Title: Systematic review of knowledge translation strategies to promote research uptake in child health settings

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Background

Effective strategies that assist evidence-based decision-making for healthcare professionals are crucial to ensuring high quality patient care and outcomes. Over the past decade there has been a rapid expansion of available scientific evidence to inform health care interventions with a concomitant endorsement of evidence-based health care by professional governing bodies, healthcare professional training programs and regional health authorities. Despite these factors, there is a widening gap between research (what we know) and practice (what we do) with the majority of healthcare professionals not drawing upon the best research evidence to guide clinical practice decisions (Institute of Medicine, 2001). Previous research demonstrates that 30 - 40% of patients do not receive care complying with current research evidence and 20 - 25% of the care provided is not needed or potentially harmful (Freedman et al., 2011; Grol, 2011; Hampers & Faries, 2002; Johnson et al., 2006; Knapp, Simon & Sharma, 2008; Schuster, McGlynn & Brook, 1998). In response, knowledge translation (KT) strategies have been developed and implemented to bridge the research practice gap, yet their impact on health care delivery and patient outcomes has been varied (Grimshaw et al., 2004; Bero et al., 1998; Oxman, Thomson, Davis & Haynes, 1995; Thompson, Estabrooks, Scott-Findlay, Moore & Wallin, 2007). Previous systematic reviews have explored KT strategies in relation to various professional groups, such as physicians, nurses and allied health professionals (Grimshaw et al., 2004; Bero et al., 1998; Oxman, et al., 1995; Thompson et al., 2007; Scott et al., 2012) and multidisciplinary systematic reviews specific to one clinical area (i.e., spinal cord injury, child and youth mental health) (Barwick et al., 2012; Noonan et al., 2014) or one area of practice (i.e., public health, rehabilitation) (LaRocca, Yost, Dobbins, Ciliska & Butt, 2012; Menon, Korner-Bitensky, Kastner, McKibbon, & Straus, 2009) have been completed. However, a systematic

review of KT strategies in child health irrespective of professional group and clinical focus has not been completed. While the concept of multidisciplinarity draws on knowledge from different disciplines separately, interdisciplinarity synthesizes knowledge from the disciplines into an interactive whole (Choi & Pak, 2006). As effective health care delivery is dependent upon interdisciplinary collaboration, and the science of KT is well-accepted as being interdisciplinary, a more productive approach would be to systematically review the literature and include interventions for multiple provider groups respective of the unique features of the clinical setting.

Child health settings are unique, multidisciplinary settings encompassing a wide-range of healthcare professionals. Previous research points to the unique challenges of child health settings including higher emotional investment from healthcare professionals (Coetzee, 2004; Watson & Field, 1995), the expectation of family-centered care (Bruce et al., 2002; Hutchfield, 1999), and unique ethical situations (Watson & Field, 1995). Thus, in the current health care climate that demands care to be based upon recommendations from the latest, accepted research, it is essential that KT strategies employed in child health settings be: 1) multidisciplinary in nature thereby reflecting the eclectic professional mix evidenced in today's child health settings (and not developed on a discipline by discipline basis), and 2) based upon previous research findings from similar child health settings.

Understanding the most effective ways of translating evidence into clinical practice for different health professional groups and different health care settings has been identified as a key priority in North America (Dault, Lomas & Barer, 2004; Institute of Medicine, 2001). This highlights the need to break down organizational and professional silos that characterize healthcare and understand the most effective ways of translating evidence into practice from the

perspective of health professional groups and settings. The goal of this study was to identify and synthesize the evidence on interventions aimed at putting research into child health settings.

Methods

Literature Search

A comprehensive search strategy was developed by a health research librarian in collaboration with content expertise of the research team to identify all relevant articles (Appendix A). The following electronic databases were searched: MEDLINE, PubMED, Ovid MEDLINE, Cochrane Central Register of Controlled Trials, EPOC systematic review database, Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects, Health Technology Assessment Database, HealthStar, EMBASE (Excerpta Medica), CINAHL, PsycINFO (Psychological Abstracts) and Sociological Abstracts using date (1985-May 2008) using language (English) and restrictions (Morrison et al., 2009). The date restrictions reflect the emergence of the evidence-based medicine/evidence-based practice and the KT movements and were purposively selected to capture all relevant literature. Reference lists of relevant articles were also examined. The same search strategy was updated in 2011 by a health research librarian to identify all relevant articles from the time of the previous search (2008) to 2011. The research designs were restricted to randomized controlled trials (RCTs), controlled clinical trials (CCT), and controlled before-after (CBA) studies. The research design restriction was determined after the initial 2008 search was executed due to volume of literature. The updated 2011 search only included these three designs.

Inclusion Criteria

Studies were included if they met the following pre-determined inclusion criteria:

1) primary research study employing either RCT, CCT, or CBA study design;

2) target population was healthcare professionals (i.e., physicians, nurses, allied health professionals) working in child health settings;
3) interventions had a primary purpose of implementing research into pediatric practice; and
4) outcomes measured the change at the professional/process, patient, or economic level.

Study Selection

Two reviewers (LA, MA) independently screened the search results to determine whether the study met the inclusion criteria. Each article was rated as include, exclude or unclear. The full texts of all articles classified as include or unclear were retrieved for review. Two reviewers independently assessed the full reports of each potentially relevant study using standard forms and predetermined inclusion criteria. Where there were disagreements between the two reviewers, a third reviewer (SS) discussed the discrepancies and made the final determination.

