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The Recursive Effects of Quality of Life and Functional Limitation among Older Adult Cancer Patients: Evidence from the Survey of Health and Retirement in Europe

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Abstract

Older cancer patients need to cope with two major stressful situations simultaneously – age-related stress and stress illness-related stress. The current study aimed to explore whether patients' quality of life (QoL) and functional limitations have a reciprocal effect over time, and further aimed to assess whether these effects differ by age group.

Data were drawn from the two first waves of the Survey of Health, Ageing, and Retirement in Europe. Five hundred ninety-eight participants reported that they were diagnosed with cancer or malignant tumors. All participants completed self-report questionnaires tapping personal and medical data, QoL and functional limitations. By using a two-wave cross-lagged design findings showed a reciprocal relationship between QoL and functional limitations among older cancer patients. This reciprocal relationship was stronger in the direction from QoL to functional limitations, especially among those 75 and older in comparison to younger patients (50–74). This suggests that assessment of QoL may be beneficial to clinicians in predicting deterioration in functional limitations among older patients receiving cancer treatment.

Keywords

older patients; cancer; quality of life; functional limitation

Introduction

Cancer is the most common disease world over with incidence rates that increase with advancing age, for most of its types (Wedding *et al.*, 2007). Older cancer patients comprise

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the majority of cancer patients in developed countries (Yancik & Ries 2004). Improvement of medical treatments has lead to growing numbers of older cancer survivors (Brenner 2002) and added interest in exploring and promoting their quality of life (QoL) (e.g., Repetto *et al.* 2001a; 2001b). According to Wedding *et al.* (2007), elderly cancer patients tend to consider QoL as more important than extended survival, when compared to younger patients.

QoL is a broad ranging concept that incorporates, in a complex way, the person's physical health, psychological state, level of independence, social relationships, personal beliefs and their relationship to salient features of the environment (WHO International 2008). According to Baumann *et al.* (2009), age exerts a negative influence on one's physical, mental, social and functional, but not emotional aspects, of life. Thus, one may assume that in line with the prolonged stress model (Mages & Mendelsohn 1979), older cancer patient who need to cope with two major stress situations simultaneously – age-related and illness-related stress – will reveal worse QoL. However, comparing QoL of older cancer patients to their same-age counterparts without cancer demonstrated conflicting results: some studies reported similar QoL (e.g., Fredheim *et al.* 2008), others reported better (e.g., Krouse *et al.* 2007) and some reported worse QoL among older cancer patients (e.g., Baker *et al.*, 2003; Thome *et al.* 2004). According to Hyde *et al.* (2003) this inconsistency may stem from the diverse definition of QoL among older people that is a complex and a multifaceted phenomenon that requires greater understanding. They suggested adapting a 'needs satisfaction' approach to measuring QoL in early old age which consists of four equally important domains of need: control (the need to actively influence one's environment), autonomy (the need to limit unwanted interference by others), self-realization (the need to reflectively choose one's way as a human being) and pleasure (the need to be satisfied with one's life) (Hyde *et al.*, 2003).

Another variable which may represent older cancer patients' conditions is functional limitations. Several potential reasons for the increased prevalence of functional limitations (i.e. inability to perform a physical action, task, or activity in an efficient, typically expected or competent manner, WHO, 2002) were found among cancer patients and survivors. Reasons included cancer treatments, socio demographic factors (age, income), psychosocial factors (depression, increased stress, and poor mental health status), and reduced tendency to engage in behaviors that reduce the prevalence of functional limitations (Schootman *et al.* 2009). Individuals who reported functional limitations were found to be at increased risk for health problems, for progression to disability, and, possibly, for earlier mortality (Reuben *et al.* 2004; Fried *et al.* 2005; Onder *et al.* 2005). Very few studies have specifically examined the functional limitations of older cancer patients, or evaluated factors that influence how function may change over time once the diagnosis of cancer is made, and how QoL reflects those changes (Garman & Cohen 2002). Moreover, given that functional limitation evaluation lies along a spectrum between performance status, evaluation and the broader evaluation of QoL (Garman & Cohen 2002), one may assume that QoL and functional limitations may have a reciprocal relationship. However, while deficiency of QoL is acknowledged to be an independent adverse health outcome (e.g., Blane *et al.* 2004), the other possibility, that QoL may be a predictor of adverse health outcomes such as functional limitations has not been assessed. This way of thinking was found with regard to QoL as a

predictor of death and clinical complications among older people who suffer from lung cancer (Movsas *et al.* 2009), metastatic prostate cancer (Sullivan *et al.* 2006) and community-dwelling outpatients aged 65+ in Italy (Bilotta *et al.* 2011).

