Effect of the Physical Environment on the Health-related Quality of Life of the Low-income Korean Elderly Population

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Abstract
Background: The increasing number of elderly citizens due to changes in the social structure is of national interest. This study aimed to provide basic data for devising policies to promote the quality of life of elderly National Basic Livelihood Security System (NBLSS) beneficiaries in South Korea by identifying the effects of their general characteristics and physical environment on their health-related quality of life (HRQoL).
Methods: Using the 2013 Korean Community Health Survey (KCHS) raw data, we analyzed 3537 NBLSS beneficiaries aged 65 yr and older. HRQoL was measured using the Euro QoL five-dimension questionnaire (EQ-5D). Hierarchical multiple regression analyses were used to predict the EQ-5D scores.
Results: The explanatory power for HRQoL increased to 21.4% when the general characteristics and physical environment were included. HRQoL showed statistically significant differences in the environmental variable, level of safety ($P=0.001$), natural environment ($P=0.001$), living environment ($P=0.001$), traffic condition ($P<0.001$), and access to health services ($P<0.001$). Physical environment positively correlated with HRQoL ($r=0.119$, $P<0.001$), thus confirming its influence ($\beta=0.092$, $P<0.001$).
Conclusion: We should strive to manage the physical environment to improve the quality of life of elderly NBLSS beneficiaries.

Keywords: Elderly, Health, Korean community health survey, Low income, Quality of life

Introduction

The National Basic Livelihood Security System (NBLSS) was implemented as a part of a public assistance policy to guarantee sustainable living for people who find it difficult to survive and develop their self-supporting abilities in South Korea (1). As of 31 December 2014, the number of NBLSS beneficiaries reached 1.33 million (905000 households), accounting for 2.6% of the total population. The ratio of NBLSS beneficiaries to the total population per age group is the highest among the elderly aged 65 yr or older (2). The proportion of recipients is increasing because of the accelerated population aging, changes in family structure, and lack of financial reserve, which demand attention and adequate measures to improve the quality of life (QoL) of the low-income elderly population (1, 3). A combination of various physical and mental factors, such as social retirement, changed roles within the family, and physical aging may under-
mine the QoL of the elderly (4). Health-related quality of life (HRQoL) refers to one’s subjective well-being because of the impact of one’s health status on the purpose, expectations, standards, and interests of life (5). HRQoL is affected by personal environment, community environment, and public policy factors (6). HRQoL measured with the Euro QoL five-dimension questionnaire (EQ-5D) provides the key criteria for the assessment of public health policies, understanding of the disadvantaged classes, and evaluation of policy proposals and decision-making (7). The EQ-5D is currently used in HRQoL research on diverse social strata globally (8-12).

Rapid escalation of healthcare and medical costs due to the growing prevalence of obesity, asthma, heart disease, and cancer has heightened the need for research on urban environment and health (13), and previous studies assessed the QoL of urban residents in connection to their physical environment (14-16). The physical environment influences the individual's health in homes, neighborhoods (e.g., environments that increase physical activity, such as boardwalk, bicycle path, etc.) and workplace, which affect the HRQoL (6). The physical environment exerts significant influence on the subjective health status of urban and rural residents (17), suggesting the importance of considering them when developing health promotion programs for local residents.

However, nearly all studies assessing the QoL of elderly Korean citizens have only focused on demographic features and health status at the individual level (3, 5, 19), and there has been no investigation of the physical environment at the level of local communities. This study aimed to examine the association between the HRQoL, general characteristics, and physical environment of the NBLSS recipients elderly in Korea. The ultimate goal was to contribute to creating healthier community environments and improve the HRQoL of the target population.

Materials and Methods

Study design and databases
This study used a descriptive and cross-sectional research design. The 2013 Korean Community Health Survey (KCHS) data were used for this study. The Korea Centers for Disease Prevention and Control (KCDC) conducts a community health survey annually by sending trained surveyors to investigate a representative sample (n=900) from each of the 254 cities, districts, and borough public health centers in Korea using a computer-assisted personal interviewing technique. The questionnaire consisted of general characteristics, diseased condition, the EQ-5D, environmental factors, etc. In 2013, 228781 people were surveyed, of which 3645 individuals were elderly (≥65 yr) NBLSS beneficiaries. After excluding 108 individuals for having omissions in the EQ-5D scores, data from 3537 individuals were included in the analysis.

