Kalfoss, M., Low, G. & Molzahn, A.

The Suitability of the WHOQOL–BREF for Canadian and Norwegian Older Adults.

AUTHOR POST PRINT VERSION

Mary Kalfoss, Gail Low, Anita Molzahn. The suitability of the WHOQOL-BREF for Canadian and Norwegian older adults. European Journal of Ageing 5. (2008), 77-89.

The Suitability of the WHOQOL–BREF for Canadian and Norwegian Older Adults

Mary Kalfoss, RN, DrPH
Professor, Department of Research, Diakonova University College
Linstowsgate 5, 0166, Oslo, Norway
47 22 98 53 50
Mary.Kalfoss@c2i.net

Gail Low, RN, BSN, MA (Gerontology), PhD
Assistant Professor, Faculty of Nursing,
University of Alberta, 3rd Floor Clinical Sciences Building
Edmonton, AB, Canada T6G 2G3
(780)492-2947
e-mail: gail.low@ualberta.ca

Anita E. Molzahn, RN, PhD
Professor, School of Nursing, University of Victoria
PO Box 1700, Victoria, B.C. V8W 2Y2
(250)721-7958
e-mail: amolzahn@uvic.ca

Acknowledgements: The authors would like to acknowledge the contributions of the WHOQOL-OLD Group in the design of the original study that led to the compilation of the data sets. We acknowledge the work of Liv Halvorsrud and Janice Robinson for data collection in Norway and Canada respectively. Funding for the original project was obtained from the European Commission 5th Framework Competition, the University of Victoria Internal SSHRC grants, and Diakonova University College funding, Oslo. We are also grateful to EJA's referees for their valuable suggestions.

Key words WHOQOL-BREF, reliability, validity, older adult, quality of life

Abstract

The aim of this study was to examine the validity and reliability of the WHOQOL-BREF, a generic QOL scale, among older people in Canada and Norway. Very similar data from the Canadian and Norwegian Field Trial data (Canada n = 192; Norway, n = 469) were analyzed and compared. Higher negatively skewed mean scores were found for all WHOQOL-BREF domains in Canada. For both study samples, missing values were highest for the sex item from the social domain. Ceiling effects were found (Canada n=21; Norway n=11) primarily among items in the physical and environmental domains. In both study samples, a multitrait multimethod procedure indicated items correlated most strongly with their parent domains; however, equally appreciable correlations were observed between physical, psychological, and environmental items (r=.33 to .64; p<.01). The social domain had the lowest internal consistency (α=0.67 Canada, α=0.55 Norway). Confirmatory factor analyses (CFA) yielded marginal goodness-of-fit between the hypothesized WHOQOL-BREF measurement model and the sample data as well as differing patterns of domain misspecification. Patterns of correlations (p<.01) of WHOQOL-BREF domains with WHOQOL-OLD facets, a global QOL item, the SF-12, and the GDS provided evidence of convergent and divergent validity. Domain scores also significantly discriminated between health and unhealthy populations and presence of morbidity. Empirical support was found, in part, for the construct validity of the WHOQOL-BREF in older adults. Further exploration of the scale's validity in comparative studies of older people across cultures is recommended.

Word count: 246

Introduction

Appraisal of quality of life (QoL) of older adults is increasingly important given the predicted increases in the population over 65 years. People in Europe are older than any other world region, and older adults are expected to increase to 25% of the population in several European countries by 2020 (United Nations 2002). In Norway, the 2006 Census showed that people aged 65 or over accounted for 13% of the population and are expected to increase to 18% in 2039 and 21% in 2050 (Statistics Norway 2006). Similarly, in Canada, the 2001 Census showed that people over 65 accounted for 13% of the population, and are predicted to increase to 15% by 2011; people aged 80 or over are expected to grow an additional 43% from 2001 to 2011 (Statistics Canada 2005). Many policy makers believe this situation will result in higher expenditures on health and social services (OECD 1999).

Although QoL measurement is becoming increasingly important (Walker 2005a, Walker 2005b, Walker 2005c), issues exist regarding measurement in older adults. These issues include: no widely supported theory of QoL for younger or older adults (Brown, Bowling and Flynn 2004), lack of age-specific measurements (Haywood et al. 2004), questionable appropriateness of QoL instruments designed for younger adults (Bowling 1997, Haywood et al. 2004, Power et al. 2005), lack of lay perspectives in the development of assessments (Bowling 2006), and the need for multi-dimensional assessments (Bowling 2001). Further, explicit criteria for defining good measurement properties are lacking (Terwee et al. 2007), and minimal evidence is given in the reporting of measurement properties (Haywood et al. 2004; 2005; 2006). Thus, it can be questioned whether existing QoL measures can be universally regarded as legitimate due to a lack of reliability, validity, responsiveness, precision, interpretability, feasibility, and acceptability of the instruments for the samples under study (Bowling and Ebrahim 2005; Fitzpatrick et

al. 1998; Streiner and Norman 2003; Haywood et al. 2004; Haywood et al. 2005; Streiner and Norman 2006; Terwee et al. 2007). These issues make it difficult to compare findings across settings and countries, and illustrate the need to test instruments which can be used for comparative cross-cultural research in gerontology (Deeg and Wahl 2006; Terwee et al. 2007).

Hence, the aim of this study was to examine and compare psychometric characteristics of the WHOQOL-BREF using data from older people living in Canada and Norway. The analysis of very similar data obtained during the 2004 WHOQOL-OLD Group Field Trial enabled cross-cultural comparisons. We selected these two samples because of our own interests in these populations and because we were interested in how the instrument would perform in these northern countries with public health care systems, acknowledging that there are cultural differences.

WHOQOL Background

In the early 1990s, the WHOQOL Group began collaborative efforts to define and measure QoL cross-culturally. This group defined QoL as an "individual's perception of their position in life, in the context and culture and value systems in which they live, and in relation to their goals, expectations, standards and concerns" (WHOQOL Group 1995a, p.1405). The definition reflects a multidimensional concept addressing physical health, psychological state, social relationships, and environment based on subjective appraisals.

Based upon this definition, the WHOQOL–100 was developed. It is a generic instrument, intended to measure multidimensional QoL in both healthy and unhealthy people (Fitzpatrick et al. 1992). The development of the WHOQOL instruments is described elsewhere (WHOQOL Group 1992; 1995a,b,c). While the WHOQOL-100 facilitates comprehensive assessment of QoL, it has been found to be cumbersome for epidemiological and clinical studies. The shorter 26–item version known as the WHOQOL-BREF (WHOQOL Group 1995a; WHOQOL Group

1998a,b; WHO 1997), now translated into 50 languages, was selected for assessment in the present study. Although the WHOQOL Group has also developed an add-on module to measure QoL in older adults, this module is used in conjunction with either the WHOQOL-100 or BREF (Power et al. 2005); as a result, it is important that the BREF be tested with and appropriate for older adults.

The WHOQOL domains are: physical (7 items), psychological (6 items), social relationships (3 items) and environmental (8 items). Two global questions address overall QoL and health satisfaction. Each item is scored on a 5-point Likert scale with respect to the last two weeks. Higher scores indicate higher QoL, with the exception of three negatively worded items (questions 3, 4, and 26) which are recoded. Use of domain level profiles is recommended (WHO 1996).

Both international (Skevington et al. 2004; WHOQOL Group 1998a,b) and national studies have confirmed or partially confirmed the validity and reliability of the WHOQOL–BREF in younger and middle-aged populations (Amir et al. 1999; De Girolamo et al. 2000; Fang et al. 2002; Fleck et al. 2000; Hanestad et al. 2004; Hsiung et al. 2005; Hwang et al. 2003; Jang et al. 2004; Jaracz et al. 2006; Kalfoss et al. 2007 in press; Leplege et al. 2000; Leung et al. 2005; Lin et al. 2002; Min et al. 2002; Norholm and Bech 2001; O'Carroll et al. 2000; Ohaeri et al. 2004; Taylor et al. 2004; Saxena et al. 1998; Trompenaars et al. 2005; Yao et al. 2002). To our knowledge, only five studies have specifically examined the psychometric properties of the WHOQOL-BREF among older adults.

