Findings however from this principal components analysis were somewhat inconsistent with a confirmatory factor analysis. While all parameters (i.e., factor loadings) were significant in a positive direction as hypothesized, the χ^2 test statistic did not support a strict unidimensional factor solution (χ^2 = 104.875, *df* = 5, p=0.0). The RMSEA (0.126) did not support close fit but SRMSR (0.03) and CFI (0.977) did support close fit. The confirmatory factor analysis also showed a substantial proportion of measurement error in the five items (range 35%–65%).

Modification indices, which suggest how much the χ^2 test is expected to improve if a currently fixed parameter is freed to be estimated, suggested freeing eight of the possible ten measurement error covariances (the two exceptions were the error covariances for items 2 and 3, and items 3 and 5). A thoughtful re-examination of the five items comprising the scale revealed a level of content overlap (and thus redundancy) with respect to two pairs of items: (1) item 1 (give new knowledge or information) and item 2 (raise awareness), and (2) item 3 (help change your mind) and item 4 (give new ideas). We therefore considered the possibility that systematic error variance might be causing these items to cluster together on more than one dominant factor (as seen in the principal components analysis). We consequently hypothesized that in addition to the five items loading onto a single factor; there would be error covariances for items 1 and 2, and items 3 and 4. We chose not to correlate errors on the remaining six pairs of items as suggested by the modification indices because these did not resonate with our theory. The second model, where we correlated errors on items 1 and 2, and items 3 and 4, resulted in an acceptable fit ($\chi^2 = 4.484$, $df = 3$, p=0.214), and the close fit statistics also improved (RMSEA=0.0191, SRMSR=0.01, CFI=1.00).

IRT Model Fit

The differences between the observed and expected proportions of cases (i.e., residuals) for the response categories were mostly 0.00, and no value exceeded 0.02. The highest residual values were for item 3 (help change your mind): response category 2 rarely (residual = 0.0124) and response category 4 frequently (residual = 0.0146). The residuals for the five items are presented in Table 4-2 and overall indicate good IRT model-data-fit.

IRT Analyses of the CRU Scale

Item and Scale Properties.

***Item Parameters*.** Table 4-3 presents the discrimination and threshold parameters for the five items, ordered in the table by their average location (threshold) on the CRU latent trait continuum. The average of the threshold parameters for each item (b_j for each item) indicates that all five items tend to differentiate between negative (below average) latent trait values. This means that the items were best able to discriminate between individuals possessing relatively ‘low’ to ‘almost average’ levels of CRU, but *not* between individuals possessing ‘high’ levels of CRU. The most easily endorsed item for the study participants was item 5 (help make sense of things), and the least easily endorsed (most difficult) item was item 3 (help change your mind).

Item parameters in Table 4-3 are presented graphically in Figure 4-3 to illustrate the relationship between the threshold and discrimination parameters for the five items. As can be seen in Figure 4-3, all items tend to fall in the low region of the trait continuum. Item 3 (help change your mind) differs noticeably from the other four items. It has the highest threshold but it has the lowest (weakest) discriminatory power. The other four items are very similar in that they display strong discrimination and low thresholds on the latent trait suggesting these may not all be necessary in a CRU scale.

Trace Lines. Figure 4-4 shows the trace lines for the specific response categories for the items in column 1, and the item information curves for the items in column 2. The top two figures in column 3 compare some item information curves from column 2, and the bottom two figures present the scale information curve and scale standard error of measurement curve. Inspection of the trace lines for the five items, in general, shows fairly good separation in the response categories. There is some overlap between response categories 2 (rarely) and 3 (occasionally), and between response categories 3 (occasionally) and 4 (frequently) for each item. This indicates respondents may have had difficulty differentiating between these response categories. This overlap was greatest in item 5 (help make sense of things) but even here it was not extreme. The trace lines also indicate that, for each item, the first three response categories, and sometimes the fourth category tended to respond to relatively low trait levels ($\theta < 0$). Only the fifth response category consistently differentiated among individuals having trait levels above the mean. These findings suggest that current category labels lack discriminatory power for individuals possessing trait levels that are average to high.

Information Function and Standard Error of Measurement. Table 4-4 shows the item and scale information function values, and scale standard error of measurement value, for the CRU scale across the full range of latent trait levels. From Table 4-4 and Figure 4-4 (columns 2 and 3), we observe that the information functions for items 2, 4, and 5 are relatively similar; they each have peaks at -2 and 0 on the latent trait continuum, providing the most information for individuals at these trait levels. Their accuracy decreases sharply as the latent trait reaches higher levels (i.e., $\theta > +1$). The information functions for items 1 and 3 are relatively flat for the lower portion of the latent trait continuum. They do not have distinct peaks but generally provide more information (although less information than items 2, 4, and 5) at lower latent trait levels than at higher trait levels. While item 3 provides the least information of the five items at low to average trait levels, it provides the most information (though still little) at the highest trait levels (i.e., +2 to +3).

The scale information function, computed by summing the individual item information functions, supplies a similar picture; information peaks at low and average CRU trait levels (at θ of -2 and 0 respectively). The standard error of measurement plot also shows that the CRU scale captures conceptual use of research findings most precisely at low to average trait levels. At higher trait levels, the standard error rapidly increases, indicating less precision (see Column 3 in Figure 4-4).

Marginal Reliability. The IRT framework does not have a point estimate of reliability as traditionally defined because a scale's characteristics differ at various latent trait levels. In IRT the closest parallel is a statistical index called *marginal reliability*, which is an estimate of a scale's average reliability across the full range of trait levels [14]. The marginal reliability for the CRU scale was 0.858. Table 4-5 shows the change in the scale's marginal reliability if each of the 5 items is individually deleted from the scale to produce a four-item CRU scale. Item 3 has the lowest discriminatory power (Table 4-3) so its deletion might be expected to provide the least reduction in the scale's reliability, but item 3 is the only item with some ability to differentiate among higher levels of the trait (Figure 4-4, column 2). Thus, the overall impact of deleting this item would be about as detrimental to overall marginal reliability as would the deletion of any other item (Table 4-5). While the average time to complete the 5-item scale was acceptable at 1 minute, 6 seconds (standard deviation = 35.72 seconds), the marginal reliability estimates indicate that the number of items in the scale (and thus completion time) could be reduced further without significantly reducing its overall reliability.

Discussion

Our discussion is organized around three areas: scale revisions, scoring implications, and future directions using IRT applications.

Scale Revisions

New Items.

The parameter estimates, information functions, and the scale standard error plot show that the CRU scale can precisely measure healthcare aides' conceptual use of research at low to average trait levels. At higher trait-levels the item and scale information functions sharply decreased and the scale standard error increased, indicating appreciably less measurement precision at high trait levels. Currently, individuals who possess both average and high trait levels will choose the higher response categories (i.e. frequently or very frequently) to the scale items. The addition of new items that describe higher trait levels are needed; selection of the higher response categories on these items would be limited to individuals possessing high trait levels, allowing for discrimination at the higher end of the latent trait continuum. It is possible that the existing items are more precise at low to average trait levels than at high levels because they reflect activities that are 'easy' (i.e., indicative of low levels of CRU). By developing items that consist of 'harder' (or more extreme) activities, higher trait levels will be tapped. A second option, in lieu of developing 'new' harder items, is to modify the labels on the response categories for the existing items on the scale. For example, using the label ‘almost always’ as the final response option rather than ‘very frequently’ may result in different findings, including an ability to discriminate between individuals at higher trait levels. This would need to be assessed in future research.

Removal of Items.

Table 4-5 indicates that the CRU scale may be shortened without a noticeable drop in precision. Items 1 (give new knowledge), 2 (raise awareness), and 5 (help make sense of things) each demonstrated similar average threshold parameters (b_j) indicating all three items may not be necessary. Item 1 displayed the lowest discriminatory power of the three items indicating it could be safely removed from the scale without significantly affecting the scale’s precision, which was supported by a reduction in marginal reliability of only 2.3% when removed from the scale. While precision would be relatively untouched, removal of item 1 would reduce the length of the CRU scale significantly (by 20%). This would allow for the addition of a new item that taps higher trait levels, improving the applicability of the scale to a wider range of individuals without increasing respondent burden (i.e., time to complete the scale). The confirmatory factor analysis also supported reducing the scale (by removing one of items 1and 2, and items 3 and 4) due to content overlap.

To further assess which items may be considered for removal and/or revision, we visually examined the information function curves of items 1 and 2, and also items 3 and 4, in side-by-side graphs (Figure 4-4, column 3). Items 1 and 2 display similar item information trends – they both provided the most information at low to just above average trait levels; item 2 however provided slightly more information. This suggests that item 1 could be removed from the scale without significant loss of information. Items 3 and 4 both provide the most information at low to just above average trait levels. However, the difference in the amount of information provided at these levels by the two items is substantial (Figure 4-2, column 3). In addition, the decrease in information at high trait levels does not drop for item 3 as quickly as it does for item 4. That is, item 3 maintains a similar level of information (although low) across the full range of trait levels. This suggests that despite similar content, these two items function differently and should both be retained in the scale.

Response Categories.

The optimal number of response categories needed to assess psychological constructs like CRU is largely unknown. Inspection of the trace lines in this study showed overlap between response categories 2 (rarely) and 3 (occasionally) and, again, between response categories 3 (occasionally) and 4 (frequently) for the majority of items. This indicates that the number of response categories offered could be decreased from five to four by removing option 3 (occasionally). The inclusion of a neutral response option like occasionally has, for some time, been an issue of debate in psychological research [10].

Scale Scoring Implications

The item parameters in Table 4-3 reveal information about how each of the five items in the CRU scale relates to the latent trait, as well as information about the levels of the latent trait required for an individual to endorse a particular response category on each item. These findings suggest that combining the items to create a summed or mean overall trait score for each study participant (which is commonly done in psychological research), while practical, may not be defensible. For example, the item threshold parameters in this study suggest that the fourth threshold (b_4) is higher for item 3 (help change your mind) than for any of the other items. This means choosing ‘very frequently’ for item 3 requires a higher level of CRU than choosing the same response category in any of the other items. However, in a summed or mean score approach to the latent trait, all responses would be weighted the same. The slope parameters (a parameter, discrimination) for the items could also play a role in weighting the items to derive a summed or mean score. For example, item 4 (give new ideas) had a slope that was almost double item 3 (help change your mind). Thus, an individual’s response to item 4 is more clearly linked to their latent trait level than their response to item 3. That is, item 3 may have a weaker relationship to the latent trait (CRU) and as a result, more of the observed variability in item 3 compared to item 4 may be due to ‘other’ things beyond the latent trait. Thus, while item 3 contributes to our knowledge about an individual’s true level of CRU, it does not contribute as much information as item 4 and therefore should be weighted differently in an overall score. These findings suggest that the five items in the CRU scale should receive differential weighting if a summed or mean score for the scale is sought. However, before a weighting formula can be decided, we suggest further validation studies with additional samples.

Future Directions Using IRT Applications

This study was an initial attempt to use IRT methods to assess the CRU scale. In addition to the item and scale analyses presented in this paper, IRT methods could also be used in future analyses targeted at: (1) tailoring the scale so that it can be used in different populations and/or for different purposes, and (2) gaining an improved understanding of CRU, including how individuals’ levels of the trait can change over time. Two broad IRT applications that could assist with these goals are: (1) scale construction and refinement, and (2) differential item functioning.

Scale Construction and Refinement.

If a bank of items (questions) measuring the full range of CRU were available, IRT could be used to create tailored versions of the CRU scale. For example, versions of the scale could be developed to tap only specific trait ranges. Fredrick Lord [35] outlined a four-step procedure using IRT's information function to create this kind of tailored test (scale): (1) decide on the shape (trait range) desired for the scale information function (called the target information curve), (2) select items with item information curves that will fill the target information curve, (3) cumulatively add up several item information curves, and (4) continue adding items until the area under the target information curve is filled. Two approaches to selecting items to fill the target information curve focus on: (i) maximum information, and (ii) theta maximum [36]. The *maximum information* approach focuses on item discrimination (*a* parameter) and employs the maximum value of the information function for items irrespective of their location in the latent trait range. The *theta maximum* approach, on the other hand, focuses on item thresholds (*b* parameters) and attends to the location on the theta scale at which an item has the most information [36]. With the CRU scale, we are most interested in the latter. That is, we could use the theta maximum IRT approach to create versions of the CRU that would permit identification of variables related to above average CRU trait values to allow for the development of interventions to increase CRU. This style of CRU scale would require developing and testing new items with information functions that peak at the higher end of the CRU continuum.

Differential Item Functioning.

With psychological concepts like CRU, different groups of healthcare providers (e.g., healthcare aides, nurses, physicians) and different cultural groups may perform differently on a scale due to differential discrimination and threshold parameters rather than because of different trait values. This is referred to as differential item functioning (DIF). DIF occurs when one group of individuals has a different probability of endorsing an item or response category within an item, compared to a second group of individuals, after controlling for the value of the latent trait [37]. If it can be assuredly assumed that the latent trait is invariant with respect to the samples, IRT becomes a strong method for detecting DIF [37]. However, attempting to differentiate between trait-based versus parameter group differences is not a value-free activity [38-40]. Two researchers' conceptualizations of the latent trait may differ even if they use the same label, or verbal description for the trait, and such conceptual differences can influence the construction of the scale [39].

DIF analysis has been developed and utilized in educational research to identify biased test items that would favor for example boys or girls. DIF analysis has also been useful in analyses of psychological constructs by detecting equivalence (or lack thereof) in item content across cultural groups, survey administrations, and translated versions of a survey [41, 42]. We believe DIF analysis holds similar potential in the assessment of research utilization. The CRU scale described in this paper was designed as a generic assessment tool that could be used with a variety of healthcare providers (e.g., healthcare aides, licensed practical nurses, registered nurses, physicians, allied care providers) but our data came from only healthcare aides and therefore did not permit DIF analysis by care provider group. Future applications of the CRU scale should examine multiple healthcare provider groups, and assess DIF and item bias to determine whether the scale is applicable across multiple populations as it is intended to be.