Data Extraction

Two independent reviewers (LA, MA) applied a research design algorithm (Hartling, Bond, Santaguida, Viswanathan & Dryden, 2011) and the Cochrane Effective Practice and Organisation of Care Review Group (EPOC) Data Collection Checklist (2015) to extract data from the included studies. Key data extracted were: study design, subjects, setting, interventions and outcomes (Appendix B). Data was then checked for accuracy and completeness. Discrepancies were discussed and resolved by referring to the original report, and if needed, third party adjudication.

Quality Criteria

Methodological quality of included studies was assessed using the Quality Assessment Tool for Quantitative Studies (Effective Public Health Practice Project, 2009) (Appendix C). Content validity (determined by content experts), construct validity (91.7% and 65% for two

reviews), inter-rater reliability (Kappa statistic 0.71 and 0.64 for two reviewers) have been established for this tool (Thomas, Ciliska, Dobbins & Micucci, 2004). Two reviewers (LA, MA) independently used this tool to assess the quality of included studies. The validated rating process included assigning a global quality rating of weak, moderate or strong to each study based on eight component rating sections: selection bias, study design, confounders, blinding, data collection methods, withdrawals and dropouts, intervention integrity, and analysis. Where there were disagreements between the two reviewers, a third reviewer (SS) discussed the discrepancies and made the final determination. Studies were not excluded based on methodological quality assessment rating because we sought to explore the general state of this science in child health settings.

Data Analysis

Study outcome data were aggregated and analyzed according to the type of KT strategy(ies) using the EPOC Data Collection Checklist (2015) (Appendix B) . The KT strategies were tabulated using descriptive statistics. Descriptive (narrative) analysis was also used to identify potential patterns (e.g., similarities, anomalies, etc.) in terms of targeted behaviours, study outcomes, and intervention effectiveness. This descriptive analysis satisfied two goals: it allowed us to 1) examine strategies that were successful and; 2) explore what it was about different strategies that worked, for whom, and under what circumstances (Pawson, Greenhalgh, Harvey & Walshe, 2005). Meta-analyses could not be conducted due to methodological and clinical heterogeneity of the studies.

Results

Included Studies

Figure 1 (Appendix D) illustrates the study inclusion/exclusion process for both searches. Overall, 21 studies met the inclusion criteria and were included in the systematic review (Table 1). Of these studies, there were 13 RCTs, 2 CCTs, and 6 CBAs.

Table 1 (Appendix E) provides a detailed overview of the studies including author, year of publication, country of origin, profession, intervention(s), type of targeted behaviour, primary outcome, and intervention effect on primary outcome. Studies in Table 1 are organized by research design, with authors listed in alphabetical order within each research design category.

Methodological Quality

The methodological quality of included studies was assessed using the Quality Assessment Tool for Quantitative Studies (Effective Public Health Practice Project, 2009). Studies were classified as strong (n = 2), moderate (n = 8), and weak (n = 11) (Appendix F). Both studies rated as strong were RCTs. Six RCTs and two CBAs were rated as moderate. Five RCTs, two CCTs, and four CBAs were classifies as weak.

KT Interventions

Studies employing single KT interventions (n = 9) and multiple KT interventions (n = 10) were evenly divided. The two remaining studies were three-arm trials, with one trial comparing two different single interventions to a non-intervention control (Clarkson et al., 2008) and the other trial comparing two different single interventions to a multiple intervention group (Hillman et al., 1999). The majority of interventions included an educational component (n = 14) (e.g., educational material, educational meeting, educational outreach visit). Other interventions that were studied included: clinical multi-disciplinary teams (n = 4), audit and feedback (n = 3), reminders (n = 3), and financial (n = 2).

Primary Outcomes

158 Of the 21 included studies, the primary outcomes were professional/process outcomes (n
159 = 14), patient outcomes (n = 1), and economic outcomes (n = 2). One study identified both
160 professional/process and patient outcomes as primary outcomes (Horbar et al., 2004) and three
161 studies did not clearly identify the primary outcome from multiple outcomes identified and
162 measured (Cabana et al., 2006; Clark, Cabana, Kaciroti, Gong & Sleeman, 2008; Epstein et al.,
163 2007).

164 **Effect of Intervention(s)**

165 Primary outcomes were classified using three broad categories (i.e., professional/process,
166 patient, economic); however, it was typical for an identified primary outcome to be measured in
167 multiple ways. At times, this practice led to inconsistent (mixed) results within the primary
168 outcome(s). To address this, we looked for consistency (e.g., all positive or all negative effects)
169 within the results. Studies were classified as having inconsistent (mixed) effect on primary
170 outcomes if they satisfied one of the following three criteria. First, the study demonstrated
171 statistically significant improvement in some of the outcomes identified as primary but not in
172 others. Second, the number of measures was unclear or only a portion of a measure's sub
173 components achieved statistically significant change (e.g., tenets of the theory of planned
174 behavior include attitudes, normative influences, perception of control and intention yet change
175 may not be achieved in all components). Third, all groups, including the control group, showed a
176 change in behavior and therefore the change could not be attributed to the KT intervention
177 strategy. Studies that had all positive or all negative effects for the same outcome were
178 categorized as having consistent effect. Finally, studies in which the results were not clearly
179 linked to the identified outcome(s) were classified as 'unclear.'

Table 3 (Appendix G) reveals several findings: 1) less than half of the included studies demonstrated consistent effect on the primary outcome(s) (n = 8); 2) the remaining 13 studies reported inconsistent (mixed) effect on the primary outcome(s); and, 3) the number of measures and outcomes used to determine the effect of the intervention(s). The majority of studies demonstrating a consistent, positive effect employed a single measure classified as one primary outcome; however, the majority of studies demonstrating inconsistent (mixed) effect used multiple measures classified as one or more primary outcomes.

