RESEARCH ARTICLE

Influence of Offspring on Quality of Life among Cancer Patients and Survivors: Results from the Korean Longitudinal Study of Aging (KLoSA), 2008-2011

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Abstract

Background: To examine whether offspring improve or reduce quality of life (QOL) among cancer patients and survivors. Materials and Methods: We used data from the Korean Longitudinal Study of Aging (KLoSA) from 2008 to 2011. There were 490 research subjects in our study: 245 cancer patients and survivors and 245 controls matched using propensity scores. Results: For cancer patients and survivors with no offspring, the QOL estimate was -2.831 lower (SE: 5.508, p-value: 0.623) than that of those with two offspring, while for those with five or more offspring, the QOL estimate was 7.336 higher (SE: 2.840, p-value: 0.036). For non-cancer patients and survivors with one child, the QOL estimate was -11.258 lower (SE: 2.430, p-value: 0.002) than that of those with two offspring, while for those with five or more offspring, the QOL estimate was -4.881 lower (SE: 2.484, p-value: 0.090). Conclusions: This article provides evidence for a beneficial effect of offspring upon QOL in cancer patients and survivors, indicating that offspring are important for them.

Keywords: Offspring - loneliness - depressive disorder - Korean cancer patients

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Introduction

In South Korea, cancer has been the leading cause of death since 1983, and the overall incidence rate increased 3.3% per year (1.5% in males and 5.3% in females) from 1999 to 2010 (Jung et al., 2010). Many epidemiological studies have suggested that cancer risk is associated with a western lifestyle (Zhang et al., 2012).

A previous study indicates that cancer influences quality of life (QOL) in patients and their families (Montazeri et al., 1996). Studying QOL, especially in patients with a life-threatening disease such as cancer, is becoming increasingly important. This is due to several factors, including understanding patients' experiences of the impact of the disease and its treatments. It has been argued that such understanding may help to deliver effective and efficient healthcare. Many previous QOL studies have been conducted in patients with cancer. These studies have found that the QOL of patients with cancer is affected by many factors, such as treatment with palliative intent, socioeconomic status, psychosocial and demographic factors, social and family support, and the presence of a spouse caregiver (Dorval et al., 1998; Parker et al., 2003; Ashing-Giwa and Lim, 2009; Ezat WPS, 2014). In addition, there are arguments for and against positive effects of social networks and competence on subjective well-being (Pinquart and Sorensen, 2000).

Sociologists stress the importance of offspring within the social network of aging parents (Bures et al., 2009). Offspring can provide social support and care. A greater number of offspring might therefore prevent loneliness in old age. Offspring also express gratitude and provide parents with feelings of meaning in life, which might positively affect mental health (Evenson and Simon, 2005). QOL is subjective, and a patient's own judgment in this respect is a major determinant; it has been described as a "quality of being" (Benner, 1985).

Cancer and its treatment have a substantial impact on mental and social health and, consequently, on the QOL of patients (Alptekin et al., 2010). In this new era of cancer management, more emphasis is placed on QOL *vs* quantity of life (Marra et al., 1996). Therefore, the purpose of our study was to investigate whether offspring improve or reduce QOL among cancer patients and survivors.

Materials and Methods

Study sample and design

Data were drawn from the Korean Longitudinal Study of Aging (KLoSA), a nationwide survey of community-dwelling South Koreans aged 45 years and older conducted using multistage stratified cluster sampling. Our study used a sample drawn from the first to fourth waves of KLoSA; the survey is repeated every even-numbered year by the Korea Labor Institute to collect the basic data needed to devise and implement effective

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Table 1. General Characteristics of Study Subjects at Baseline (2008) after Propensity Score Matching