Additionally, the complexity of studying QoL and functional limitations of older cancer patients is also shown with regard to the effects of cancer on different age groups of older patients. In a recent study conducted by Cohen (2014), findings revealed that nonlinear associations exist between age and depression, anxiety, and somatic symptoms in cancer patients aged 60 years and older. These symptoms were lowest in the 70–79 years age group as compared with the 60–69 and 80+ years age groups, and the highest in the 80+ years age group. Cohen's (2014) findings were in line with previous studies (Arndt *et al.* 2006; Palgi *et al.* 2013; Harden 2008), that found that patients in their 60s to early 70s had better physical and mental QoL than patients in their 50s or patients in their late 70s and older. These results suggest that studying QoL and functional status among older cancer patients should examine differences between age groups.

Following the literature reviewed above, the current study aimed to explore the following questions: 1) Can QoL be a predictor of functional limitations among older cancer patients, suggesting a potential reciprocal nature of the functional limitations-QoL relationship? 2) Does the potential reciprocal nature of the functional limitations-QoL relationship operate in different ways across age groups?

Method

Participants and Procedure

Data were drawn from the two first waves of the Survey of Health, Ageing, and Retirement in Europe (SHARE; Börsch-Supan *et al.* 2008). The SHARE data include data regarding persons aged 50 years and older and their spouses regardless of age from eleven countries. Based on probability samples of households in each participating country, SHARE represents the community-dwelling older population. The data were collected by a comprehensive computer-assisted personal interview, which lasted about 90 minutes, and a supplementary paper Drop-Off questionnaire, which was generally returned at a later date. In the computer-assisted interview, interviewers read the questions to the participants and typed their answers. The paper Drop-Off questionnaires were completed by the participants. Informed consent was obtained from all participants prior to the interview.

In total, there were 31,115 participants in Wave 1 (W1, 2004-6). Of them, 18,742 participated in Wave 2 (W2, 2006-8). These participants were interviewed in eleven countries (Austria, Belgium, Denmark, France, Greece, Italy, Netherlands, Germany, Spain, Sweden and Switzerland). The current study focused only on participants who reported having cancer, whose data is included in both waves of SHARE, and who did not have missing values for the main study variables. Overall, there were 598 participants who reported that they were diagnosed with cancer or malignant tumors (including leukemia or lymphoma, but excluding minor skin cancers), and who filled the other aforementioned criteria (see Figure 1).

Attrition analyses comparing participants who reported having cancer and participated in both waves ($n = 598$) to those who reported having cancer and participated in W1 only ($n = 435$). These analyses showed that those who did not participate in both waves were older, had a higher proportion of men, and reported lower QoL than those who did. However, the size of these differences was small (Cohen's d for age and QoL was 0.17, and -0.24 , respectively, and for gender was 0.084). Moreover, the groups did not differ in education, number of medical conditions other than cancer and functional limitations.

Measures

Quality of life—QoL was measured using 12 items originating from the Control, Autonomy, Self-realization and Pleasure (CASP-19) (CASP-12; Hyde *et al.* 2003). This measure conceptualizes QoL in terms of need satisfaction in four domains: having a sense of control, autonomy, self-realization, and pleasure. Control is defined as the ability to actively intervene in one's environment. Autonomy is defined as the ability of an individual to be free from the unwanted interference of others. Self-realization and pleasure capture the active and reflexive processes of self-fulfillment. The items are rated on a scale ranging from "never" (1) to "often" (4). In the present analysis, completion of a minimum of 10 items was required for scoring a sum, with scores of 10–11 items being interpolated by dividing the sum score by the number of completed items and then multiplying that value by 12. Internal reliability for the CASP-12 measured by Cronbach's α was .82 and .77 at W1 and W2, respectively.

Functional limitations—The functional limitation measure (adapted from Nagi 1976) included five physical activities, specifically stooping, kneeling, or crouching, reaching or extending arms above shoulder level, pulling or pushing heavy objects, lifting or carrying heavy weights, and picking up a small coin from a table. Each limitation was rated with a dichotomized answer (*not having difficulties/having difficulties*). Functional limitation reflected the sum of difficulties reported. Internal reliability (Kuder-Richardson's ρ) was .63 and .65 at W1 and W2, respectively.