Von Steinbuchel et al. (2006) studied the psychometric properties of the WHOQOL-BREF in healthy French-speaking Swiss older adults (n=262, M=73.4 years) and found high test–retest reliability and validity. These authors recommended the use of item profiles for both individuals and samples. Hawthorne et al. (2006) in exploring preliminary population norms and effect sizes of the Australian WHOQOL-BREF

among younger, middle-aged and older adults (*n*=931, *M*=48.2 years) found that scores declined by age group, with males exhibiting a more consistent decline in physical health across the life span, especially between 50 to 69 years. Although the authors found significant differences in WHOQOL-BREF scores by health status and gender, they suggested that the BREF domains were not particularly sensitive in detecting small differences in health status due to the pattern of effect sizes with overlap of confidence intervals. Chachamovich et al. (2006) studied the psychometric properties of the Brazilian WHOQOL-BREF in hospitalized and community–based older adults (*n*=424, mean age not given) and showed that the instrument was able to discriminate levels of depressive symptoms, hopelessness, and health status across all domains. Unacceptable reliability was found for the social domain; evidence of its criterion validity was also lacking. Naumann and Byrne (2003) explored the psychometric properties of the WHOQOL–BREF in 39 Australian older adults (*M*=78.05 years) with depression, showing good validity and reliability for the physical, psychological and environmental domains, but not the social domain. QoL scores were found to be to be strongly correlated with severity of depression, number of self–reported physical symptoms and self–assessed health status. Lastly, Hwang et al. (2003) conducted a population survey (*n*=12,000, *M*=73.4 years) with the Taiwanese WHOQOL–BREF and reported satisfactory discriminant validity, responsiveness and reliability.

Method

Procedure and Subjects

The data for this study were collected in a larger study of QoL of older adults funded by the European Commission, conducted in collaboration with the World Health Organization (Power et al. 2005); 23 countries were included in the original project. Inclusion criteria

common to both countries were: 60 or more years of age, English or Norwegian speaking, resident of British Columbia or Norway, and no illness likely to cause death within the next six months or significant cognitive impairment.

In the Canadian Field Trial study, a sample stratified by age (60-70, 71-80, and 81+) was sought. Letters were sent to 1000 eligible randomly selected people from the databases of the British Columbia Ministry of Health Client Registry. Older adults who responded to a letter of invitation to participate were sent questionnaires by mail. The response rate to the letters was 42%; of those who responded, 60% agreed to complete the questionnaire. The return of study packages for those agreeing to participate was 80.4% (n=202). In the Norwegian Field Trial study, two cohorts took part. The largest consisted of a randomly selected stratified sample of older adults from 20 geographically dispersed communities drawn by allocated proportional design by Statistics Norway. Of the 802 elders who were sent invitations to participate, 401 consented and were sent questionnaires by mail. Another randomized sample of 89 older adults receiving formalized health care services (home care) was drawn from Statistics Norway to increase participation of frailer older people more likely to have morbidities, primarily with a view to capturing varied levels of QoL (WHOQOL Group 1997). These frailer older people were also personally interviewed to minimize respondent burden. A total of 490 respondents participated in the Norway, yielding a response rate of 53.1%.

Instruments

In addition to the WHOQOL-BREF, the WHOQOL-OLD, SF-12, and GDS were used in this study.The *WHOQOL–OLD* is a 24-item 6-facet generic module containing facets that older adults from 15 countries considered meaningful to QoL that are not included in the WHOQOL-BREF; its facets include sensory abilities, autonomy, past, present and future activities, death and dying, and intimacy. Use of facet level profiles

is recommended (WHOQOL-OLD Group 2005); each facet contains 4 items scored on a 5 point Likert scale; higher scores indicate higher QoL, and the time frame for assessment is the past two weeks. The consistency reliability for the WHOQOL-OLD in this study was α=0.90 for Canada and α=0.89 for Norway..

The *SF-12* is an instrument measuring health and functional status; its domains include physical functioning, role physical, role emotional, and mental health; items pertaining to bodily pain, general health, social functioning, and vitality are included. Scores are weighted and summed according to the SF-12 user manual (Ware et al. 2002); the time frame assessed is the past 4 weeks. The consistency reliabilities of the SF-12 for Canada and Norway were α=0.88 and α=0.71 respectively.

The *Geriatric Depression Scale* (GDS) is available in two versions, one with 30 items and one with 15 items. In Canada, depression was assessed with the 30 item GDS (Sheik and Yesavage 1986). The shorter GDS-15 was used in the Norway (D'Ath et al. 1994; Yesavage et al. 1983). For the purposes of this study, to facilitate comparisons, items from the *GDS–15* were selected for analysis. Each item of the GDS is scored dichotomously (No/Yes) and to obtain a depression score, the number of depressive symptoms is totalled. The value range is 0 to 15, with higher values indicating more depressive symptoms; the time frame for the measure is the present. The consistency reliability in the current study was α=0.88 for the Canada and α=0.80 for the Norway.

Data Analysis

This psychometric evaluation of the BREF was performed using recommended criteria for instrument evaluation (Bowling and Ebrahim 2005; Fitzpatrick et al. 1998; Haywood et al. 2004, Haywood et al. 2005; Streiner and Norman 2003, Streiner and Norman 2006). For both older

Canadians and Norwegians, we explored the general scaling qualities (numbers of items for which there are >20% ceiling and floor effects (Andresen 2000; Holmes and Shea 1997) and skew (tendency to higher response categories, the critical cut-off being either >-.50 or < .50) (Trompenaars et al 2005).

Convergent validity was assessed through the presence of positive and significant correlations with the global QoL item on the BREF, and the four facets of the WHOQOL-OLD. With respect to the SF-12, the BREF physical domain was expected to correlate positively with physical function, role physical, and bodily pain, and the BREF psychological domain with social function, role emotional, and mental health. Similar findings were expected for the WHOQOL-BREF social domain and SF-12 social functioning ratings. Divergent validity was expected with significant negative correlations between all BREF domains and GDS scores.

We also assessed the ability of the BREF to discriminate using two health-related variables, morbidity and subjective health status. In both countries, morbidity was assessed with an open ended question asking participants to list any conditions that influenced their QoL. The number of medical conditions was recorded from 0 (for none) to 5 (5 or more). Approximately 29% of Canadians and 51% of Norwegians were without morbidity. Health status was assessed using a global item from the WHOQOL-OLD asking whether respondents perceived themselves to be healthy or unhealthy; 81% of Canadian and 84% Norwegian participants considered themselves to be healthy.

We also examined Pearson Product Moment Correlation Coefficients between domains, items and domains, and items within domains using a multitrait multimethod procedure to assess construct validity (Andresen 2000). We expected correlations between domains, items and domains, and items within domains to be 0.30 or higher (Andresen 2000).

We then used confirmatory factor analysis to examine the hypothesized measurement structure of the BREF, using maximum likelihood estimation with AMOS 6.0 (Byrne, 2001). Based on recommendations from previous psychometric studies, the measurement model was specified with indicators for each WHOQOL-BREF domain and it was assumed that each domain would load onto a second-order factor, namely QoL (Skevington et al. 2004; WHOQOL-Group 1998a,b). Criteria for GFI and CFI were set at .90 , the RMSEA at < .05 (Ullman 2001) and model χ^2 values more than 2 deviations from the mean χ^2 value or its degrees of freedom were also considered indicative of ill fit (L. Hayduk, personal communication November 22, 2007).

