ORIGINAL ARTICLE

J Korean Acad Community Health Nurs (지역사회간호학회지)

ISSN 1225-9594 (Print) / ISSN 2288-4203 (Online)
Vol. 25 No. 3, 217-224, September 2014
http://dx.doi.org/10.12799/jkachn.2014.25.3.217

# The Influence of Health Literacy and Diabetes Knowledge on Diabetes Self-care Activities in Korean Low-income Elders with Diabetes

Jeong, Jihye · Park, Namhee · Shin, So Young

Department of Nursing, College of Medicine, Inje University, Busan, Korea

**Purpose:** This study aimed to assess the levels of and relationships among health literacy, knowledge about diabetes, and self-care activities in the Korean low-income elderly with diabetes and to identify factors influencing the self-care activities of this vulnerable population. **Methods:** This study surveyed a total of 151 low-income elderly patients with diabetes registered at 16 Visiting Health Care Services in B City, Korea. Health literacy was measured with the Newest Vital Sign. Diabetes knowledge was measured with the Diabetes Knowledge Test. The Summary of Diabetes Self-care Activities Questionnaire was used to assess diabetes self-care activities. A stepwise multiple regression analysis was conducted to identify significant factors influencing diabetes self-care activities in these patients. **Results:** In the regression model, diabetes knowledge (β=.322, $p<.001$), exercise (β=.337, $p<.001$), and experiences of diabetes education (β=.241, $p=.001$) were significantly associated with increased diabetes self-care activities in low-income elderly patients with diabetes when gender, education, health literacy, and subjective health state were controlled. **Conclusion:** To improve diabetes self-care activities in the low-income elderly with diabetes, it is important to develop a customized program considering their knowledge, exercise, and diabetes education experience.

**Key Words:** Health literacy, Knowledge, Self care, Diabetes mellitus, Aged

## INTRODUCTION

As the increase in the elderly population has led to an accumulative increase in the morbidity of chronic disease, the importance of chronic disease management is becoming evident to prevent its complications. Among such chronic diseases, the morbidity of diabetes has persistently increased in Korea. The prevalence rate of diabetes has increased from 8.6% in 2001 to 10.1% in 2010[1]. In particular, the morbidity of diabetes has increased with the aging population, representing up to 23.6% in the population aged over 70, which corresponds to 1 out of 4 older adults having diabetes[1]. Underserved classes such as the low-income class have a higher morbidity in diabetes and have a lower practicing rate in decreasing health risk behavior factors than the class with an income level in the upper high 25%[2]. Therefore, more active management strategy is required to improve health equity[2].

The recognition and treatment rates of diabetes has increased in these days and reached up to 73.2% and 61.0%, respectively. However, the management rate of diabetes is only 28.5% which is below half of those recognition and treatment rates[1]. The diabetes management rate and follow-up test rate for detecting diabetes-related complications are lower in patients in the low-income population than those in the general population[3]. According to the American Diabetes Association[4], considering that the population with a low management rate of diabetes showed a 2~4 fold higher incidence of cardiovascular diseases and spent 2.3 fold more on medical expenses due to diabetes-related com-

Corresponding author: Park, Nam hee
Department of Nursing, College of Medicine, Inje University, 633-165 Kaegum-dong, Busanjin-gu, Busan 614-735, Korea.
Tel: +82-51-890-6832, Fax: +82-51-891-6832, E-mail: parknh@inje.ac.kr

- This article is a revision of the first author's master's thesis from Inje University.

Received: Jun 5, 2014 | Revised: Sep 25, 2014 | Accepted: Sep 29, 2014

plications such as hypertension (67%), neuropathy (60~70%), non-traumatic amputation (60%), renal failure (44%), and blindness (28.5%) than the population without diabetes, it has been suggested that diabetes management is an important and urgent social problem.