Cautions

Assessment of Unidimensionalty and Local Independence

Two pairs of items in the CRU scale violated the IRT assumption of local independence, which underpins appropriate summing of item information functions to obtain the scale information function. Despite this, our scale-level findings are remarkably consistent with our item-level analyses. Researchers suggest that IRT models are relatively robust to departures from statistical homogeneity and that such violations do not exert a distorting effect on parameter estimation [9, 43, 44]. However, there is little methodological evidence supporting this claim. The issue is further complicated by there being no agreed benchmark for testing the homogeneity of a scale. The most common approach used is to assess comparative eigenvalues and percentages of variance and covariance in the first and second components from a principal components analysis. Confirmatory factor analysis, the only approach capable of statistically *testing* the unidimensional assumption, is only occasionally referred to in the IRT literature.

When confirmatory factor analysis is used to determine whether the IRT assumption of unidemsionality has been met, a combination of fit indices is commonly reported. These indices provide estimates of closeness of fit, but do not *test* fit per se. The χ^2 statistic, which is seldom reported in papers assessing dimensionality for IRT models, is the only *statistical* test of unidimensionality. Future applications of IRT should use CFA (and report the χ^2 statistic) as a means of 'testing' whether a set of items meets the assumption of unidimensionality.

Lack of Precision at Higher Trait Levels.

The decline in measurement precision in the CRU scale seen at high trait levels is likely because of a lack of items that tap such trait levels. However, the lack of precision may also, in part, be explained by the characteristics of the study participants in this first validation study. For all five items, the average threshold parameters (b_j) are negative. This means that the respondents, on average, answered each of these items on the higher end of the scale (i.e., towards frequently/very frequently use). This may reflect a bias (social desirability effect) on behalf of the respondents (i.e., wanting the interviewer administering the scale to believe they use research more then they do). However, it is most likely a reflection of the difficulty level of the items comprising the scale. Therefore, new items tapping higher CRU difficulty are needed.

Conclusions

A scale that can precisely capture the full range of CRU trait levels will assist in evaluating interventions designed to increase conceptual research use by care providers. This, in turn, we believe, will play a role in improving patient care and organizational outcomes. In this study, Samejima's GRM [19] was used to examine the precision of the conceptual research utilization (CRU) scale across the full range of latent trait levels for healthcare aides. The CRU scale adequately measured healthcare aides' conceptual use of research at low to average trait levels but displayed less than desirable precision for high levels of CRU. The analyses indicate the scale could be shortened by eliminating one question without lowering its precision. The analyses also suggest that the scale could be slightly improved by locating more clearly distinct response options. The most important direction provided by the analyses was the need for new items that tap high CRU (trait) levels.

Although the validation results presented in this paper are very promising with respect to measuring CRU at low to average trait levels, we caution that this initial assessment of the CRU scale was conducted in one country, with one group of care providers. As with any new scale, caution is warranted until the scale has been investigated using a variety of statistical approaches in multiple applications and settings. Additional validation studies of the CRU scale using both IRT and CTT approaches are planned.

Figure 4-1. 1PLM Trace Lines for Three Dichotomous Items (Varying Threshold Parameters)

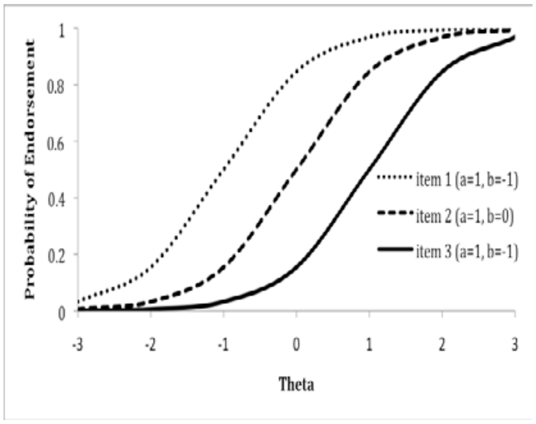

Figure 4-2. 2PLM Trace Lines for Three Dichotomous Items (Varying Discrimination Parameters)

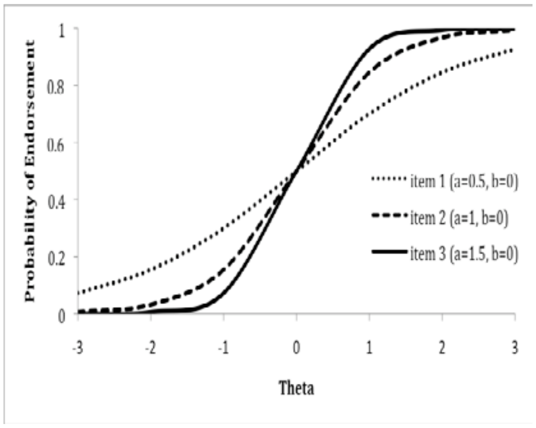

Figure 4-3. Map Of The Item Threshold And Item Discrimination Parameters For The CRU Scale Items

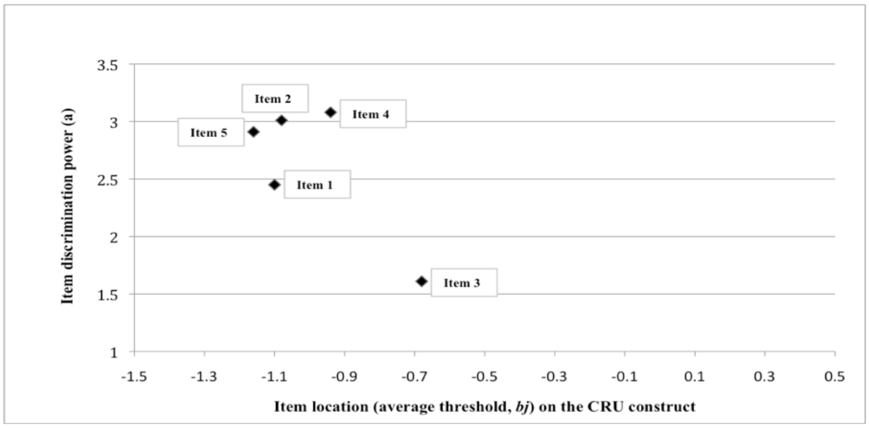

Figure 4-4. Item Trace Lines (Column 1), Item Information Curves (Columns 2 and 3), and Scale Information and Standard Error of Measurement Curves (Column 3)

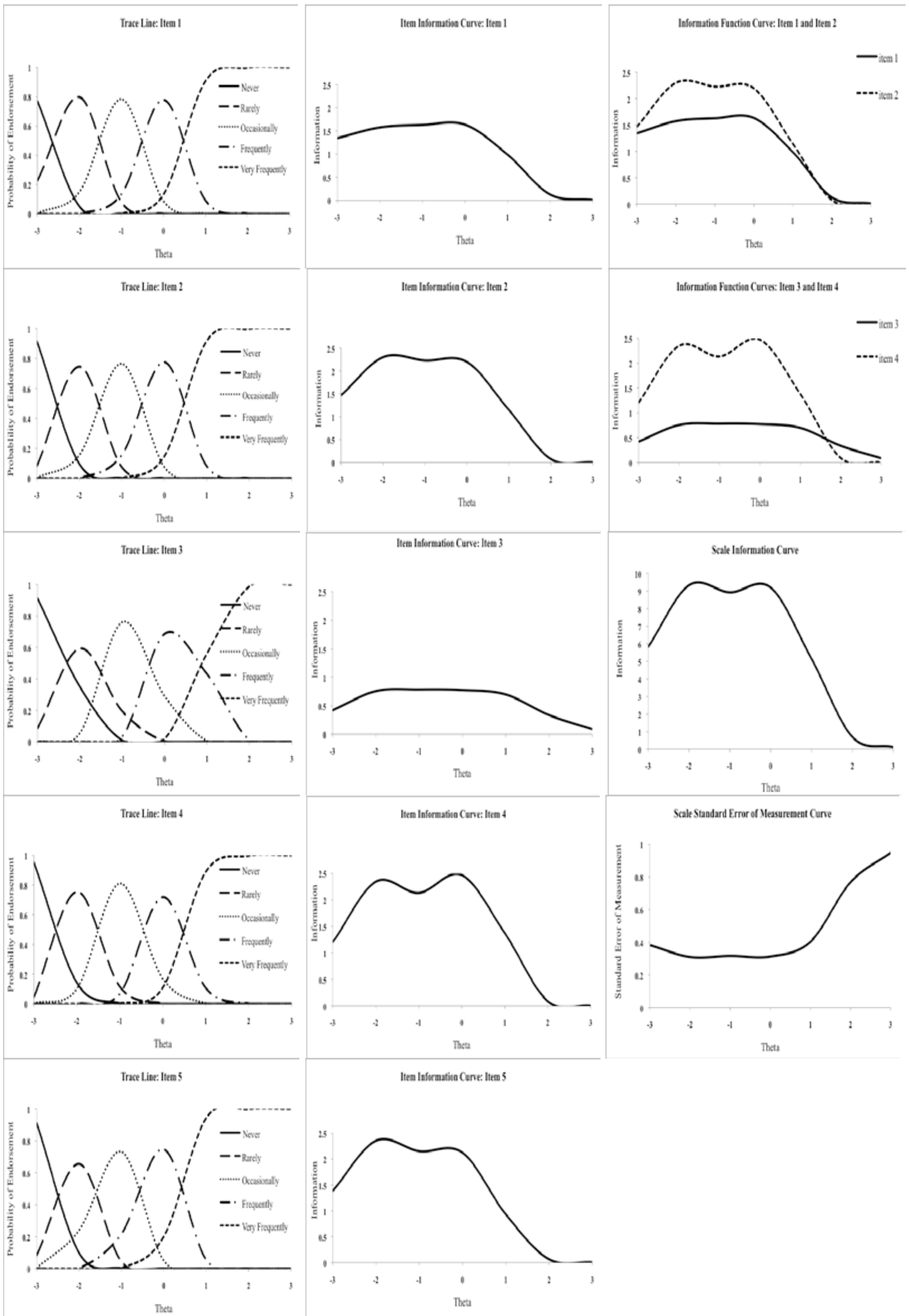

Table 4-1. Characteristics of Healthcare Aides Completing the CRU Scale (n=1349)

Demographic Characteristic		n (%)
Gender	Male	88 (6.5%)
	Female	1250 (92.7%)
	Missing Values	11 (0.8%)
Age	< 20 years	13 (1.0%)
	20-24 years	64 (4.7%)
	25-29 years	92 (6.8%)
	30-34 years	117 (8.7%)
	35-39 years	175 (13.0%)
	40-44 years	221 (16.4%)
	45-49 years	215 (15.9%)
	50-54 years	193 (14.3%)
	55-59 years	157 (11.6%)
	60-64 years	79 (5.9%)
	65-70 years	21 (1.6%)
	Missing Values	2 (0.1%)
Education Level	High School	1228 (91.0%)
	HCA Certificate	1110 (82.3%)
	Other Certificate/Diploma	616 (45.7%)
Shift Worked Most of the Time	Day Shift	688 (51.0%)
	Evening Shift	489 (36.2%)
	Night Shift	172 (12.8%)
	Missing Values	0
English as a First Language	Yes	697 (51.7%)
	No	651 (48.3%)
	Missing Values	1 (0.1%)
		Mean (SD)
Number of Years Worked as a Healthcare Aide		10.48 (8.84)
Number of Years Worked on Unit		4.49 (5.28)
Hours Typically Worked in Two Weeks		64.90 (17.95)

Table 4-2. Item Residuals for Assessment of IRT Model-Data Fit

Item	**Residuals** (|Observed Proportion – Expected Proportion|)				
	Response 1 Never	Response 2 Rarely	Response 3 Occasionally	Response 4 Frequently	Response 5 Almost Always
Item #1 Give new knowledge	0.0016	0.0061	0.0005	0.0093	0.0044
Item #2 Raise awareness	0.0012	0.0043	0.0013	0.0082	0.0040
Item #3 Help change your mind	0.0048	0.0124	0.0072	0.0146	0.0099
Item #4 Give new ideas	0.0010	0.0046	0.0006	0.0089	0.0059
Item #5 Help make sense of things	0.0009	0.0056	0.0063	0.0098	0.0010

Table 4-3. IRT Parameter Estimates for Items in the CRU Scale
(ordered by b_j)

Item	Discrimination Parameter (S.E.)	Category Threshold Parameters (S.E.)				Average Threshold Parameter
	a	b_{j1}	b_{j2}	b_{j3}	b_{j4}	b_j
Item #5 Help make sense of things	2.91 (0.13)	-2.53 (0.14)	-1.73 (0.07)	-0.70 (0.04)	0.33 (0.04)	-1.16
Item #1 Give new knowledge	2.45 (0.12)	-2.71 (0.17)	-1.59 (0.08)	-0.56 (0.04)	0.45 (0.04)	-1.10
Item #2 Raise awareness	3.01 (0.14)	-2.54 (0.15)	-1.60 (0.07)	-0.60 (0.04)	0.42 (0.04)	-1.08
Item #4 Give new ideas	3.08 (0.15)	-2.43 (0.13)	-1.48 (0.06)	-0.38 (0.04)	0.50 (0.04)	-0.94
Item #3 Help change your mind	1.61 (0.09)	-2.15 (0.15)	-1.33 (0.09)	-0.21 (0.06)	0.94 (0.07)	-0.68

S.E. = standard error

Table 4-4. Item and Scale Information Functions at Various Trait Levels

Items	**Trait Level**						
	-3.0	**-2.0**	**-1.0**	**0**	**1.0**	**2.0**	**3.0**
Item #1 Give new knowledge	1.343	1.574	1.629	1.634	0.987	0.128	0.011
Item #2 Raise awareness	1.467	2.301	2.229	2.196	1.147	0.077	0.004
Item #3 Help change your mind	0.421	0.754	0.783	0.773	0.697	0.337	0.087
Item #4 Give new ideas	1.206	2.347	2.135	2.472	1.377	0.091	0.004
Item #5 Help make sense of things	1.389	2.358	2.154	2.125	0.933	0.065	0.004
Scale Information Function	6.827	10.373	9.930	10.200	6.141	1.697	1.111
Scale Standard Error of Measurement	0.383	0.310	0.317	0.313	0.404	0.768	0.949

Table 4-5. Change in Marginal Reliability after Removal of Items

	Marginal reliability estimate	% Change in marginal reliability
5-item scale	.858	Not applicable
Item Removed		
Item 1	.838	2.3%
Item 2	.833	2.9%
Item 3 (lowest *a*)	.838	2.3%
Item 4 (highest *a*)	.830	3.3%
Item 5	.834	2.8%

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Chapter 5: Paper #4

Validation of the Conceptual Research Utilization Scale: An Application of the Standards for Educational and Psychological Testing in Healthcare

Janet E. Squires[1,*]
Carole A. Estabrooks[2]
Christine V. Newburn-Cook[3]
Mark Gierl[4]

[1] PhD Candidate, Faculty of Nursing, University of Alberta, Edmonton, Alberta, Canada

[2] Professor and Canada Research Chair (in Knowledge Translation), Faculty of Nursing, University of Alberta, Edmonton, Alberta, Canada

[3] Professor and Associate Dean of Research, Faculty of Nursing, University of Alberta, Edmonton, Alberta, Canada

[4] Professor and Canada Research Chair (in Educational Measurement), Department of Educational Psychology, University of Alberta, Edmonton, Alberta, Canada

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Background

Research utilization refers to the "process by which specific research-based knowledge (science) is implemented in practice" [1]. In recent years, we have gained insights into the construct of research utilization, in particular as it applies to nursing practice [2, 3]. Despite these gains, little has been done to develop robust (reliable and valid) measures of research utilization in nursing and in healthcare generally. In fact, access to such measures is a persistent and unresolved problem in the research utilization field [1, 4, 5]. Obtaining reliable and valid assessments of research utilization in healthcare settings is essential for several reasons. First, they are necessary to empirically verify the assumption that patient outcomes are sensitive to varying levels of research utilization by healthcare providers. Secondly, and importantly, robust measurement of research utilization is needed to better understand the latent construct, including its causal predictors and effects. These causal mechanisms will inform the development and evaluation of interventions to improve patient care by increasing healthcare providers' use of research findings in clinical practice.