Ethical review
The raw dataset was obtained from the KCDC after registering to access the database. We submitted a research plan for the use of raw data was electronically submitted to the KCDC homepage and obtained an approval for using the data (No. 2013-06EXP-01-3C). All personal identification information was deleted from the data before analysis. Participants in this survey provided their informed consent.

Measurement
Health-related quality of life (HRQoL)
The EQ-5D is an instrument for measuring HRQoL. It is a simple scale developed by the EuroQoL Group for the measurement of overall health. It is currently being used in numerous countries after validation and computation of weighted values corresponding to the cultural values (20). It provides a single index score for
the health state after measuring and adjusting these 5 health states, used to measure HRQoL (10). We used the model developed by the KCDC (21), which applied the weighted values for HRQoL in the Korean context, for calculating the EQ-5D index score. The EQ-5D index scores ranges from -1 to +1; -1, 0, and +1 indicating severe, moderate, and no problem respectively (19). The internal reliability of the scale (Cronbach’s α) was .78 in a previous study (22), and .84 in this study.

Physical environment
Physical environment was measured by the subjects’ positive attitudes toward their local community. It comprised of 5 items measured using a dichotomous scale (Satisfied-1 point, Unsatisfied-0 point): satisfaction with the “level of safety,” “natural environment,” “living environment,” “traffic condition,” and “access to health services.” The physical environment was measured by the sum of all the responses.

General Characteristics
The general characteristics were examined in terms of demographic and health-related characteristics. For demographic characteristics, age, sex, educational level, marital status, employment status, and residential area were surveyed. For health-related characteristics, the subjective health status, experience of depression, degree of obesity, comorbidity, and experience of accidents were surveyed. Subjective health status measured on a 5-point Likert scale (5 for very healthy, 4 for healthy, 3 for average, 2 for unhealthy, and 1 for very unhealthy), with a higher score indicating a better subjective health status. Experience of depression was defined as having experienced depression in their daily life for more than two weeks in a year; measured as ”not depressed” or “experienced depression.” Degree of obesity measured with the body mass index (BMI), calculated by dividing the body weight (kg) by the square of the height (m²). BMI<18.5 was classified as “underweight,” 18.5~<23.0 as “normal weight,” 23.0~<25.0 as “overweight,” and ≥25.0 as “obese” (23). Comorbidity was the number of chronic diseases diagnosed by a physician (i.e., hypertension, diabetes, arthritis), measured as “no disease,” “one disease,” “two diseases,” and “three diseases.” Experience of accidents was the number of accidents, addictions, and fall injuries sustained in the past year, measured as ”no accidents, addictions, and fall injuries,” “experienced once,” and “experienced twice.”

Statistical analysis
Data were analyzed using SPSS (Version 22, IBM, Armonk, NY). The general characteristics of the subjects were analyzed using frequency and percentage. The difference in the EQ-5D by general characteristics was identified using the t-test and analysis of variance. The correlations between the EQ-5D and related variables were analyzed through Pearson’s correlation. Hierarchical multiple regression analyses were used to predict the EQ-5D. Demographic characteristics (age, sex, educational level, marital status, employment status, residential area) were entered in Model I, and health-related variables (subjective health status, experience of depression, degree of obesity, comorbidity, experience of accidents) were entered in Model II. In addition, environmental variable (physical environment) was entered in Model III to identify the effects of the variables entered in each model. The general characteristics were coded as dummy variables, except for comorbidity and experience of accidents. The Durbin-Watson statistic was 1.914, indicating no autocorrelation in the residuals, and correlation coefficients ranged from 0.047~0.249, indicating independence. Tolerance ranged from 0.741~0.980, and variance inflation factor (VIF) ranged from 1.021~1.350, which indicates an absence of multicollinearity, satisfying the basic assumptions of regression.

