Research Article

Effects of Hypertension, Diabetes, and/or Cardiovascular Disease on Health-related Quality of Life in Elderly Korean Individuals: A Population-based Cross-sectional Survey

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SUMMARY

Purpose: This study explored health-related quality of life (QoL) in Korean elderly individuals with hypertension, diabetes, and/or cardiovascular disease (CVD).
Methods: This study used a population-based cross-sectional design. Data were obtained from the Fourth Korean National Health and Nutrition Examination Survey 2008, which involved a nationally representative sample. Data on health-related QoL were collected using the EuroQoL-5 Dimension instrument and via health interviews. The sample consisted of 1,467 Korean individuals aged 60 years and older. A multiple linear regression model was used to analyze health-related QoL.
Results: After controlling for sociodemographic and lifestyle variables, individuals with one of the aforementioned chronic diseases had lower EuroQoL-5 Dimension scores, ranging from 0.186 among those with only hypertension to 0.469 among those with hypertension plus CVD, compared with those without a chronic disease (higher scores are indicative of more limitations). The impact of comorbid diseases was greater than that of any single disease except diabetes. CVD had a stronger negative impact on QoL than did any other single disease studied. Whereas the physical elements of QoL were influenced by all diseases, the psychological components were influenced only by hypertension plus diabetes and hypertension plus CVD.
Conclusion: We found that both the number and the type of diseases affected QoL scores. Efforts to prevent or manage diabetes, CVD, and related risk factors should include psychological support.

Introduction

As the population of the world ages, the proportion of individuals with more than one disease (i.e., comorbidity) is increasing (Piccirillo et al., 2008; Weale, 2009). A previous study showed that the prevalence of comorbid conditions increased with age, from 10% in those 0–19 years of age to 78% in those aged 80 and older (van den Akker, Buntinxa, Metsemakersa, Roosb, & Knottnerusa, 1998). As in most other countries, in Korea, the number of people at 60 years of age and older is increasing, accounting for approximately 18.0% of the total population in 2011. Indeed, Korea is expected to be the most aged country in the world in 2050 (Korea National Statistical Office, 2006).

The presence of comorbid conditions complicates the relationship between a specific disease and outcome variables (Rijken, Kerkhof, Dekker, & Schellevis, 2005). Data have shown that comorbid conditions were associated with poorer functional status, a higher risk of dying, and greater use of health services (van Weel & Schellevis, 2006). Therefore, efforts to manage chronic diseases should be directed at both the disease itself and the ability to function in daily life, that is, health-related quality of life (QoL) (van Manen et al., 2003). Moreover, the presence of comorbid conditions is a general problem, but the negative effect is greater in older than in younger individuals (Schäfer et al., 2010).

Despite its importance, no accurate definition of comorbidity is available. Valderas, Starfield, Sibbald, Salisbury, and Roland (2009) defined comorbidity as the existence of more than one definite condition in an individual or the co-occurrence of several chronic diseases in one person. Comorbidity has also been defined as the presence of additional diseases in relation to an index disease in one individual (Piccirillo et al., 2008; Weale, 2009). One etiological

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model (Valderas et al., 2009) identified five categories of comorbidity: comorbid conditions with no etiological association, those involving direct causation, those sharing associated factors, those with heterogeneous relationships, and those that are independent. Schäfer et al. (2010) identified three patterns of multimorbidity. The first involved cardiovascular/metabolic disorder, which occurs primarily in elderly individuals, especially in Korea. Indeed, more than 60% of elderly patients suffer from hypertension, and about 22% suffer from diabetes. Moreover, cardiovascular disease (CVD) was the second leading cause of death in Korea, exceeded only by malignant neoplasm (Ministry of Health and Welfare, 2009; Statistics Korea, 2010). Given these data, it would not be surprising if Korean elderly individuals suffered from multiple conditions. Accordingly, this study focused on three diseases (hypertension, diabetes, and CVD) and their comorbid relationships.

Previous studies about QoL in those with hypertension, diabetes, and/or CVD have suffered from several limitations. First, many studies operationalized comorbidity in terms of the number of diseases, severity, or diseases pairs. The first approach simply adds the number of conditions without regard to severity (Lima et al., 2009a,b; Walker, 2007). Comorbidity indices such as the Charlson Index, the Cumulative Illness Rating Scale, and the Index of Coexisting Diseases include both the number and the severity of diseases but do not examine how a specific disease affects QoL when it co-occurs with other diseases (Maddigan, Feeny, & Johnson, 2005; Walker).