Diabetes knowledge about diabetes diet, regular exercise, blood glucose test, medication therapy, symptom management, complication prevention, and foot hygiene is required for successful diabetes self care. Exercise is important in reducing blood glucose levels especially in elderly patients with diabetes[5-7]. Diabetes knowledge should be undertaken in advance for effective diabetes management. It has been reported that low-income diabetes patients have low levels of diabetes knowledge and the levels of diabetes knowledge are directly related to glucose control capabilities in this population. Therefore, developing effective strategies to provide health information and improve knowledge levels in this vulnerable population of low-income elderly patients with diabetes is necessary[5,8,9].

However, it may be hard to understand such health information due to difficult medical terms or lack of knowledge[10].

It was reported that the literacy level of diabetes patients on health information could influence diabetes knowledge, self-care activities, and blood glucose control[11,12]. It is reported that high health literacy levels are significantly related to high diabetes knowledge levels and the maintenance of low HbA1c levels. While, low health literacy levels are associated with difficulty in maintaining low HbA1c levels and incidence of complications such as diabetic retinopathy[11,12].

In particular, the elderly population with low health literacy may have limited interpretative ability of blood pressure or blood glucose levels which is basic knowledge required for self-care. Inappropriate understanding of the methods and time schedules for medication administration could result in serious health problems. The health literacy levels of older adults directly affect disease-related knowledge levels and relate to medication administration and self-care activities[11,13] Increased age and low-income level were verified as important factors impairing the understanding of health information and its utilization in daily lives[14,15]. The results of these previous studies imply the necessity of assessing diabetes self-care activities status in low-income elderly diabetes patients.

Developing education programs which take into account the level of health literacy in advance may be more effective in the improvement of diabetes knowledge and diabetes self-care activities in the elderly diabetes patients. Therefore, this study aimed to assess the relationship between health literacy and diabetes knowledge, and to identify the factors that should be considered to improve self-care activities in low-income elderly with diabetes

## METHODS

### 1. Design

This was a cross-sectional, descriptive survey study.

#### 1) Sample and setting

The subjects of this study were 151 low-income elderly diabetes patients aged 65 years and older, registered at Visiting Health Care Services in B City, Korea from July 2nd, 2012 to August 31st, 2012. The number of estimated subjects was calculated by using G-power analysis 3.0. At least 118 subjects were needed to perform a multiple regression analysis including 10 variables, with an effect size of 0.15, a power of 0.8, and a two-tailed ? of 0.05. A sample size of 151 was sufficient for this study. Using a convenient sampling method, persons aged 65 and older among diabetes patients registered at 16 Visiting Health Care Services in B City were first chosen. Among them, persons in the low-income population conforming to the selection criteria of this study were chosen. A minimum of 2 persons to a maximum of 22 persons per each Visiting Health Care Service participated in the study. Detailed selection criteria for subjects included the followings: a) low-income elderly patients diagnosed as diabetes by a physician, b) having at least one month period of diabetes medication administration, c) having communicative skills to understand and judge the content of questionnaires, and d) agreeing to participate in the study after listening to the detailed explanation of the study process. Subjects were provided the full explanations regarding the aims and needs of the study. We explained that there would be no harm for study participation. We also explained that collected data would be used for the study purpose only and subjects might stop participating at any time during the study. Visiting nurses were trained via one face-to-face interview and feedback discussion regarding study aims, survey contents, and assessment methods.

#### 2) Ethical considerations

This study was approved by the Public Institutional

Review Board (PIRB12-010-05).

## 2. Measures

### 1) Health Literacy

Health literacy was measured with the Newest Vital Sign which was published by Weiss et al.,[16] in "Quick assessment of literacy in primary care the newest vital sign" and translated and validated by Kim[14]. It comprises 6 questions with a total score of 6 (where 0~1=limited literacy class, 2~3=potentially limited literacy class, and 4~6=appropriate literacy class). The reliability of the tool from the study by Kim[14] was Cronbach's α=.76 while that of this study was Cronbach's α=.73.