		Total		Cancer		P-value		
		N	%	Yes	%	No	%	
Number of offspring	0	15	3.1	7	46.7	8	53.3	0.812
	1	40	8.2	19	47.5	21	52.5	
	2	125	25.5	64	51.2	61	48.8	
	3	143	29.2	77	53.9	66	46.2	
	4	81	16.5	40	49.4	41	50.6	
	≥5	86	17.6	38	44.2	48	55.8	
Proportion of cohabitating offspring	0	268	54.7	136	50.8	132	49.3	0.538
	>0 and ≤0.499	100	20.4	53	53.0	47	47.0	
	≥0.500	122	24.9	56	45.9	66	54.1	
Average age of offspring (years)	Q1 (≤31.3)	140	28.6	65	46.4	75	53.6	0.329
	Q2 (31.4–44.9)	202	41.2	109	54.0	93	46.0	
	Q3 (≥45.0)	148	30.2	71	48.0	77	52.0	
Number of male offspring	0	71	14.49	40	56.34	31	43.66	0.543
	1	185	37.76	90	48.65	95	51.35	
	2	150	30.61	77	51.33	73	48.67	
	≥3	84	17.14	38	45.24	46	54.76	
Number of female offspring	0	113	23.06	54	47.79	59	52.21	0.8969
	1	140	28.57	71	50.71	69	49.29	
	2	142	28.98	74	52.11	68	47.89	
	≥3	95	19.39	46	48.42	49	51.58	
Age (years)	≤59	153	31.2	72	47.1	81	52.9	0.4024
	60–69	172	35.1	93	54.1	79	45.9	
	≥70	165	33.7	80	48.5	85	51.5	
Sex	Male	214	43.7	102	47.7	112	52.3	0.362
	Female	276	56.3	143	51.8	133	48.2	
Residential region	Urban	318	64.9	168	52.8	150	47.2	0.088
	Rural	172	35.1	77	44.8	95	55.2	
Education	≤Elementary school	274	55.9	133	48.5	141	51.5	0.330
	Middle school	69	14.1	30	43.5	39	56.5	
	High school	101	20.6	57	56.4	44	43.6	
	≥College	46	9.4	25	54.4	21	45.7	
Marital status	Single	396	80.8	198	50.0	198	50.0	1.000
	Married	94	19.2	47	50.0	47	50.0	
Employed	Yes	126	25.7	54	42.9	72	57.1	0.063
	No	364	74.3	191	52.5	173	47.5	
Number of interactions with friends	Everyday	82	16.7	41	50.0	41	50.0	1.000
	1–6 times per week	238	48.6	119	24.3	119	24.3	
	None	170	34.7	85	17.4	85	17.4	
Income	Yes	77	15.7	31	40.3	46	59.7	0.063
	No	413	84.3	214	51.8	199	48.2	
Smoking status	Smoker	348	71.0	174	50.0	174	50.0	1.000
	Former smoker	104	21.2	52	50.0	52	50.0	
	Never smoker	38	7.8	19	50.0	19	50.0	
Alcohol use	Drinker	152	31.0	57	37.5	95	62.5	0.001
	Former drinker	64	13.1	40	62.5	24	37.5	
	Never drinker	274	55.9	148	54.0	126	46.0	
Depressive symptoms	Yes	90	18.4	52	57.8	38	42.2	0.102
	No	400	81.6	193	48.3	207	51.8	
Chronic disease	Yes	266	54.3	133	50.0	133	50.0	1.000
	No	224	45.7	112	50.0	112	50.0	
Total		490	100.0	245	50.0	245	50.0	

social and economic policies that address emerging trends related to population aging. The original KLoSA study population comprised South Koreans living in 15 large administrative areas.

In the first baseline survey in 2006, 10,254 individuals in 6,171 households (1.7 per household) were interviewed using the Computer-Assisted Personal Interviewing method. There were 292 individuals with cancer. The second survey, in 2008, followed up with 8,688 subjects, who represented 86.6% of the original panel. The third survey, in 2010, followed up with 7,920 subjects, who represented 80.3% of the original panel, and the fourth survey, in 2012, followed up with 7,486 subjects, who represented 76.2% of the original panel.

Respondent samples comprise a total of 16,613 individuals (see Table 1) from 6,314 households, 16,255 individuals from 6,207 households, 15,625 individuals from 6,207 households, 14,696 individuals from 6,034 households, and 14,604 individuals from 5,735 households from wave 3 (2008) to wave 7 (2012), respectively.