Second, several studies exploring comorbidity have relied on a restricted sample (Gijsen et al., 2001) or have presented results without adjusting for age, sex, lifestyle, and so on (Kang, Kim, Park, & Lee, 2006). Additionally, several studies have not included a no-disease group as a control group (Poljičanin et al., 2010). These limitations have made it difficult to judge the degree to which a specific disease reduces QoL.

Third, research on chronic disease-related QoL has focused primarily on analyzing differences in QoL related to specific diseases without considering comorbidity or the comorbidity of serious diseases, such as schizophrenia, cancer, CVD, diabetes mellitus, chronic obstructive pulmonary disorder (COPD), and so on. CVD is the second most common cause of mortality among Korean elderly individuals (Korea National Statistical Office, 2006) and is characterized by a high prevalence as well as long periods of morbidity (Schram et al., 2008). Hypertension and diabetes are frequently associated with CVD (Poirier et al., 2006). These diseases are expected to significantly affect QoL, as they are often not completely treated, require lifestyle changes to manage, and may result in disability if poorly managed (Di Libero, Fargnoli, Pittiglio, Mascio, & Giaquinto, 2001; Guilick, 1997; Kim, Chae, & Cho, 2009). Thus, research regarding the relationship of hypertension, diabetes, and/or CVD with QoL based on population-based data is needed. For these reasons, this study examined the individual and joint effects of hypertension, diabetes, and CVD, which are the most common diseases among Korean elderly individuals, on QoL in this population. Indeed, QoL may differ according to the kind and number of comorbid diseases. We also compared groups of elderly individuals with hypertension, diabetes, CVD, and combinations thereof with a no-disease control group, all of whom were drawn from a national sample, to study differences in QoL.

Methods

Study design

This population-based cross-sectional study explored QoL in elderly Korean individuals aged 60 years and older using data collected in the health interviews and health examinations of the Fourth Korean National Health and Nutrition Examination Survey (KNHANES IV 2008), a nationwide representative cross-sectional survey of the noninstitutionalized Korean population conducted by the Korean Centers for Disease Control and Prevention. This study was approved by the institutional review board of the Korean Centers for Disease Control and Prevention (No. 2008-04EXP-01-C). KHANES IV 2008 used a stratified, multistage, probability-cluster, complex sampling design to select household units based on region, sex, and age. Data were assigned weights to assure the equal probability of being sampled and of covering missing data to represent Korea's population. A total weight was assigned to each participant in three steps: (a) calculation of the base weight (1/final probability), (b) adjustment for nonresponses, and (c) post-stratification adjustment to match the 2005 National Census Registry population control totals. Final probability was calculated by multiplying four factors: the probability of the primary sampling unit being selected (264,186 sampling units), the probability of a segment of the primary sampling unit being selected, the probability of each household being selected (each sampling unit included approximately 60 households), and the probability of an individual being selected. The health interview was performed by trained examiners, and diagnoses were made following scientific and medical principles based on a physician's decision about whether or not participants had a given disease.

Settings and samples

In 2008, 12,528 subjects were invited to participate in the present study, and 9,744 agreed to do so. The sample for this study was limited to elderly Korean individuals aged 60 years and older who had hypertension, diabetes, and/or CVD or had no disease (controls), yielding a final sample of 1,467 individuals. We limited the final sample to six groups: those with hypertension only ($n = 712$), those with diabetes only ($n = 168$), those with CVD only ($n = 71$), those with hypertension plus diabetes ($n = 186$), those with hypertension plus CVD ($n = 80$), and those with no disease ($n = 250$) (Figure 1). Individuals with other serious diseases such as cancer, COPD, arthritis, and psychosocial problems, were excluded because these conditions exert a negative effect on QoL. Only groups with at least 20 members were used in analyses.