### 2) Diabetes Knowledge

Diabetes knowledge was measured with the Michigan Diabetes Research and Training Center developed by Fitzgerald et al.[6] and modified and translated into Korean by Choi[17]. It comprises a total of 18 issues (19 questions) consisting of one issue about causes, 1 issue about symptoms, 3 issues (4 questions) about the proper level of blood glucose control, 4 issues about diet, 1 issue about exercise, 4 issues about general management, and 5 issues about medication. Scores of 1 for a right answer and 0 for a wrong answer yield a minimum score of 0 to a maximum score of 19 (where high scores =higher levels of diabetes knowledge). Since the division into the group treated with oral hypoglycemic agents only and the group treated with both oral hypoglycemic agents and insulin injections was considered insignificant in this study, 4 issues related to insulin administration were excluded from the original tool with an approval of the author[17]. Fourteen issues (15 questions) were used in the final analysis with a score range from 0 to 15. The reliability of the tool from the study by Choi[17] was Cronbach's α=.75 while that of this study was Cronbach's α=.70.

### 3) Diabetes Self-care Activities

Diabetes self-care activities were measured with the 25-questionnaire Summary of Diabetes Self-Care Activities Questionnaire (SDSCA) developed by Toobert & Glasgow[18], modified by Toobert et al.[19], and translated into Korean by Chang & Song[20]. When excluding questions that could not be scored, a total of 17 questions assessed the domains of diet, exercise, medication, blood glucose test, and foot management. Subjects were asked to answer such questions as 'how many days did you conduct a blood glucose test within the last 7 days?' and select the number of days an activity was conducted from 0 to 7. One question was asking 'the number of days to administer insulin injection' which the subject for insulin administration only could answer. Therefore, we calculated an average score of this question with the question asking 'the number of days to administer diabetes medication' with an approval by the author[20]. The total score ranged from 0 to 112 (where higher scores=high levels of self-care activities). The reliability of the tool from the study by Chang & Song[20] was Cronbach's α=.77 while that of this study was Cronbach's α=.74.

### 4) Data Analysis

General characteristics were analyzed with frequencies, percentages, and descriptive statistics (means and standard deviations). The levels of health literacy, diabetes knowledge, and diabetes self-care activities were calculated by frequencies, percentages, and descriptive statistics (means and standard deviations). The differences in health literacy, diabetes knowledge, and diabetes self-care activities according to the general characteristics of subjects were analyzed by independent t-test, one-way ANOVA and post verification tests and were confirmed by Scheffe? test. The relationships among health literacy, diabetes knowledge, and diabetes self-care activities were assessed with Pearson's correlation coefficients.

A stepwise multiple regression analysis was conducted to assess the influencing factors of diabetes self care activities in low-income elderly diabetes patients. Diabetes knowledge, health literacy, and general characteristics including gender, educational level, exercise, diabetes education experience, subjective health state were included in the analysis. Durbin-Watson value of 1.81 showed no autocorrelation problem. A tolerance limit of .934~.975 and variation inflation factor of 1.026 ~1.071 showed that there was no problem of multicollineality. All analyses were conducted using the IBM SPSS Statistics, version 19.0.

# RESULTS

## 1. General Characteristics and the Levels of Health Literacy, Diabetes Knowledge, and Diabetes Self-care Activities

General characteristics and the levels of health literacy, diabetes knowledge, and diabetes self-care activities are shown in Table 1. The M±SD of health literacy

score was 2.2±1.77, and ranged from 0~6.

The proportions of subjects with limited literacy, possibility of limited literacy, and adequate literacy were 39.7% (n=60), 31.8% (n=48), and 28.5% (n=43), respectively. The M±SD of diabetes knowledge score was 8.3±2.63, and ranged from 0~15. The M±SD of diabetes self-care activities score was 68.1±15.72, and ranged from 0~112 with an average score of 68.1±15.72(Table 1).