Table 2. Quality of Life in Relation to General Study Subject Characteristics at Baseline (2008)

	Quality of life								
				Cancer					
				Yes			No		
	Mean	SD	P-value	Mean	SD	P-value	Mean	SD	P-value
Number of offspring									
0	43.3	23.5	<0.0001	45.7	27.6	<0.0001	41.3	21.0	<0.0001
1	46.8	29.2		45.3	35.3		48.1	23.2	
2	57.0	26.8		53.4	28.8		60.8	24.2	
3	57.8	23.2		56.5	24.3		59.2	22.0	
4	52.3	21.3		50.0	23.6		54.6	18.9	
≥5	55.6	21.9		57.6	20.5		54.0	23.0	
Proportion of cohabitating offspring									
0	52.1	25.2	<0.0001	51.4	27.1	<0.0001	52.7	23.2	<0.0001
>0 and ≤0.499	56.3	22.2		55.1	23.0		57.7	21.4	
≥50.0	60.2	23.4		57.7	25.7		62.4	21.3	
Average age of offspring (years)									
Q1 (≤31.3)	58.2	24.5	<0.0001	55.1	26.9	<0.0001	60.9	22.0	<0.0001
Q2 (31.4–44.9)	56.9	22.7		57.9	23.2		55.8	22.1	
Q3 (≥45.0)	49.2	25.7		45.8	27.8		52.3	23.3	
Number of male offspring									
0	47.7	30.9	<0.0001	49.0	33.4	<0.0001	46.1	27.6	<0.0001
1	58.4	21.7		56.2	24.8		60.5	18.0	
2	52.3	24.3		51.2	23.9		53.4	24.8	
≥3	58.2	22.5		57.4	23.6		58.9	21.8	
Number of female offspring									
0	55.5	25.5	<0.0001	54.3	28.4	<0.0001	56.6	22.6	<0.0001
1	53.1	25.9		52.1	27.3		54.1	24.5	
2	55.6	23.2		51.6	23.6		60.0	22.1	
≥3	56.1	22.7		58.5	24.8		53.9	20.5	
Age (years)									
≤59	50.5	25.1	<0.0001	50.0	27.3	<0.0001	50.9	23.2	<0.0001
60–69	55.8	23.9		54.9	25.9		56.8	21.4	
≥70	58.2	23.7		55.4	24.9		60.9	22.4	
Sex									
Male	57.7	24.0	<0.0001	57.7	25.1	<0.0001	57.6	23.0	<0.0001
Female	52.9	24.6		50.7	26.3		55.2	22.4	
Residential region									
Urban	54.7	25.6	<0.0001	54.0	27.0	<0.0001	55.5	24.2	<0.0001
Rural	55.5	21.9		52.9	23.9		57.6	20.1	
Education									
≤Elementary school	52.0	24.0	<0.0001	49.4	25.4	<0.0001	54.5	22.3	<0.0001
Middle school	54.3	22.0		51.3	22.9		56.7	21.3	
High school	60.1	25.5		61.1	27.4		58.9	23.0	
≥College	62.0	25.3		62.0	24.8		61.9	26.4	
Marital status									
Single	57.1	23.4	<0.0001	55.8	25.1	<0.0001	58.4	21.5	<0.0001
Married	46.0	26.5		44.7	28.0		47.2	25.1	
Employed									
Yes	61.6	21.1	<0.0001	60.0	19.1	<0.0001	62.8	22.5	<0.0001
No	52.7	25.1		51.8	27.4		53.6	22.2	
Number of interactions with friends									
Everyday	43.2	27.8	<0.0001	59.1	22.0	<0.0001	58.2	20.4	<0.0001
1--6 times a week	56.4	24.2		52.7	26.4		60.1	21.3	
None	58.6	21.1		45.1	30.2		41.2	25.3	
Income									
Yes	58.8	22.2	<0.0001	55.8	24.1	<0.0001	60.9	20.9	<0.0001
No	54.2	24.7		53.3	26.3		55.2	23.0	
Smoking status									
Smoker	55.8	23.7	<0.0001	54.0	25.4	<0.0001	57.7	21.7	<0.0001
Former smoker	52.7	26.0		52.9	27.6		52.5	24.5	
Never smoker	53.2	26.6		52.6	28.1		53.7	25.9	
Alcohol use									
Drinker	60.7	21.8	<0.0001	62.1	20.7	<0.0001	59.8	22.5	<0.0001
Former drinker	45.9	25.1		45.5	26.8		46.7	22.4	
Never drinker	53.9	24.9		52.6	26.9		55.5	22.4	
Depressive symptoms									
Yes	42.7	24.3	<0.0001	42.5	26.6	<0.0001	42.9	21.0	<0.0001
No	57.7	23.6		56.6	25.1		58.7	22.1	
Chronic disease									
Yes	56.9	24.1	<0.0001	54.1	26.1	<0.0001	59.7	21.7	<0.0001
No	52.6	24.6		53.0	26.0		52.2	23.2	
Total	55.0	24.4		53.6	26.0		56.3	22.6	