Measurements and instruments

Measures of hypertension, diabetes, CVD, and comorbidity

We compared specific pairs of diseases to assess QoL in elderly individuals with comorbid conditions. Hypertension, diabetes, and CVD were identified based on the health interview and clinical data. Individuals were identified as suffering from hypertension, diabetes, and CVD if they met one of the following criteria according to the health examination: having been diagnosed with or prescribed treatment for one or more of these conditions by a doctor, having a systolic blood pressure of 140 mmHg or higher and a diastolic blood pressure of 90 mmHg or higher (hypertension), or a fasting blood glucose level of 126 mg/dL or higher (diabetes). CVD included angina pectoris, myocardial infarction, and stroke. Comorbidity was defined as having two of the chronic diseases listed above.

Blood pressure was checked using a mercury sphygmomanometer (Baumanometer, W. A. Baun Co., New York, USA). The elderly subjects were asked not to drink caffeine or smoke for 30 minutes prior to the measurement, and all rested for at least 10 minutes before measurement. The blood pressure of all participants was checked twice, separated by a 5-minute interval, and the average of the measurements was used in the final analysis. If the first two measurements differed by more than 5 mmHg, additional
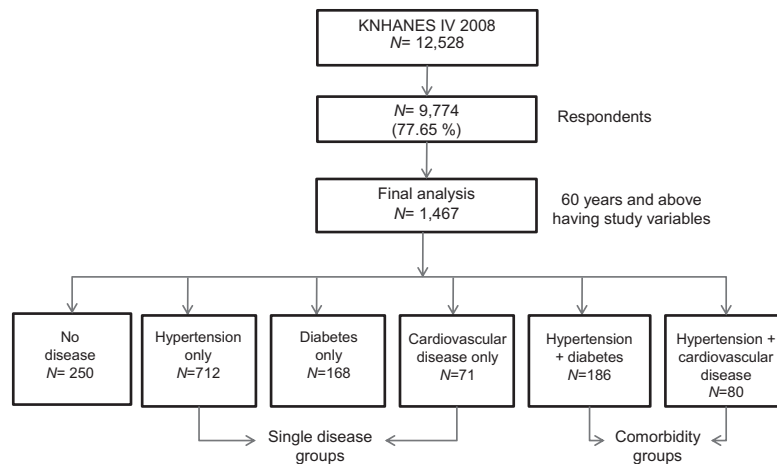
Figure 1. The process of study sample extraction.

readings were taken. The first and fifth Korotkoff sounds were used to indicate the systolic and diastolic blood pressure, respectively.

Blood samples were collected in the morning through an antecubital vein using vacutainer tubes containing ethylenediaminetetraacetic acid from subjects who had fasted overnight. The samples were then centrifuged, refrigerated, and transferred to a central national laboratory. Plasma fasting glucose was analyzed using an enzymatic technique. The analyzing equipment and reagent were Hitachi 7600/Hitachi (Tokyo, Japan) and Pureauto S GLU/Sekisui (Tokyo, Japan).

Measures of QoL

The EuroQoL-5 Dimensions (EQ-5D; EuroQoL Group, 1990) is widely used to measure QoL. This study employed the Korean version of the EQ-5D-3L, a very valid and reliable measure of health-related QoL (Kang, & Kim et al., 2006; Kang, Shin, Park, Jo, & Kim, 2006; Kim et al., 2009), to evaluate QoL. The EQ-5D-3L defines QoL in terms of five dimensions: mobility, self care, usual activities, pain or discomfort, and anxiety or depression. Each dimension is rated on a scale from 1 to 3, where 1 indicates no problems, 2 indicates some problems, and 3 indicates severe problems. A higher score represents a greater limitation on the corresponding dimension. The Cronbach's alpha was .78 for this study.

Covariates

In addition to the above variables, data on sociodemographic characteristics (sex, age, education, current employment, and economic status) and current lifestyle that could affect QoL were collected (Walker, 2007; Weale, 2009). Lifestyle was measured by asking whether respondents were currently smoking or drinking alcohol, exercising at least three times per week on a regular basis, monitoring the salt in their diet, feeling sufficiently depressed to continuously affect their lives for more than 2 weeks during the preceding year, and experiencing more stress than they normally do.

Data analysis

Descriptive statistics were used to examine the comorbidity, sociodemographic characteristics, and QoL associated with chronic diseases. Chi-square test was used to explore differences in the sociodemographic characteristics according to the chronic disease. Analysis of variance and Tukey's post hoc test were also used to explore differences in QoL according to the chronic disease. Multiple regression analysis was performed to explore the effect of each chronic disease on QoL, focusing on a comparison with the group

with no chronic diseases after adjustment for sex, age, education, current employment, smoking, alcohol consumption, monitoring dietary salt, and exercise. All analyses were performed using SPSS 16.0 software (IBM SPSS Statistics, Chicago, IL, USA).