RCTs Demonstrating Consistent, Positive Effect

The three RCTs that demonstrated consistent, statistically significant effects were single KT intervention studies that assessed healthcare professional/process outcomes. Christakis, Zimmerman, Wright, Garrison, Rivara & Davis (2001), used reminders to influence the prescribing behaviours of residents (n = 29), attendings (n = 7) and nurse practitioners (n = 2) for the treatment of acute otitis media. The success of the intervention was measured using a healthcare professional/process outcome specifically defined as a reduced duration of therapy below the typical 10-day course. The study findings revealed that the intervention group receiving the reminders had a statistically significant increase in antibiotic prescriptions of less than 10 days duration. In a related study, Davis et al. (2007) used reminders to influence prescribing behaviours of residents (n = 37), attendings (n =7), and nurse practitioners (n = 4) for the treatment of acute otitis media, allergic rhinitis, sinusitis, constipation, pharyngitis, croup, urticarial, and bronchiolitis. Intervention success was measured using a healthcare professional/process outcome; specifically, the proportion of prescriptions dispensed in accordance with research evidence for the eight conditions together. This study found that in the intervention group receiving the reminders, provider prescribing behaviour in accordance with

the evidence for all eight conditions assessed as a single group was shown to have a statistically significant increase. Tebb, Wibbelsman, Neuhaus & Shafer (2009) used a clinical multidisciplinary team to influence clinical prevention services of administrators, medical assistants, nurses, and other practitioners in ten urgent care sites in relation to screening for chlamydia trachomatis (CT). The success of the intervention was measured using healthcare professional/process outcome specifically defined as an increase in the clinic-specific proportion of adolescent girls screened for CT. The implementation of a clinical multidisciplinary team in the intervention sites resulted in a statistically significant improvement in the clinic-specific proportion of adolescent girls screened for CT.

CCTs Demonstrating Consistent, Positive Effect

Two CCTs demonstrated consistent, statistically significant effects on the primary outcome(s). Clarkson et al. (2008) used a three-arm study to measure the effect of fee-for-service and educational meetings to improve dentists' sealant treatment rate. The success of the intervention was measured by a healthcare professional/process outcome, specifically defined as an increased percentage of 12 -14 year olds with sealed secondary permanent molars. A statistically significant increase in the use of sealant treatment was observed in the fee-for-service-arm, as compared with the education arm (i.e., educational meeting) and the no-intervention control arm. The education-arm experienced a consistent, but non-statistically significant increase in sealant treatment. Shafer et al. (2002) used the creation of a clinical multidisciplinary team to influence clinical prevention services of administrators, medical assistants, nurses, and other practitioners in relation to screening sexually active adolescent girls for chlamydia trachomatis (CT) during routine check-ups. Intervention success was measured using the healthcare professional/process outcome of an increase in the CT screening rate for 14

- 18 year old girls during routine check-ups. The implementation of a clinical multidisciplinary team in the intervention sites resulted in statistically significant improvement in urine-based CT screening rate.

CBAs Demonstrating Consistent, Positive Effect

One CBA study demonstrated consistent, statistically significant effects on the primary outcome(s). Naimoli, Rowe, Lyaghfouri, Larbi & Lamrani (2006) used multiple KT interventions (i.e., two different educational meetings and educational outreach visits) to influence the use of evidence-based clinical guidelines and prescribing behaviours of physicians, nurses, nursing aids, and other healthcare professionals. Intervention success was determined by measuring the healthcare professional/process outcome of overall guideline adherence and appropriate antibiotic prescriptions. Children in the intervention group received better quality care; improved guideline adherence and appropriate antibiotic prescriptions were strongly associated with the intervention.

Discussion

This systematic review assessed the evidence on KT strategies aimed at integrating research into healthcare professionals' practice in child health settings. More than half of the included studies displayed mixed effects on primary outcome measures (n = 13), a phenomenon that has previously been noted in other multidisciplinary systematic reviews in the health sciences (Scott et al., 2012). This may be attributed to issues surrounding study outcomes, including outcome identification (i.e., too broad, unclear which is primary), outcome measurement (i.e., multiple measures for broad outcomes), and outcome reporting (i.e., not reporting data for all outcome measures, lack of detail). Lack of methodologically-sound research on KT interventions is also evident in this review, as it has been in previous systematic

reviews (Barwick et al., 2012; Menon et al., 2009; Noonan et al., 2014; Scott et al., 2012). Even among the three most rigorous study designs (i.e., RCT, CCT, CBA) 12 studies in this review were assessed to be methodologically weak. Given the state-of-the-science, strong practice recommendations cannot be generated from this synthesized evidence base.

Effective KT Interventions

Six of eight studies with consistent effects on outcome measures displayed statistically significant, positive effects (Table 3). In this cohort of studies, all three study designs were represented (RCT = 3, CCT = 2, CBA = 1). Interestingly, two of these studies showed consistent, statistically significant, positive effects on outcomes related to the management of acute otitis media, specifically reduction and/or appropriateness of antibiotics use (Christakis et al., 2000; Davis et al., 2007). This may be due to the increased strength and clarity of the evidence for reducing the role of antibiotics in treatment and management of this condition (Coker et al., 2010; Venekamp, Sanders, Glasziou, Del Mar & Rovers, 2015), and the relative ease of measuring well-defined health professional/process outcomes related to this (i.e., duration of therapy, proportion of prescriptions dispensed).