To assess the ability of the instrument to discriminate, we used Student t-tests to identify whether there were significant differences in BREF domain ratings between older adults who considered themselves to be healthy versus unhealthy and between those with morbidity (versus no morbidity).

Data Handling

We followed the international protocol for handling and scoring data of missing data for the BREF (WHOQOL Group, 1997). With respect to missing values, among Canadians, those most prevalent were from the three item social domain (23.5%; *n*=51) and least prevalent were from the eight item environmental domain (10.5%; *n*=16). Among Norwegians, the greatest number of missing values were again observed for the social domain (18.5%; *n*=91) and the least, for the seven item physical domain (10.8%; *n*=58). At the item level, there were few missing responses except for the sexuality item (question 21) in Canada (18.8%; *n* = 38) and Norway (15.7%; *n*=77). Similar patterns were noted by others (Amir et al. 2004; Chachamovich et al. 2006; Hwang et al 2003; Power et al. 2005; Von Steinbuchel et al. 2006). Other problematic items

included question 18 on work capacity from the physical domain (6.4%; *n*=13) for Canada and question 9 on the physical environment (4.7%; *n*=23) for Norway.

The mean score of items within each BREF domain was used to calculate the domain score, and where more than two items were missing from the physical, psychological and environmental domains, that respondent's domain score was not calculated and the assessment discarded (WHOQOL Group, 1997). There are only three items in the social domain; hence, if there was more than one item missing for a respondent, that assessment was excluded from further analyses. These excluded assessments on the BREF represented a 4% loss of all cases for both countries (Canada *n*=10; Norway *n*=21). Among the remaining cases (Canada *n*=192; Norway *n*=469), where an item within a particular domain was missing, the mean of all other items within that particular domain was substituted (WHOQOL Group, 1997). Although there is some debate about the best approach for handling missing values, Schafer and Graham's (2002) preliminary investigations show this method of ipsative mean imputation is reasonable. The Little MCAR test further revealed missing responses on the BREF were missing completely at random for Canada (X^2=457.68; *df*=523, *p*=.98). For Norway, responses were found not to be missing at random (X^2=348.48; *df*=306; *p*=.05). This observation led to what Graham and Schafer (2002) refer to as a natural tendency to speculate that observed patterns of missingness are due to the phenomenon being measured. Of the 91 responses missing in the social domain, the majority were due to the sexuality item (n=77) and this was twice as high as that observed among Canadian elders despite assurances of confidentiality. Far more Norwegians (88%) than Canadians (67%) also reported being married or partnered. The non-random missingness observed among Norwegian elders may be attributed to the personal or sensitive nature of the sexuality item, particularly when self-report questionnaires are used to collect data (Schafer & Graham).

Ethical Considerations

The study was approved by the Norwegian Data Inspectorate and the Regional Ethical Committee and the University of Victoria Human Research Ethics Committee.

Results

Demographics

The mean age of participants in the Canada was 72.8 years (*SD* = +/-8.5; range of 60-95); 53.1% were female and 46.9% male. Approximately 67% were married or partnered, 3% were never married, and 30% were separated, divorced or widowed; 52% had post-secondary education. Approximately 43% reported living at home unsupported and 2.2% resided in nursing homes and residential care facilities. Norwegian participants were slightly older (*M*=75.71; *SD* =+/- 8.0; range of 60-91 years). Fifty-eight percent were female and 42% male. Most were married or partnered (88%); 8% were never married, and 4% separated, widowed or divorced. Just over one-third had post-secondary education. Approximately 65% lived at home unsupported and 3.3% lived in nursing homes and residential care settings.

Scaling Qualities

As shown in Table 1, item scores ranged from 1 through 5. Canadians had higher mean scores on all WHOQOL-BREF domains than did Norwegians (see Table 1). Twenty-one items in the Canadian data set displayed ceiling effects, as compared to 11 in the Norwegian data set. In both samples, ceiling effects were found for the following items: physical pain, medical treatment, mobility, personal relationships, safety,

conditions of living place, access to health services, and satisfaction with transport. No floor effects were found in either sample. Non-normal distributions were found for all domains in the Canadian sample, skewed to higher scale values.

Consistency Reliability

The internal consistency of the domains in the Canadian sample for the physical, psychological, social relationships, and environmental domains were 0.89, 0.81, 0.67, and 0.86, respectively. For Norway, these were 0.87, 0.81, 0.55, and 0.80 respectively. The Cronbach's alpha coefficients for the total scale were α=0.93 (Canada) and α=0.92 (Norway).

Construct Validity

In Canada, significant domain-to-domain correlations ranged from r=0.43 to 0.65 (p<.01) between physical-social, and psychological-environmental domains respectively. In Norway, these ranged from r=0.42 to 0.68 (p<.01). An item–to-domain correlation matrix showed all items correlated highest with their parent domains for both countries (p<.01 for all). For the physical domain, inter-item correlations ranged from r=0.66 to 0.85 (Canada) and r=0.56 to 0.85 (Norway); for the psychological domain r=0.60 to 0.84 (Canada) and r=0.62 to 0.78 (Norway); for the social domain r=0.72 to 0.84 (Canada) and r=0.67 to 0.77 (Norway); and for the environmental domain r=0. 65 to 0.79 (Canada) and r=0.56 to 0.74 (Norway).

In examining the item correlation matrix, for Canada, correlations of items within domains ranged from r=0.30 to 0.76 (p<.01), the lowest between accepting bodily appearance and both life enjoyment and meaning, and the highest between items of ADL performance and mobility, energy and work capacity. For the Norwegian sample, correlations ranged from r=0.19 to 0.78 (p<.01), the lowest between personal relationships

and sex, and the highest ADL performance with energy and work capacity. In the Canadian sample, correlations higher than within-domain correlations were between self-satisfaction and negative feelings with energy, ADL performance and work capacity (r=0.43 to 0.57), and between safety, health of the physical environment, money, leisure, and access to health services with life enjoyment and meaning (r=0.41 to 0.59). This was evident between all physical domain items and satisfaction with self and leisure (r=0.33 to 0.64) among Norwegians.

In a confirmatory factor analysis, the model tested using the Canadian data set (n=192) showed marginal fit (see Figure 1), the reported χ^2 value being >10 standard deviations (sd=22.27) above the mean χ^2. The observed standardized residual covariance matrix for Canada contained two values greater than the critical value for significance (2.58; Byrne 2001) These two significant residual covariances were observed between leisure and energy, and between physical pain and personal relationships. These misspecifications implicated the physical, environmental, and social domains. Observed patterns of item-to-parent domain loading coefficients were highest for the psychological domain and the lowest for the social domain, particularly for the sexuality item. As the most homogenous BREF domain, the six hypothesized items in the psychological domain explained 82% of its variance; far less variance (R^2=.66) was explained by the items in the social QoL domain.

As shown in Figure 2, the lack of fit was far more evident among the Norwegian sample; all fit indices failed to reach the set criteria, the reported model χ^2 being nearly 46 standard deviations above mean χ^2. Numerous residuals >2.58 were observed, the vast majority arising between items from the physical domain with items from the social and environmental domains. Leisure cross-loaded onto the physical domain. 'Mobility' appeared to cross-load onto the environmental domain. Further, sleep cross-loaded onto the social, environmental, and psychological domains. One item from the psychological domain, satisfaction with self, cross-loaded onto the physical domain. Though generally lower in size

than in the Canadian sample, item-to-parent domain loadings were also highest for the psychological domain, and lowest for the social domain, again particularly for sexuality. As observed within the Canadian sample, the most variance was explained in the psychological domain (92.5%), and only 54.8% of the variance was explained by the six items in the physical domain.