Results

General characteristics of six disease groups

The general characteristics of the sample are presented in Table 1. The 1,467 subjects included 644 men (43.9%) and 823 women (56.1%). Most reported having relatively little formal education, and about 71% were not employed. Additionally, 44.4% and 45.3% of the subjects reported currently smoking and drinking, respectively. We found significant differences in the sociodemographic characteristics and lifestyle among the six disease groups with regard to sex ($p < .001$), age ($p < .001$), education ($p < .001$), employment ($p < .001$), economic status ($p = .047$), alcohol drinking ($p < .001$), smoking ($p < .001$), regular exercise ($p = .004$), and stress ($p < .001$). The groups did not differ with regard to monitoring dietary salt.

Compared with those with no chronic diseases, persons with at least one of the three diseases were more likely to be female, less educated, and under greater stress; they were less likely to be employed and to exercise regularly. Those with no chronic diseases and high economic status were less likely to drink alcohol and smoke.

Additionally, compared with those with only hypertension or diabetes, those with hypertension plus diabetes were more likely to score at the median with regard to sex, age, economic status, and exercise; more likely to be less educated, to smoke, and to report stress; and less likely to be employed and drink alcohol. Compared with those with only hypertension or CVD, those with hypertension plus CVD were more likely to score at the median with regard to sex and age; more likely to be less educated, to be employed, to be of lower economic status, and to drink alcohol, smoke, and exercise regularly. They were also less likely to report stress (Table 1).

QoL of six disease groups

Table 2 and Figure 2 presents total EQ-5D scores and scores on each dimension. These show the dimensions with the highest and lowest QoL scores. Significant QoL differences were found between each of the five chronic-disease groups and the no-disease group

Table 1 General Characteristics and Their Differences by Six Disease Groups (n, %).

Categories	Types	Total	No disease	Single disease groups			Comorbidity groups		χ^2	p
				Hypertension only	Diabetes Only	CVD only	Hypertension + diabetes	Hypertension + CVD		
	Total	1,467	250 (17.1)	712 (48.5)	168 (11.5)	71 (4.9)	186 (12.7)	80 (5.3)		
Sex[*]	Male	644 (43.9)	168 (67.2)	246 (34.6)	80 (47.6)	37 (52.1)	85 (45.7)	28 (35.0)		
	Female	823 (56.1)	82 (32.8)	466 (65.4)	88 (52.4)	34 (47.9)	101 (54.3)	52 (65.0)	86.086	< .001
Age[*]	60−69	755 (51.4)	145 (58.0)	338 (47.5)	104 (61.9)	30 (41.7)	104 (55.9)	34 (42.5)		
	70−79	713 (48.6)	105 (42.0)	374 (52.5)	64 (38.1)	42 (58.3)	82 (44.1)	46 (57.5)	22.963	< .001
Education	Elementary	1,047 (71.3)	148 (59.2)	535 (75.1)	129 (76.8)	46 (64.8)	124 (67.0)	62 (77.5)		
(n = 1,464)	Middle	157 (10.7)	41 (16.4)	61 (8.6)	22 (13.1)	10 (14.1)	13 (7.0)	10 (12.5)	61.479	< .001
	≥ High	263 (18.0)	61 (24.4)	116 (16.3)	17 (10.1)	15 (21.1)	48 (25.9)	8 (10.0)		
Employment[*]	Yes	416 (29.1)	108 (43.9)	181 (26.0)	52 (32.7)	11 (16.2)	44 (23.8)	20 (26.7)	38.701	< .001
(n = 1,430)	No	1,014 (70.9)	138 (56.1)	516 (74.0)	107 (67.3)	57 (83.8)	141 (76.2)	55 (73.3)		
Economic status[*]	Lower 25%	317 (23.2)	57 (24.9)	150 (22.8)	37 (22.7)	17 (25.0)	41 (23.7)	15 (19.2)		
(n = 1,367)	Lower 50%	349 (25.2)	61 (26.6)	159 (24.2)	52 (31.9)	9 (13.2)	45 (26.0)	23 (29.5)	25.233	.047
	Upper 50%	345 (25.2)	66 (28.8)	176 (26.7)	32 (19.6)	22 (32.4)	30 (17.3)	19 (24.4)		
	Upper 25%	358 (26.2)	45 (19.7)	173 (26.3)	42 (25.8)	20 (29.4)	57 (32.9)	21 (26.9)		
Alcohol drinking[*]	Yes	664 (45.3)	158 (63.2)	314 (44.1)	69 (41.1)	29 (40.3)	72 (38.7)	23 (28.8)	46.768	< .001
	No	803 (54.7)	92 (36.8)	398 (55.9)	99 (58.9)	43 (59.7)	114 (61.3)	57 (71.3)		
Smoking[*]	Yes	652 (44.4)	152 (60.8)	265 (37.2)	76 (45.2)	40 (55.6)	91 (49.2)	28 (35.0)	65.576	< .001
	No	815 (55.6)	198 (39.2)	447 (62.8)	92 (54.8)	32 (44.4)	94 (50.8)	52 (65.0)		
Regular exercise[*]	Yes	742 (50.6)	131 (52.2)	317 (44.6)	94 (56.3)	29 (40.3)	90 (48.6)	48 (60.0)	17.072	.004
(n = 1,465)	No	723 (49.4)	120 (47.8)	393 (55.4)	73 (43.7)	43 (59.7)	95 (51.4)	32 (40.0)		
Low salt diet	Yes	908 (69.3)	144 (66.1)	443 (69.4)	103 (68.7)	49 (73.1)	112 (66.7)	57 (81.4)	6.957	.224
(n = 1,311)	No	403 (30.7)	74 (33.9)	195 (30.6)	47 (31.3)	18 (26.9)	56 (33.3)	13 (18.6)		
Felt stress[*]	Yes	378 (25.8)	21 (8.4)	215 (30.2)	45 (26.8)	24 (33.8)	46 (24.7)	27 (34.2)	52.656	< .001
(n = 1,466)	No	1,088 (74.2)	230 (91.6)	496 (69.8)	123 (73.2)	47 (66.2)	140 (75.3)	52 (65.8)		