### 2. Differences in Health Literacy, Diabetes Knowledge, and Diabetes Self-care Activities according to GeNeRal Characteristics

The differences in health literacy according to general characteristics were statistically significant in education level (t=-3.18, $p$=.002), diabetes education experience (t=2.40, $p$=.017), and subjective health state (F=3.56, $p$=.016). The difference in diabetes knowledge according to general characteristics was statistically significant in diabetes education experience (t=2.69, $p$=.006) and subjective health state (F=4.28, $p$=.006). The difference in diabetes self-care activities according to general characteristics was statistically significant in gender (t=-2.34, $p$=.021), education level (t=-3.19, $p$=.002), exercise (t=5.43, $p$<.001), diabetes education experience (t=4.48, $p$<.001), and subjective health state (F=6.66, $p$<.001) (Table 2).

### 3. Correlations among Health Literacy, Diabetes Knowledge and Diabetes Self-care Activities

The correlations among health literacy, diabetes knowledge, and diabetes self-care activities are shown in Table 3. Diabetes self-care activities had a statistically significant positive correlation with health literacy (r=.31, $p$<.001), and diabetes knowledge (r=.42, $p$<.001). Furthermore, health literacy and diabetes knowledge had a statistically significant positive correlation (r=.42, $p$<.001). The higher the health literacy level, the higher the diabetes knowledge level was; and the higher the health literacy level and diabetes knowledge level, the higher the diabetes self-care activities level was.

### 4. Influencing Factors of Diabetes Self-care Activities

The results of a stepwise regression analysis to identify influencing factors of diabetes self-care activities are shown in Table 4. In addition to health literacy and diabetes knowledge, gender, education level, exercise, diabetes education experience, and subjective health state which showed significant differences in diabetes self-care activities, were analyzed in the regression model. Durbin-Watson value of 1.81 verified that there was no auto-correlation problem in this regression model. The tolerance limit of .934~.975 and variation inflation factor of 1.026~1.071 showed no multi-collinearity problem. Influencing factors of diabetes self-care activities in low-income elderly diabetes patients were found to be diabetes knowledge (β=.32, $p$<.001), exercise (β=.33, $p$<.001), and diabetes education experience (β=.24, $p$=.001), and three variables in the regression model accounted for 34.4% of the variance in diabetes

**Table 1.** General Characteristics and the Levels of Health Literacy, Diabetes Knowledge, and Diabetes Self-care Activities

| Variables | n (%) or M±SD |
|---|---|
| Age (year) | 73.8±5.15 |
| Gender | |
| Female | 126 (83.4) |
| Male | 25 (16.6) |
| Marital state | |
| Yes | 122 (80.8) |
| No | 29 (19.2) |
| Education level | |
| ≤ Elementary school | 104 (68.9) |
| ≥ Middle school | 47 (31.1) |
| Disease duration (year) | 10.2±8.00 |
| Medication | |
| Oral hypoglycemic agents | 120 (79.5) |
| Insulin and oral agents | 31 (20.5) |
| Exercise | |
| Yes | 104 (68.9) |
| No | 47 (31.1) |
| Diabetes education experience | |
| Yes | 103 (68.2) |
| No | 48 (31.8) |
| Subjective health state | |
| Very poor | 9 (6.0) |
| Poor | 47 (31.1) |
| Moderate | 76 (50.3) |
| Good | 19 (12.6) |
| Health literacy | 2.2±1.77 |
| Limited literacy | 60 (39.7) |
| Possibility of limited literacy | 48 (31.8) |
| Adequate literacy | 43 (28.5) |
| Diabetes knowledge | 8.3±2.63 |
| Diabetes self-care | 68.1±15.72 |

**Table 2.** Differences in Health Literacy, Diabetes Knowledge, Diabetes Self-care Activities according to General Characteristics