In the social sciences, three kinds of knowledge utilization are discussed: instrumental, conceptual, and symbolic (or persuasive) [6-9]. Research utilization is a specialized form of knowledge utilization. Stetler [10] introduced the concepts of instrumental, conceptual, and symbolic research utilization into the nursing literature in the 1980's. Estabrooks [2] built on Stetler's conceptualization by modifying the initial definitions of instrumental, conceptual, and symbolic research utilization, and by adding a fourth kind of research utilization, overall research utilization. *Instrumental research utilization* is a direct use of research knowledge. It refers to the concrete application of research in clinical practice, either in making specific decisions or as knowledge to guide specific interventions related to patient care. For instrumental use, the research is often translated into a material and useable form (e.g., a policy, protocol or guideline). C*onceptual research utilization* (CRU) refers to the cognitive use of research where the research findings may change one's opinion or mind set about a specific practice area but not necessarily one's particular action. It is an indirect application of research knowledge. An example of CRU would be the use of knowledge on the importance of Family-Centered Care to guide clinical practice. *Symbolic (or persuasive) research utilization* is the use of research knowledge as a political tool in order to influence policies and decisions *or* to legitimate a position. For instance, using a research-based pain assessment to advocate for appropriate medication orders would be an example of symbolic research utilization. Finally, *overall research utilization* refers to the use of any kind of research in any way in clinical practice and is conceptualized as an omnibus construct. Overall research utilization may include any combination of the three kinds of research utilization discussed above [2, 11].

Conceptual Research Utilization

While the number of studies examining research utilization has increased significantly in the past decade, the majority continue to examine research utilization as a general construct [12]. Conceptual use of research findings has received little attention. The concept of CRU originated in the 1970's in investigations of how social science policy makers 'use research'. It was discovered that policy makers most frequently use research, not to act upon a situation, but rather to *inform* their decision-making process [13-16]. As a result, the concept of CRU is believed to be more reflective of research utilization at the individual practitioner level than are the other (i.e., instrumental, symbolic, overall) kinds of research utilization [16-18]. Furthermore, in studies where multiple kinds of research utilization have been assessed, regardless of the study's context, CRU often occurred more frequently than did the other kinds of research utilization [19-24].

We located 11 articles published between 1989 and 2009, whose authors had measured CRU in healthcare, by nursing care providers (registered nurses, licensed practical nurses, and/or healthcare aides) [2, 19-29]. The majority of articles (7 of 11) used a single item developed by Estabrooks [2] to measure CRU. This item consists of a definition and examples of CRU, followed by a question that asks respondents to indicate on a 7-point frequency scale (1 'never' to 7 'nearly every shift') how often they used research in this [conceptual] way in the past year. One study [26] used the same basic question with a modified 5-point frequency scale (1 never to 5 very often). The findings from these studies have shown individual variability in the reported CRU score as well as consistency across the various studies (when the question is asked of professional nurses). Recent work conducted by two members of our research team (JES and CAE), however, revealed this same question lacked validity when used with unregulated nursing care providers (i.e., healthcare aides). This was believed to be due to the difficulty the healthcare aids had in comprehending the meaning of CRU [30]. As a result, a new multi-item scale - the *Conceptual Research Utilization Scale* (hereafter called the CRU scale) – was developed to assess the extent to which nursing service delivery providers (including unregulated healthcare aides) use research conceptually in their practice.

The CRU scale was developed as part of a larger research program – the *Translating Research In Elder Care* (TREC) program [31]. Development of the CRU scale was guided by two key principles: (1) brevity – the scale was required to be less than 10 items so that it could be easily administered as part of a larger survey in busy resource-stretched nursing homes; and, (2) generality – the scale was intended to capture the concept of CRU broadly so that it could be administered in a wide range of nursing home settings. Therefore, terminology that is specialty (e.g., dementia care) and culture (e.g., Canadian or American) specific was intentionally avoided. The scale items were derived from an 18-item checklist designed by Stetler and Caramanica [28] to evaluate an evidence-based practice initiative. Six items (later reduced to five items) from the checklist were selected and modified (with permission from the checklist developers) for use with nursing care providers in nursing homes. The scale underwent several feasibility iterations with healthcare aides in two nursing homes in Alberta, Canada before being tested more fully in the TREC study. The final version of the scale, presented in the Appendix, contained five items and asked respondents to score how often best practice knowledge [i.e., research] led (for them) to the activities reflected in each of the items. A 5-point Likert-type frequency scale was used where 1 indicated 'never', 2 indicated 'rarely', 3 indicated 'occasionally', 4 indicated 'frequently' and 5 indicated 'very frequently'. Higher scores indicated a higher level of CRU by the respondent.

Psychometric Testing Process

Assessment of the psychometric properties of a new instrument involves testing the instrument for: (1) validity, (2) reliability, and (3) acceptability [32-34]. *Validity* refers to the extent to which a measure achieves the purpose for which it is intended, and is determined by the "degree to which evidence and theory support the interpretations of test scores entailed by proposed users of tests" [35] (p. 9). Validity, therefore, is the most fundamental consideration in evaluating the scores obtained from any instrument and the interpretations made based on these scores. *Reliability* refers to the consistency of measurement obtained when using an instrument repeatedly on a population of individuals or groups [35]. Reliability can be tested, using test-retest (stability) or internal consistency (Cronbach Alpha) statistics. *Acceptability* refers to ease of use and is evaluated by the number of respondents who are able to complete an instrument without omitting any items and the length of time it takes to complete the instrument [33].

Study Purpose

In this study, we completed the first phase of an assessment of the psychometric properties (i.e., validity, reliability, and acceptability) of the CRU scale items when completed by healthcare aides in nursing homes. We used the *Standards for Educational and Psychological Testing* (the *Standards*) [35] as a framework to guide our validity assessment. In a planned second phase of our psychometric assessment, we will add to the validity assessments presented in this paper by testing the formal structure of research utilization using structural equation modeling. That is, we will test the hypotheses that conceptual research utilization (as measured using the CRU scale items), instrumental research utilization, and symbolic research utilization directly cause overall research utilization [2].

The Standards

The *Standards*, which are considered best practice in the field of psychometrics [36], follow closely the work of American psychologist Sameul Messick [37-39], who viewed validity as a unitary concept with all validity evidence contributing to construct validity. Validity, in this framework, therefore refers to a process rather than a discrete event. It involves accumulating evidence from a variety of sources to provide a strong scientific basis for proposed score interpretations. *It is the interpretations of these scores (i.e., responses to the questions on the instrument) that are then evaluated for validity, not the instrument per se*. Accordingly, an instrument will produce more or less valid score interpretations depending on the context and interpretations being sought. For example, an instrument might produce a more valid interpretation that CRU leads to overall research utilization for registered nurses in hospitals, and at the same time, a less valid interpretation of the same hypothesis for healthcare aides in nursing homes. Evidence for validity, using the *Standards*, arises from four core domains or sources: (1) content; (2) response processes; (3) internal structure; and (4) relations to other variables. No one source of validity evidence in this framework is considered always superior to the other sources. The source(s) of evidence sought for any particular validation is determined by the desired interpretation(s) one would like to make based on the scores that will be obtained with the instrument [40, 41]. Since this is the first validation study on the CRU scale, we sought evidence from all four sources. Content evidence is usually the first type of evidence sought in the assessment of a new instrument. In this study, however, it comprised the second type of validity evidence: we sought and used response processes evidence to modify the scale before performing a formal content validity assessment with experts and therefore, discuss it first.

Response Processes.

Response processes refers to empirical evidence of the fit between the concept under study (here, CRU) and the responses given by respondents on the item(s) developed to measure the concept [35]. Response process evidence can come in a variety of forms but is most often derived from observations or interviews employed to determine if an individual’s behavior or verbal explanation(s) are congruent with their responses to an instrument item/question [42].

Content.

Content refers to the extent to which the items included in an instrument adequately represent the content domain of the concept of interest [33]. Content evidence is largely a matter of judgment, and can involve: (1) *a priori* efforts by scale developers (i.e., careful conceptualization through development or selection of items that are based on existing literature or theory) and, (2) *a posteriori* efforts (after the scale is developed) using a panel of content experts to evaluate the relevance of the scale's items to the concept of interest [43, 44].

Internal Structure.

Internal structure refers to the relationships between the items in an instrument. Factor analytic approaches are frequently used to assess internal structure. Factor analysis refers to a group of statistical techniques, and is often classified into two broad categories: (1) exploratory factor analysis (EFA) and (2) confirmatory factor analysis (CFA). In EFA, the focus is to explore relatively independent, coherent subsets of variables, in order to identify the latent concepts that could have produced the observed pattern of variances and covariances among the variables [45]. In CFA, a hypothesized factor structure is statistically *tested* [46].

Relations to Other Variables.

Analyses of the relationships between scores on the concept of interest (CRU) and variables external to the concept provide the final source of validity evidence in the *Standards*. External variables may include measures, which the concept is expected to predict, as well as other scales hypothesized to measure the same concept, and related or different concepts. This type of evidence is most often expressed in the form of bivariate correlations, statistical (predictive) models, and/or multi-group-comparisons [35].

Methods

Ethics approval was obtained from the Human Research Ethics Board at the University of Alberta. Operational and administrative approvals were obtained from the research facilitation committee overseeing the participating facilities and the TREC research program. We used three samples to conduct the validation study presented in this paper. A description of the samples, data collection and analytic approaches taken are described next.

Sample 1

Description and Data Collection.

The first sample collected *response process* validity evidence. After selecting the items to comprise the scale (originally developed for nurses in hospital settings), two members of our research team (JES and CAE) modified them for applicability to healthcare aides in nursing homes. Following this initial modification, response process evidence was sought from healthcare aides to determine fit between the items and the concept of CRU (i.e., sample 1). Participants consisted of 10 healthcare aides from two general units in two nursing homes in Alberta Canada. All healthcare aides employed on the two units were invited to participate. Healthcare aides completed a series of one-on-one CRU scale administration sessions with a member of the research team (JES or CAE). The interviews occurred in three iterations, with 1, 2, and 7 healthcare aides participating in each iteration respectively. Data collection occurred between December 6, 2008 and December 21, 2008. The data collection process included: reviewing a study information letter, obtaining informed consent, scale completion using interview format, and an informal conversation with a team member (JES or CAE) following scale completion.

Data Analysis.

The two members of the research team conducting the interviews (JES and CAE) met after each iteration to discuss the findings and make any changes to the scale items/response options prior to the next testing (iteration). The final form of the scale (post-iteration 3), presented in the Appendix, was subject to further validity assessments of: content (sample 2) and internal structure and relations to other variables (sample 3).

Sample 2

Description and Data Collection.

The second sample was comprised of an international panel of experts in research utilization in nursing, and was used to collect *content* validity evidence. This phase of the study occurred concurrently with the pilot testing of the scale in sample 3. A content validity survey was developed and sent to 11 international experts in the research utilization field. The experts were identified through our knowledge of the field and a search of publications in the field. A total of 10 surveys were returned for a response rate of 91%. One survey was not included in the analysis because the Likert scale of item-relevance was not completed; a total of 9 surveys were analyzed. A minimum of five experts is needed for an accurate content validity assessment [47]. The nine experts, who are identified in the acknowledgements section of this paper, represented five countries: Canada (n=3), United Kingdom (n=2), Sweden (n=2), United States (n=1), and Australia (n=1). In the content validity survey, the experts were asked to rate each of the five items comprising the CRU scale on their relevance to the concept of CRU using a 4-point Likert scale: 1 ‘not relevant’, 2 ‘item needs some revision’, 3 ‘relevant but needs minor revision’, and 4 ‘very relevant’. This is a modified version of Davis’ scale [48], which has been used in past studies examining item to concept relevance (content validity) of different concepts [33]. Participants also had the option of providing comments in an open-ended field on the survey.

Data Analysis.