Results
The EQ-5D scores according to the general characteristics
Demographic characteristics were significant differences in the degree to which the EQ-5D scores were distributed according to age, sex, ed-
ucational level, marital status, employment status, and residential area (All \( P < 0.001 \)). Health-related variables showed significant differences in the degree to which the HRQoL varied in accordance with the subjective health status (\( P < 0.001 \)), experience of depression (\( P < 0.001 \)), degree of obesity (\( P < 0.01 \)), comorbidity (\( P < 0.001 \)), and experience of accidents (\( P < 0.001 \)). In addition, there were statistically significant differences in environmental variable, level of safety (\( P < 0.01 \)), natural environment (\( P < 0.01 \)), living environment (\( P < 0.01 \)), traffic condition (\( P < 0.001 \)), and access to health services (\( P < 0.001 \)) (Table 1).

**Table 1:** The EQ-5D scores according to the general characteristics of the subjects (\( n = 3537 \))

| Characteristics | \( n(\%) \) | \( M(\ SD) \) | \( t \/ \ F(P) \) |
|-----------------|------------|---------------|-----------------|
| Age (years)     |            |               |                 |
| 65-74           | 1687 (47.7)| 0.73 (0.17)   | -9.087 (<0.001) |
| \( \geq 75 \)   | 1850 (52.3)| 0.68 (0.19)   |                 |
| Sex             |            |               |                 |
| Male            | 1065 (30.1)| 0.74 (0.20)   | -8.437 (<0.001) |
| Female          | 2472 (69.9)| 0.69 (0.18)   |                 |
| Educational level |        |               |                 |
| \( \leq \) Elementary school | 1436 (40.6)| 0.67 (0.18)   | 26.919 (<0.001) |
| Middle school   | 1380 (39.0)| 0.71 (.019)   |                 |
| High school     | 371 (10.5 )| 0.73 (0.18)   |                 |
| \( \geq \) College | 350 (9.9 )| 0.76 (0.19)   |                 |
| Marital status  |            |               |                 |
| Married         | 1260 (35.6)| 0.71(0.20)    | 16.386 (<0.001) |
| Widowed         | 1851 (52.3)| 0.69 (0.17)   |                 |
| Divorced/separated/single | 426 (12.1 )| 0.74 (0.18)   |                 |
| Employment status |        |               |                 |
| Employed        | 544 (15.4 )| 0.78 (0.14)   | -11.309 (<0.001) |
| Unemployed      | 2993 (84.6)| 0.69 (0.19)   |                 |
| Residential areas |        |               |                 |
| Province        | 2574 (72.8)| 0.70 (0.19)   | -3.639( <0.001) |
| Metropolitan city | 963 (27.2)| 0.72 (0.17)   |                 |
| Subjective health status |    |               |                 |
| Very unhealthy | 938 (26.5 )| 0.58 (0.21)   |                 |
| Unhealthy       | 1473 (41.7)| 0.70 (0.13)   | 278.688 (<0.001) |
| Average         | 772 (21.8 )| 0.81 (0.14)   |                 |
| Healthy         | 313 (8.8 )| 0.84 (0.14)   |                 |
| Very healthy    | 41 (1.2 )| 0.86 (0.13)   |                 |
| Experience of depression |     |               |                 |
| Have experienced | 522(14.8 )| 0.62 (0.21)   | -12.082 (<0.001) |
| Not experienced | 3015 (85.2)| 0.72 (0.17)   |                 |
| Degree of obesity † |        |               |                 |
| Underweight     | 279 (10.3 )| 0.70 (0.19)   | 4.788 (0.002)   |
| Normal weight   | 1268 (46.8)| 0.72 (0.18)   |                 |
| Overweight      | 589 (21.8 )| 0.73 (0.17)   |                 |
| Obese           | 572 (21.1 )| 0.70 (0.18)   |                 |
| Comorbidity †   |            |               |                 |
| None            | 824 (23.3 )| 0.77 (0.18)   | 78.971 (<0.001) |
| One disease     | 1371 (38.8)| 0.72 (0.17)   |                 |
| Two diseases    | 1062 (30.1)| 0.66 (0.19)   |                 |
| Three diseases  | 274 (7.8 )| 0.62 (0.18)   |                 |
| Experience of Accidents † |     |               |                 |
| None            | 2298 (65.1)| 0.73 (0.18)   | 68.540 (<0.001) |
| Once            | 936 (26.5 )| 0.67 (0.18)   |                 |
| Twice           | 298 (8.4 )| 0.62 (0.19)   |                 |
| Level of safety |            |               |                 |
| Satisfied       | 2901 (82.0)| 0.70 (0.18)   | 3.471 (0.001)   |
| Unsatisfied     | 636 (18.0 )| 0.68 (0.19)   |                 |
| Natural environment |      |               |                 |
| Satisfied       | 3077 (87.0)| 0.71 (0.18)   | 3.417 (0.001)   |
| Unsatisfied     | 460 (13.0 )| 0.68 (0.20)   |                 |
| Living environment |        |               |                 |
| Satisfied       | 2966 (83.9)| 0.71 (0.18)   | 3.433 (0.001)   |
| Unsatisfied     | 571 (16.1 )| 0.68 (0.19)   |                 |
| Traffic condition |        |               |                 |
| Satisfied       | 2299 (65.0)| 0.72 (0.18)   | 7.030 (<0.001)   |
| Unsatisfied     | 1238 (35.0)| 0.67 (0.19)   |                 |
| Access to health services |       |               |                 |
| Satisfied       | 2443 (69.2)| 0.71 (0.18)   | 4.720 (<0.001)   |
| Unsatisfied     | 1094 (30.8)| 0.68 (0.20)   |                 |