To investigate the association between offspring and QOL among cancer patients and survivors, we extracted a study sample using 1:1 propensity score matching (PSM), adjusting for proportion of cohabitating offspring, average number of offspring, number of male and female offspring, age, sex, residential region, education, marital status, employment status, number of interactions with friends, income, smoking status, alcohol use, self-rated health,

Table 3. Adjusted Association between Number of Offspring and Quality of Life among Cancer Patients and Survivors

	Cancer patients			Non-cancer patients		
	Estimate	SE	P-value	Estimate	SE	P-value
Number of offspring						
0	-2.831	5.508	0.623	-9.038	4.130	0.065
1	3.590	2.978	0.267	-11.258	2.430	0.002
2	ref			ref		
3	2.531	2.059	0.259	0.088	1.795	0.962
4	2.739	2.660	0.337	-0.366	2.284	0.877
≥5	7.336	2.840	0.036	-4.881	2.484	0.090
Proportion of cohabitating offspring						
0	-2.497	2.330	0.289	1.258	1.683	0.458
>0 and ≤0.499	-1.131	2.850	0.693	2.556	2.285	0.267
≥0.500	ref			ref		
Average age of offspring (years)						
Q1 (≤31.3)	-1.861	3.612	0.608	-0.308	2.157	0.887
Q2 (31.4–44.9)	4.345	2.261	0.058	3.680	3.029	0.228
Q3 (≥45.0)	ref			ref		
Age (years)						
≤59	ref			ref		
60-69	-4.608	2.455	0.065	2.267	1.921	0.241
≥70	-6.479	3.362	0.058	-0.430	2.748	0.876
Sex						
Male	5.966	2.449	0.016	-1.352	1.846	0.465
Female	ref			ref		
Residential region						
Urban	-1.403	1.715	0.499	-2.348	1.419	0.282
Rural	ref			ref		
Education						
≤Elementary school	-11.211	2.800	<0.0001	-6.608	2.293	0.004
Middle school	-10.372	3.206	0.001	-3.198	2.388	0.182
High school	-3.043	2.861	0.289	-4.144	2.216	0.063
≥College	ref			ref		
Marital status						
Single	ref			ref		
Married	3.861	2.013	0.081	2.007	1.710	0.268
Employed						
Yes	3.309	2.019	0.109	1.475	1.501	0.330
No	ref			ref		
Number of interactions with friends						
Everyday	ref			ref		
1–6 times a week	-3.084	1.754	0.081	-3.084	1.754	0.081
None	-13.270	2.519	<0.0001	-13.270	2.519	<0.0001
Income						
Yes	-1.576	2.626	0.555	0.203	1.652	0.903
No	ref			ref		
Smoking status						
Smoker	1.319	2.925	0.657	-0.644	2.262	0.780
Former smoker	-2.514	2.961	0.406	-2.029	2.269	0.385
Never smoker	ref			ref		
Alcohol use						
Drinker	2.087	2.176	0.344	1.315	1.621	0.422
Former drinker	-4.141	2.129	0.060	-4.134	2.065	0.052
Never drinker	ref			ref		
Depressive symptoms						
Yes	-9.967	2.137	<0.0001	-12.271	1.933	<0.0001
No	ref			ref		
Chronic disease						
Yes	ref			ref		
No	1.274	1.842	0.491	1.493	1.505	0.323
Year						
2008	-0.404	2.220	0.856	-2.208	1.821	0.226
2009	1.201	2.085	0.565	-1.234	1.805	0.495
2010	0.637	1.981	0.748	-1.880	1.735	0.279
2011	ref			ref		

depressive symptoms, and chronic disease. Of the 490 research subjects included 245 were cancer patients and survivors and 245 were non-cancer patients and survivors.