Of the numerous methods of quantifying agreement on *content* relevance, we chose to calculate agreement using content validity index (CVI) scores. First, for each item in the CRU scale we calculated CVI scores (referred to as I-CVI). The I-CVI was calculated as follows: the number of experts giving a rating of either 3 or 4 (relevant) divided by the total number of experts scoring the item [43]. The accepted standard in the literature for an I-CVI is 0.78 [43, 49]. Second, for the full CRU scale (all five items together) we calculated a CVI score (referred to as S-CVI). The S-CVI was calculated using two methods: (1) universal agreement (referred to as S-CVI/UA); and, (2) average or mean expert proportion (referred to as S-CVI/avg). The S-CVI/UA was calculated as the number of items that the experts gave a rating of either 3 or 4 (relevant) divided by the total number of item ratings provided by the experts [43]. An S-CVI rating of 0.80 is considered acceptable [43, 48]. Because the S-CVI/UA tends to decrease when greater than 2 experts are used, we also calculated the mean expert proportion (S-CVI/avg) as recommended by Polit and Beck [43]. The mean expert proportion refers to the average proportion of items rated as relevant across the experts, and was calculated by taking the mean of the proportion of items that were rated either 3 or 4 (relevant) across the nine experts. A value of .80 or higher is considered acceptable [43].

Sample 3

Description and Data Collection.

The third sample was used to collect evidence on: (1) *validity - internal structure evidence,* (2) *validity - relations to other variables evidence,* (3) *reliability*, and (4) *acceptability*. For this phase, a sub-analysis of data collected for the TREC program was used. TREC is a multi-level (provinces, regions, facilities, units within facilities, individuals) and longitudinal research program designed to examine the impact of organizational context on research utilization by healthcare providers and the subsequent impact of research utilization on outcomes (e.g., resident and staff health) in nursing homes across the Canadian Prairie Provinces. TREC consists of two linked projects. Data used in the current analyses are from *TREC Project 1: Building Context - an Organizational Monitoring Program in Long-Term Care* [50]. The main data collection instrument for TREC Project 1 is the TREC survey, in which the CRU scale is embedded. Data were obtained from unregulated care providers (i.e., healthcare aides) employed in 30 urban nursing homes that completed the TREC survey during the project's first year of data collection (July 2008 – June 2009). The 30 nursing homes were selected using stratified random sampling (i.e., stratified by healthcare region, owner operational model, and size). Healthcare aides within each nursing home were recruited using a volunteer, census-like sampling technique. Inclusion criteria included: (1) ability to identify a unit where they have worked for at least 3 months; and, continue to work, and (2) work a minimum of 6 shifts per month on this unit. Additional details on the sampling employed in the original (TREC) study can be found elsewhere [50].

A total of 1367 healthcare aides (representing 73% of those eligible to participate) completed the TREC survey. We assessed for significant associations between the scores obtained on each of the CRU items with respect to healthcare aide selected demographic variables (age and first language) to determine homogeneity of the sample prior to conducting our psychometric assessment. No significant differences were found by age ($p > 0.05$). Healthcare aides with English as their first language however scored significantly lower on all five CRU scale items in comparison to healthcare aides whose first language was not English (independent sample t-test, $p < 0.05$) (See Additional File 5-1). Because we desired a homogenous sample to conduct the initial psychometric analysis of the scale, we chose to conduct the analyses on healthcare aides with English as their first language (n=707 cases, n=697 cases using listwise deletion). A summary of the demographic characteristics of sample 3 is presented in Table 5-1.

Data Analysis.

Internal structure was examined using: (1) item-total statistics (using PASW Version 18.0 [51]), (2) principal component analysis (PCA) (using PASW Version 18.0 [51]), and (3) confirmatory factor analysis (CFA) (using LISREL [52]). From the item-total statistics, items were considered for removal and/or revision if any of the following three criteria were met: (1) the item correlated with the total CRU scale score below 0.30 (using item-total correlations), (2) the item caused a substantial drop in the scale Cronbach alpha score when removed, and (3) the items were highly correlated with each other ($r > .80$) [32, 53]. The scree plot and Kaiser-criterion (eigenvalue >1) were considered in determining the optimal number of factors from the PCA [54, 55]. Since, the CRU scale had a proposed factor model (1 latent causing 5 indicators), we used CFA to test this model. The chi-square statistic, which assesses whether a model-implied covariance matrix is consistent with a sample covariance matrix, is the most stringent test of model-data fit and was therefore relied on for this testing; a non-significant chi-square value implies acceptable fit. We also report three fit indices that have been commonly used: (1) the root mean square of approximation (RMSEA); (2) the standardized root mean square residual (SRMSR); and, (3) the comparative fit index (CFI). A RMSEA < 0.06 and SRMSR < 0.09 [34, 56] and a

CFI value > 0.90 [34, 57] are frequently reported as a 'close fit'. However, the trustworthiness of such indices have been questioned [58, 59] and therefore, while we report these indices for consistency with the literature, we did not depend on them as an assessment of fit in our analysis.

While there is a paucity of empirical studies examining the relations between CRU and external variables, there is evidence to hypothesize that CRU is: (1) correlated with instrumental and symbolic research utilization [2] and that (2) CRU is a cause of overall research utilization [2, 20]. We further hypothesized that the mean values for each CRU item would improve with increasing levels of instrumental, symbolic, and overall research utilization. To examine these three hypotheses, we conducted the following analyses: (1) bivariate correlations between each CRU scale item and instrumental, persuasive, and overall research utilization; (2) assessment for change in mean scores for each CRU item at increasing levels of instrumental, persuasive, and overall research utilization; and, (3) a series of multivariate linear regression models (one for each CRU item) where overall research utilization was the dependent variable and CRU was entered as an independent variable to determine its role in predicting overall research utilization.

To assess the reliability of the CRU scale we calculated three internal consistency coefficients: (1) Cronbach alpha; (2) Guttman split-half reliability; and, (3) Spearman-Brown reliability. Coefficients can range from 0 to 1; a coefficient of 0.70 is considered acceptable for newly developed scales while 0.80 or higher is preferred and indicates the items may be used interchangeably [32, 33].

We assessed acceptability of the CRU scale by evaluating: (1) missing-value rates; and, (2) the average length of time it took for the healthcare aides to complete the scale.

Results

Validity Assessment

Response Process Evidence.

Revisions were made to several of the items as a result of this phase of the study. *First*, general wording changes were made to make the items more reflective of nursing homes and the work of healthcare aides. Examples of wording changes included using the word 'resident' instead of 'patient'. General wording changes were also made to the stem (lead-in) for the 5 items. For example, we changed the word 'research' to 'best practice' to reflect terminology commonly used and understood by healthcare aides. *Second*, item 3 was reworded from ‘help to change your attitudes or beliefs about how to care for residents’ to ‘help to change your mind about how to care for residents’ to increase clarity. *Third*, one of the original six items was removed. The item ‘help you plan your workday better’ was removed because its interpretation by the healthcare aides (according to the comments they provided) was not congruent with the concept of CRU. *Fourth*, changes were made to the response options used. We began with a 5-point frequency scale (1 ‘10% or less of the time’ to 5 ‘almost 100% of the time’). However, the healthcare aides found these options difficult to interpret. In iteration 2 we then trialed a 5-point Likert scale (1 ‘never’ to 5 ‘almost always’), which the healthcare aides interpreted more easily. Discussions with healthcare aides following iteration 2 resulted in one final change – response option 5 was changed from ‘almost always’ to ‘very frequently’. The revised CRU scale (stem, items, and response options) was then tested in iteration 3; no additional changes were required, providing evidence of fit between the construct of CRU and the five items as they were interpreted by healthcare aides (i.e., response process validity evidence).

Content Evidence.

Table 5-2 summarizes the content validity index (CVI) scores calculated from the responses provided to the content validity survey completed by the expert panel. Items 2 through 5 displayed acceptable (> 0.78) I-CVI scores while item 1 (give new knowledge or information) was below the accepted standard with a score of 0.55. Several members of the expert panel also provided additional comments on item 1. One expert stated that there was some “uncertainty” around item 1. Another expert stated there was “conceptual overlap” between items 1 and 4 (item 4 - give you new ideas). Two experts also suggested that item 1 could reflect both instrumental and conceptual research utilization.

The scale content validity/universal agreement (S-CVI/UA) score was 0.40, indicating low universal agreement on the scale with respect to relevancy of the five items taken together by ALL experts (Table 5-2). The alternative measure, the S-CVI/avg (i.e., average proportion relevant) and was 0.87, which exceeded the accepted standard of 0.80 [43]. Given the low relevance score assigned to item 1 and additional comments provided regarding this item, for exploratory purposes, we also calculated the S-CVI with item 1 removed (i.e., on a 4-item scale). The resulting S-CVI/UA was unchanged and S-CVI/avg increased slightly to 0.94. Overall, these findings provide support for acceptable content validity of the CRU scale generally and items 2 through 5 specifically. The findings also suggest revision of the wording to or deletion of item 1 should be considered.

Internal Structure Evidence.

Outliers. Prior to conducting analyses to assess the internal structure of the CRU scale, we examined sample 3 data for univariate and multivariate outliers. Factor analytic techniques are built on the assumption of few or no outliers [46]. To assess for univariate outliers the frequency distributions of each scale item was examined; values greater than 3 standard deviations from the mean (of which there were none) would indicate univariate outliers [45]. Screening for multivariate outliers was by calculation of the Mahalanobis distance scores for all cases (D^2_i). D^2_i is computed as a function of the deviations of the *i*th person's scores from the means on all the measured variables. A case is a multivariate outlier if the probability associated with its D^2 is 0.001 or less [46]. All cases in our sample had probability values for D^2 of 0.014 or greater. No outliers (univariate or multivariate) were therefore identified and, so all cases were retained for the remaining analyses.

Item-Total Statistics. To test for scale homogeneity, corrected item total correlations for the items were calculated. All corrected item-total correlations exceeded the accepted cutoff of .30 indicating each item was related to the overall scale [32] (See Table 5-3). Inter-item correlations (data not shown) were also within acceptable ranges (less then 0.80) for all pairs of items [32]. Therefore, all five items were retained and entered into the PCA.

Principal Components Analysis (PCA). Before running the PCA, the Kaiser-Meyer-Olkin measure of sampling adequacy and the Bartlett test of sphericity were assessed to determine if the data was appropriate for PCA [60, 61]. The large value calculated by the Bartlett's test of sphericity indicated that the correlation matrix for the five items was not an identity matrix ($\chi^2 = 2012.702$, $df = 10$, $p < 0.001$), and the Kaiser-Meyer-Olkin measure indicated acceptable sampling adequacy (0.866). From the PCA, one-dominant factor (eigenvalue =3.529 accounting for 70.6% of variance and covariance in the items) was extracted from the scale items. Visual inspection of the scree plot (i.e., plot of the eigenvalues) was consistent with this finding. Factor loadings were substantial, ranging from 0.610 to 0.759 (See Table 5-3).

Confirmatory Factor Analysis (CFA). The one-dominant factor model that emerged from the PCA was somewhat inconsistent with the findings from the CFA. While all parameters (i.e., factor loadings) in the CFA were significant in a positive direction as hypothesized, the χ^2 test statistic did not support a strict 1-factor model ($\chi^2 = 69.53$, $df = 5$, p=0.0). The RMSEA (0.140) did not support close fit but SRMSR (0.03) and CFI (0.977) did support close fit. Based on these findings, we rejected the simple 1-factor model.

Modification indices, which suggest how much the χ^2 test is expected to improve if a fixed parameter is freed to be estimated, suggested freeing seven of the possible ten measurement error covariances in the model (the three exceptions were the error covariances for: items 1 and 5; items 2 and 3; and items 4 and 5). A careful re-examination of the five items comprising the scale revealed a level of content overlap with respect to two pairs of items: (1) items 1 (give new knowledge or information) with 2 (raise awareness) and (2) items 3 (help change your mind) with 4 (give new ideas). We therefore considered the possibility that systematic error variance may be causing these items to group together beyond their dependence on one principal factor. We hypothesized that in addition to the five items loading onto a single factor; there would be error covariances for items 1 and 2, and items 3 and 4. We chose not to allow the errors on the remaining five pairs of items identified in the modification indices to correlate because they did not match our error theory.

The second model, where we correlated errors on items 1 and 2, and items 3 and 4, resulted in improved and a marginally acceptable fit ($\chi^2 = 6.86$, $df = 3$, $p=0.075$). The close fit statistics also improved (RMSEA=0.043, SRMSR=0.009, CFI=0.999). We concluded based on these findings that the 1-factor model incorporating limited error theory was superior to the strict 1-factor model. However, the need to correlate errors to attain a better-fitting model raised the question of why items that overlap in content are necessary in the scale. As a final modification, we therefore selected to drop item 1 and rerun model 2. We dropped item 1 based on: (1) our error theory, (2) that it received the lowest I-CVI score (Table 5-2), and (3) that it displayed a lower factor loading compared to item 2 in the PCA (Table 5-3). We were not also able to drop one of items 3 and 4 because the model would be just identified ($df=0$) and not testable if we dropped two items. We tested the above-specified model (1-factor, item 1 removed, correlated error between items 3 and 4). Although this third model was restricted in testing power with $df=1$, it resulted in improved fit in comparison to the previous two models ($\chi^2 = 2.43$, $df = 1$, $p = 0.119$). The close fit statistics remained relatively unchanged from model 2 (RMSEA=0.045, SRMSR=0.007, CFI=0.999).

Relations to Other Variables Evidence.

Correlations and Change in Mean Values. The bivariate correlation analysis conducted on the CRU scale items is presented in Table 5-4. At this point in the scale validation process, we have elected not to derive a score for a 4-item scale score (i.e., without item 1), instead the scale score is based on all 5 items. The CRU items, as well as the total CRU scale score (obtained by taking a mean of the five items), were positively correlated with instrumental research utilization, symbolic research utilization, and overall research utilization (each measured in the TREC survey by single items and scored on a five-point frequency scale from 1 ‘never’ to 5 ‘almost always’). The magnitude of the associations were low to moderate, and were strongest with symbolic research utilization, followed by overall research utilization and finally instrumental research utilization. The only exception to this trend was with item 3 (help change your mind) where the correlation coefficient was minimally higher with instrumental research utilization compared to overall research utilization.

We also hypothesized that each of the CRU items and the total scale score would show a trend of increasing mean values from lowest to highest levels of the three other kinds of research utilization (See Table 5-4). This trend was largely evident, supporting our hypothesis that as healthcare aides increased their reported use of CRU, they simultaneously increased their reported use of the other kinds (i.e., instrumental, persuasive, and overall) of research utilization. Also implicit in this analysis is that while all five CRU items generally conform to this trend, some items (e.g., item 1) have consistently lower starting mean values while other items (e.g., item 5) have higher starting mean values regardless of the kind of research utilization they are being examined against. In addition, some items (e.g., item 2) show more rapid increases in mean values compared to other items (e.g., item 3).