Covariates—Covariates included gender, education and medical conditions other than cancer. Education was also included and was recorded by one of seven education levels according to the International Standard Classification of Educational Degrees (ISCED-97; UNESCO, 1997). Medical conditions (other than cancer) were assessed by a sum of listed illnesses that participants reported to have been diagnosed by a physician. The illnesses included heart disease (e.g., myocardial infarction, coronary thrombosis, or any other heart problem including congestive heart failure), high blood pressure, high cholesterol, stroke or cerebral vascular disease, diabetes or high blood sugar, chronic lung disease such as chronic bronchitis or emphysema, asthma, arthritis (including osteoarthritis or rheumatism), osteoporosis, stomach or duodenal ulcer or peptic ulcer, Parkinson disease, cataracts, and hip fracture or femoral fracture.

Data Analysis

A two-wave cross-lagged design was used to analyze the data using AMOS 20.0 program (see Figure 2).

Model fit was first assessed by the χ^2 measure, but due to the sample size (which was less than 250 subjects in some analyses) we followed the recommendations by Hu and Bentler (1999), and further used the Comparative Fit Index (CFI) and the standardized root mean squared residual (SRMR). Scores above .95 indicate acceptable fit for CFI, and values below .08 indicate adequate fit for SRMR (Hu & Bentler 1999).

A number of nested models were compared with the proposed model of cross-lagged mutual causality. This model included (1) autoregressive paths only, (2) QoL-to-functional limitation only and (3) functional limitation-to-QoL only. In order to confirm our first hypothesis, the cross-lagged model (including both cross-lagged effects and autoregressive paths) would fit the data better than each of the other three alternative models.

For age invariance analyses (second hypothesis) a multiple-group approach was used, comparing the baseline model without constraints with more constrained models. For this purpose, participants were divided into three age groups that were meaningful and that closely corresponded to age tertiles: 50–64 ($n = 163$), 65–74 ($n = 293$), and 75 and above ($n = 125$).

Results

Participants demographics and medical characteristics

The sample included 598 participants. Mean age was 66.22 ($SD = 9.45$), 64.0% were women, and mean education level was 2.69 ($SD = 1.50$), closely corresponding to upper secondary education. These participants were divided across the eleven countries included in the study (ranging from 4.3% participants from Spain to 20.2% participants from Belgium).

Participants were further asked about the site of their cancer. Table 1 presents the distribution of cancer sites.

Quality of life and functional limitations

Table 2 presents the descriptive statistics for the study variables.

As can be seen, levels of QoL and functional limitation did not change much across the study waves. QoL correlated strongly across the waves, $r = 0.62$, $p < .0001$, as did functional limitation, $r = 0.55$, $p < .0001$. QoL and functional limitation negatively correlated at both waves, but showed a stronger association at W2 (for W1: $r = -0.29$, $p < .0001$; for W2: $r = -0.41$, $p < .0001$). Moreover, the two variables moderately correlated across waves (QoL at W1-Functional limitation at W2: $r = -0.35$, $p < .0001$; Functional limitation at W1-QoL at W2: $r = -0.30$, $p < .0001$). Finally, covariates mostly showed moderate correlations with the main variables (absolute value r ranged -0.01 to 0.30).

Finally, before continuing to the main analyses, we compared participants with different cancer sites on the main variables (QoL and functional limitation) after controlling for covariates (age, gender, education and number of medical conditions other than cancer). This analysis found no significant differences in the main variables between participants

with different cancer sites (QoL at W1: $p = .950$; QoL at W2: $p = .831$; Functional limitation at W1: $p = .921$; Functional limitation at W2: $p = .460$).

The cross-lagged model—The cross-lagged model exhibited acceptable model fit ($\chi^2 = 33.14$, $df = 6$, CFI = 0.96, SRMR = 0.03). Selected parameter estimates are presented in Table 3.

Higher levels of QoL at W1 were associated with lower levels of functional limitation at W1 ($\phi = -0.25$, $p < .0001$). Similarly, higher levels of QoL at W2 were associated with lower levels of functional limitation at W2 ($\phi = -0.22$, $p < .0001$). The autoregressive regression weights were positive and significant ($\beta = 0.59$ and 0.49 for QoL and functional limitation, respectively, $p < .0001$). Supporting our first hypothesis, a higher level of QoL at W1 was related to lower functional limitation at W2 ($\beta = -0.20$, $p < .0001$) and a higher level of functional limitation at W1 was related to lower QoL at W2 ($\beta = -0.12$, $p < .0001$).