Independent variables

Number of offspring, our independent variable, was divided into five categories: 0, 1, 2, 3, 4, and 5 or more.

Control variables

The proportion of cohabitating offspring was the number of offspring living with the parent divided by the total number of offspring; it was divided into three categories: 0, >0 and ≤0.499, and ≥0.500. Average age of offspring was divided into three categories: Q1 (≤31.3 years), Q2 (31.4-44.9 years), and Q3 (≥45.0 years). We also included the number of male and female offspring as covariates.

Age groups were divided into three categories: ≤59, 60-69 and ≥70 years. Education status was divided into four categories: elementary school or less, middle school, high school, and college or more. Income status was divided into two categories, yes or no, and the number of interactions with friends was divided into three categories: every day, 1-6 times per week, or never. Employment status was divided into two categories: employed and unemployed. Self-rated health, depressive symptoms, daily life restrictions, and number of chronic disease were also included as covariates in our analyses.

Dependent variables

Subjective QOL records the respondent's current overall state on a vertical, visual analogue scale ranging from 0 (worst overall state) to 100 (best overall state), with endpoints labeled 'best imaginable overall state' and 'worst imaginable overall state.' A measure of general well being that includes physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health.

Analytical approach and statistics

Analysis of variance (ANOVA) and mixed models were used to investigate the association between offspring and QOL in cancer patients or survivors. For all analyses, the criterion for statistical significance was p≤0.05, two-tailed. All analyses were conducted using the SAS statistical software package, version 9.2 (SAS Institute Inc., Cary, NC, USA).

Propensity score matching

PSM is a statistical matching technique that attempts to estimate the effect of a treatment, policy, or other intervention by accounting for covariates that predict whether or not a treatment is received. Propensity scores are used in observational studies to reduce bias.

A propensity score is the predicted probability of an outcome. It has been shown that a sample matched on propensity score will be similar for all covariates considered when computing the propensity score. Thus, matching on propensity score can reduce selection bias in an observational study. Here, the SAS LOGISTIC procedure was used to create propensity scores; we explain the matching macro used to create propensity score matched-pair samples.

SAS software allowed us to perform multivariate logistic regression with the LOGISTIC procedure. The PROC LOGISTIC options allow users to calculate and save the predicted probability of the dependent variable, or the propensity score, for each observation in the data set. This single score (between 0 and 1) represents the relationship between multiple characteristics and the dependent variable. In the case of an observational study, the dependent variable could be a treatment group. The propensity score would then be the predicted probability of receiving the treatment (Rosenbaum and Rubin, 1983).

Results

Table 1 lists the general characteristics of the 245 research samples at baseline, after PSM. Mean QOL was 43.3 (SD: 23.5) for those with zero offspring, 46.8 (SD: 29.2) for those with one child, and 55.6 (SD: 21.9) for those with five or more offspring (Table 2).

Table 3 shows the adjusted effect of number of offspring on QOL. For cancer patients with zero offspring, the QOL estimate was -2.831 lower (SE: 5.508, p-value: 0.623) than for those with two offspring, while for those with five or more offspring the estimate was 7.336 higher (SE: 2.840, p-value: 0.036). Table 4 shows the adjusted

Table 4. Adjusted association between Number of Offspring and Quality of life among Cancer Patients and Controls

	Quality of life					
	Cancer patients			Non-cancer patients		
	Estimate	SE	P-value	Estimate	SE	P-value
Number of male offspring						
0	ref			ref		
1	1.058	2.116	0.631	4.094	2.068	0.186
2	4.048	2.369	0.126	3.582	2.330	0.264
≥3	4.331	2.923	0.177	7.979	2.703	0.098
Number of female offspring						
0	ref			ref		
1	1.071	1.987	0.607	1.939	1.803	0.324
2	-4.055	2.149	0.101	4.176	1.870	0.067
≥3	6.427	2.670	0.047	1.215	2.321	0.620