Regression Analyses. A series of 6 regression models were run (See Table 5-5). Overall research utilization was the dependent variable in all six models. In Model 1, the CRU scale score was entered as an independent variable whereas in Models 2-6, the five individual CRU items were entered as independent variables in one model each respectively. A selection of other variables, as suggested in past research as significantly related to and/or or predictive of overall research utilization, were entered as control variables including: frequency of in-service attendance [20, 23]; belief suspension (i.e., the degree to which an individual is able to suspend previously held beliefs in order to implement a research finding) [20, 22, 23]; attitude towards research [20, 22-24]; instrumental research utilization [2, 20]; and, symbolic research utilization [2, 20].

The CRU scale score remained a significant predictor of overall research utilization after controlling for the effects of the other entered covariates (Model 1). In each of the remaining models (i.e., models 2 through 6), the individual CRU item (with one exception: Item 3, Model 4) was a significant predictor of overall research utilization as hypothesized, providing *relations to other variables* validity evidence. The magnitude of the relationship (as evidenced by the unstandardized beta coefficients) between CRU and overall research utilization however ranged from .027 (item 3) to .117 (item 5) indicating that some of the items in the CRU scale are more powerful predictors of overall research utilization than others, and as a result, may also have a stronger relationship to CRU.

Reliability Assessment

Cronbach alpha for the 5-item CRU scale exceeded the accepted standard (> 0.70) for scales intended to compare groups (alpha = 0.894) [32]. By odd-even split of the five items, the Guttman split-half reliability was estimated to be 0.858, and the unequal length Spearman-Brown reliability of 0.894, also exceeded accepted standards [32].

Acceptability Assessment

The percentage of healthcare aides providing complete data on the CRU scale (i.e., with no missing data) was high at 98.6% (n= 697 of 707 healthcare aides). The average time for completion of the five items was minimal, specifically 1 minute and 6 seconds.

Discussion

English as First Language

The aim of this paper was to report the psychometric properties of responses obtained with the CRU scale when used with healthcare aides in nursing homes. In line with previous studies [62, 63], a substantial number (48%) of the healthcare aides in the TREC study (which comprised our sample 3) were not from Canada and therefore, did not speak English as their first language. This is challenging from a psychometric perspective because a homogenous sample is preferred for psychometric assessments such as factor analysis. There is some evidence to suggest that healthcare aides differ on several psychological concepts, for example, job satisfaction and burnout [63, 64], by ethnicity [65] of which first language spoken is a component. In our analysis, we found that healthcare aides who spoke English as their first language reported significantly lower scores on all five CRU scale items in comparison to healthcare aides who did not report English was their first language. These differences may reflect difficulty in general in understanding the English language (and thus what the CRU items were asking). They may also reflect a social desirability bias on part of healthcare aides who do not speak English as their first language since their scores on all five items were consistently ‘higher’ than the scores of aides who did speak English as their first language. The finding may, however, also be a valid discovery that can be explained by examining the specific cultural practices of the healthcare aides in question. This could be a fruitful area for future investigation. Although the finding that healthcare aides who speak English as their first language responded differently on the CRU scale compared to healthcare aides who do not speak English as their first language is not fully understood at this time, this study underscores the importance of collecting demographic data on healthcare aides on native language and ethnicity, as well as assessing differences by both variables prior to conducting psychometric analyses.

Validity

In this study, we aimed to assess the validity of the CRU scale and each of its items when completed by healthcare aides in nursing homes. A sound validity argument integrates various types of evidence to make a determination about the degree to which existing evidence and theory support the intended interpretations of scale scores for specific uses [35]. The *Standards'*, adopted in this study, focuses on content, response processes, internal structure, and relations to other variables evidence to obtain a unitary and comprehensive perspective of validity. In this framework all validity evidence builds construct validity and exists as a matter of degree, meaning interpretations from scores are more or less valid given a specific context. The *Standards'* approach therefore provides an alternative to the traditional conceptualization of validity which views validity as: (1) distinct types (e.g., content, criterion, construct) and (2) existing or not. In this study, we systematically performed several analyses to seek validity evidence (in each of the four domains comprising the *Standards*) with respect to the scores and interpretations obtained from CRU scale when employed with healthcare aides in nursing homes. While it does do not provide a complete picture of all aspects of validity, it does provide a much needed first look at several critical issues that need to be addressed before more in-depth validity studies can be undertaken with additional groups of healthcare providers.

Content validity is an important source of validity evidence; it is essential to identifying the concept being measured and is an early step in establishing construct validity. We explored content validity in a number of ways. First, we attempted to include a representative sample of items by reviewing the existing literature and modifying previously developed statements designed to capture conceptual use of knowledge in acute care hospitals with professional nurses. Second, before conducting a formal content validity assessment with experts in the field, we assessed the appropriateness of the scale with respondents representative of those for whom it was developed (i.e., healthcare aides). This latter activity is formally labeled as 'response process' validity evidence in the *Standards*. Based on this analysis, several revisions were made to the scale before it was formally assessed for item-concept relevance (i.e., content validity evidence) with an expert panel. This process (integrating content and response process approaches into validation efforts) illustrates the importance of considering multiple evidence sources. A traditional (more compartmentalized) approach to validity assessment would have resulted in the original items being assessed for relevance by an expert panel (content) without knowledge of misfit between the items and the concept of CRU (as interpreted by the healthcare aides, response processes evidence). However, by adopting the *Standards* approach and letting multiple evidence sources inform one another, we were able to pilot test a form of the CRU scale that produced more valid score interpretations, then would have been used, if a traditional approach to validity assessment was taken.

Our validity assessment revealed that two of the five items included in the CRU scale require revision (i.e., items 1 and 3). The formal (expert) content validity assessment resulted in item 1 (give new knowledge or information) being rated at an unacceptable level with respect to its relevance to CRU. Some experts also identified item 1 as having content overlap with the concept of instrumental research utilization. While the bivariate correlation between item 1 and instrumental research utilization was low moderate (0.295), of the five scale items, it correlated the strongest with instrumental research utilization, lending some empirical support to the expert panel's assessment of the item. Other issues with item 1 also emerged in our analysis. For example, item 1 had the second lowest factor loading in the PCA (though still substantial, Table 5-3), and model fit increased significantly in the CFA when the item was removed from the model. Post-analysis inspection of the item also revealed it to be a 'double-barreled' item, meaning it conveys two ideas: (1) give new knowledge and (2) give new information. Such items should be avoided wherever possible in instrument development since endorsement of the item might refer to either or both ideas [66]. Taken together, these findings suggested removal or revision of item 1 (so that it reflects only one idea and does not overlap with the meaning of instrumental research utilization) before testing the CRU scale with additional samples.

Item 3 received a perfect relevance score in the formal content validity assessment (Table 5-2). However, the healthcare aides experienced difficulty comprehending this item according to our response process work, which occurred prior to this assessment. Item 3 also exhibited the lowest factor loading of the five items in the PCA and the lowest corrected item total correlation (Table 5-3). In our assessment of change in mean values with increasing levels of instrumental, persuasive, and overall research utilization, Item 3 displayed the least change (Table5-4). In addition, the regression analysis showed item 3 was the only CRU scale item that was not a significant predictor of overall research utilization (Table 5-5). Combined, these findings indicate the healthcare aides may have had continued difficulty interpreting the item. These findings also demonstrate the importance of taking a comprehensive approach to validity assessment. While the formal content assessment revealed a perfect match between item 3 and CRU, the other evidence sources rendered the scores and interpretations from this item as less valid. We trust the formal content validity assessment finding that the item is a good match with CRU. However, we believe, as seen in the response process evidence collected, that the healthcare aides in our sample had difficulty understanding the item, thus rendering their responses to it as less valid. Future work with this item is required and should entail additional response process work with healthcare aides to ensure clarity in the wording of the item without appreciable loss in meaning.

Relations with other variables evidence added to the construct validity argument for the CRU scale generally, and for items 2, 4, and 5 in particular. Statistically significant bivariate relationships between both the scale score and the item scores with instrumental, persuasive, and overall research utilization reinforce past empirical research [2, 20], providing supporting validity evidence. The regression analyses also provided supporting validity evidence by showing that the CRU scale score, and the scale items individually (with one exception - item 3) were predictors of overall research utilization, after controlling for other covariates [2, 20]. The magnitude of the effect, however, varied according to the CRU item used in the regression equation. For example, item 5 (help make sense of things) had the strongest effect, suggesting that this item may have greater predictive validity than the remaining four items (Table 5-5). The differential effect magnitudes for the five items also have implications for the selection of a single CRU indicator (for researchers who are performing analyses that do not require multiple indicators) and for deriving an overall score for the scale e.g., item weighting.

Derived Score Implications

The internal structure and relations to other variables analyses reveal information about how each of the five items in the CRU scale relate to the latent concept of CRU. These findings suggest that combining the items to create a summed or mean derived score for each study participant (which is commonly done in psychological research), while practical, may not be optimal. For example, item 5 (help make sense of things) had an unstandardized beta coefficient that was substantially higher (77% higher) than that of item 3 (help change your mind). Thus, item 5 appears to have a stronger relationship to CRU than does item 3. Therefore, it (item5) item should be weighted higher in an overall CRU score than item 3. While the findings from this study suggest that the items in the CRU scale should receive differential weighting when a derived score is sought, further validation work with additional samples should first be undertaken to determine if the trends reported in this paper are replicable before a weighting schema is proposed.

Limitations

Although the psychometric assessment reported in this paper is promising, the findings presented should be considered in light of the study's limitations. First, the study was conducted in one country with one group of healthcare providers – healthcare aides. Assessment of a new instrument is a multi-step process that requires multiple revisions and reassessment across a range of settings and provider groups. Second, our reliability assessment was limited to tests of internal consistency. Future applications of the CRU scale should examine scale stability (test retest reliability) in addition to the scale's internal consistency.

Third, because this was the first administration of the CRU scale, it has not yet been used in studies of research utilization interventions. Therefore, it is not known whether the scale is sensitive to and able to detect changes in CRU over time or if it is sensitive to patient outcomes. Despite these limitations, the CRU scale addresses an important gap in health services research – the ability to assess care providers' conceptual use of research findings. To date, research utilization has been measured predominantly as an omnibus or general concept. Failure to measure conceptual research utilization results in: (1) an underestimate of the extent to which healthcare providers use research in practice and, (2) a lack of understanding of the true research utilization process.

Conclusions

The CRU scale assessed in this paper showed acceptable beginning psychometric properties with respect to responses from healthcare aides in nursing homes whose first language was English. The analyses of validity, reliability, and acceptability are promising. These findings, however, are not generalizable beyond healthcare aides who speak English as their first language. Based on the findings, we suggest that items 1 (give new knowledge or information) and 3 (help change your mind) undergo minor revision, supplemented by response process validation evidence before being subjected to validity assessments in additional samples. Future research should also include: (1) longitudinal work to determine whether the CRU Scale and its items are sensitive to changes in levels of CRU and (2) exploration of the links between CRU and resident (patient) and organizational outcomes.

Table 5-1. Sample 3 Characteristics (n=707)

Demographic Characteristic		n (%)
Gender	Male	34 (4.8%)
	Female	668 (94.5%)
	Missing Values	5 (0.7%)
Age	< 20 years	11 (1.6%)
	20-29 years	108 (15.3%)
	30-39 years	126 (17.8%)
	40-49 years	212 (30.0%)
	50-59 years	184 (26.0%)
	60-69 years	65 (9.2%)
	>70 years	0 (0%)
	Missing Values	1 (0.1%)
Education Level	High School *Missing Values*	615 (87.0%) 2 (0.3%)
	HCA Certificate *Missing Values*	592 (83.7%) 0
Shift Worked Most of the Time	Day Shift	373 (52.8%)
	Evening Shift	226 (32.0%)
	Night Shift	108 (15.3%)
	Missing Values	0
English as a First Language	Yes	707 (51.7%)
	No	659 (48.2%)
	Missing Values	1 (0.1%)
		Mean (SD)
Number of Years Worked as a Healthcare Aide		11.8 (9.65)
Number of Years Worked on Unit		4.8 (5.58)
Hours Typically Worked in Two Weeks		65.30 (18.09)

Table 5-2. Content Validity Index (for relevance)

Item	Expert									Number in agreement	Item CVI
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**		
1	3	4	3	2	1	1	4	3	2	5	0.55
2	4	4	4	4	3	4	4	4	2	8	0.89
3	4	4	3	4	4	4	4	4	4	9	1
4	4	3	3	4	4	4	4	4	4	9	1
5	4	4	4	4	4	4	4	3	2	8	0.89
Proportion Relevant	1.00	1.00	1.00	.80	.80	.80	1.00	1.00	.40		

Mean I-CVI = .844
Mean I-CVI (item 1 removed)=.920

S-CVI/UA = .40
S-CVI/UA = (item 1 removed) =.40

S-CVI/avg = .87
S-CVI/avg (item 1 removed) = .94

Table 5-3: Item Characteristics (n=697[1])

Item	Corrected Item-Total Correlations	Factor Loading
Item #1: Give new knowledge or information	0.722	0.688
Item #2: Raise awareness	0.782	0.756
Item #3: Help change your mind	0.666	0.610
Item #4: Give new ideas	0.788	0.759
Item #5: Help make sense of things	0.749	0.716
Notes: Eigenvalue = 3.529; variance explained = 70.579% [1]listwise deletion resulted in the removal of 10 cases fir a final sample size of 707 cases.		