CVD = cardiovascular disease.
[*] $.001 \leq p \leq .05$.

($F = 19.49$, $p < .001$), with the overall QoL of the no-disease group being better than that of any other group. The overall QoL of the diabetes-only and hypertension-only groups was better than that of the comorbid-disease groups, followed by that of the CVD-only group. The overall QoL of the group with hypertension plus CVD was even worse, but the standard deviation of the total scores was higher than that of the CVD-only group. Similarly, the no-disease groups scored best with regard to all physical components (mobility, self care, usual activities, and pain or discomfort) of QoL, followed by the hypertension-only and diabetes-only groups, the groups with two comorbid diseases, and, finally, the CVD-only group. In contrast, the group with the hypertension plus CVD was the most likely to report anxiety and depression (Table 2 and Figure 2).

Effects of hypertension, diabetes, and/or cardiovascular disease on EQ-5D score

After adjusting for sociodemographic and lifestyle variables, those with at least one of the chronic diseases examined in this study had significantly lower EQ-5D scores compared to those with no chronic diseases. Scores ranged from 0.186 for the hypertension-only group to 0.469 for the group with hypertension and CVD ($.001 \leq p \leq .05$), with higher scores indicating greater limitations. In the comorbid-disease groups, the combined effect of both conditions was smaller than was the sum of the independent effects of each of, as the scores of those with hypertension plus diabetes ($\beta = -.318$) were lower than the sum of the scores of those with hypertension only ($\beta = -.186$). Similarly, the scores of those with hypertension and CVD ($\beta = -.469$) were lower than the sum of the scores for those with hypertension only ($\beta = -.186$) and CVD only ($\beta = -.463$). CVD had the greatest impact on QoL in that those with CVD only ($\beta = -.463$) or hypertension plus CVD ($\beta = -.469$) had lower QoL scores than did those with any other combination of diseases. With the exception of the diabetes-only group, which reported worse QoL than did those with CVD-related diseases, the impact of single diseases on QoL was less severe than that of co-morbid diseases. The physical components (mobility, self care, usual activities, and pain or discomfort) of QoL were affected by all disease combinations. However, the psychological components

Table 2 EQ-5D Mean Scores by Six Disease Groups.