Note: M: Mean, SD: Standard Deviation, † missing data involved.

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Relations among major variables

The EQ-5D scores were significantly negatively correlated with comorbidity (P<0.001) and experience of accidents (P<0.001), and positively correlated with physical environment (P<0.001) (Table 2).

Factors affecting the EQ-5D scores

First, among demographic characteristics, age (P<0.001), sex (P<0.001), educational level (P<0.01), marital status (P<0.05), employment status (P<0.001), and residential area (P<0.001) were found to have significant associations, with an explanatory power of 8.1% (P<0.001). Second, when health-related variables were entered in Model I, the demographic variables were significant and subjective health status (P<0.001), experience of depression (P<0.001), degree of obesity (P<0.01), comorbidity (P<0.001), and experience of accidents (P<0.001) were associated, with the explanatory power of Model II being 20.6% (P<0.001). When the environmental variable was entered in Model II, physical environment was significant (P<0.001), and the explanatory power of Model III was 21.4% (P<0.001) (Table 3).

Table 2: Correlation between the EQ-5D, comorbidity, experience of accidents, and physical environment.

| Variable                      | EQ-5D | Comorbidity r (P) | Experience in accidents | Physical environment |
|-------------------------------|-------|-------------------|-------------------------|----------------------|
| EQ-5D                         | 1.00  |                   |                         |                      |
| Comorbidity                   | -0.249 (<0.001) | 1.00 |                         |                      |
| Experience of accidents       | -0.192 (<0.001) | 0.091 (<0.001) | 1.00 |                      |
| Physical environment          | 0.119 (<0.001) | -0.008 (0.647) | -0.038 (0.023) | 1.00 |