Table 5-4: Assessment of Relations with Other Variables Validity: Correlation of CRU Items with Other Kinds of Research Utilization and Increasing Mean Values of CRU by Increasing Levels of Other Kinds of Research Utilization

CRU Item	Instrumental Research Utilization						Symbolic Research Utilization						Overall Research Utilization					
	Pearson *r*	Level of Research Use[1]					Pearson *r*	Level of Research Use[1]					Pearson *r*	Level of Research Use[1]				
		1	2	3	4	5		1	2	3	4	5		1	2	3	4	5
1	.295**	2.00	2.54	3.33	3.47	3.93	.369**	2.36	3.24	3.39	3.82	4.13	.332**	1.67	2.81	3.05	3.57	3.98
2	.263**	2.80	2.85	3.25	3.54	3.93	.361**	2.68	3.27	3.41	3.81	4.17	.279**	2.67	3.06	3.19	3.85	3.97
3	.247**	2.40	2.54	2.94	3.21	3.63	.320**	2.36	2.94	3.12	3.47	3.86	.232**	2.33	3.00	2.86	3.28	3.64
4	.233**	2.40	3.00	3.17	3.44	3.79	.339**	2.52	3.15	3.36	3.67	4.04	.278**	2.67	2.87	2.99	3.52	3.84
5	.191**	3.00	3.31	3.37	3.67	3.93	.318**	2.64	3.39	3.57	3.88	4.15	.317**	3.00	3.19	3.05	3.68	4.07
Scale Score	.294**	2.52	2.85	3.21	3.46	3.84	.406**	2.51	3.20	3.37	3.73	4.07	.342**	2.47	2.99	3.02	3.53	3.90

Notes:
[1] = 1'never'; 2'rarely'; 3 'occasionally'; 4 'frequently'; 5 'almost always'
** $p<0.01$

Table 5-5. Regression Analyses (Dependent Variable: Overall Research Utilization)

Model	Variable	Unstandardized Beta	Standardized Beta	*P*-value
Model 1 Adjusted R^2= .345	**Conceptual Research Utilization (scale score)**	**.109**	**.122**	**.001**
	Instrumental Research Utilization	**.362**	**.356**	**<.001**
	Symbolic Research Utilization	**.165**	**.222**	**<.001**
	Belief Suspension	**.103**	**.105**	**.002**
	Attitude towards Research	.101	.060	.060
	In-services	.007	.011	.738
Model 2 Adjusted R^2= .352	**Item #1: Give new knowledge**	**.094**	**.126**	**<.001**
	Instrumental Research Utilization	**.358**	**.353**	**<.001**
	Symbolic Research Utilization	**.167**	**.225**	**<.001**
	Belief suspension	**.110**	**.111**	**.001**
	Attitude towards research	.104	.062	.053
	In-services	.007	.011	.737
Model 3 Adjusted R^2= .339	**Item #2: Raise awareness**	**.064**	**.082**	**.019**
	Instrumental Research Utilization	**.368**	**.363**	**<.001**
	Symbolic Research Utilization	**.176**	**.236**	**<.001**
	Belief suspension	**.113**	**.114**	**.001**
	Attitude towards research	**.107**	**.064**	**.047**
	In-services	.012	.020	.537
Model 4 Adjusted R^2= .335	Item #3: Help change your mind	.027	.039	.253
	Instrumental Research Utilization	**.374**	**.368**	**<.001**
	Symbolic Research Utilization	**.187**	**.251**	**<.001**
	Belief suspension	**.116**	**.117**	**<.001**
	Attitude towards research	**.110**	**.065**	**.044**
	In-services	.016	.025	.437
Model 5 Adjusted R^2= .339	**Item #4: Give new ideas**	**.061**	**.081**	**.021**
	Instrumental Research Utilization	**.371**	**.366**	**<.001**
	Symbolic Research Utilization	**.179**	**.240**	**<.001**
	Belief suspension	**.106**	**.108**	**.001**
	Attitude towards research	.106	.063	.050
	In-services	.010	.016	.628
Model 6 Adjusted R^2= .353	**Item #5: Help make sense of things**	**.117**	**.151**	**<.001**
	Instrumental Research Utilization	**.370**	**.364**	**<.001**
	Symbolic Research Utilization	**.165**	**.221**	**<.001**
	Belief suspension	**.100**	**.101**	**.002**
	Attitude towards research	.094	.056	.081
	In-services	.006	.010	.757

Additional File 5-1. CRU Scores by First Language

Item	EFL[1]	Mean (STD Dev)	t -test Statistic	Degrees of Freedom	Significance
Item #1: Give new knowledge or information	Yes[2] No[2]	3.66 (1.058) 4.20 (0.892)	-10.201	1346	< 0.001
Item #2: Raise awareness	Yes No	3.69 (1.023) 4.25 (0.862)	-10.859	1346	< 0.001
Item #3: Help change your mind	Yes No	3.37 (1.142) 3.65 (1.266)	-4.196	1346	< 0.001
Item #4: Give new ideas	Yes No	3.57 (1.047) 4.13 (0.926)	-10.312	1346	< 0.001
Item #5: Help make sense of things	Yes No	3.76 (1.023) 4.34 (0.799)	-11.639	1346	< 0.001

[1]EFL= English as first language
[2] sample size: listwise deletion used. Yes (English as first language, n=697), No (English not first language, n=651)

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Chapter 6: Summary, Conclusions, and Contributions

This chapter contains: (1) a summary of the findings from each of the four studies that comprise this thesis, (2) the main conclusions drawn from each study, (3) a summary of study limitations, (4) a description of the contributions this research makes methodologically and to research utilization in nursing theory, and (5) the next steps in my program advancing the science of research utilization.

Summary of Findings: The Four Papers Constituting this Thesis

Paper #1: Measuring Research Utilization in Healthcare Organizations: A Systematic Review of Reliability and Validity of Research Utilization Instruments

This paper has been submitted to: *Implementation Science*. (Submitted: August 20th, 2010).

Citation. Squires, J.E., Estabrooks, C.A., O'Rouke, H.M., Gustavsson, P., Newburn-Cook, C.V., & Wallin, L. (in review). Measuring Research Use in Healthcare Organizations: A Systematic Review of Reliability and Validity of Research Utilization Instruments. *Implementation Science.*

Key Findings. In this study (Study #1), using a comprehensive search strategy, 42,770 titles were identified, of which 108 met my inclusion criteria. These 108 articles represented 97 original studies, describing 60 unique research utilization instruments. Only seven (12%) of the instruments were assessed in multiple (>1) studies. A total of 25 (42%) of the instruments were tested with nurses; 5 of these instruments were tested in multiple studies. Of the 60 instruments identified overall, the reports on 12 (20%) of these displayed no validity evidence. The remaining 48 (80%) instruments were classified into a 3-level validity hierarchy according to the number of validity sources (using the four sources outlined in the *Standards* [1] as a grouping framework) that were reported in 50% or more of the studies assessing the instrument. Instruments falling under Level 1 (n=6, 10%) had evidence reported from any three validity sources. For single-item measures this entailed all possible validity sources. Level 2 instruments (n=16, 27%) had evidence reported from any two validity sources, and Level 3 instruments (n=26, 43%) had evidence reported from any single validity source. While a large set of research utilization instruments were identified in this systematic review, a rather discouraging picture in terms of the psychometric properties of research utilization instruments emerged. Several of the instruments, which were labelled research utilization measures, did not actually measure research utilization; rather they measured factors that may make research utilization more probable (e.g., reading journals). Additionally, among the instruments identified that do measure research utilization directly (i.e., not a proxy measure), several substantial methodological gaps were evident.

Paper #2: Individual Determinants of Research Utilization by Nurses: A Systematic Review Update

This paper is in review at: *Implementation Science*. (revised and resubmitted, July 17th 2010).

Citation. Squires, J.E., Estabrooks, C.A., Gustavsson, P., & Wallin, L. (in review). Individual Determinants of Research Utilization by Nurses: A Systematic Review Update. *Implementation Science.*

Key Findings. In order to perform a comprehensive validity assessment of the research utilization instruments tested with nurses in Study #1, I needed to systematically evaluate existing knowledge on individual (nurse) factors associated with research utilization. This synthesis was necessary in order to adequately assess the fourth evidence source listed in the *Standards* [1]: relations to other variables. This study (Study #2) comprised an update of a previous review in this area (Estabrooks 2003 [2]). For this study (Study #2), I adapted the search strategy developed for Study #1. Of the 501 articles deemed potentially relevant and retrieved for Study #1, 45 articles satisfied the inclusion criteria for this review (Study #2). The majority (n=39, 87%) of articles examined research utilization generally (i.e., an omnibus concept) while the remaining articles (n=6, 13%) examined specific kinds of research utilization (i.e., instrumental, conceptual, persuasive, overall). Individual (nurse) factors identified in the review were grouped according to the same six broad categories used in the previous review (Estabrooks, 2003 [2]) to allow for comparability: (1) beliefs and attitudes, (2) involvement in research activities, (3) information seeking, (4) education, (5) professional characteristics, and (6) socio-demographic/socio-economic characteristics. A seventh category, critical thinking, emerged in this review update in studies examining kinds of research utilization. Positive relationships, at statistically significant levels, with research utilization as a general concept were found with individual (nurse) factors in four categories: (1) beliefs and attitudes, (2) information seeking, (3) education, and (4) professional characteristics. The only characteristic assessed in a sufficient number of studies and displaying consistent findings with the kinds of research utilization was attitude towards research (in the beliefs and attitudes category), which was shown to have a positive association with instrumental and overall research utilization.

Paper #3: An Item Response Theory Analysis of the Conceptual Research Utilization Scale

This paper is in review at: *Psychological Assessment*. (Submitted: July 18th, 2010)

Citation. Squires, J.E., Estabrooks, C.A., Hayduk, L., Gierl, M., & Newburn-Cook, C. (in review). An Item Response Theory Analysis of the Conceptual Research Utilization Scale. *Psychological Assessment.*

Key Findings. In this study (Study #3), I analyzed the responses from 1349 unregulated nursing care providers (healthcare aides) working in 30 urban Canadian nursing homes who completed the newly developed *Conceptual Research Utilization Scale*. Samejima's graded response model was used. I found that some of the items in the *Conceptual Research Utilization Scale* are redundant because they contribute little to the overall precision of the scale. The scale (and each of the five items) was also shown to be most precise for unregulated nursing care providers (healthcare aides) with low to average conceptual research utilization trait levels. The scale became substantially less precise at higher trait levels. I also found that the scale could be shortened without significantly decreasing its precision by reducing the number of items. Additionally, the analyses suggest that the scale could be improved by locating more clearly distinct response options and that the individual items may require weighting where an overall scale score is desired. The most important direction, however, provided by the item response theory analyses from this study is the need for new items that differentiate *high* conceptual research utilization levels.

Paper #4: Validation of the Conceptual Research Utilization Scale: An Application of the Standards for Educational and Psychological Testing in Healthcare

This paper is in review at: *BMC Health Services Research*. (Submitted: July 26th, 2010).

Citation. Squires, J.E., Estabrooks, C.A., Newburn-Cook, C., & Gierl, M. (in review). Validation of the Conceptual Research Utilization Scale: An Application of the Standards for Educational and Psychological Testing in Healthcare. *BMC Health Services Research.*

Key Findings. In this study (Study #4), I analyzed the responses from 707 unregulated nursing care providers (healthcare aides) working in 30 urban Canadian nursing homes who completed the *Conceptual Research Utilization Scale*. The 707 healthcare aides represented the respondents (from Study #3) who spoke English as their first language. I used the *Standards* [1] to guide the validity evidence that I sought and assessed. Reliability of the scale was acceptable with Cronbach's alpha, Guttman split-half reliability, and Spearman-Brown reliability coefficients exceeding the normally accepted standards. There was also acceptable evidence of content validity for the scale generally and for four of the five items specifically, each displaying item content validity index scores above acceptable standards. Internal structure assessment by principal components analysis predicted a 5-item 1-factor model (accounting for 70.6% of the variance and covariance among the items in the scale). Confirmatory factor analysis, however, revealed strongest fit was for a 4-item 1-factor model, supporting the findings from the content validity assessment that one of the five items needed revision. Bivariate associations between conceptual research utilization and other kinds of research utilization (with which conceptual research utilization was hypothesized to correlate) were statistically significant ($p<0.01$) for all items in the scale, providing supporting relations to other variables evidence. The scale score and four of the five items were also shown to be significant predictors (as hypothesized) of overall research utilization in multivariate linear regression after controlling for other known covariates, providing additional 'relations to other variables' validity evidence.

Study Conclusions

In Study #1, I identified 60 research utilization instruments, of which almost half (n=25 [42%]) were tested with nurses. None of the assessments of the scores obtained using these instruments showed strong validity evidence. This may be due to several reasons. For example, (1) the instruments themselves may be inadequate, (2) there may be limited understanding of validity and how to adequately assess it among researchers in the field, and/or (3) the findings may be a result of poor reporting of validity evidence. Another important conclusion resulting from this study is the identification that substantial core methodological gaps in the measurement of research utilization (in nursing and in healthcare generally) persist. These gaps, which center around: lack of construct clarity, limited use of measurement theory, and lack of standard psychometric assessment, will need to be addressed before the science of research utilization in nursing can be significantly advanced.

In Study #2, I confirmed conclusions drawn in a previous review (Estabrooks [2]) that a positive attitude towards research and nursing role (leadership/advanced practice compared to staff nurse) are associated, at statistically significant levels, with nurses' research utilization. I also built on previous knowledge in the literature by identifying additional individual (nurse) factors important to research utilization. I further reinforced that important methodological weaknesses persist in the research utilization in nursing literature, predominantly: (1) poor methodological quality and (2) limited statistical rigor. These weaknesses will need to be addressed in future research utilization studies.

In Study #3, I demonstrated that the newly developed *Conceptual Research Utilization Scale* most precisely measured conceptual research utilization by unregulated nursing care providers (healthcare aides) at low to average trait levels. From this finding, I concluded that new items which differentiate high conceptual research utilization (trait) levels are needed before the scale is used in additional studies to: (1) assess which factors predict conceptual research utilization by unregulated nursing care providers, (2) design interventions to increase conceptual research utilization by unregulated nursing care providers, and (3) test the effectiveness of interventions to improve patient (and other) outcomes by increasing conceptual research utilization by unregulated nursing care providers. In this study, I also concluded that: (1) the *Conceptual*

Research Utilization Scale could be shortened without substantially decreasing its precision by removing some of the current items and (2) a weighting of items may be needed when combining the individual item scores to obtain a concept score.