| Variables | Health literacy | | Diabetes knowledge | | Diabetes self-care activities | |
|---|---|---|---|---|---|---|
| | M±SD | t or F (*p*) | M±SD | t or F (*p*) | M±SD | t or F (*p*) |
| Age (year) | | 2.65 (.074) | | 2.66 (.073) | | 2.93 (.056) |
| 65~70 | 2.7±1.66 | | 8.7±2.80 | | 72.5±17.81 | |
| 71~75 | 1.9±1.86 | | 8.6±2.51 | | 68.2±16.28 | |
| ≥76 | 2.1±1.71 | | 7.6±2.54 | | 64.7±12.53 | |
| Gender | | -1.01 (.312) | | -0.50 (.617) | | -2.34 (.021) |
| Female | 2.2±1.77 | | 8.2±2.63 | | 66.8±15.22 | |
| Male | 2.6±1.75 | | 8.5±2.69 | | 74.8±16.81 | |
| Marital state | | 1.26 (.206) | | 1.75 (.081) | | 0.91 (.362) |
| Yes | 2.3±1.77 | | 8.5±2.70 | | 68.7±15.61 | |
| No | 1.8±1.73 | | 7.5±2.18 | | 65.7±16.23 | |
| Education level | | -3.18 (.002) | | -1.95 (.052) | | -3.19 (.002) |
| ≤Elementary school | 1.9±1.70 | | 8.0±2.47 | | 65.5±15.12 | |
| ≥Middle school | 2.9±1.76 | | 8.9±2.89 | | 74.0±15.55 | |
| Diagnosis duration (year) | | 0.61 (.652) | | 0.42 (.791) | | 0.85 (.491) |
| ≤5 | 2.4±1.80 | | 8.1±2.79 | | 66.8±14.96 | |
| 6~10 | 1.9±1.74 | | 8.1±2.55 | | 67.9±16.17 | |
| 11~15 | 2.3±1.65 | | 8.6±2.45 | | 66.1±15.36 | |
| 16~20 | 2.2±1.85 | | 8.8±2.57 | | 74.2±15.33 | |
| ≥21 | 2.6±1.92 | | 8.7±2.83 | | 70.0±18.51 | |
| Medication | | 0.95 (.341) | | 0.90 (.366) | | -0.02 (.979) |
| Oral hypoglycemic | 2.3±1.81 | | 8.4±2.65 | | 68.1±16.13 | |
| Insulin and oral agent | 2.0±1.61 | | 7.9±2.54 | | 68.2±14.24 | |
| Exercise | | 1.46 (.144) | | 1.81 (.072) | | 5.43 (<.001) |
| Yes | 2.4±1.78 | | 8.5±2.56 | | 72.4±13.92 | |
| No | 1.9±1.73 | | 7.7±2.72 | | 58.7±15.43 | |
| Diabetes duration experience | | | | | | |
| Yes | 2.5±1.75 | 2.40 (.017) | 8.7±2.63 | 2.79 (.006) | 71.8±14.25 | 4.48 (<.001) |
| No | 1.7±1.72 | | 7.4±2.44 | | 60.2±15.94 | |
| Subjective health state | | 3.56 (.016) | | 4.28 (.006) | | 6.66 (<.001) |
| Very poor[a] | 1.2±1.39 | | 8.0±3.16 | b<d | 67.8±15.34 | b<c, d |
| Poor[b] | 1.9±1.66 | | 7.4±2.31 | | 60.6±15.94 | |
| Moderate[c] | 2.3±1.75 | | 8.5±2.76 | | 70.8±15.50 | |
| Good[d] | 3.1±1.89 | | 9.8±1.80 | | 76.2±7.54 | |

self-care activities (F=27.20, $p$<.001)(Table 4).

## DISCUSSION

This study assessed the relationships between health literacy, diabetes knowledge, and diabetes self-care activities in low-income elderly with diabetes and identified the influencing factors of diabetes self-care activities. The findings of this study showed that diabetes knowledge, exercise, and diabetes education experience have a significant influence on diabetes self-care activities.

Diabetes self care activities in low-income elderly diabetes patients had statistically significant differences in gender, education level, exercise, diabetes education experience, and subjective health state. Although our study showed higher levels of diabetes self care activities in men than women, the study by Park et al.[21] reported conflicting results with women having higher levels of diabetes self care activities than men. More research is needed to identify the influence of gender on diabetes self care activities.