Table 3: Effect of the variables on the EQ-5D score

| Variables                      | Predictors | Model I | Model II | Model III |
|-------------------------------|------------|---------|----------|-----------|
|                               | Categories (Reference group) | β | t (P) | β | t(P) | β | t(P) |
| Demographic factors           | Age (≥75) | -.146 | -8.730 | -.166 | -10.628 | -.168 | -10.818 |
|                               | Sex (male) | .121 | 6.719 | .054 | 3.120 | .059 | 3.458 |
|                               | (<0.001) | (<0.001) | (0.002) | (<0.001) | (<0.001) | (<0.001) |
|                               | Education level (≥college) | .049 | 2.900 | .032 | 2.038 | .036 | 2.278 |
|                               | (0.004) | (<0.001) | (0.042) | (<0.001) | (<0.001) | (<0.023) |
|                               | Marital status (with spouse) | .044 | -2.497 | -.038 | -2.329 | -.041 | -2.504 |
|                               | (0.013) | (<0.001) | (0.020) | (<0.001) | (<0.001) | (<0.023) |
|                               | Employment status (employed) | .167 | 10.043 | .117 | 7.508 | .114 | 7.317 |
|                               | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) |
|                               | Residential area | .058 | 3.499 | .053 | 3.432 | .049 | 3.199 |
|                               | (metropolitan) (≤0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) |
| Health factors                | Subjective health status | .177 | 11.496 | .173 | 11.269 | .173 | 11.259 |
|                               | (≥healthy) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) |
|                               | Experience of Depression (have) | -.149 | -9.763 | -.141 | -9.236 | -.141 | -9.236 |
|                               | Degree of obesity (normal) | -.041 | 2.680 | .039 | 2.610 | .039 | 2.610 |
|                               | | (0.007) | (0.009) | (0.009) | (0.009) | (0.009) | (0.009) |
|                               | Comorbidity | -.159 | -10.069 | -.159 | -10.135 | -.159 | -10.135 |
|                               | | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) |
|                               | Experience of Accidents (have) | -.135 | -8.859 | -.133 | -8.759 | -.133 | -8.759 |
|                               | | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) |
| Environment factor            | Physical environment | .989 | 26.509 | 1.097 | 30.975 | 1.050 | 29.413 |
|                               | | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) | (<0.001) |
| Const. (B)                    | | .083 | .209 | .206 | .214 | .214 | .214 |
| F                              | | .081 | .126 | .08 | .08 |
| R²                            | | .083 | .083 | .008 | .008 | .008 | .008 |
Discussion

In terms of demographic characteristics, the EQ-5D score was higher among the younger elderly (65-74 yr), men, college graduates or higher, employed, living in a large city, and had no spouse. Our results were partially similar to previous studies (1, 9, 10, 19, 24, 25) that found significant effects on the HRQoL of the Korean low-income elderly population. With regard to marital status, precedent studies have shown that the presence of a spouse was significantly associated with higher HRQoL, which was the opposite of that in our study (9, 19, 26); however, in Spain (11), single individuals had higher QoL than married or widowed individuals did. Unlike previous studies, in our study, subjects who were voluntarily single (divorced, separated, unmarried) had a significantly better QoL. Additional replication studies and meta-analysis would be required to elucidate whether this result is a group-specific phenomenon that is only demonstrated among low-income elderly, or if it is an accurate reflection of the rising “twilight divorce” and unmarried rates in the Korean society. An antecedent study recommends conducting more studies to investigate the influence of marriage on HRQoL (27).

Among the health-related variables, the EQ-5D score was higher among individuals with better subjective health status, no experience of depression, normal body weight, less comorbidity, and no experience of accidents. Subjective health status was found to be the most significant predictor of HRQoL among the Korean NBLSS beneficiaries. It was also found to be a significant influence factor of HRQoL in previous studies on disadvantaged citizens in rural areas (5), female elderly NBLSS recipients who live alone (3), and frail elderly citizens (28). As respondents with low socioeconomic status have low expectations for health, which affects the EQ-5D score, it is important to devise policies that minimize adverse health outcomes caused by socioeconomic inequality (10).

Comorbidity was found to be a significant predictor of HRQoL. This was similar to the results suggested by precedent researches, where the EQ-5D score was lower among individuals with comorbidity (10, 12, 24, 25, 29). As a measure of comorbidity in this study, we examined the prevalence of hypertension, diabetes, and arthritis-3 diseases that are generally highly prevalent and are under national management (12). In addition to the effects in the health-related aspects, management of these diseases also contributes to the improvement of QoL among low-income elderly persons, necessitating more active chronic disease management. In our study, comorbidity was presented as the number of diseases present, which does not reflect the severity of the diseases (26); thus, future studies should consider using objective indicators of comorbidity, such as the Cumulative Illness Rating Scale or Charlson Comorbidity Index (24).