Convergent validity was assessed by exploring correlations among the WHOQOL-BREF domains and WHOQOL-OLD facets, with all being positively and significantly correlated. In Canada, correlations ranged from r=0.19 to 0.77, from the social domain with the death and dying facet to the psychological domain with the past, present and future facet (p <.01 for all). In Norway, correlations ranged from r=0.16 to .68 for physical domain with death and dying, and the physical domain with social participation; the social domain also weakly correlated with the death and dying facet (r=0.19, p <.01). All WHOQOL-BREF domains positively and significantly correlated with overall QoL; coefficients ranged in size from r=0.40 to 0.67 (Canada) and r=0.45 to 0.58 (Norway) with the strongest associations between the physical and psychological domains. Correlations with SF-12 domains were all statistically significant (p <.01); these ranged from r=0.24 to 0.78 (Canada) and r=0.21 to 0.76 (Norway). In both samples, the lowest correlations related to the social domain; the physical domain correlated most highly with physical function, role physical, and bodily pain (r=0 .66 to 0.78), and the psychological domain with social function, role emotional, and mental health (r=0.45 to 0.62). The social domain correlated most strongly with mental health and vitality (r=0.41 to 0.57) and most weakly with social functioning (r=0.29, Canada; r=0.32, Norway). The environment correlated most highly with general health in the Canadian sample (r=0.54) and vitality among the Norwegians (r=0.48).

With respect to divergent validity, all WHOQOL-BREF domain scores were negatively correlated (p <.01) with GDS scores. Coefficients ranged from r= -0.47 to -0.76 for Canada, and -0.46 to -0.59 for Norway.

Student t-tests shown in Tables 2 and 3 show the ability of the WHOQOL-BREF to discriminate. Significant differences in all domain scores were observed between unhealthy and healthy older adults, and those with and without morbidities in both countries.

Discussion

Information about measurement properties is essential for instrument selection (Bowling and Ebrahim 2005; Fitzpatrick et al. 1998; Haywood et al. 2004; Haywood et al. 2005; Streiner and Norman 2003; Streiner and Norman 2006). In this study, we compared findings with respect to the reliability and validity of the WHOQOL-BREF, an instrument designed to assess QoL across cultures, in older people living in Canada and Norway.

Regarding scaling qualities, response distributions showed that data were skewed to higher scale scores on all domains in both Canada and Norway. Such ceiling effects are well documented in QoL research (Jang et al. 2004; Wirnsberger 1998) although others have noted that ceiling effects decrease with age (McHorney 1996; Ware 1997). The BREF was originally developed for use with younger adults. Using measures in one population when they were designed for another has resulted in both floor and ceiling effects (O'Boyle 1997). In this study, ceiling effects were found for both countries with respect to items in the physical (pain, medical treatment, mobility), social (personal relationships), and environmental (safety, conditions of living place, access to health services, satisfaction with transport) domains. The items on pain and medication were also found to be problematic in 7 of the 24 original centres testing the WHOQOL-BREF (WHOQOL Group 1998a,b).

Hwang et al. (2003) also found ceiling effects for pain, medical treatment and negative feelings; further, items concerning working capacity and sexual activity had high missing values and poor test–retest reliabilities. Pain, medical treatment, being respected, and healthy environment have been shown to have poor test–retest reliability among patients with HIV infection (Fang et al. 2002). Such effects suggest that the scale may not be responsive to change in older adults with high scores.

The consistency reliability of three domains was found to be acceptable. However, the social domain exhibited lower reliability in both samples. Similar patterns were noted in international WHOQOL Group findings, and other studies of middle-aged and older adults (Chachamovich et al. 2006; Hanestad et al. 2004; Hawthorne et al. 2006; Jang et al. 2004; Jaracz et al. 2006, Kalfoss in press 2007; Trompenaars et al. 2005). Lower alpha values for the social domain may be partly due to the limited number of unrelated items in this domain (Yao et al. 2002). On the other hand, sexuality might also be considered separate and distinct from social relationships among older people. It seems that they define social roles as functional and mutually supportive, and that they serve to keep the family intact (Hilleras et al. 2001).

The construct validity of the WHOQOL–BREF was supported in part in the correlation matrix analyses. Though all items were most strongly associated with their parent domains for the Canadian and Norwegian samples, higher than expected within domain correlations were consistently observed among the two study samples between items in the psychological, physical, and environmental domains. Skevington et al. (2004) noted that in some unspecified countries, items on safety and energy were more strongly associated with the psychological domain than their intended domains, environment and physical respectively, suggesting departure from their expected measurement structure. Among Swiss older adults, items not well correlated with their respective domains were sleep, medication, negative feelings, self esteem, meaningful life, home

environment and physical environment, and sexuality (Von Steinbuchel et al. 2006) suggesting overlap among all four WHOQOL-BREF domains.

In the confirmatory factor analysis, though all 24 of the items were retained for Canada and Norway, residual covariance patterns provided further evidence of domain overlap and these patterns markedly differed between these two countries. Among Canadians, misspecification was observed in the hypothesized relationships between two items from the physical domain -- energy and pain – and leisure and personal relationships respectively**.** These findings indicate partial overlap among the physical, social and environmental domains; however, no suggested cross-loadings were observed. Seemingly, energy and pain among Canadians elders influences their opportunities for leisure and for fostering satisfying personal relationships. This pattern of findings reflects the trend among Canadian seniors to devote time to paid and household work, and passive activity has been steadily declining in the wake of active pursuits such as volunteer work and out-of-home leisure (Victorino and Gauthier 2005), linking having goals, hobbies, a sense of purpose, and interest in life to successful aging (Tate et al. 2003). In two recent QoL studies among older Canadians, poor health has been found to detract from meaningful activity and the sense of connectedness with intimate contacts (Low et al. in press), and physical health problems limit volunteerism (Kloseck et al. 2006). Physical independence has also been found to enhance social, physical, and meaningful and productive activity (Bourque et al. 2003; Menec 2003).

Among Norwegians, the physical domain was most problematic and the least homogenous. In this study, opportunities for leisure appears to be affiliated with Norwegian elders' perceived pain, energy, mobility, ability to complete activities of daily living, and capacity for work. Several European QoL studies support these findings. Older people in the Netherlands link activities to maintaining and improving health,

accepting health decline, and adjusting one's activity and expectations to satisfactory QoL (Puts et al. 2007). In a study of Finnish elders, being mobile and physically active enhanced leisure activity, as was the case with the lack of morbidity and being physically active (Lampinen et al. 2006). Among German elders, work-related success and experience have also been found to predict intensity of voluntary social engagement such as hobby work (Bukov et al. 2002). Mobility among older Norwegians seemed to influence their perceived satisfaction with transportation, and notably, quality of sleep impacted on older Norwegians' satisfaction with personal relationships and safety, as well as their perceptions of bodily appearance, self, and negativity in general. Hanestad and colleagues (2004), in an earlier study of 4000 persons of varying ages from the Norway, also found partial support for the four-domain structure of the BREF manifesting in part as cross-loadings between life enjoyment, safety and the physical environment. Overall, these findings suggest lack of conceptual clarity of the varied WHOQOL-BREF domains in both countries, warranting further testing before domain profile scores are utilized (Von Steinbuchel et al. 2006).

In the confirmatory factor analysis, the fit of the initial second order factor model did not meet the criteria set forth in this study in either Canada or Norway. Findings from several WHOQOL-BREF psychometric studies generally indicate marginal fit among, for example, two samples of over 5000 adults (mean age=40) living in 23 countries (Skevington et al. 2004) and among unhealthy and healthy Taiwanese people with a mean age of 41.5 (Yao et al. 2002). In a study of 1200 Chinese older adults aged 65 to 103, Hwang et al. (2003) achieved marginal fit by allowing error in measurement errors for items from the physical domain and environmental domains (pain and medical treatment, mobility and leisurely activities, social care and transport) to covary and two cross-loadings (self esteem on social relationships and energy on psychological). Jaracz and colleagues (2006) reported a marginal fit among 908 Polish healthy and sick respondents with a mean age of 35 (range=18-85) and

lack of fit was noted by Von Steinbuchel et al. (2006) in their study of 192 Swiss older adults (M =73.4 years; range=60-90), and Leung and colleagues (2005) among healthy and sick respondents aged 19 to 91 (n=301; M=52.8 years) in Hong Kong. Among psychotic adults (aged 18–60 years) in Nigeria, Ohaeri et al. (2004) found a lack of empirical support for the four domain BREF measurement model. Although differences in model fit may be explained by differences among samples (Byrne 2001), results suggest a complex multifaceted pattern of relationships among domains and error covariances indicative of a lack of measurement model congruence, albeit a wide range of ages, across cultures.