The finding that subjects with increased educational levels had increased diabetes self care activities is analo-

**Table 3.** Correlations among Health Literacy, Diabetes Knowledge, and Diabetes Self-care Activities

| Variables | Health literacy | Diabetes knowledge | Diabetes self-care activities |
|---|---|---|---|
| | r (*p*) | r (*p*) | r (*p*) |
| Health literacy | 1 | | |
| Diabetes knowledge | .42 (. < 001) | 1 | |
| Diabetes self-care activities | .31 (< .001) | .42 (< .001) | 1 |

**Table 4.** Influencing Factors of Diabetes Self-care Activities

| Variables | B | SE | β | t (*p*) | $R^2$ | Adj. $R^2$ | F (*p*) |
|---|---|---|---|---|---|---|---|
| Constant | 38.82 | 3.68 | | 10.54 (< .001) | | | |
| Diabetes knowledge | 1.92 | 0.40 | .32 | 4.70 (< .001) | .18 | 0.17 | |
| Exercise | 11.39 | 2.26 | .33 | 5.02 (< .001) | .30 | 0.29 | |
| Diabetes education experience | 8.11 | 2.28 | .24 | 3.54 (.001) | .35 | 0.34 | 27.20 (< .001) |

gous with the study result by Park & Kim[22]. There was a significant difference in diabetes self care activities by diabetes education experience. Therefore, diabetes education may be an effective intervention even for subjects with low education levels to improve diabetes self care activities. Exercise was a significant difference diabetes self care activities in this study. Exercise such as walking is effective in reducing blood glucose levels in older patients. Therefore, regular exercise should be in care plans to improve diabetes self care activities in low-income elderly diabetes patients[7].

According to Park[23], type II diabetes patients with better subjective health states had lower levels of HbA1c and higher levels of diabetes self care activities than their counterparts. This finding shows that a patient's subjective health evaluation is related to actual his/her health status. Only 12.6% of subjects reported good subjective health states in this study. Assessing and improving subjective health states in low-income elderly diabetes patients are important for increasing diabetes self care activities.

From the correlation analysis among health literacy, diabetes knowledge, and diabetes self-care activities, diabetes self-care activities had statistically significant positive correlations with health literacy and diabetes knowledge while health literacy and diabetes knowledge had a statistically significant positive correlation. These findings are parallel with the study by McCleary [24]. These findings indicate that increased health literacy is associated with increased diabetes knowledge, and increased diabetes knowledge is related to increased diabetes self care activities. Therefore, assessing how low-income elderly patients with diabetes understand and utilize diabetes related information is a significant step to improve diabetes self care activities in this population.

In the stepwise regression analysis to identify influencing factors of the diabetes self-care activities in study subjects, diabetes knowledge, exercise, and diabetes education experience were found to be statistically significant variables with an explanation power of 34.4%. Diabetes knowledge has been reported as an influencing factor of diabetes self-care activities in many previous studies[11,25]. According to Yang[25], older patients with high levels of foot care knowledge have high levels of self-care activities. Acquisition of diabetes knowledge should be ahead of performing diabetes self-care activities and it is possible through effective education. According to Zhang & Kim[26], individuals who engaged in exercise had high levels of diabetes self-care activities compared to those who did not engage in exercise. Mun[27] reported that exercise might reduce depression and improve self efficacy which might motivate self-care activities. Therefore, a strategy to encourage physical activities and exercise not only for low-income diabetes patients who have abilities to independently perform daily activities but also for those who have insufficient abilities to independently perform daily activities is required. Diabetes education experience was also related to self-care activities and this result was similar to the study findings of Yoo[28]. Individuals with diabetes education experience may have

more opportunities to have disease-related knowledge and repetitive educations can help accumulating diabetes knowledge. This accumulated knowledge may affect glucose control capabilities and self-care activities in diabetes patients[11,12]. In this regard, improving diabetes knowledge though education is important to prevent diabetes-related complications and improve self-care activities. Considering cognitive impairment in older adults related to aging process, repetitive education and feedback should be provided.