Additionally, this cohort of six studies with consistent, statistically significant, positive effects largely examined single KT interventions (n = 5). This finding aligns with recent knowledge synthesis evidence indicating that single KT interventions may be as effective as or more effective than multi-component KT interventions (Squires, Sullivan, Eccles, Worswick & Grimshaw, 2014). In this review, two of the single KT intervention studies used reminders (Christakis et al., 2000; Davis et al., 2007), reflecting previous synthesized evidence that reminders are effective in changing health professional behaviours in a variety of clinical practice settings (Cheung et al., 2012). Another two studies in this review employed

multidisciplinary teams as the KT intervention (Shafer et al., 2002; Tebb et al., 2009). This aligns with previous evidence indicating that multidisciplinary teams can lead to positive changes in health care (Zwarenstein, Goldman & Reeves, 2009) and strengthens our assertion of the importance of multidisciplinarity for practice change efforts in child health settings. This is a promising area requiring further research to fully understand the benefits of multidisciplinary teams as a KT strategy in child health.

Removing studies that were assessed to have weak methodological quality from this cohort of six, only three studies of moderate to strong methodological quality demonstrated effective interventions (Christakis et al., 2000; Naimoli et al., 2006; Tebb et al., 2009). The interventions in this group included two single, non-educational interventions (i.e., reminders, clinical multidisciplinary team), and one multiple educational intervention (i.e., educational meeting "train the trainer," educational meeting "group session lead by trainer," educational outreach visits). Limited recommendations can be drawn about the effectiveness of these specific KT interventions; however, these findings align with systematic review evidence demonstrating the effectiveness of reminders (Arditi, Rege-Walther, Wyatt, Durieux, & Burnand, 2012; Shojania et al., 2009). Previous research has also shown modest practice change using educational meeting and workshop interventions (Forsetlund et al., 2009); effectiveness of this strategy is enhanced by incorporating didactic and interactive components, focusing on serious outcomes, and increasing attendance at these sessions (Forsetlund et al., 2009). Clinical specific systematic reviews on KT strategies also highlight a similar over reliance on educational approaches, yet consistently educational sessions result in little improvement (Barwick et al., 2012; Noonan et al., 2014). Other key features of the three moderate to high quality, effective intervention studies were: 1) they were all multidisciplinary, and 2) they examined a small

number of professional/process outcome measures (i.e., Christakis et al., 2000 and Tebb et al., 2009 each had one outcome measure and Naimoli et al., 2006 had two outcome measures) at the level of individual behaviour change, rather than more distal outcomes examining the results of individual behaviour change (i.e., patient level or economic outcomes).

Future Research

A number of KT intervention categories were absent from this review, including local consensus process, local opinion leaders, and marketing, which emphasize a ground-up approach to communicating within a multidisciplinary team rather than the top-down approach of educational materials and meetings. Future research should explore the use of these KT interventions, as a variety of related communication techniques (i.e., team liaison, consensus, regular team meetings, local champion), were reported as knowledge translation facilitators by Noonan and colleagues (2014). Patient-oriented interventions, including financial and organizational approaches were also not used in this setting, most likely due to the complexity of family-centered care and the extent of parent involvement. Structural and regulatory interventions were also absent, likely due to the purview of control of these overarching healthcare decisions. These gaps illustrate the historical emphasis on education as an approach to KT, which has not proven to be widely beneficial for creating and sustaining practice change in a variety of professions, settings, and health conditions (Scott et al., 2012). Further research into under-utilized KT interventions is key to understanding what works, for whom, and in what context.

Limitations

This review was limited to three study designs. A complementary review of the remaining study designs extracted during the initial stages of this review could provide further

understanding of the outcomes of interventions aimed at changing the behaviors and practices of other healthcare providers. These other study designs include pretest-posttest, case studies and qualitative research.

Conclusions

There is an urgent need to provide recommendations to pediatric healthcare professionals and decision-makers responsible for increasing the utilization of research in child health care settings. This multidisciplinary review, specific to child health settings, serves as a 'state of the science' on KT strategies used in pediatric professionals' clinical practice.

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Appendix A

Search Strategy Sample from 1995-2008 (1 database only)

The same search strategy was run in the same databases from 2008 to 2011 with the date limitors changed to reflect this updated time period.

Ovid MEDLINE search (6/2/2008)

1. exp adolescent/
2. exp child/
3. exp infant/
4. exp pediatrics/
5. (child* or infant* or adolescent* or p*ediatric*).mp.
6. 1 or 2 or 3 or 4 or 5
7. exp diffusion of innovation/
8. (diffus* adj5 innovat*).mp.
9. exp evidence based medicine/
10. exp health services research/
11. exp utilization review/
12. exp organizational innovation/
13. exp information dissemination/
14. exp technology transfer/
15. (knowledge adj5 (utiliz* or uptake or transfer* or implement* or disseminat* or translat*)).mp.
16. (research adj5 (utiliz* or uptake or transfer* or implement* or disseminat* or translat*)).mp.
17. evidence based medicine.mp.
18. (health adj5 services adj5 research).mp.
19. (utiliz* adj5 review).mp.
20. (organization* adj5 innovat*).mp.
21. (information adj5 disseminat*).mp.
22. (technology adj5 transfer*).mp.
23. exp practice guideline/
24. exp guideline/
25. exp intervention studies/
26. exp clinical protocols/
27. exp organizational case studies/
28. exp guideline adherence/
29. exp professional staff committees/
30. exp professional review organizations/
31. exp practice guidelines as topic/
32. exp licensure/
33. exp nursing audit/
34. exp medical audit/
35. exp dental audit/
36. exp clinical audit/
37. exp benchmarking/
38. exp physician's practice patterns/
39. exp delivery of health care, integrated/
40. exp health knowledge, attitudes, practice/
41. exp attitude of health personnel/
42. exp point of care systems/
43. exp dentist's practice patterns/
44. exp interdepartmental relations/