Convergent validity was supported by significant positive correlations between all domains of the WHOQOL-BREF with those of the WHOQOL-OLD and the global QOL item. Patterns of correlations indicate the lowest values pertained consistently to the social domain, also found to have the lowest consistency reliability in both study samples. The physical and psychological domains were strongly correlated with their affiliated physical and mental health component of the SF-12 as noted by others (Amir et al. 2004; Von Steinbuchel et al. 2006). The social domain correlated weakly with the social functioning component of the SF-12 in both study samples. Poor concurrent validity with measures of social support has been reported by Nauman and Byrne (2003a). A comparison of the domain scores by health status and presence of morbidity showed that the WHOQOL-BREF has power to discriminate between groups, also reported by others (Amir et al. 1999; Chachamovich et al. 2006; Hawthorne et al. 2006; Hwang et al. 2003; Jang et al. 2004; Tazaki et al. 1998; von Steinbuchel et al. 2006). In contrast, Nauman and Byrne (2003) found no relationship between morbidity and QoL scores.

Although originally developed for use with younger adults, in both Canada and Norway, empirical support was found through conventional assessments for the convergent and divergent validity of the BREF, and for its consistency reliability in all but the social domain.

Further, the instrument is able to discriminate between healthy and unhealthy groups. The weakest evidence emerged for the construct validity of the BREF with higher within domain correlations suggesting overlap between the physical, psychological and environmental domains for both countries, especially for the physical domain in the Norwegian sample. The lack of fit for the hypothesized measurement structure of the BREF was also most marked for the Norwegian sample. Misspecified relationships observed between items from the physical, social, and environmental domains were common to both countries; however, patterns of their covariances unaccounted for by the hypothesized measurement structure of the BREF differed. The psychological domain was found to be most homogenous, with its items explaining the most variance for both countries; the social domain in Canada and the physical domain for Norway, particularly with respect to the sleep item explained the least variance.

The analysis of findings for Canadian and Norwegian elders in this study suggest that what counts in relation to QOL may be weighted differently and may relate in idiosyncratic ways, manifesting empirically as disparities in the significance of paths in models (Bernheim 1999; Cummins 1996). Replication studies are rarely undertaken to further validate models of QOL, yet they enable researchers to disentangle sample-dependent findings (Low and Molzahn 2007). In this study, there were cultural differences noted in the patterns found in the BREF measurement model. On an empirical level, it seems reasonable to conclude that the BREF illuminates differences in generic QoL across cultures, and that QoL is affected in complex ways by a broad array of factors (Bowling et al. 2003; Pukrop 2003). Evidence of marginal fit or the lack thereof is not unique to the present study and has also been reported among Swiss (Von Steinbuchel et al. 2006) and Chinese (Hwang et al. 2003) older adults, the latter of these two reporting different suggested modifications than those observed in the present study. Cultural differences serve as a

reminder that older people alone possess intimate knowledge of adaptation to the ageing process and their QoL (Laidlaw et al. 2007). Further comparative studies of the BREF among older people living in different countries would add to our existing knowledge of the meaning of QoL in the third age and further invite us to embrace its complexities.

Limitations

This study has shortcomings. Canadian older adults were recruited from one geographic area, limiting the generalizability of the findings. Further, the sample size of the Canadian group was smaller than expected due to a low response rate. The response rate for Norwegian adults was 53% but lower than that reported in other studies (Bowling 2006; Strawbridge et al. 2002). The vast majority of participants from both countries appraised themselves as healthy, suggesting possible response bias. Equally noteworthy, the non-random patterns of missingness was observed in the far larger Norwegian study sample ($p=.05$) and speculated to be due to the personal and sensitive nature of the sexuality item, coupled with the use of self-report data If departures from complete randomness are not serious, the impact of this bias may be unimportant; however, practically speaking, it is difficult to judge how large biases might be and reasons for non-responses can vary from elder to elder (Schafer & Graham, 2002). Another limitation is the lack of data with which to examine test-retest reliability. The evidence yielded in examining the construct validity of the BREF was also not consistent with its hypothesized measurement structure, this being most marked for the Norwegian sample. We only report suggested modifications given our lack of theoretical justification for revising the model (Hayduk 1996; Hayduk et al. 2006) based on the Norwegian findings.

Conclusion

Evidence for the effective performance of instruments among older adults should facilitate evidence-based practice (Haywood et al. 2004). Although ceiling effects were found for some items in the physical and environmental domains and higher than acceptable missing data was found for the sexuality item, some evidence supported the construct validity of the WHOQOL-BREF for use with older adults. Further work is recommended to further examine the measurement structure of the WHOQOL-BREF among older adults across cultures; comparative psychometric studies among international samples of older adults, including the publication of randomized population norms, would help further explain variations in findings by country.

References

Altman DG (1999) Practical statistics for medical research. Chapman & Hall, London

Amir M, Lewin-Epstein N, Becker G, Buskila D (2004) Psychometric properties of the SF-12 (Hebrew version) in a primary care population in Israel. Medical Care 40: 918–928

Amir M, Roziner I, Knoll A, Neufeld MY (1999) Self-efficacy and social support as mediators in the relation between disease severity and quality of life in patients with epilepsy. Epilepsia 40: 216–224

Andresen, EM (2000) Criteria for assessing the tools of disability outcomes research. Arch Phys Med Rehab 81 (2): S15 – S20

Bernheim JL (1999). How to get serious answers to the serious question: "How have you been?": Subjective quality of life (QOL) as an individual experiential emergent construct. Bioethics 13: 272-287

Bourque P, Pushkar D, Bonneville L, Beland F (2003) Contextual effects on life satisfaction among older men and women. Can J Aging 24: 31-44

Bowling A (1997) Measuring health. Open University Press

Bowling A, Gabriel Z, Dykes J, Dowding LM, Evans O, Fleissig A et al. (2003). Let's ask them: A national survey of definitions of quality of life and its enhancement among people aged 65 and over. Int J Aging & Hum Dev 56: 269-306

Bowling A, Ebrahim SS (eds) (2005) Handbook of health research methods: investigation, measurement and analysis. Open University Press, Maidenhead

Bowling A (2001a) Measuring disease: a review of disease specific quality of life measurement scales. 2 edn, Open University Press, Philadelphia

Bowling A (2005) Ageing well: quality of life in old age. Open University Press, Maidenhead

Bowling A (2006) Lay perceptions of successful ageing: findings from a national survey of middle aged and older adults in Britain. Eur J Ageing, 3, 126 – 136

Brown J, Bowling A, Flyn T (2004) Models of QoL: a taxonomy, overview and systematic review of the literature.European Forum on Population Ageing Research.