In Study #4, I demonstrated that the *Conceptual Research Utilization Scale* has acceptable *initial* psychometric properties (from a classical test score theory perspective) with respect to responses from unregulated nursing care providers (healthcare aides) working in nursing homes. Based on a series of reliability, validity, and acceptability analyses, I concluded that refinements to two of the five items in the scale are needed (items 1 – give new knowledge or information and 3 – help change your mind) and confirmed the finding in Study #3 that a weighting of the individual items may be needed where an overall concept (conceptual research utilization) score is desired.

Limitations

The Systematic Reviews (Study #1 and Study #2)

While rigorous and comprehensive methods were used for the identification of studies in both systematic reviews, which comprise Study #1 (systematic review of research utilization instruments) and Study #2 (systematic review update of individual factors associated with research utilization by nurses) of this thesis, I did not search all grey literature sources. Consequently the reviews may not be representative of all relevant work in the field. Further, the majority of reports included in both reviews represent published work (with the exception of some theses). Since studies with negative results are often not published, a reporting bias towards positive findings is possible in Study #1 and Study #2.

There are two limitations that are specific to Study #1. First, reporting of findings consistent with the four sources of validity evidence in the *Standards* [1] in the original study articles was limited. Therefore, I may have concluded lower levels of validity for some instrument scores than actually exist. If this is true, my findings may, in some cases, reflect poor reporting rather than less validity. Second, I did not conduct a quality assessment of the included articles. There are no universal criteria to grade the quality of instruments. Therefore, in line with other recent systematic reviews of instruments [3, 4], I did not use restrictive criteria to rate the quality of each study. However, I did create a 3-level instrument hierarchy, which instruments were placed within according to the average number of validity sources displayed in the reports assessing the instruments. This assessment was based on a comprehensive and systematic evaluation of validity sources according to the *Standards* [1], which is considered best practice in the field of psychometrics [5].

There are also two limitations that are specific to Study #2. First, I used a vote counting approach to determine which individual (nurse) factors were significantly associated with research utilization. Vote counting adds up the number of statistically significant positive and negative associations to conclude whether an association exists overall. There are weaknesses with using vote counting. For example, this approach to synthesis fails to account for: (1) effect sizes (vote counting gives equal weight to all associations, regardless of magnitude) and (2) precision of the estimate from the primary studies (vote counting gives equal weight to comparisons irrespective of sample size). To lessen these problems, I reported the following in Study #2 as recommended by Grimshaw and colleagues [6]: (1) all associations showing a positive direction of effect, (2) the number of comparisons showing statistically significant effects (regardless of direction), and (3) the magnitude of effect when it was provided in the articles. A second limitation to Study #2 is that while I did perform a quality assessment on the included articles using validated tools [7-12], the instrument (reliability and validity) assessment within the quality assessment was based on a traditional conceptualization of validity (i.e., as types) and was therefore, restricted to statements of validity made by the original authors of each article. In future systematic reviews, I would take a revised approach and assess the *extent* of validity of instrument scores using the *Standards* [1].

The Empirical Studies (Study #3 and Study #4)

In study #3 (assessment of the precision of the *Conceptual Research Utilization Scale*), I used item response theory to assess precision of the scores obtained with the *Conceptual Research Utilization Scale* when administered to unregulated nursing care providers (healthcare aides) in nursing homes. There are three limitations associated with this study. First, two pairs of items in the *Conceptual Research Utilization Scale* violated the item response theory assumption of local independence, which underpins appropriate summing of item information functions to obtain the scale information function. Despite this finding, the scale-level findings are remarkably similar to those obtained in the item-level analysis. Second, while the decline in measurement precision in the *Conceptual Research Utilization Scale* seen at high trait levels is likely because of a lack of items that differentiate such trait levels, it may also possibly be due to other factors that were not investigated in this study: (1) characteristics of the study participants which were not collected in the original dataset from which my secondary analysis was conducted and (2) a social desirability effect (given the original data was collected in interview format). Finally, the analyses presented in this study were completed on the full sample of healthcare aides available (n=1349). The subsequent and final study in this thesis (Study #4) revealed statistically significant differences on all five items in the *Conceptual Research Utilization Scale* by whether or not English was the respondent's first language; respondents with English as their first language (n=707) responded consistently lower on each item. As a result, the lower precision estimates at high trait levels determined in Study #3 may possibly be the result of the higher scores reported by healthcare aides without English as their first language.

In study #4 (assessment of the psychometric properties of the *Conceptual Research Utilization Scale*), I examined the psychometric properties of the scores obtained with the *Conceptual Research Utilization Scale* when used with unregulated nursing care providers (healthcare aides) in nursing homes (speaking English as their first language). There are three limitations associated with this study. First, while the initial assessment of the scale conducted in this study was comprehensive, guided by the *Standards* [1], it was conducted in one country with one group of nursing care providers. Assessment of a new instrument is a multi-step process that requires multiple revisions and reassessment across a range of settings and provider groups. Second, the reliability assessment was limited to tests of internal consistency (this is based on the data that was available to me through secondary analysis). Third, because this was the first administration of the *Conceptual Research Utilization Scale*, it is not known whether the scale is sensitive to changes in conceptual research utilization over time or patient (or other) outcomes.

Contributions

The proper object and goal of nursing has been described generally as *the human experience of illness and health* and *to restore, maintain and promote the health of individuals, groups and/or communities* respectively [13, 14]. To accomplish this goal, nursing requires both science and art. Multiple definitions of nursing science and art abound the literature. Johnson [15] describes nursing science as "empirical knowledge that is grounded and tested in experience, specifically special experience" (p. 9). She further defines special experience as "the experience we have as the result of investigative efforts" (p. 9). Scientific knowledge is therefore, she asserts, 'general' in nature [15]. Among the multiple definitions of nursing art that can be found, two common components often cited are: (1) the ability to nurse and (2) the establishment of therapeutic relationships with patients. Johnson [15] defines art as "any skill or technique that includes the useful, the liberal, and the fine arts" (p. 10) and nursing art as a "useful art" that includes "practical know-how that an individual nurse has in a particular situation, which is used to achieve a particular result" (p. 10). Johnson [15] further contends that the nature of the art of nursing has primacy over the nature of the science of nursing and thus, that "nursing science must ultimately serve the art of nursing" [15] (p. 9).

It is generally agreed that nursing science is one important component of the discipline of nursing [15, 16]. The exact nature of this science however remains an issue of debate. Currently, four positions of nursing science can be found in the literature: (1) as a basic science, (2) as an applied science, (3) as a practical science, or (4) as a combination of basic, applied, and practical sciences [15]. My thinking is aligned with the position that nursing is a practical science.

Accordingly, I hold the view, in line with nurse scientists who adhere to a 'practical science' perspective [15, 17], that nursing research should ultimately produce (or verify) knowledge that ultimately leads to something which informs nursing practice. That is, nursing knowledge should be produced to achieve a practical (practice) end. Following this conceptualization, the science and art of nursing are intricately connected. This is consistent with Johnson [15] who states, "To disarticulate these two aspects [science and art] of nursing is to dismember nursing" (p. 15). The study of research utilization is concerned exactly with this - maintaining a connection between nursing science and nursing art. That is, research utilization is about using empirical knowledge (science) to inform nursing practice (art) with the ultimate aim of achieving the goal of nursing (to restore, maintain and promote the health of individuals, groups or communities). However, as illustrated in Chapter 1 of this thesis, a gap between what we know (research/ science) and what we do (practice/art) exists. In order to reduce this gap we need to better understand the problems associated with implementing research findings into nursing practice. But before we can do this we require reliable and valid measures of research utilization, the attainment of which was the focus of this thesis.

Specific contributions from this research come in two forms: methodological and theoretical (i.e., to research utilization in nursing theory).

Methodological Contributions

The methodological contributions resulting from this thesis can be classified according to:

(A) The identification of methodological gaps that need to be addressed for the research utilization in nursing field to significantly advance

(B) Application of new methods that will potentially advance future study in the field

A. Methodological Gaps.

1. <u>Identification of Gaps</u>. (Study #1/Chapter 2; Study #2/Chapter 3)

In this thesis, I: (a) confirmed the existence of several methodological gaps in the measurement of research utilization literature generally (and in nursing specifically) and (b) identified the existence of several new (previously unidentified) methodological gaps. These gaps are listed next and are described in more detail in Study #1 (Chapter 2).

Existing methodological gaps confirmed in this research are:

1. Lack of construct clarity of research utilization and the *best* method(s) for its measurement

2. Lack of research utilization theory underpinning the development of research utilization instruments

3. Lack of measurement theory underpinning:
    a. the development of research utilization instruments
    b. the psychometric assessment of the scores obtained using research utilization instruments

4. Lack of standard or advanced psychometric assessment of the scores obtained using research utilization instruments and their resulting inferences

5. Lack of robustly designed studies examining the measurement of research utilization in healthcare and in nursing in particular (this gap is described in Study #2, Chapter 3)

New methodological gaps identified in this research include:

1. Limited reporting of study findings that can be construed as validity evidence for research utilization instruments

2. Little replication of validity assessments from research utilization instruments (i.e., minimal use of the same instrument in multiple studies)

3. Lack of assessment of:
    a. acceptability and feasibility of research utilization instruments
    b. responsiveness of research utilization instruments

4. An over-reliance on the validity assessment reported in the index (original) study for research utilization instruments without adequate appraisal of its robustness or correctness

5. Failure to re-assess validity of research utilization instruments when:
    a. modifications are made to a research utilization instrument
    b. the instrument is being used with a different population or in a different context than the original assessment

2. Understanding 'Lack of Construct Clarity' Gap. (Study #1/Chapter 2)

'Lack of construct clarity' of research utilization is cited as one of, if not the, most significant contributor to poor measurement science in research utilization science [18-21]. I believe this thesis begins to unravel some of the complexity as to *why* there is lack of construct clarity and by doing so, makes a significant contribution to the field.

I found that lack of clarity stems from four areas. While researchers in the field (e.g., Estabrooks [18, 22, 23], Settler [24], Squires [22], Backer [25]) identified some of these problems areas previously, they did not examine them critically as a set of core reasons for limited construct clarity. The four areas are:

1. A lack of definitional precision of research utilization

2. Confusion around the formal structure of research utilization

3. Lack of use of substantive (research utilization or related) theory in the development of research utilization instruments

4. Confusion between factors associated with research utilization and the use of research *per se*

An explanation of how each of these four areas contributes to our understanding of lack of construct clarity in the field can be found in Study #1 (Chapter 2).

B. Application of New Methods.

1. Application of the *Standards*. (Study #1/Chapter 2; Study #4/Chapter 5)

In this thesis, I presented what I believe is the first application of the *Standards* (a framework for establishing validity from the field of Education and considered best practice in psychometrics [1]) in an instrument review in healthcare, as well as the first full (and practical) application of the framework to guide an instrument validation study in nursing. By using the *Standards*, I challenged traditional thinking about validity, i.e., that it exists or not and that it is a property of an instrument rather than the scores obtained with the instrument. In doing this, I introduced, into the nursing and healthcare literature, a more contemporary view of validity and provided a template for how this conceptualization can be applied to guide validation of nursing constructs. The standards approach is described in detail in Study #1 (Chapter 2) and Study #4 (Chapter 5).

2. Precision of Research Utilization Instruments. (Study #3/Chapter 4)

Measurement precision is critical to the quality of inferences and the consequent decisions that can be drawn from an instrument [26]. Traditionally, in the nursing literature, measurement precision has been equated with reliability and assessed using the Cronbach alpha coefficient. While this approach provides useful information, it incorrectly assumes that all instruments are equally precise across the full range of possible trait scores. My thesis is the first research in the research utilization field, which I am aware of, that demonstrates research utilization is not uniformly precise across the full range of trait values. As a result, this research contributes methodologically to the field by providing evidence that traditional (Cronbach Alpha) reliability assessments do not provide sufficient precision estimates for research utilization instruments. This research also contributes by introducing the item information function (in item response theory) as a supplementary approach to the Cronbach Alpha coefficient for assessing precision of research utilization instruments. This contribution is described in Study #3 (Chapter 4).

3. Item Weighting. (Study #3/Chapter 4)

In nursing research, multiple items are frequently combined to create a summed or mean construct score. While this approach is practical, it is not always defensible. There is little in the nursing literature, however, with respect to how to determine if items should be weighted. This thesis demonstrated that item threshold and item discrimination parameters in item response theory (a relatively unused approach in nursing) can provide insights into whether, and to what extent, items should be weighted when deriving a scale score. This contribution is described in Study #3 (Chapter 4).

Theoretical (Research Utilization in Nursing Theory) Contributions

In addition to making significant methodological contributions, the findings described in this thesis also contribute to research utilization in nursing theory by validating (supporting) existing theoretical knowledge and generating new theoretical knowledge. The theoretical contributions include:

A. Assessment of research utilization instruments and development of an instrument hierarchy (building theory)

B. Validation of known associations between individual (nurse) factors and research utilization (confirming theory), as well as the identification of new individual factors associated with research utilization (building theory)

C. Generation of new knowledge on research utilization behaviours by unregulated nursing care providers in long-term care (nursing home) settings (building theory)

D. Confirmation that elements of Rogers' Diffusion of Innovations theory [27] are transferable to research utilization in nursing (building theory regarding the applicability of Rogers' theory to nursing)

A. Assessment of Research Utilization Instruments and Development of an Instrument Hierarchy. (Study #1/Chapter 2)

Little is known about the reliability and validity of research utilization instruments. This thesis contributes significantly to building knowledge in this area. I presented the only comprehensive assessment to date of the reliability and validity of research utilization instruments in the nursing (and in healthcare) literature. In doing this, I also developed and presented the first research utilization instrument hierarchy of which I am aware. The hierarchy can be used: (1) to identify populations and settings for, and sources of evidence that should be sought, in future validation studies; and, (2) by nursing and other health services researchers and decision-makers to inform their selection of research utilization instruments to conduct research and/or evaluate research utilization in their organizations.

There is widespread discussion, but with little consensus, in the literature as to what is the *best* approach to measuring research utilization. The assessment of research utilization instruments presented in this thesis support there are two main approaches to conceptualizing (and thus measuring) research utilization: (1) process (or stages/steps) and (2) variance (or variable/discrete event) (see Section E: Process and Variance Conceptualizations of Research Utilization for additional contributions with respect to these two conceptualizations). A second contribution (related to research utilization conceptualization) coming from this assessment is the identification of several instruments labeled as 'research utilization instruments' that do not actually measure research utilization *per se.* Rather, they measure factors believed to be desirable qualities for making research utilization happen. While such measures can be treated as proxies for research utilization, they should be clearly labeled in this manner so that appropriate interpretations based on their scores can ensue.