45. exp program development/
46. exp practice management/
47. exp models, organizational/
48. exp efficiency, organizational/
49. exp organizational policy/
50. exp reminder systems/
51. exp decision support systems, management/
52. exp decision support systems, clinical/
53. exp informatics/
54. exp audiovisual aids/
55. exp teaching materials/
56. exp pamphlets/
57. exp formularies/
58. exp manuals as topic/
59. exp persuasive communication/
60. exp interdisciplinary communication/
61. exp feedback/
62. exp educational technology/
63. exp inservice training/
64. exp education, continuing/
65. exp education, professional/
66. exp interprofessional relations/
67. 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22
68. 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66
69. 6 and 67 and 68
70. limit 69 to (english language and yr="1985 - 2008")

ediatric).mp.
6. 1 or 2 or 3 or 4 or 5
7. exp diffusion of innovation/
8. (diffus* adj5 innovat*).mp.
9. exp evidence based medicine/
10. exp health services research/
11. exp utilization review/
12. exp organizational innovation/
13. exp information dissemination/
14. exp technology transfer/
15. (knowledge adj5 (utiliz* or uptake or transfer* or implement* or disseminat* or translat*)).mp.
16. (research adj5 (utiliz* or uptake or transfer* or implement* or disseminat* or translat*)).mp.
17. evidence based medicine.mp.
18. (health adj5 services adj5 research).mp.
19. (utiliz* adj5 review).mp.
20. (organization* adj5 innovat*).mp.
21. (information adj5 disseminat*).mp.
22. (technology adj5 transfer*).mp.
23. exp practice guideline/
24. exp guideline/
25. exp intervention studies/
26. exp clinical protocols/
27. exp organizational case studies/
28. exp guideline adherence/
29. exp professional staff committees/
30. exp professional review organizations/
31. exp practice guidelines as topic/

32. exp licensure/
33. exp nursing audit/
34. exp medical audit/
35. exp dental audit/
36. exp clinical audit/
37. exp benchmarking/
38. exp physician's practice patterns/
39. exp delivery of health care, integrated/
40. exp health knowledge, attitudes, practice/
41. exp attitude of health personnel/
42. exp point of care systems/
43. exp dentist's practice patterns/
44. exp interdepartmental relations/
45. exp program development/
46. exp practice management/
47. exp models, organizational/
48. exp efficiency, organizational/
49. exp organizational policy/
50. exp reminder systems/
51. exp decision support systems, management/
52. exp decision support systems, clinical/
53. exp informatics/
54. exp audiovisual aids/
55. exp teaching materials/
56. exp pamphlets/
57. exp formularies/
58. exp manuals as topic/
59. exp persuasive communication/
60. exp interdisciplinary communication/
61. exp feedback/
62. exp educational technology/
63. exp inservice training/
64. exp education, continuing/
65. exp education, professional/
66. exp interprofessional relations/
67. 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22
68. 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66
69. 6 and 67 and 68
70. limit 69 to (english language and yr="1985 - 2008")

673 Appendix B

674 Interventions Section of the Cochrane Effective Practice and Organisation of Care Review Group

675 Data Collection Checklist (p. 9-12)

676 2. INTERVENTIONS
677 EPOC reviews include professional, financial, organisational or regulatory interventions.
678 State all interventions for each comparison/study group. (The categories are not
679 mutually exclusive.)
680
681 **2.1 Type of intervention**
682
683 **2.1.1 Professional interventions**
684 a) Distribution of educational materials (Distribution of published or printed recommendations
685 for clinical care, including clinical practice guidelines, audio-visual materials and
686 electronic publications. The materials may have been delivered personally or through
687 mass mailings.)
688 b) Educational meetings (Health care providers who have participated in conferences, lectures,
689 workshops or traineeships.)
690 c) Local consensus processes (Inclusion of participating providers in discussion to ensure that
691 they agreed that the chosen clinical problem was important and the approach to managing
692 the problem was appropriate.)
693 d) Educational outreach visits (Use of a trained person who met with providers in their practice
694 settings to give information with the intent of changing the provider's practice. The
695 information given may have included feedback on the performance of the provider(s).
696 e) Local opinion leaders (Use of providers nominated by their colleagues as 'educationally
697 influential'. The investigators must have explicitly stated that their colleagues identified
698 the opinion leaders.)
699 f) Patient mediated interventions (New clinical information (not previously available) collected
700 directly from patients and given to the provider e.g. depression scores from an
701 instrument.)
702 g) Audit and feedback (Any summary of clinical performance of health care over a specified
703 period of time. The summary may also have included recommendations for clinical
704 action. The information may have been obtained from medical records, computerised
705 databases, or observations from patients.)
706 The following interventions are excluded:
707 • Provision of new clinical information not directly reflecting provider performance which was
708 collected from patients e.g. scores on a depression instrument, abnormal test results.
709 These interventions should be described as patient mediated.
710 • Feedback of individual patients' health record information in an alternate format (e.g.
711 computerised). These interventions should be described as organisational.
712 h) Reminders (Patient or encounter specific information, provided verbally, on paper or on a
713 computer screen, which is designed or intended to prompt a health professional to recall
714 information. This would usually be encountered through their general education; in the
715 medical records or through interactions with peers, and so remind them to perform or

avoid some action to aid individual patient care. Computer aided decision support and drugs dosage are included.)
i) Marketing (Use of personal interviewing, group discussion ('focus groups'), or a survey of targeted providers to identify barriers to change and subsequent design of an intervention that addresses identified barriers.)
j) Mass media ((i) varied use of communication that reached great numbers of people including television, radio, newspapers, posters, leaflets, and booklets, alone or in conjunction with other interventions; (ii) targeted at the population level.)
k) Other (Other categories to be agreed in consultation with the EPOC editorial team.)