In this study, health literacy had a statistically significant positive correlation with diabetes self-care activities, but it was excluded from the final stepwise regression analysis. Some studies found that health literacy was a significant influencing factor of diabetes self-care activities[29,30], but some other studies reported that it had no direct influence on diabetes self-care activities [24]. Since there were conflicting results in these studies regarding the relationship between health literacy and diabetes self-care activities, further studies should be performed repetitively. These conflicting results may be due to the use of various tools in assessing health literacy. Attention should be paid to selecting instruments, and the development of standardized assessment tools is important to effectively assess health literacy considering the characteristics of the elderly diabetes patients.

This study has significance in that it provides important information about the relationship between health literacy, diabetes knowledge, and diabetes self-care activities and influencing factors of diabetes self-care activities in low-income elderly diabetes patients in Korea for developing a differentiated strategy to improve diabetes self-care activities in this vulnerable population.

## CONCLUSION

The results of this study suggest that, in addition to enhancing diabetes knowledge and encouraging exercise, providing continuous health education is critical for low-income elderly with diabetes to improve diabetes self-care activities. Especially for low-income elderly with diabetes, repetitive education to change recognition in diabetes self-care and various community-based resources and support are necessary.

Unexpectedly, health literacy is excluded in the final stepwise regression analysis because it was not statistically significant. Therefore, further studies exploring the relationships among the variables that may affect diabetes self-care activities and those developing standardized instruments that can assess health literacy are suggested. In addition, by performing further studies that compare the levels of health literacy between general elderly population and low-income elderly, developing effective strategies to improve health literacy is needed. Furthermore, more studies are recommended that investigate the effects of diabetes self-care activities on managing blood sugar levels, preventing diabetes-related complications, and improving quality of life in low-income older adults with diabetes.

## REFERENCES


1. Korea Centers for Disease Control & Prevention. Korea health statistics 2011: The 5th Korea national health and nutrition examination survey. Policy Report. Seoul: Korea Centers for Disease Control & Prevention; 2012 December. Report No.: 11-1351159-000027-10.
2. Ministry of Health and Welfare. The 3rd national health promotion strategy 2011-2020 (HP2020). Policy Report. Seoul: Ministry of Health and Welfare; 2011 June. Report No.:11-1352000-000285-13.
3. Kim HY, Yun WJ, Shin MH, Kweon SS, Ahn HR, Choi SW, et al. Management of diabetic mellitus in low-income rural patients. Korean Journal of Preventive Medicine and Public Health. 2009;42(2):315-322. http://dx.doi.org/10.3961/jpmph.2009.42.5.315
4. American Diabetes Association. Statistics about diabetes [Internet]. Alexandria VA: American Diabetes Association. 2011 [cited 2012 February 18]. Available from: http://www.diabetes.org/diabetes-basics/diabetes-statistics/?loc=DropDownDB-stats.
5. American Diabetes Association. Standards of medical care in diabetes-2009. Diabetes Care. 2009;32(1):13-61. http://dx.doi.org/10.2337/dc09-S013
6. Fitzgerald JT, Anderson RM, Funnell MM, Hiss RG, Hess GE, Barr PA, et al. The reliability and validity of a brief diabetes knowledge test. Diabetes Care. 1998;21(5):706-710. http://dx.doi.org/10.2337/diacare.21.5.706
7. Lee HJ, Park KY, Park HS, Kim IJ. The effect of problem solving nursing counseling and intensified walking exercise on diabetes self-care, coping strategies, and glycemic control among clients with DM type 2. Journal of Korean Academic Nursing. 2005;35(7):1314-1324.
8. Fenwick EK, Xie J, Ress G, Finger RP, Lamoureux EL. Factors associated with knowledge of diabetes in patients with type 2 diabetes using the diabetes knowledge test validated with rasch analysis. Public Library of Science. 2013;8(12):1-12. http://dx.doi.org/10.1371/journal.pone.0080593