Byrne BM (2001) Structural equation modeling with AMOS: Basic concepts, applications, and programming. Erlbaum, Mahwah, NJ

Chachamovich E, Trentini C, Fleck MP (2006) Assessment of the psychometric performance of the WHOQOL-BREF instrument in a sample of Brazilian older adults. Int Psychogeriatr DOI: 10. 1017/s1041610206003619

Cummins R (1996). The domains of life satisfaction: An attempt to order chaos. Soc Indic Res 38: 303-328

D'Ath P, Katona P, Mullan E, Evans S, Katona C (1994) Screening, detection and management of depression in elderly primary care attenders. The acceptability and performance of the 15 item Geriatric Depression Scale (GDS15) and the development of short versions. Fam Pract 11: 260-266

Deeg DH and Wahl HW (2006) Expanding the frontiers of ageing research. Eur J Ageing 3: 1-2

Deyo RA, Diehr P, Patrick D (1991) Reproducibility and responsiveness of health status measures. Clinl Trials J 12: 1425– 1585

De Girolamo G, Rucci P, Scocco P, Beccchi A, Copps F, D'Addario A, et al. (2000) Quality of life assessment: validation of the Italian version of the WHOQOL- Bref. Epidemiol Psychiatr Soc 9: 45–55

Fang CT, Hsiung PC, Yu CF, Chen MY, Wang JD (2002) Validation of the World Health Organization quality of life instrument in patients with HIV infection. Qual Life Res 11: 753– 762

Fang FM, Tsai WL Chien CY, Chiu HC, Wang CJ, Chen HC, Hsiung CY (2005) Changing quality of life in patients with advanced head and neck cancer after primary radiotherapy or chemoradiation. Oncology 68: 405-413

Fleck MP, Louzada S, Xavier M, Chachamovich E, Viera G, Santos L, et al. (2000) Applications of the Portuguese version of the abbreviated instrument of quality of life WHOQOL–BREF. Rev Saude Publica 34: 178–183

Fitzpatrick R, Davey C, Bixton M, Jones DR (1998) Evaluating patient – based outcome measures for use in clinical trials. Health Technol Assess 2(14): 1-74

Hanestad BR, Rustøen T, Knudsen Ø Jr, Lerdal A, Wahl AK (2004) Psychometric properties of the WHOQOL – BREF Questionnaire for the Norwegian general population. J Nurs Meas 12: 147–159

Hasanah CI (2003) Approaches and methodological as well as interpretative issues in quality of life research in Malaysia. Malaysian Journal of Medical Sciences 10(2): 60-65

Hawthorne G, Herrman H, Murphy B (2006) Interpreting the WHOQOL–Bref: Preliminary population norms and effect sizes. Soc Ind Res 77: 37 – 59. DOI 10.1007/s11205-005-5552-1

Hayduk LA (1996) LISREL: Issues, debates, and strategies. Baltimore: Johns Hopkins University Press

Hayduk LA, Cummins G, Boadu K, Pazderka-Robinson, Boulianne S (2006). Testing! Testing! One, two, three – Testing the theory in structural equation models. Personality and Indiv Diff, 42: 841-850

Haywood KL, Garratt AM, Fitzpatrick R (2005) Older people specific health status and quality of life: a structured review of self-assessed instruments. J Eval Clin Practice 11(4): 315-327

Haywood KL, Garratt AM, Fitzpatrick R (2006) Quality of life in older people a structured review of self-assessed health instruments. Expert Review Pharmacoeconomics Outcomes Res 2(6): 181-194

Haywood K L, Garratt AM, Schmidt LJ, Mackintosh A, Fitzpatrick R. (2004) Health Status and Quality of Life in Older People: A Review. National Centre for Health Outcomes Development, Oxford

Hilleras PK, Jorm AF, Herlitz A,Winblad B (2001). Life satisfaction among the very old: A survey of a cognitively intact sample aged 90 years or above. Int J Aging & Hum Dev 52: 71-90

Hilleras, PK,Aguero-Torres, H, Winbald, B (2001). Factors influencing well-being in the elderly. Curr Opin Psych 14: 361-365

Hsiung PC, Fang CT, Chang YY, Chen MY, Wang JD (2005) Comparison of the WHOQOL – BREF and the SF-36 in patients with HIV infection. Qual Life Res 14: 141-150

Hwang HF, Liang WM, Chiu YN, Lin MR (2003) Suitability of the WHOQOL-BREF for community-dwelling older people in Taiwan. Age Ageing 32(6): 593-600

Homes W, Shea J (1997) Performance of a new HIV/ Aids-targeted quality of life (HAT- QOL) instrument in asymptomatic seropositive individuals. Qual of Life Res 6: 561–571

Jang Y, Hsieh CL, Wang YH, Wu YH (2004) A validity study of the WHOQOL–BREF Assessment in persons with traumatic spinal cord injury. Arch Phys Med Rehabil 85: 1890-1895

Jaracz K, Kalfoss MH, Gorna K, Baczyna G (2006) Quality of life in Polish respondents: Psychometric properties of the Polish WHOQOL–Bref. Scand J Caring Sci 20: 251-260

Kaiser HF, Caffrey J (1965) Alpha factor analysis. Psychometrika 30: 1-14

Kalfoss MH, Isaksen AS, Thuen F, Alve S (2007) The suitability of the WHOQOL-BREF in cancer relatives. In press. Cancer Nursing

Kline P (1986) A Handbook of Test Construction. London: Methuen

Kloseck M, Crilly RG, Mannell RC (2006). Involving the community elderly in the planning and provision of health services: Predictors of volunteerism and leadership. Can J Aging 25: 77-91

Laidlaw K, Power MJ, Schmidt S, the WHOQOL-OLD Group (2007). The attitudes to ageing questionnaire (AAQ): development and psychometric properties. Int J Ger Psychiatr 22: 367-379

Lampinen P, Heikkinen RL, Kauppinen M, Heikkinen E (2006). Activity as a predictor of mental well-being among older adults. Aging & Mental Health, 10(5), 454-466

Lin MR, Huang C, Hwang HF, Tsai LW, Chian YN (2002) The impact of the Chi-Chi earthquake on quality of life among elderly survivors in Taiwan – A before and after study. Qual Life Res 11: 379–388
Lin TH (2006) Missing data imputation in quality–of–life assessment: imputation for the WHOQOL-BREF. Pharmacoeconomics 24: 917–925

Leplege A, Reveillere C, Ecosse E, Caria A, Riviere H (2000) Psychometric properties of a new instrument for evaluating quality of life, the WHOQOL–26, in a population of patients with neuromuscular disease. Encephale 26: 13-22

Leung KL, Wong WW, Tay, MSM, Chu, MML, Ng SSW (2005) Development and validation of the interview version of the Hong Kong Chinese WHOQOL–BREF. Qual Life Res 14: 1413–1419

Low G, Molzahn AE (2007) Predictors of quality of life in old age: A cross-validation study. Res Nurs Health 30: 141-150

Low G, Molzahn AE, Kalfoss M (in press). Quality of life of older adults in Canada and Norway: Examining the Iowa Model. West J Nurs Res

McHorney CA (1996) Measuring and monitoring general health status in elderly persons; practical and methodological issues in using the SF – 36 health Survey. Gerontologist 36: 571 - 583

Menec VH (2003) The relation between everyday activities and successful aging: A 6 year longitudinal study. J Gerontol B Psychol Sci Soc Sci 58B: S74–S82

Min SK, Kim KI, Lee CI, Jung YC, Suh SY, Kim DK (2002) Development of the Korean versions of the WHO quality of life scale and the WHOQOL–BREF. Qual Life Res 11: 539– 600

Molzahn AE, Page G (2006) Field testing the WHOQOL-100 in Canada. Can J Nurs Res 38: 106-123

Naumann VJ and Byrne G (2003) WHOQOL–BREF as a measure of quality of life in older patients with depression. Int Psychogeriatr DOI: 10:1017/S1041610204000109

Norholm V, Bech P (2001) The WHO quality of life (WHOQOL) questionnaire in Danish validation study. Nord J Psychiatry 55: 229–35

Nunnally JC, Bernstein IH (1994) Psychometric Theory, 3rd ed. McGraw-Hill, New York

O'Boyle CA (1997) Measuring the quality of later life. Philosophy Transactions of the Royal Society of London 352: 1871-1879