2.1.2 Financial interventions

2.1.2.1 Provider interventions

a) Fee-for-service (provider has been paid for number and type of service delivered)
b) Prepaid (no other description)
c) Capitation (provider was paid a set amount per patient for providing specific care)
d) Provider salaried service (provider received basic salary for providing specific care)
e) Prospective payment (provider was paid a fixed amount for health care in advance)
f) Provider incentives (provider received direct or indirect financial reward or benefit for doing specific action)
g) Institution incentives (institution or group of providers received direct or indirect financial rewards or benefits for doing specific action)
h) Provider grant/allowance (provider received direct or indirect financial reward or benefit not tied to specific action)
i) Institution grant/allowance (institution or group of providers received direct or indirect financial reward or benefit not tied to specific action)
j) Provider penalty (provider received direct or indirect financial penalty for inappropriate behaviour)
k) Institution penalty (institution or group of providers received direct or indirect financial penalty for inappropriate behaviour)
l) Formulary (added or removed from reimbursable available products)
m) Other (other categories to be agreed in consultation with the EPOC editorial team)

2.1.2.2 Patient interventions

a) Premium (Patient payment for health insurance. It is important to determine if the patient paid the entire premium, or if the patient's employer paid some of it. This includes different types of insurance plans.)
b) Co-payment (Patient payment at the time of health care delivery in addition to health insurance e.g. in many insurance plans that cover prescription medications the patient may pay 5 dollars per prescription, with the rest covered by insurance.)
c) User-fee (Patient payment at the time of health care delivery.)
d) Patient incentives (Patient received direct or indirect financial reward or benefit for doing or encouraging them to do specific action.)
e) Patient grant/allowance (Patient received direct or indirect financial reward or benefit not tied to specific action.)
f) Patient penalty (Patient received direct or indirect financial penalty for specified behaviour e.g. reimbursement limits on prescriptions.)

g) Other (other categories to be agreed in consultation with the EPOC editorial team)

2.1.3 Organisational interventions

2.1.3.1 Provider orientated interventions

a) Revision of professional roles (Also known as 'professional substitution', boundary encroachment' and includes the shifting of roles among health professionals. For example, nurse midwives providing obstetrical care; pharmacists providing drug counselling that was formerly provided by nurses and physicians; nutritionists providing nursing care; physical therapists providing nursing care. Also includes expansion of role to include new tasks.)

b) Clinical multidisciplinary teams (creation of a new team of health professionals of different disciplines or additions of new members to the team who work together to care for patients)

c) Formal integration of services (bringing together of services across sectors or teams or the organisation of services to bring all services together at one time also sometimes called 'seamless care')

d) Skill mix changes (changes in numbers, types or qualifications of staff)

e) Continuity of care (including one or many episodes of care for inpatients or outpatients)

• Arrangements for follow-up.

• Case management (including co-ordination of assessment, treatment and arrangement for referrals)

f) Satisfaction of providers with the conditions of work and the material and psychic rewards (e.g. interventions to 'boost morale')

g) Communication and case discussion between distant health professionals (e.g. telephone links; telemedicine; there is a television/video link between specialist and remote nurse practitioners)

h) Other (other categories to be agreed in consultation with the EPOC editorial team)

2.1.3.2 Patient orientated interventions

a) Mail order pharmacies (e.g. compared to traditional pharmacies)

b) Presence and functioning of adequate mechanisms for dealing with patients' suggestions and complaints

c) Consumer participation in governance of health care organisation

d) Other (other categories to be agreed in consultation with the EPOC editorial team)

2.1.3.3 Structural interventions

a) Changes to the setting/site of service delivery (e.g. moving a family planning service from a hospital to a school)

b) Changes in physical structure, facilities and equipment (e.g change of location of nursing stations, inclusion of equipment where technology in question is used in a wide range of problems and is not disease specific, for example an MRI scanner.)

c) Changes in medical records systems (e.g. changing from paper to computerised records, patient tracking systems)

d) Changes in scope and nature of benefits and services

e) Presence and organisation of quality monitoring mechanisms

f) Ownership, accreditation, and affiliation status of hospitals and other facilities
g) Staff organisation
h) Other (other categories to be agreed in consultation with the EPOC editorial team)

2.1.4 Regulatory interventions

Any intervention that aims to change health services delivery or costs by regulation or law.
(These interventions may overlap with organisational and financial interventions.)

a) Changes in medical liability
b) Management of patient complaints
c) Peer review
d) Licensure
e) Other (other categories to be agreed in consultation with the EPOC editorial team)

Appendix C

Effective Public Health Practice Project Quality Assessment Tool for Quantitative Studies

COMPONENT RATINGS

A) SELECTION BIAS

(Q1) Are the individuals selected to participate in the study likely to be representative of the target population?

1. Very likely
2. Somewhat likely
3. Not likely
4. Can't tell

(Q2) What percentage of selected individuals agreed to participate?