Depression has a greater effect on the QoL than health problems or behaviors among the low-income elderly population (1, 10), suggesting that physical or psychological factors threaten QoL in the low-income elderly population than in the general elderly population. With regard to degree of obesity, the normal group had a better EQ-5D score than that of the abnormal group. This was similar to a previous study on the HRQoL of elderly citizens who regularly visited welfare centers (19), controlling abnormal obesity degree among the elderly is important for managing their HRQoL, and subjects classified into normal and abnormal groups instead of merely examining them based on the BMI values. The absence of experiences of accidents was associated with a higher EQ-5D score. Factors related to independence are prioritized with regard to the HRQoL of the elderly population (30), accidents that affect independence are speculated to have adverse effects on the HRQoL. Particularly, falls injuries restrict the mobility of elderly persons and ultimately undermine their HRQoL (8, 30), supporting the findings of this study. With regard to environmental variable, physical environment was found to be a significant predictor of the HRQoL in the elderly NBLSS beneficiaries. Individuals who reside in physically inadequate environments perceive their environ-
ment negatively and ultimately show low HRQoL. The satisfaction with the area of residence and neighborhood environment has been confirmed to affect life satisfaction of the elderly (31). Subjective health status was higher in groups satisfied with their physical environment, suggesting that improving the community environments would bring about better health outcomes (15, 17). Therefore, continued interest is important to encourage local governments to implement community environmental improvement projects and help local residents develop positive perceptions about their environment (32). We measured the presence of satisfaction about the level of safety, natural environment, living environment, traffic condition, and access to health services, but future research should apply the appropriate assessment tools to the physical environment. Specifically, the management of HRQoL in terms of the physical environment requires a multidisciplinary approach. Experts in the field related to the physical environment of local residents are required to enhance the understanding of HRQoL. Further, undergraduate programs should start a course on health and QoL, and basic education should be provided integrating this. In addition, continuous exchange of information among specialized disciplines, such as organizing multidisciplinary academic conferences, are necessary. This study was a secondary analysis of a cross-sectional survey and there was a limit to the predictors and use of appropriate instruments in the prior study. Therefore, this study will need to be repeated using appropriate tools to target populations. Despite this limitation, this study provided meaningful contributions by identifying the demographic factors, health-related factors, and physical environment that have significant effects on the HRQoL of elderly NBLSS beneficiaries. In the community, we must seek out various ways to improve the elements that constitute the physical environment. Further, the management of subjective health status was important to improve the HRQoL of the elderly NBLSS beneficiaries. For the vulnerable NBLSS beneficiaries, systematic approaches to regional health policy and healthier community environments are required.

**Ethical considerations**

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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**Conflicts of Interest**

The authors declare that there is no conflict of interest.