	EQ-5D (mean score)	Limitations[a] (mean score)				
		Mobility (LQ1)	Self-care (LQ2)	Usual activities (LQ3)	Pain or discomfort (LQ4)	Anxiety or depression (LQ5)
Range	1.59 (−0.59 to 1.00)	2 (1−3)	2 (1−3)	2 (1−3)	2 (1−3)	2 (1−3)
No disease [(a)]	0.92 (0.09)	1.17 (0.39)	1.03 (0.19)	1.21 (0.43)	1.21 (0.43)	1.16 (0.38)
Hypertension only [(b)]	0.81 (0.18)	1.54 (0.54)	1.16 (0.38)	1.41 (0.55)	1.67 (0.67)	1.33 (0.56)
Diabetes only [(c)]	0.82 (0.18)	1.51 (0.55)	1.15 (0.39)	1.37 (0.58)	1.67 (0.68)	1.26 (0.48)
CVD only [(d)]	0.74 (0.18)	1.71 (0.51)	1.28 (0.55)	1.65 (0.63)	1.87 (0.69)	1.35 (0.49)
Hypertension + diabetes [(e)]	0.79 (0.22)	1.57 (0.55)	1.23 (0.50)	1.40 (0.61)	1.64 (0.71)	1.34 (0.61)
Hypertension + CVD [(f)]	0.75 (0.24)	1.68 (0.60)	1.36 (0.62)	1.63 (0.63)	1.71 (0.67)	1.43 (0.61)
F (p)	19.49 (p < .001)	21.77 (p < .001)	9.73 (p < .001)	18.57 (p < .001)	19.24 (p < .001))	4.96 (p < .001)
Tukey's post hoc (p < .05)	a > c > b > e > f > d	d > f > e > b > c > a	f > d > e > b > a	d > f > b > e > c > a	d > f > c > b > e > a	f > e > b > a

EQ-5D = EuroQoL-5 Dimension; LQ = quality of life; CVD = cardiovascular diseases.
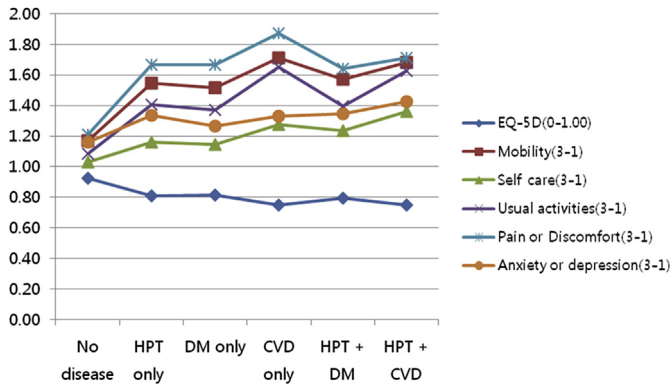[a] LQ1−LQ5 measures were checked in reverse.

Figure 2. EQ-5D total score and mean score by six disease groups. Note. HTN = hypertension; DM = diabetes mellitus; CVD = cardiovascular diseases.

(anxiety or depression) were influenced only by hypertension plus diabetes ($\beta = -.109$) and hypertension plus CVD ($\beta = -.250$) (Table 3).

Discussion

The two goals of Healthy People 2010 focus on increasing the quality and the longevity of the life of each Korean individual and eliminating health disparities in the country (Korean Ministry for Health, Welfare and Family Affairs, 2005). Therefore, QoL is a very useful measure for evaluating the degree to which these goals have been achieved. Indeed, attainment of these goals requires detection and adequate management of comorbid conditions.

In this study, QoL in those with one or more frequently related chronic diseases with high morbidity and mortality among Korean elderly individuals (hypertension, diabetes, and CVD) was compared with that in a no-disease control group. Our results suggest that both the number and the type of comorbid diseases affect QoL. The QoL of those with hypertension plus CVD was worse than that of those with hypertension only or CVD only. Other studies of comorbidity using the disease-count method found that the QoL of those with more diseases was consistently worse than that of those with one disease or with fewer diseases. According to a population-based study of Brazilians aged 60 years or older, having any of the seven diseases (arthritis, back-pain, depression/anxiety, diabetes, hypertension, osteoporosis, and stroke) was significantly negatively correlated with scores on one or more sections of the Short Form-36 (SF-36), whereas having three or more diseases was significantly negatively correlated with scores on all the sections of the SF-36 (Lima et al., 2009a,b). An Australian population-based study of people aged 20 years or older found correlations between number of diseases and impairments in the ability to perform daily activities (Walker, 2007).