Adjusted for proportion of cohabitating offspring, average age of offspring, age, sex, residential region, education, marital status, employment status, number of interactions with friends, income, smoking status, alcohol use, depressive symptoms, chronic disease,

effect of offspring composition on QOL. For cancer patients and survivors with three or more female offspring, the QOL estimate was 6.427 higher (SE: 2.670, p-value: 0.047) than for those with zero female offspring.

Discussion

In this study, our primary purpose was to investigate the impact of offspring on QOL among cancer patients and survivors using longitudinal models to analyze a nationally representative sample of South Korean adults 45 years or older.

The associations were independent of other offspring-related variables (proportion of cohabitating offspring, number of male offspring, number of female offspring, and average age of offspring), sociodemographic variables (age, sex, education, marital status, number of interactions with friends, income, and employment status), health risk behavior variables (smoking status and alcohol consumption), health status (depressive symptoms and number of chronic diseases), and year of KLoSA data survey.

QOL is difficult to define and varies among individuals. It has been argued that QOL is a uniquely personal perception. A previous study indicates that patients define QOL in different ways (Montazeri et al., 1996). For example, in that study, a significant proportion of patients defined QOL as health (42%), enjoyment of life (25%), and family life (24%), while the majority of the same individuals stated that a good QOL for themselves consisted of family life (58%), health (51%), and social life and leisure activities (43%). As in this previous study, we found family life has a relatively large effect on the QOL of patients with cancer.

Questions of QOL in cancer patients and survivors become increasingly important as long-term survival increases (Gotay and Muraoka, 1998; Carver et al., 2006). One common definition used in the literature is an 'individual's' perception of their position in life in the context of the culture and value system in which they live and in relation to their goals, expectations, and standards (WHO). Although QOL is generally regarded as a multidimensional concept (Cummins, 2005), QOL dimensions that have been identified from a family perspective have focused on emotional health, relationships, and an enjoyable/meaningful life (Pain et al., 1998).

The importance of family well-being has been stressed in the course of studying cancer (Sherwood et al., 2004). A highly malignant cancer will cause a state of crisis within the family (Salander, 1996; Wideheim et al., 2002), and the affliction limits the patient's capacity to carry out daily life activities, which increases the burden to the family (Wideheim et al., 2002).

Many previous studies (Evenson and Simon, 2005; Buber, 2008) on the association between offspring and health outcomes have identified relatively large, significant, and positive U-shaped effects. However, our results suggest that QOL in patients with cancer significantly increases with number of offspring, in contrast to what was observed in controls (Table 3). We also found that as the number of female offspring increased among cancer patients and survivors, QOL increased.

This study has a number of strengths and limitations. One strength is that the participants in the survey are representative of the overall population. Because the sample size is large, the results can be generalized to South Korean adults aged 45 years or older.

Nevertheless, we do acknowledge possible sample bias. First, respondents' reports were subjective, so recall bias may exist. Second, personality characteristics are likely to be associated with QOL; failure to include them in our statistical models could lead to an exaggeration of the association of interest. Third, we did not measure the effect of multiple births because of a small sample size. Fourth, although we analyzed longitudinal data, the results could reflect reverse causality between QOL and number of offspring. Fifth, although severity of disease and survival rate at 5 years affect QOL in cancer patients and survivors, we did not adjust for these factors because of insufficient data. Finally, although some recent investigations have focused on QOL in infertile patients (Bolsoy et al., 2010; Aarts et al., 2011), we could not determine fertility status in this study.

In conclusions, this article provides evidence for an association between number of offspring and QOL in cancer patients and survivors. In contrast to a previous study performed in the general population, offspring are important for cancer patients and survivors. Further investigations are required to more precisely measure QOL in cancer patients and survivors; to achieve this, research into the best ways of measuring and assessing QOL in cancer patients and survivors must continue.

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