O'Carroll RE, Smith K, Couston M, Cossar JA, Hayes PA (2000) Comparison of the WHOQOL – 100 and the WHOQOL – Bref in detecting change in quality of life following liver transplantation. Qual Life Res 9: 121-124

Ohaeri JU, Olusina AK, Al-Abassi Abdul-Hamid M (2004) Path analytical study of the short version of the World Health Organization Quality of Life Instrument. Psychopathology 37: 242–248

Organisation for Economic Cooperation and Development (1999) Maintaining prosperity in an ageing society, OCED, Paris

Power M, Quinn K, Schmidt S, WHOQOL-OLD Group (2005) Development of the WHOQOL–Old Module. Qual Life Res 14: 2197–2214

Power M, Harper A, Bullinger M, (1999) The World Health Organization WHOQOL – 100: tests of the universality of quality of life in 15 different cultural groups worldwide. Health Psychology 18: 495–505

Pukrop R (2003). Subjective quality of life. Critical look at a modern construct. Der Nervenarzt 74*:* 48-54

Puts MTE, Shekary N, Widdershoven G, Helde J, Lips P, Deeg DJH (2007). What does quality of life mean to older frail and non-frail community-dwelling adults in the Netherlands? Qual Life Res 16*:* 263-277

Saxena S, Chandiramani K, Bhargava R (1998) WHOQOL – Hindi: A questionnaire assessment of quality of life in health care settings in India. World Health Organization Quality of Life. Natl Med J India 11: 160–165

Schafer JL, Graham JW (2002) Missing data: Our view of state of the art. Psychological Methods, 7: 147-177

Sheikh JI, Yesavage JA (1986) Geriatric depression scale (GDS). Recent evidence and development of a shorter version. Clin Gerontol 5: 165-173

Skevington SM (2002) Advancing cross-cultural research on quality of life: Observation drawn from the WHOQOL development. Qual Life Res 11: 135-144

Skevington SM, Lotfy M, O'Connell KA (2004) The World Health Organization's WHOQOL-BREF quality of life assessment: Psychometric properties and results of the international field trial. A report from WHOQOL Group. Qual Life Res 13: 299-310

Statistics Canada (2005) Population projections for 2001, 2006, 2011, 2016, 2021 and 2026. July 2003 CANSIM table. Retrieved March 8, 2005 from www.statscan.ca/english/Pgdb/demo23b.htm

Statistics Norway. Statistical Yearbook of Norway 2006. 02 Population, Tables 45, 46, 58, 60. Retrieved February 16, 2006 from (www.ssb.no/english/yearbook/emne02.html)

Straub D, Boudrea, MC, Gefen D (2004) Validation guidelines for IS positivist research. Communications of the Association for Information Systems, 13: 380-427

Strawbridge WJ, Wallhagen MI, Cohen CD (2002) Successful ageing and well-being. Self-rated compared with Rowe and Kahn. Gerontologist 42: 727-733

Streiner D, Norman GR (eds) (2003) Health measurement scales: a practical guide to their development and use. 3 edn, Oxford University Press, Oxford

Streiner DL, Norman GR (2006) "Precision" and "accuracy": two terms that are neither. J Clin Epidemiol 59(4):327-30

Tate RB, Lah L, Cuddy TE (2003). Definition of successful aging by elder Canadian males: The Manitoba follow-up study. Gerontologist 43: 735-744

Taylor WJ, Myers J, Simpson RT, McPherson KM, Weatherall M (2004) Quality of life of people with rheumatoid arthritis as measured by the World Health Organization Quality of Life Instrument, short form (WHOQOL-BREF): score distributions and psychometric properties. Arthritis Rheum 51: 350-7

Tazaki M, Nakane Y, Endo T, Kakikawa F, Kano K, Hiroomi K, et al. (1998) Results of a qualitative and field study using the WHOQOL instrument for cancer patients. Jpn J Clin Oncol 28: 134-141

Terwee, CB, Bot SDM, de Boer MR, van der Wint DAWM, Knol, DL, Dekker J et al. (2007) Quality criteria were proposed for measurement properties of health status questionnaires. J. Clin Epidemiol 60: 34-42

Trompenaars F, Masthoff ED, Van Heck GL , Hodiamont PP, De Vries J (2005) Content validity, construct validity and reliability of the WHOQOL – Bref in a population of Dutch psychiatric outpatients. Qual Life Res 14: 151–160

Ullman JB (2001) Structural equation modeling. In: Tabachnick G & Fidell LS (eds), Using multivariate statistics (4th ed) Allyn and Bacon, Toronto, Ontario, pp. 653-771

United Nations Organizations (2002) World Population Ageing 1950–2021. UNO, New York

Victorino CC, Gauthier AH (2005). Are Canadian seniors becoming more active? Empirical evidence based on time-use data. Can J Aging 24: 45-56

Von Steinbuchel N, Lischetzke T, Gurny M, Eid M (2006) Assessing quality of life in older people: psychometric properties of the WHOQOL – Bref. Eur J Ageing 2: 116–122

Walker A (2005 a) A European perspective on quality of life in old age. Eur J Ageing 2: 2-12

Walker A (2005b) Growing older in Europe. Open University Press, Maidenhead

Walker A (2005c) Understanding quality of life in old age. Open University Press, Maidenhead

Ware JE (1997) SF – 36 Health Survey. Manual and interpretation Guide. The Health Institute, New England Medical Centre. Boston, MA. Nimrod Press. Second Edition

Ware JE, Kosinski M, Turner-Bowker DM., Gandek B, Keller SD (2002). How to score: Version 2 of the SF-12 health (with a supplement documenting version 1).Lincoln, RI, Quality Metric Incorporated and Boston MA: Health Assessment Lab

WHOQOL Group (1992) The World Health Organization Quality of Life Assessment (WHOQOL World Health Organization. Measuring Quality of Life. The development of the World Health Organization Quality of Life Instrument (WHOQOL). WHO, Geneva

WHOQOL Group (1998a) Development of the WHOQOL-BREF quality of life assessment. Psychol Med 28: 551-558

WHOQOL Group (1998b) Development of the World Health Organization WHOQOL – BREF Quality of Life Assessment. Psychol Med 28: 551–558

The WHOQOL-OLD Group (2005) The WHOQOL-OLD Manual World Health Organization (W.H.O.) group in Copenhagen (WHO/EURO)

World Health Organization (1995a) The World Health Organization quality if life assessment (WHOQOL): Position paper from the World Health Organization. Soc Sci Med 41: 1403-1409

World Health Organization (1995b) WHOQOL – 100. Facet Definitions and Questions. WHO/MNH/PSF/951.B. Rev.1 WHO, Geneva

World Health Organization (1995c) Field Trial: WHOQOL – 100. The 100 Questions and Response scales. MNH/PSF 95. ID Rev, WHO, Geneva

World Health Organization (1996) The World Health Organization's WHOQOL – BREF Quality of life Assessment: Psychometric Properties & Results of the International Field Trial

World Health Organization (1997) WHOQOL – BREF. Introduction, administration, scoring, and generic version of the assessment. MNH/PSF 97.4 WHO, Geneva

Wirnsberger RM, de Vries J, Breteler, Van Heck G. Wouters EFM, Drent M (1998) Evaluation of quality of life in sarcoidosis patients. Respir Med 92: 750-756

Yao G, Chung CW, Yu CF, Wang JD (2002) Development and verification of the validity and reliability of the WHOQOL-BREF Taiwan version. J Formosa Med Assoc, 101: 342–351

Yao G, Wu CH (2005) Factorial invariance of the WHOQOL–BREF among disease groups. Qual Life Res 14: 1881-1888

Yesavage JA, Brink TL, Rose TL, Lum O, Huang V, Adey M, Leirer O (1983) Development and validation of a geriatric depression screening scale: a preliminary report. J Psychiatr R 17: 37-49

Table 1.
Data distribution and Cronbach's alpha for BREF domains

Domains (number of items)		Mean (SD)	95% CI	Kurtosis	Skewness	Test of normal distribution[a]	Cronbach's alpha
Physical (7)	(C)	16.13 (2.96)	15.72 - 16.56	.854	-.979	.114***	.888
	(N)	14.47 (3.05)	14.19 - 14.75	-.211	-.434	.090***	.866
Psychological (6)	(C)	16.05 (2.13)	15.74 – 16.35	.802	-.592	.111***	.809
	(N)	15.00 (2.08)	14.81 – 15.19	.282	-.326	.121***	.809
Social (3)	(C)	15.66 (2.68)	15.28 – 16.05	.497	-.600	.133**	.667
	(N)	15.14 (2.12)	14.95 – 15.33	.249	-.271	.167***	.545
Environmental (8)	(C)	16.81 (2.36)	16.47 – 17.14	.670	-.871	.116***	.859
	(N)	15.32 (2.05)	15.13 – 15.50	.923	-.313	.068***	.803

Note. CI, confidence interval. C, Canada (n = 192). N, Norway (n = 469).