Of the seven groups analyzed, the CVD-related groups (the CVD-only and CVD-plus-hypertension groups) had the worst QoL scores. This is because CVD itself greatly affects physical functioning, resulting in depression or other negative psychological consequences. Although we did not distinguish among the individual diseases classified as CVD because of the small number of cases, other studies have consistently shown that stroke has the greatest effect on QoL (Bardage & Isacson, 2001; Maddigan et al., 2005; Poljičanin et al., 2010; Xie at al., 2006).

Research in Korea has also shown that QoL in elderly Korean individuals is most strongly correlated with CVD followed by backache and joint disease (Nam et al., 2000) and that QoL in Korean homebound CVD patients was significantly worse than was that of healthy people (Kim, Kang, Kim, Wang, & Chang, 2006). CVD

Table 3 Influences of Hypertension, Diabetes, Cardiovascular Disease and Comorbidities on EQ-5D[a].

Categories	Single disease groups						Comorbidity groups			
	Hypertension only		Diabetes only		CVD only		Hypertension + diabetes		Hypertension + CVD	
	Unstandardized β	Standardized β	Unstandardized β	Standardized β	Unstandardized β	Standardized β	Unstandardized β	Standardized β	Unstandardized β	Standardized β
EQ-5D (Total)	−.075*	−.186*	−.045*	−.330*	−.036*	−.463*	−.022*	−.318*	−.026*	−.469*
Mobility (LQ1)	.240*	.196*	.136*	.281*	.106*	.378*	.068*	.332*	.065*	.383*
Self-care (LQ2)	.072*	.089*	.048*	.159*	.054*	.273*	.034*	.223*	.046*	.359*
Usual activities (LQ3)	.225*	.186*	.121*	.267*	.129*	.473*	.059*	.293*	.081*	.505*
Pain or discomfort (LQ4)	.344*	.229*	.241*	.401*	.161*	.482*	.077*	.317*	.081*	.439*
Anxiety or depression (LQ5)	.075	.062	.027	.062	.028	.111	.023*	.109*	.040*	.250*

Note. EQ-5D = EuroQoL-5 Dimension; CVD = cardiovascular diseases.
*.001 ≤ p ≤ .05
[a] Multiple linear regression analysis was used after adjustment for sex, age, education, employment, smoking, alcohol drinking, low salt diet, and exercise were made (no-disease group = 0).

has consistently been found to have a negative effect on QoL in terms of physical activities and emotional well-being (Ahlsio, Britton, Murray, & Theorell, 1984).

In this study, QoL in those with hypertension was worse than that of healthy people without any diseases. Some previous studies have reported that QoL in patients with hypertension was poorer than that among healthy people (Bardage & Isacson, 2001; Nam et al., 2000), whereas other studies have reported that hypertension had no significant effect on QoL (Arnold et al., 2004) or found no significant relationship (Stewart et al., 1989; Xie et al., 2006). Studies showing that hypertension did not influence QoL suggested that this was because most patients with hypertension were asymptomatic and did not differ from those without this condition in terms of their performance of daily activities as long as they followed their medication regimen (Kim et al., 2001). Therefore, the QoL of those with hypertension is thought to be related to how well their blood pressure is controlled. Further studies regarding the effect of disease management on the QoL of patients with hypertension are needed.

Moreover, those with diabetes only had worse QoL than did those with diabetes plus hypertension. This may be because some respondents who had been classified into the diabetes-only group in this study may have had other nonvascular comorbid conditions that reduced their QoL. Other studies have found that nonvascular comorbid conditions, such as retinopathy, nephropathy, or musculoskeletal diseases, are important predictors of QoL in diabetes patients (Rubin & Peyrot, 1999; Wandell, 2005; Wandell, Brorsson, & Aberg, 1997). Diabetes itself was associated with worse QoL in this study and other population-based studies (Schram et al., 2008; Wee, Cheung, Li, Fong, & Thumboo, 2005). The most common comorbid chronic diseases among diabetic patients were hypertension, chronic lung diseases, and osteoarthritis of the hip/knee (Schellevis, Velden, Lisdonk, Eijk, & Weel, 1993). Those with more comorbid conditions used significantly more hypoglycemic medications and injectable insulin (Glynn, Monane, Gurwitz, Choodnovskiy, & Avorn, 1999). A longitudinal study in Amsterdam found that diabetes plus arthritis resulted in a noticeable decline in physical functioning (Kriegsman, Deeg, & Stalman, 2004). To summarize, although the influence of diabetes on QoL should be explored in the context of disease duration and medication regimen, diabetes has consistently been found to have a negative effect on QoL, and this effect is even more pronounced when diabetes co-occurs with other diseases.