**References**

1. Kim HY, Oh KS, Oh KO et al (2008). [Quality of life in low-income Korean Aged]. *J Korean Acad Nurs*, 38(5): 694-703.
2. Ministry of Health and Welfare (2014). 2014 National Basic Livelihood Security Recipients Status.
3. Bak SS, Kim KS, Choi JH (2010). Quality of life of older women living alone –National Basic Livelihood Act Recipients. *J Korean Gerontol Nurs*, 12(3): 248-55.
4. Kim HK, Lee HJ, Park SM (2010). Factors influencing quality of life in elderly women living alone. *J Korean Gerontol Soc*, 30(2): 279-92.
5. Kim JI (2013). Levels of health-related quality of life (EQ-5D) and its related factors among vulnerable elders receiving home visiting health care services in some rural areas. *J Korean Acad Community Health Nurs*, 24(1): 99-109.
6. Ferrans CE, Zerwic JJ, Wilbur JE, Larson JL (2005). Conceptual model of health-related quality of life. J Nurs Scholarsh, 37(4):336-42.
7. Kang EJ, Shin HS, Park HJ, Jo MW, Kim NY (2006). A valuation of health status using EQ-5D. Korean J Health Econ Policy, 12(2): 19-43.
8. Thiem U, Klaassen-Mielke R, Trampish U et al (2014). Falls and EQ-5D rated quality of life in community dwelling seniors with concurrent chronic diseases: a cross-sectional study. Health Qual Life Outcomes, 12(5): 301-8.
9. Sultana M, Sarker AR, Mahumud RA et al (2016). Inequalities in health status from EQ-5D findings; a cross-sectional study in low-income communities of Bangladesh. Int J Health Policy Manag, 5(5): 301-8.
10. Sun S, Chen J, Johannesson M et al (2011). Population health status in China: EQ-5D results, by age, sex and socio-economic status, from the National Health Services Survey 2008. Qual Life Res, 20(3): 139-20.
11. Garcia-Gordillo MA, Collado-Mateo D, Oliveira PR, Adua JC (2016). Application of EQ-5D-5L questionnaire in patients suffering from urinary incontinence. Actas Urol Esp, 40(7): 457-62.
12. Chin YR, Lee IS, Lee HY (2014). Effects of Hypertension, Diabetes, and/or Cardiovascular Disease on Health-related Quality of Life in Elderly Korean Individuals: A Population-based Cross-sectional Survey. Asian Nurs Res (Korean Soc Nurs Sc), 8(4): 267-73.
13. Srinivasan S, O’Fallon LR, Deyreich A (2003). Creating healthy communities, healthy homes, healthy people: initiating a research agenda on the built environment and public health. Am J Public Health, 93(9): 1369-71.
14. Cho NS, Hwang EJ (2014). A Comparative study on conditions of a livable city. Soc Sci Gen Studies, 32(2): 235-67.
15. Joungh YJ, Lee SK (2015). The study on the causality among built environment, social relationship, and health of the elderly. J Korean Region Develop Assoc, 27(2): 75-94.
16. Sung HG (2011). A study on the impacts of residential neighborhood built environment on personal health indicators—focused on the planning elements of transit-oriented development. J Korea Plan Assoc, 46(3): 235-51.
17. Lee JA, Park JH, Kim M (2015). Social and physical environments and self-rated health in urban and rural communities in Korea. Int J Environ Res Pub Health, 12(11): 14329-41.
18. Kim KR (2015). Policy considerations for the living conditions of older Koreans. Health Welfare Forum, 223: 68-78.
19. Kim HR (2014). Predicting factors of health related quality of life among older adults at senior centers in Korea. J Korean Gerontol Nurs, 16(2): 95-106.
20. Brooks R, Rabin RM, Charro F (2005). The measurement and evaluation of health status using EQ-5D. Dordrecht: The Netherland Kuver Academic Publisher.
21. Korea Centers for Disease Control (2010). South Korean time trade-off values for EQ-5D health states. Seoul, Korea: Korea Centers for Disease.
22. Lee HK, Cho SH, Kim JH, Choo HI (2014). [Influence of self-efficacy, social support and sense of community on health-related quality of life for middle-aged and elderly-residents living in a rural community]. J Korean Acad Nurs, 44(6): 608-16.
23. Korean Society for the Study of Obesity (KSSO) (2000). Obesity diagnostic criteria. Guide to obesity treatment. Seoul: Han-wui hak.
24. Hong SW (2009). [Factors influencing health-related quality of life in Korean Medicaid beneficiaries]. J Korean Acad Nurs, 39(4): 480-9.
25. Chung SS, Joung KH (2010). Predictors of Health-related Quality of Life (HRQoL) in the home- dwelling disabled persons by using EQ-5D: results from the 3rd Korean National Health and Nutritional Examination Survey 2005. J Korean Acad Adult Nurs, 22(3): 291-302.
26. Fortin M, Lapointe L, Hudon C et al (2004). Multimorbidity and quality of life in primary care: A systematic review. Health Qual Life Outcomes, 251.
27. Aghamolaei T, Tavafian SS, Zare S (2011). Determinants of health related quality of life on people living in Bandar Abbas, Iran. Iran J Public Health, 40(3): 128-35.
28. Yim ES, No KH (2010). The effects of related factors on health-related quality of life for the frail elderly. J Korean Acad Community Health Nurs, 21(1): 12-20.
29. Ko HY, Lee JK, Shin JY, Jo E (2015). Health-related quality of life and cardiovascular disease risk in Korean adults. Korean J Fam Med, 36(6): 349-56.
30. Chang NT, Chi LY, Ysnh NP, Chou P (2010). The impact of fall and fear of falling on health-related quality of life in Taiwanese Elderly. *J Community Health Nurs, 27*(2): 84-95.
31. Ferández-Portero C, Alrócn D, Padura ÁB (2017). Dwelling conditions and life satisfaction of older people through residential satisfaction. *J Environ Psychol, 49:* 1-7.
32. Kim WJ, Kim TY (2013). A study on the neighborhood physical and social environment and health: The mediating role of perceived environments. *Journal of Community Welfare, 46:* 23-47.