1. 80 - 100% agreement
2. 60 – 79% agreement
3. less than 60% agreement
4. Not applicable
5. Can't tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

B) STUDY DESIGN

Indicate the study design

1. Randomized controlled trial
2. Controlled clinical trial
3. Cohort analytic (two group pre + post)
4. Case-control
5. Cohort (one group pre + post (before and after))
6. Interrupted time series
7. Other specify _____
8. Can't tell

Was the study described as randomized? If NO, go to Component C.

No Yes

If Yes, was the method of randomization described? (See dictionary)

No Yes

If Yes, was the method appropriate? (See dictionary)

No Yes

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

C) CONFOUNDERS

(Q1) Were there important differences between groups prior to the intervention?

1. Yes
2. No
3. Can't tell

The following are examples of confounders:

1. Race
2. Sex
3. Marital status/family
4. Age
5. SES (income or class)
6. Education
7. Health status
8. Pre-intervention score on outcome measure

(Q2) If yes, indicate the percentage of relevant confounders that were controlled (either in the design (e.g. stratification, matching) or analysis)?

1. 80 – 100% (most)
2. 60 – 79% (some)
3. Less than 60% (few or none)
4. Can't Tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

D) BLINDING

(Q1) Was (were) the outcome assessor(s) aware of the intervention or exposure status of participants?

1. Yes
2. No
3. Can't tell

(Q2) Were the study participants aware of the research question?

1. Yes
2. No
3. Can't tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

E) DATA COLLECTION METHODS

(Q1) Were data collection tools shown to be valid?

1. Yes
2. No
3. Can't tell

(Q2) Were data collection tools shown to be reliable?

1. Yes
2. No
3. Can't tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

F) WITHDRAWALS AND DROP-OUTS

(Q1) Were withdrawals and drop-outs reported in terms of numbers and/or reasons per group?

1. Yes
2. No
3. Can't tell

4. Not Applicable (i.e. one time surveys or interviews)

(Q2) Indicate the percentage of participants completing the study. (If the percentage differs by groups, record the lowest).

1. 80 -100%
2. 60 - 79%
3. less than 60%
4. Can't tell
5. Not Applicable (i.e. Retrospective case-control)

RATE THIS SECTION	STRONG	MODERATE	WEAK	
See dictionary	1	2	3	Not Applicable

G) INTERVENTION INTEGRITY

(Q1) What percentage of participants received the allocated intervention or exposure of interest?

1. 80 -100%
2. 60 - 79%
3. less than 60%
4. Can't tell

(Q2) Was the consistency of the intervention measured?

1. Yes
2. No
3. Can't tell

(Q3) Is it likely that subjects received an unintended intervention (contamination or co-intervention) that may influence the results?

1. Yes
2. No
3. Can't tell

H) ANALYSES

(Q1) Indicate the unit of allocation (circle one)
community organization/institution practice/office individual

(Q2) Indicate the unit of analysis (circle one)
community organization/institution practice/office individual

(Q3) Are the statistical methods appropriate for the study design?

1. Yes
2. No
3. Can't tell

(Q4) Is the analysis performed by intervention allocation status (i.e. intention to treat) rather than the actual intervention received?

1. Yes
2. No
3. Can't tell

GLOBAL RATING
COMPONENT RATINGS
Please transcribe the information from the gray boxes on pages 1-4 onto this page. See dictionary on how to rate this section.

. A	SELECTION BIAS	STRONG	MODERATE	WEAK	
		1	2	3	
B	**STUDY DESIGN**	**STRONG**	**MODERATE**	**WEAK**	

		1	2	3	
C	**CONFOUNDERS**	**STRONG**	**MODERATE**	**WEAK**	
		1	2	3	
D	**BLINDING**	**STRONG**	**MODERATE**	**WEAK**	
		1	2	3	
E	**DATA COLLECTION METHOD**	**STRONG**	**MODERATE**	**WEAK**	
		1	2	3	
F	**WITHDRAWALS AND DROPOUTS**	**STRONG**	**MODERATE**	**WEAK**	
		1	2	3	Not Applicable

GLOBAL RATING FOR THIS PAPER (circle one):

1 STRONG (no WEAK ratings)

2 MODERATE (one WEAK rating)

3 WEAK (two or more WEAK ratings)

With both reviewers discussing the ratings:
Is there a discrepancy between the two reviewers with respect to the component (A-F) ratings?
No Yes