[a]Kolmogorov-Smirnov test with Lillefor's correction.

**p < .01. ***p < .001.

Table 2.
BREF domain and overall item mean scores for total sample and by health status

Domains		Total sample Mean (SD)	Unhealthy Mean (SD)	Healthy Mean (SD)	t	p-value
Physical	(C)	16.13 (2.96)	12.04 (2.95)	16.95 (2.18)	-10.662	.000
	(N)	14.47 (3.05)	10.80 (2.47)	15.40 (2.45)	-15.562	.000
Psychological	(C)	16.05 (2.13)	13.91 (2.10)	16.46 (1.91)	-6.604	.000
	(N)	15.00 (2.08)	13.54 (2.08)	15.38 (1.93)	-6.795	.000
Social	(C)	15.66 (2.68)	13.76 (3.24)	16.01 (2.42)	-3.618	.001
	(N)	15.14 (2.12)	13.98 (1.94)	15.42 (2.07)	-5.825	.000
Environmental	(C)	16.81 (2.36)	14.24 (2.92)	17.31 (1.90)	-5.529	.000
	(N)	15.32 (2.05)	13.40 (1.83)	15.69 (1.98)	-7.225	.000

Note. C, Canada. N, Norway.

Canada (N = 192); healthy (n = 160); unhealthy (n = 30).

Norway (N = 469); healthy (n = 364); unhealthy (n = 85).

Table 3.
BREF domain and overall item mean scores for total sample, and those with and without morbidities

Domains		Total sample	Without morbidity	With morbidity	t	p value
		Mean (SD)	Mean (SD)	Mean (SD)		
Physical	(C)	16.13 (2.96)	18.20 (1.49)	15.29 (3.00)	-8.983	.000
	(N)	14.47 (3.05)	16.05 (2.49)	12.84 (2.70)	-13.392	.000
Psychological	(C)	16.05 (2.13)	16.82 (1.76)	15.73 (2.19)	-3.325	.001
	(N)	15.00 (2.08)	15.53 (2.11)	14.45 (1.92)	-5.091	.000
Social	(C)	15.66 (2.68)	16.60 (2.45)	15.28 (2.68)	-3.178	.002
	(N)	15.14 (2.12)	15.50 (2.19)	14.77 (1.97)	-3.828	.000
Environmental	(C)	16.81 (2.36)	17.37 (1.81)	16.58 (2.52)	-2.432	.035
	(N)	15.32 (2.05)	15.78 (2.10)	14.84 (1.89)	-5.101	.000

Note. C, Canada. N, Norway.

Canada (N = 192); without morbidity (n = 55); with morbidity (n = 137).

Norway (N = 469); without morbidity (n =238); with morbidity (n = 231).

Figure 1. Second Order Factor Model of WHOQOL-BREF for Older Adults in Canada

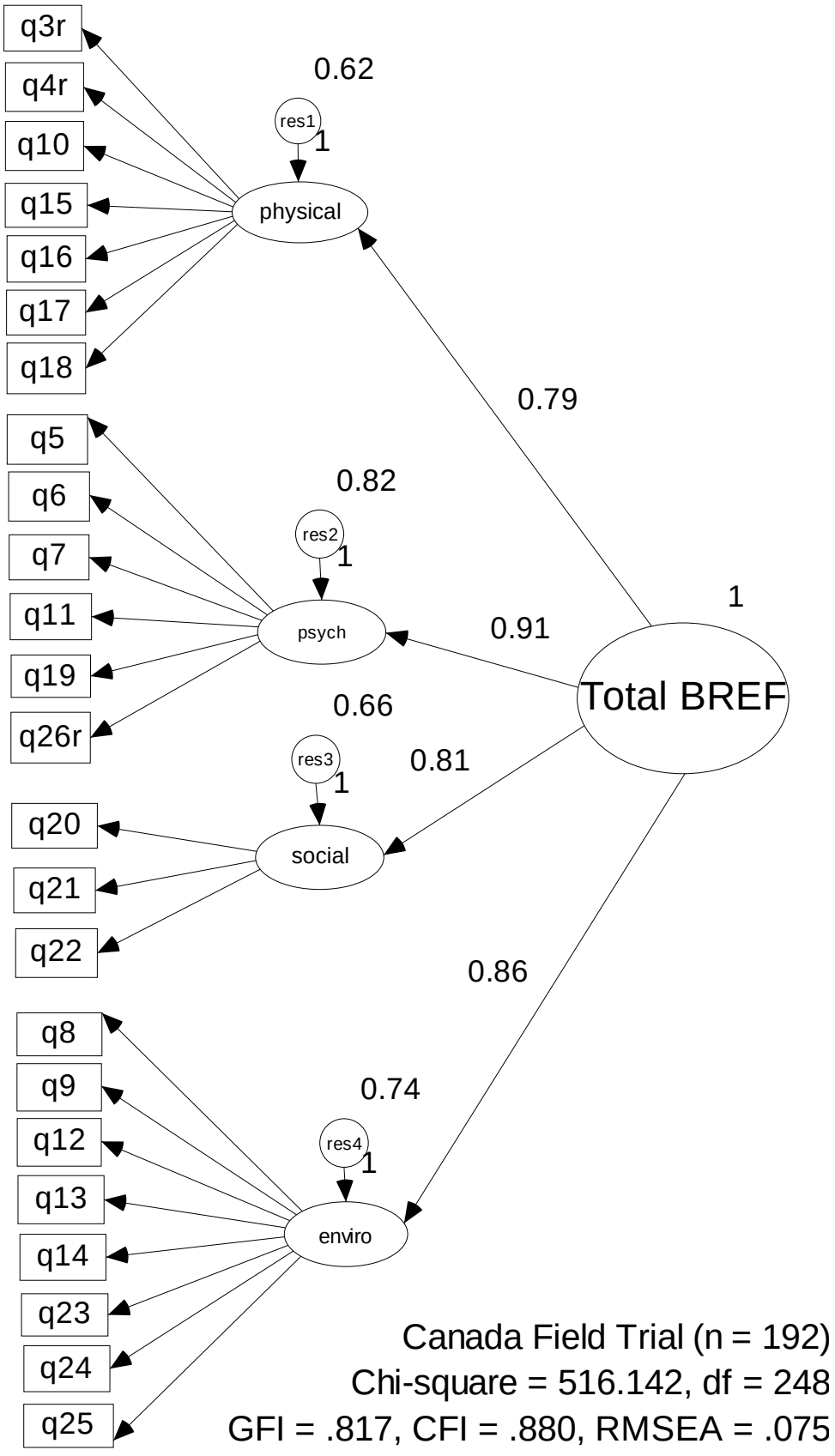

Figure 2. Second Order Factor Model of the WHOQOL-BREF for Older Adults in Norway