To test whether the size of association was larger in one direction (e.g., from QoL at W1 to functional limitation at W2) than the other (e.g., from functional limitation at W1 to QoL at W2) we imposed equality constraints on these regression weights and compared the fit of this model to the model without constraints. The constraints led to deterioration in model fit ($\chi^2 = 11.92$, $p < .001$), indicating that the association was stronger in the direction from QoL at W1 to functional limitation at W2.

Subsequently, we examined a number of nested models to the proposed model of cross-lagged mutual causality. Both the QoL-to-Functional limitation ($\chi^2 = 46.94$, $df = 7$, CFI = 0.95, SRMR = 0.04) and Functional limitation-to-QoL models ($\chi^2 = 67.64$, $df = 7$, CFI = 0.92, SRMR = 0.05) fit the data better than a stability model, including only autoregressive paths ($\chi^2 = 84.51$, $df = 8$, CFI = 0.90, SRMR = 0.07), $\chi^2 = 37.57$ and 16.87 , respectively, $p < .001$. The cross-lagged model showed better model fit than the stability model, QoL-to-Functional limitation model and Functional limitation-to-QoL model ($\chi^2 = 13.80$, 34.50 and 51.37 , respectively, $p < .001$), supporting a reciprocal relationship across time between QoL and functional limitation.

Invariance testing of cross-lagged estimates—The cross-lagged estimate linking functional limitation at W1 to QoL at W2 was invariant across age groups ($\chi^2 = 1.59$, $p = .451$). This meant that the estimate did not significantly differ across the three age groups. However, the cross-lagged estimate linking QoL at W1 to functional limitation at W2 was not invariant across age ($\chi^2 = 9.56$, $p = .008$). Inspection of the estimate showed that it was the strongest among those 75 and older ($\beta = -0.36$, $p < .0001$) and weaker among those 50–64 ($\beta = -0.22$, $p < .0001$) and 65–74 ($\beta = -0.13$, $p = .008$).

Discussion

The present study aimed to explore whether patients' quality of life (QoL) and functional limitations have a reciprocal effect on each other over time, and whether these effects differ by age group. Findings show that a reciprocal relationship does exist between QoL and functional limitations among older cancer patients. This reciprocal relationship was stronger

in the direction from QoL to functional limitation, especially among those 75 and older in comparison to those 50–64 and 65–74 years old.

The relationship that was found between functional limitation and QoL is in line with previous studies (e.g., Rosenthal 2001; Garman & Cohen 2002; Fehlauser *et al.* 2005; Wolinsky *et al.*, 2007). Functional limitation has a unique role in the context of QoL, because it represents the essential life skills that a person needs to be able to accomplish on a daily basis. Inability to complete many of the functional skills may have dire ramifications on health and toleration to cancer therapy (Garman & Cohen 2002).

However, this is the first study that revealed a valid relation in the opposite direction - from QoL to functional limitation. This suggests that assessment of QoL may be beneficial to clinicians in predicting deterioration in functional limitations among older patients receiving cancer treatment. Moreover, as this relationship was stronger among those 75 and older, it is important to be aware of this correlation when caring for cancer patients in that age group. Previous studies have stated that lower overall QoL is associated with increasing age (e.g., Hjermstad *et al.* 1998; Arndt *et al.* 2006) due to decline in personal, interpersonal and economic resources (Cohen 2014). Moreover, according the "need satisfaction" approach (Hyde *et al.*, 2003) one may assume that when needs such as self-actualization, happiness and esteem are satisfied (meaning – high QoL), the functional limitation becomes less relevant (McKenna *et al.* 1999). Lower QoL might be more common among the oldest respondents since detrimental health conditions affect their self-assessments both directly by reducing the level of life satisfaction and indirectly by pessimistically biasing their reporting styles.

These results also have several implications for clinical practice. The main conclusion is that the oldest cancer patients (75+ years) with low QoL are at the highest risk for decline in functional status. Therefore oncologists, nurses, and psycho-oncologists should focus on identifying these patients and tailoring interventions to meet their specific needs and problems. In addition, attention should be given to identifying and helping older cancer patients solve functional limitations and improving their QoL because of the reciprocal effect between them. This can be accomplished by engaging multi-disciplinary oncology teams (Husson *et al.* 2011).