If yes, indicate the reason for the discrepancy

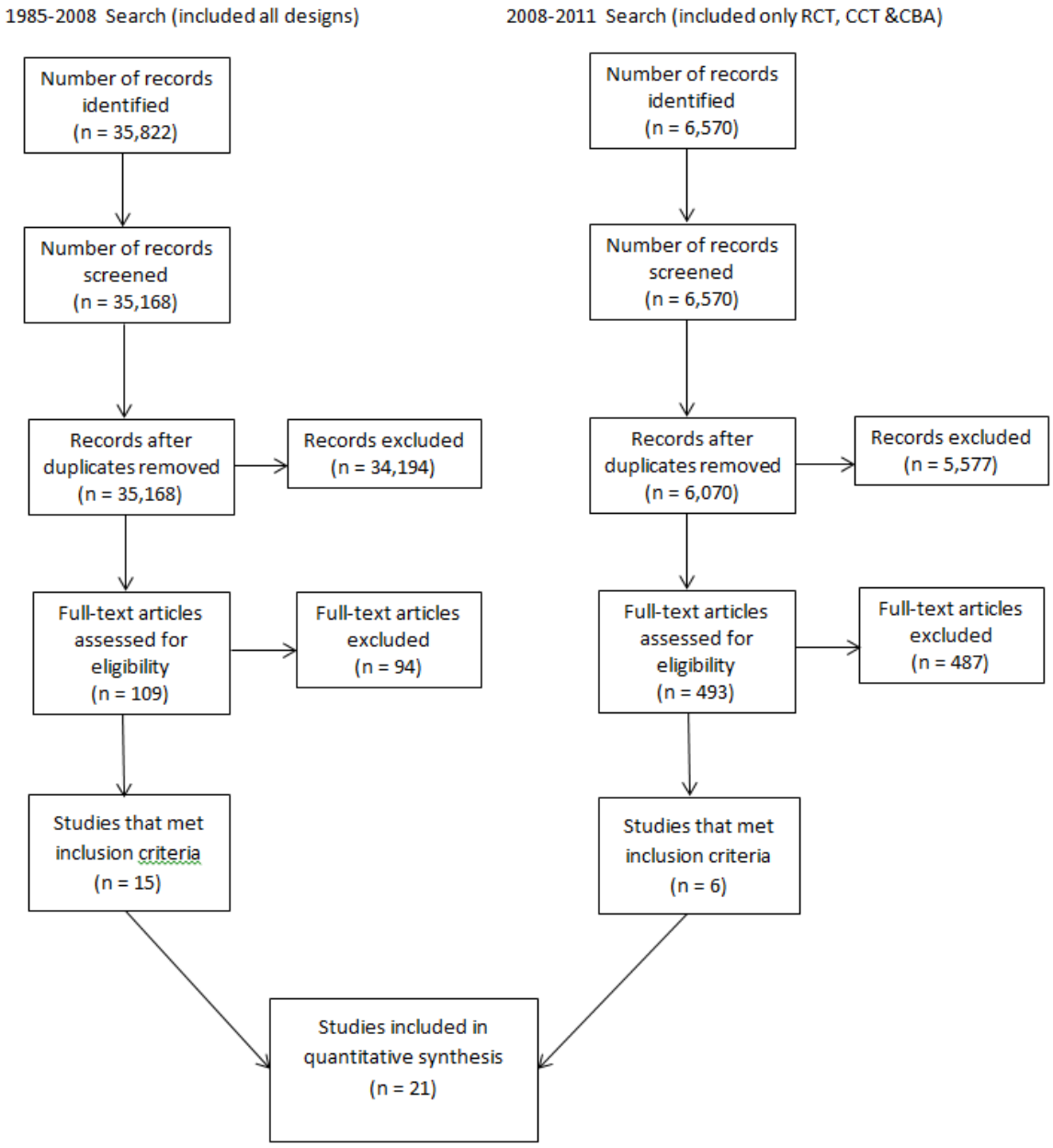
1 Oversight
2 Differences in interpretation of criteria
3 Differences in interpretation of study

Final decision of both reviewers (circle one):
1 STRONG
2 MODERATE
3 WEAK

997

998 Appendix D

999 Figure 1: Search Results and Screening Process



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1001

1002

Appendix E

Table 1: Overview of Included Studies

(uploaded as separate file)

Appendix F

Table 2: Methodological Quality Assessment Ratings

Author (Year)	**Study Design**	***Quality Assessment Tool for Quantitative Studies* rating**
Adler et al., 2009	**RCT**	**Strong**
Christakis et al., 2001		
Epstein et al., 2007	**RCT**	**Moderate**
Hillman et al., 1999		
Horbar et al., 2004		
Johnston et al., 2007		
Sanci et al., 2000		
Tebb et al., 2009		
Rogowski et al., 2001	**CBA**	
Naimoli et al., 2006		
Cabana et al., 2006	**RCT**	**Weak**
Clark et al., 2008		
Davis et al., 2007		
Liaw et al., 2008		
Sulaiman et al., 2010		
Clarkson et al., 2008	**CCT**	
Shafer et al., 2002		
D'Alessandro et al., 2004	**CBA**	
Edwards et al., 2007		
Smabrekke et al., 2002		
Tucker et al., 2008		

1060

1061 Appendix G

1062 Table 3: Effect of Intervention(s) on Primary Outcome(s)

Effect of Intervention(s) on Main Outcomes		**Primary Outcome(s)**		
		Single measurement classified as 1 EPOC outcome category*	**Multiple measurements classified as 1 EPOC outcome category**	**Multiple measurements classified as >1 EPOC outcome category**
Consistent effect	***Statistically significant positive effect***	RCT: 1. Christakis, et al., 2001 2. Davis, et al., 2007 3. Tebb, et al., 2009 CCT: 1. Shafer, et al. 2004	CBA: 1. Naimoli, et al., 2006	
	No effect	RCT: 1. Liaw, et al., 2008 2. Sulaiman, et al., 2010		
	Multi-arm trials	CCT: 1. Clarkson, et al., 2008 - statistically significant positive effect (fee arm), no effect (education arm)		
Inconsistent (mixed) effect			RCT: 1. Adler, et al., 2009 2. Hillman, et al.,1999 3. Johnston, et al., 2007 4. Sanci, et al., 2000	RCT: 1. Cabana, et al., 2006 2. Clark, et al., 2008 3. Epstein, et al., 2007 4. Horbar, et al., 2004
		CBA: 1. Rogowski, et al., 2001	CBA: 1. D'Allessandro, Kreiter & Peterson, 2004 2. Edwards, et al., 2007 3. Smabrekke, et al., 2002 4. Tucker,	

		Derscheid, Odegarden & Olson, 2008	

1063