The assessment of research utilization instruments, resulting hierarchy, and conceptualization contributions are described in Study #1 (Chapter 2).

B. Individual Factors and Research Utilization (Study #2/Chapter 3)

In this thesis, I validated and expanded upon existing nursing knowledge regarding the individual (nurse) factors that are associated with research utilization. I reinforced conclusions made in a previous review (Estabrooks [2]) that a positive attitude towards research and nursing role (i.e., working in an advanced practice/leadership role compared to staff nurse role) are positively associated with research utilization, and that age and experience are not associated with research utilization. In addition, I also expanded upon the knowledge generated in this previous review by identifying four additional factors, which are associated with research utilization by nurses. These factors are: (1) attending conferences/in-services, (2) having a graduate degree in nursing, (3) working in a specialty area, and, (4) being satisfied with one's job. I also concluded that one new additional factor was not associated with research utilization: completion of a research class.

The individual factors identified above hold promise as potential targets of future interventions to improve patient care by increasing research utilization by nurses (Figure 1-1). Research utilization interventions are more likely to be effective when based on theory or strong empirical evidence [28, 29]. The factors identified in this thesis (as a result of Study #2) are from systematic review methods. Systematic reviews represent the highest level of evidence [30]. However, to maintain their relevance, systematic reviews need to be updated regularly as new research evidence accumulates; systematic reviews that are out of date are of limited value. In conducting a systematic review update, I contributed to validating and building theory in the field by generating a *current and relevant* summary of individual (nurse) factors associated with research utilization by nurses. This list can be used to assist the design of future research utilization interventions to build further theory in the field with respect to effective research utilization interventions.

The assessment of individual (nurse) factors associated with research utilization is described in Study #2 (Chapter 3).

C. Research Utilization by Unregulated Nursing Care Providers in Long-Term Care Settings (Study #3/Chapter 4; Study #4/Chapter 5)

Current research utilization in nursing theory predominantly describes characteristics (individual and organizational) that facilitate research use by registered nurses. Other nursing care providers (such as licensed practical nurses and healthcare aides who provide the majority of nursing care in long-term care settings) have not been the focus of study or theory development. This thesis generates new knowledge in this area and thus, provides the building blocks for beginning theory on research utilization by unregulated nursing care providers.

This knowledge comes in three forms: (1) precision, reliability, validity, and acceptability of a new scale measuring conceptual research utilization; (2) the existence of, and associations between, several *kinds* of research utilization; and, (3) individual factors that predict research utilization.

In addition to generating new knowledge, the findings from Study #4 (Chapter 5) also support elements of Estabrooks' [22] theory of research utilization (although not labeled as 'theory' by Estabrooks). Estabrooks' theory proposes that instrumental research utilization, conceptual research utilization, and persuasive research utilization covary and are sources of overall research utilization. Estabrooks [22] developed this theory for, and empirically tested it, with registered nurses. While I did not formally *test* the actual model proposed in this theory, I was able to conclude through correlation and regression analyses that, in this population (healthcare aides in nursing homes): (1) the four types of research utilization proposed in Estabrooks' theory are significantly correlated with one another at low to moderate levels and (2) instrumental research utilization, conceptual research utilization, and persuasive research utilization predict overall research utilization.

The contributions listed above are described in Study #3 (Chapter 4) and Study #4 (Chapter 5).

D. **Rogers' Diffusion of Innovations Theory** (Study #1/Chapter 2; Study #2/Chapter 3; Study #4/Chapter 5)

Roger's Diffusion of Innovation Theory [27] is the dominant theory used in nursing research utilization studies. Findings from this thesis revealed that when Rogers' theory is used in nursing research utilization studies it is predominantly used to support the derivation of an adoption score (which has been equated to a 'research utilization' score in the literature) using the Nurses Practice Questionnaire (NPQ) as an assessment instrument (Study #1). The NPQ was developed by Brett [31] using Rogers' *Innovation Decision Process* Theory, a component of his larger *Diffusion of Innovations* Theory, as a guiding framework. Findings from this thesis show the 'adoption' scores obtained from the NPQ have satisfactory reliability and moderate validity (a Level 2 instrument) when completed by hospital-based nurses. This finding provides support for using Rogers' *Innovation Decision Process* Theory to research utilization in nursing. However, despite findings of adequate reliability and validity of scores obtained with the NPQ, there remain some outstanding issues associated with its use in nursing research utilization studies (see Section E: Process and Variance Conceptualizations of Research Utilization).

This thesis also provides empirical support for the use of Rogers' larger *Diffusion of Innovations* Theory [26] to guide variable (individual factor) selection to inform the design of research utilization in nursing interventions. This empirical support comes from the fact that several of the same individual factors described in Rogers' theory as positively influencing innovation diffusion (e.g., attitude, information-seeking – equated with attending conferences/in-services in Study #2) were also shown in this thesis to be consistently associated with research utilization by nurses. This lends support to being able to equate 'research' with 'innovation', which has been an inhibiting factor in using this theory to date in nursing. In addition to providing this supporting empirical evidence, this thesis also adds to Rogers' theory by identifying two additional factors important to research utilization: (1) working in specialty areas and (2) being satisfied with one's job. These two factors may also translate into being important to innovation diffusion in other disciplines.

Study #4 (Chapter 5) in this thesis also contributes to Rogers' theory [26], both in terms of validating the theory for use in the nursing sector and also generating new knowledge re additional factors important to overall research utilization. The findings from this study (Study #4) supported 'attitude towards research' as a predictor of research utilization (defined as best practices for this population – unregulated nursing care providers in nursing homes). It did not, however, support information seeking (attending conferences/in-services) as a predictor of research utilization. Study #4 also generated new knowledge that other kinds of research utilization (which are not part of Rogers' theory) also predict research utilization by unregulated nursing care providers in nursing homes.

These findings demonstrate that while components of existing theories (developed for other disciplines) such as Rogers' theory can be easily re-synthesized for use in nursing service delivery populations, they require thorough testing in nursing populations to ensure they can be practically used to explain nursing practice. That is, they cannot be applied directly as they exist in other disciplines.

E. Process and Variance Conceptualizations of Research Utilization
(Study #1/Chapter 2; Study #2/Chapter 3; Study #4/Chapter 5)

The research utilization in nursing literature is characterized by multiple conceptualizations of research utilization. These conceptualizations influence how we define research utilization and, consequently, how we measure the construct and interpret the scores obtained from such measurement. Two prevailing conceptualizations dominating the field are: (1) research utilization as process (i.e., consists of a series of stages/steps) and (2) research utilization as variable or discrete event (also referred to as the 'variance' approach). Despite debate in the literature with respect to these two conceptualizations, Study #1 of this thesis revealed that the vast majority of instruments that measure research utilization directly do so using a 'variance' approach. Only two instruments were identified that measure research utilization using a 'process' conceptualization. These two instruments are: (1) Brett's Nurses Practice Questionnaire (NPQ) [31] (which is based on Rogers' *Innovation Decision Process* Theory [27, 32]) and (2) Belkhodja and colleagues' instrument (which is based on Knott and Wildavsky's *Standards of Research Use* model [33]). The scores obtained using both of these 'process' instruments revealed acceptable reliability (Cronbach alpha above the accepted standard of .70) and moderate validity (Level 2 instruments). Despite these findings, however, an unresolved issue in using a 'process' conceptualization is: how to interpret 'process' scores of research utilization?

From a process perspective, research utilization is defined as a set of linear stages. For example, Rogers [27, 32] describes a five staged process: (1) awareness, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation. Knott and Wildavsky describe seven standards of research use, which also follow a linear process: (1) reception, (2) cognition, (3) reference, (4) effort, (5) adoption, (6) implementation, and (7) impact. I do not adhere to the belief that research utilization is a process *per se*. However, I do believe that a process (when research use in conscious and intentional) precedes the actual event of research utilization. Meaning, research utilization is the final step or end result of a process. In Rogers' theory, research utilization is step four (implementation) of the five steps with only confirmation proceeding it, and in Knott and Wildavsky's Standards perspective, research utilization is step six (implementation) of the seven steps, similarly with only impact proceeding it. Thus, research utilization as I see it is the outcome of a process. Given this view, how do we go about interpreting the range of scores that result from 'process' instruments? For instance, scores (called Total Innovation Adoption Scores) ranging from 0 to 4 are theoretically possible (and have been reported) in studies using the NPQ to assess research utilization. A stage of adoption (as per Rogers' *Innovation Decision Process* Theory [27, 32]) is then assigned to the resulting score: 0 – 0.49 (unaware), 0.5 – 1.49 (aware), 1.5 – 2.49 (persuasion), 2.5 – 3.49 (use sometimes), and 3.5 – 4.0 (use always). Using this schematic, a research utilization score of '1' is feasible. This score is interpreted as the respondent is aware of the research findings and is 1 (on a 0-4 scale) with respect to using research. What is unclear is how this is 'using research' if no 'use' is actually occurring? While no one would argue that awareness is desirable and in many cases, necessary, for research utilization to occur, it is not ' research use' *per se* nor does it guarantee that research use will occur. In line with Rogers' theory (from which this scoring is stated to have been developed), an individual may be aware of the innovation (research findings) and still chose not to use it in practice if they are not persuaded of its effectiveness.

A second complication associated with 'process' scores is how the final score is derived. For example, in Brett's' NPQ, a respondent receives 1 point if they are aware, 1 point if they are persuaded, 1 point if they use the research finding sometimes, and 2 points if they use it always; these points are additive to reach a final research utilization score that can range from 0 to 4. However, a respondent may use a research finding always but not be aware it is research or persuaded of its effectiveness (obtaining a final score of 2). Based on this score, this respondent would be classified as persuaded of, but not using, research. This would be an incorrect classification. At the same time, a score of 2 would also be obtained for a second respondent who is aware of and persuaded of the same research finding but not using it. This respondent would also be classified as persuaded of, but not using, research. In this scenario, the classification would be correct. But based on the scores obtained, both respondents would be considered ‘using research’ to the same extent – an erroneous conclusion. Whether a process conceptualization of research utilization is valid remains unclear to me; if it is, new measures with improved scoring are required. In line with my definition of research utilization (the use of research to inform practice), I believe research utilization is an event that is best measured using a variance approach.

My Next Steps

I began my journey into the science of research utilization in nursing in my Master’s program. The research I conducted there highlighted for me that there are serious limitations with current instruments used to measure research utilization by nurses. This, in part, laid the foundation for my PhD thesis, in which I conducted a much-needed exploration into research utilization in nursing measurement. In the next phases of my research program, I will: (1) continue my pursuit towards better research utilization measures for nurses specifically and extend this to other groups of healthcare providers as well as care units/ organizations; (2) evaluate whether patient outcomes are sensitive to varying levels of research utilization; (3) continue systematic investigation into the identification of factors that are important to research utilization (to inform intervention design); and (4) test the causal pathway depicted in the conceptual model shown in Figure 1-1, specifically the pathways between individual and organizational factors, research utilization, and patient outcomes (to inform intervention design). Prior to initiating this second phase of my program (outlined above), I will undertake postdoctoral studies that will focus on intervention design and evaluation (to enable me to carry out Phase 3 of my research program, which will be comprised of research utilization intervention design and evaluation. During my postdoctoral training, I plan to continue to conceptually develop my research program and write a proposal for the first project listed below.

Following my postdoctoral training I will work towards undertaking the following four projects.

1. Modification and assessment of precision, reliability, validity (following the *Standards*), and acceptability of the *Conceptual Research Utilization Scale* with regulated (registered nurses, licensed practical nurses) and unregulated (healthcare aides) nursing care providers in different facility-based settings: (1) adult hospitals, (2) pediatric hospitals, and (3) nursing homes.

2. Development and testing (following the *Standards*) of measures of instrumental, persuasive and overall research utilization with regulated (registered nurses, licensed practical nurses) and unregulated (healthcare aides) nursing care

providers in different facility-based settings: (1) adult hospitals, (2) pediatric hospitals, and (3) nursing homes.

3. Assessment of the formal structure of research utilization in nursing (utilizing data from studies one and two above).

4. Assessment of the causal links between individual factors, contextual factors, research utilization, and patient outcomes.

Conclusion

In this thesis I conducted four studies, which represent the initial steps in uncovering the current state of measurement science underpinning the science of research utilization in nursing. Findings from this thesis revealed significant under development in the measurement of research utilization in nursing and that substantial methodological advances focusing on construct clarity, use of measurement theory, and conducting standard and advanced psychometric assessments is needed for the field is to significantly advance and to ensure the availability of defensible measures of research utilization. Findings from this thesis also suggest that: (1) there is limited investigation into *kinds* of research utilization or research utilization by nursing care providers outside of hospital-based registered nurses; (2) adopting a unitary perspective of validity results in a substantially more comprehensive and accurate validity assessment compared to a traditional perspective of validity; (3) the *Standards* provides a useful framework for grouping instruments according to established validity sources, as well as for conducting and reporting findings from an instrument validation study; (4) item response theory is an appropriate theory for evaluating precision of research utilization instruments and can provide additional and valuable psychometric information that is not provided in traditional classical test score theory psychometric assessments; and (5) research utilization is currently best measured with a variance approach. Finally, investigation into the science of research utilization in nursing, with a few exceptions, is dominated by single, one time studies by individual nurse researchers. In order to fully realize substantial advances in the field, researchers will need to build programs of research extending several years to examine the core issues in the field, of which one component should be the measurement of research utilization.

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Appendix: The Conceptual Research Utilization Scale

The Conceptual Research Utilization Scale

*On your **LAST typical work day on Unit ________**, how often did best practice knowledge about things like pain management, preventing falls, and managing difficult behaviors do any of the following?*

	Never	Rarely	Occasionally	Frequently	Almost Always
1. Give you new knowledge or information about how to care for residents.	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
2. Raise your awareness about new ways to care for residents.	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
3. Help to change your mind about how to care for residents.	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
4. Give you new ideas about how to care for residents.	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5
5. Help you make sense of things you have been doing to care for residents.	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5

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