In this study, those with at least one chronic disease had worse QoL than did those with no chronic disease. Given that several other studies have reported findings that contradict this, further studies evaluating the QoL of those with chronic diseases should consider not only the presence of comorbid conditions but also their duration and treatment regimens (e.g., oral vs. injectable medications).

Because CVD was associated with the worst QoL in this study, efforts to prevent and manage hypertension and diabetes, which are known risk factors for CVD, should be implemented before CVD develops. Additionally, efforts to prevent and manage comorbid conditions should be enhanced, as having two chronic diseases reduced QoL to a greater extent than did having only one. Finally, whereas all analyzed groups, regardless of the number of comorbid diseases, scored worse on the physical components of QoL compared with the control group, only certain comorbid pairs (hypertension plus diabetes and hypertension plus CVD) were associated with a reduction in the psychological components of QoL in this study. This result is consistent with most studies on hypertension, diabetes, and CVD, which have found that, despite slight variations based on type of CVD, having only one of these diseases was not associated with a significant reduction in the psychological components of QoL

(Bardage & Isacson, 2001; Lima et al., 2009a,b), whereas combinations of these conditions were associated with significant reductions in the psychological components of QoL (Maddigan et al., 2005; Poljičanin et al., 2010). Consistent with review studies, this may be explained by the fact that diabetes and CVD are both associated with impaired mental states, such as depression, which further increase the number and influence the course of all comorbid conditions (Joynt, Whellan, & O'Connor, 2003; Talbot & Nouwen, 2000). Because the conditions that commonly co-occur with diabetes or CVD had greater impact on the psychological components of QoL than did diabetes or CVD alone, individuals with diabetes or CVD and any other diseases require emotional support in addition to disease management.

Further studies on QoL should examine the effects of having one, two, or more chronic diseases in addition to the chronic diseases that are most prevalent among elderly individuals (e.g., arthritis, COPD, and cancer) to provide a useful reference for developing priorities for disease management. Investigation of the association of QoL with hypertension, diabetes, CVD, and combinations thereof may help health providers develop methods of intervention and policies to effectively manage chronic diseases in elderly individuals, which will eventually help elderly people achieve the highest level of health and QoL.

Limitations

This study also has several limitations. First, demonstration of differences in QoL among individuals with hypertension, diabetes, CVD, and combinations thereof requires sufficiently large samples in each subgroup. Of the 24 possible combinations of hypertension, diabetes, and CVD, this study analyzed data from only those groups with 20 or more members. Further analysis with larger samples will be needed.

Second, QOL was measured using the EQ-5D. Longer term and more detailed data on QoL, disease duration, and adherence to treatment were unavailable. This limitation may have led to information bias. However, because all data were collected from a systematically randomized sample by trained personnel and medical doctors, the potential for generalization is strong. Additionally, the Korean version of the EQ-5D has been validated by several studies (Kang, Shin, et al., 2006; Kim et al., 2009).

Third, this study used secondary data from the KNHANES IV 2008, and all factors related to the diseases could not be managed or controlled. Although this study reflects the results in 2008, it added valuable information to local health-related databases. Additionally, the results of this study can form the foundation for further comparative studies.

Conclusion

Our study suggests that both the number and the type of comorbid diseases affect QoL. QoL in those with hypertension plus CVD was worse than that of those with hypertension only or CVD only. CVD and diabetes gave more negative effect on one's life than hypertension and its comorbidity. Elderly individuals suffering from diabetes and CVD along with comorbid conditions are especially in need of emotional support in addition to disease management. Nursing practice should focus not only on the number of comorbid diseases but also on the impact of each disease on QoL. Efforts to prevent and manage diabetes, CVD, and related risk factors should be intensified.

Conflict of Interest

The authors declare no conflict of interest.

Acknowledgment

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