Several study limitations should be mentioned. First, in the present study we could not assess whether the reciprocal nature of the functional limitations-QoL relationship operates differently in different cancer sites, because of the small number of participants with each type of cancer. Future studies are warranted to assess this relationship. Second, in the current study we did not assess additional important variables that were not available in SHARE. For example, personality traits were found to be related to QoL and to willingness to report physical and mental symptoms (Brett *et al.* 2014), but were not included in the first two waves of SHARE.

In conclusion, the reciprocal relation between QoL and functional limitations, which was found in the current research, is especially important among older cancer patients, as they are more vulnerable to negative health outcomes. This reinforces the importance of

considering the cancer patient's age and how age will impact on his/her overall QoL and functional status. It is also suggested that future studies should employ the reciprocal relation between QoL and functional limitations to explore the age differences in different types of cancer.

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Figure 1.
A flow chart of study participants.

Figure 2.
Specification of the tested cross-lagged model

Table 1

Site of Cancer among Study Participants

<i>Site of Cancer</i>	n	%
Breast cancer	189	31.6
Digestive cancer		
Colon or rectum	61	11.0
Esophagus	3	0.5
Liver	4	0.7
Pancreas	2	0.4
Stomach	12	2.2
Genitourinary cancer		
Bladder	20	3.6
Kidney	10	1.8
Prostate	64	11.5
Testicle	4	0.7
Gynecologic cancer		
Cervix	21	3.8
Endometrium	29	5.2
Ovary	15	2.7
Skin cancer	49	8.2
Other kinds		
Blood-related (lymphoma, leukemia, non-Hodgkin)	27	4.5
Brain	9	1.6
Head and neck (oral cavity, larynx, other pharynx)	17	2.8
Endocrine-related (thyroid)	7	1.3
Respiratory (lung)	13	2.3
Did not report cancer site	42	7.0

Table 2

Means, Standard Deviations, and Correlations for the Study Variables

Variable	M	SD	1	2	3	4	5	6	7
1. Quality of life W1	25.41	6.01	-						
2. Quality of life W2	25.01	5.82	.62***	-					
3. Functional limitation W1	0.92	1.17	-.29***	-.30***	-				
4. Functional limitation W2	0.93	1.20	-.35***	-.41***	.55***	-			
5. Age	66.22	9.45	-.03	-.16***	.16***	.26***	-		
6. Gender (% Woman)	64.0	-	-.01	.23***	.23***	.22***	-.11**	-	
7. Education	2.69	1.50	.24***	-.15***	-.15***	-.20***	-.25***	-.09*	-
8. Number of medical conditions (other than cancer)	1.42	1.36	-.18***	.30***	.30***	.21***	.25***	-.07	-.16***

Note. N = 589. Values represent Pearson coefficients except for coefficients for gender that represent point-biserial coefficients and those for education that represent Spearman's rank coefficients

* $p < .05$.

** $p < .01$.

*** $p < .001$

Table 3

Selected Parameter Estimates for the Cross-Lagged Model

	Parameter estimate			
	Unstandardized estimate	Standardized estimate	Standard error	Critical ratio
Correlations				
QoL W1 ↔ Functional limitation W1	−1.54	−0.25	0.26	−5.91***
QoL W2 ↔ Functional limitation W2	−0.96	−0.22	0.18	−5.31***
Regression weights				
Gender → QoL W1	−0.07	−0.006	0.49	−0.15
Gender → Functional limitation W1	0.62	0.25	0.09	6.74***
Medical conditions → QoL W1	−0.67	−0.15	0.17	−3.81***
Medical condition → Functional limitation W1	0.26	0.30	0.03	8.05***
Education → QoL W1	0.86	0.21	0.16	5.38***
Education → Functional limitation W1	−0.06	−0.07	0.03	−2.06*
QoL W1 → QoL W2	0.57	0.59	0.03	17.93***
Functional limitation W1 → Functional limitation W2	0.50	0.49	0.03	14.28***
QoL W1 → Functional limitation W2	−0.04	−0.20	0.007	−5.95***
Functional limitation W1 → QoL W2	−0.60	−0.12	0.16	−3.73***

Note. N = 598.

p < .001