9. Bains SS, Eqede LE. Associations between health literacy, diabetes knowledge, self-care behaviors and glycemic control in a low income population with type 2 diabetes. Diabetes Technology & Therapeutics. 2001;13(3):335-341. http://dx.doi.org/10.1089/dia.2010.0160
10. Chi-Lum B. Friend or Foe? Consumers using the internet for medical information. The Journal of Medical Practice Management. 1999;14(4):196-198.
11. Benzel Lindley JA. Exploration of factors impacting the self-care of elders with diabetes. [dissertation]. [Arizona]: Arizona University; 2005. 237 p.
12. Schillinger D, Grumbach K, Piette J, Wang F, Osmond D, Daher C, et al. Association of health literacy with diabetes outcomes. Journal of the American Medical Association. 2002; 288(4):475-482. http://dx.doi.org/10.1001/jama.288.4.475
13. Kim SH, Lee EJ. The influence of functional literacy on perceived health status in Korean older adults. Journal of Korean Academic Nursing. 2008;38(2):195-203. http://dx.doi.org/10.4040/jkan.2008.38.2.195
14. Kim JE. Measuring the level of health literacy and influence factors: Targeting the visitors of a university hospital's outpatient clinic. Journal of Korean Clinical Nursing Research. 2011;17(1):27-34.
15. Lee TW, Kang SJ. Health literacy in the Korean elderly and influencing factors. Journal of the Korean Gerontological Society. 2008;28(4):847-863.
16. Weiss BD, Mays MZ, Martz W, Castro KM, DeWalt DA, Pignone MP, et al. Quick assessment of literacy in primary care: The Newest Vital sign. Annals of Family Medicine. 2005;3(6): 514-522. http://dx.doi.org/10.1370/afm.405
17. Choi EJ. Factors related to glycemic control in patients with type 2 diabetes mellitus. [Dissertation]. [Seoul]: Yonsei University; 2007. 131 p.
18. Toobert DJ, Glasgow RE. Assessing diabetes self-management: The summary of diabetes self-care activities questionnaire. In: Bradley C, editor. Handbook of psychology and diabetes. Switzerland: Harwood Academic; 1994. p. 351-375.
19. Toobert DJ, Hampson SE, Glasgow RE. The summary of diabetes self-care activities measure: Results from 7 studies and a revised scale. Diabetes Care. 2000;23(7):943-950. http://dx.doi.org/10.2337/diacare.23.7.943
20. Chang SJ, Song MS. The validity and reliability of a Korean version of the summary of diabetes self-care activities questionnaire for older patients with type 2 diabetes. Journal of Korean Adult Nursing. 2009;21(2):235-244.
21. Park JY, Lee TY, Jang KS, Oh HY. A study on blood glucose level and self management among community dwelling type II diabetes patients. Journal of Korean Adult Nursing. 2010; 22(3):271-280.
22. Park MY, Kim KH. The study related to perceived stress, stress coping method, self-care behavior and hemoglobin A1c of elderly diabetic mellitus patients. Journal of Korean Academy Fundamental Nursing. 2008;15(2):186-194.
23. Park JY. A study on self management, hemoglobin A1c (HbA1c), and perceived health status for the type II diabetes patients. Journal of Korean Biological Nursing Science. 2010; 12(2):106-113.
24. McCleary JV. Health literacy and its association with diabetes knowledge, self-efficacy and disease self-management among African Americans with diabetes mellitus. Association of Black Nursing Faculty Journal. 2011;22(2):25-32.
25. Yang NY. Knowledge, self efficacy and self care behavior regarding foot care among elderly diabetes mellitus patients. Journal of Korean Adult Nursing. 2009;21(4):413-422.
26. Zhang HL, Kim HL. Compliance and barriers to self-care behaviors in patients with type 2 diabetes. Journal of Korean Clinical Nursing Research. 2010;16(1):155-166.
27. Mun YH. The effects of an exercise program on the physical, physiological and emotional status of the aged. Journal of Korean Academy of Community Health Nursing. 2006;17(4): 451-460.
28. Yoo JH. A study on the relationship of self-care behavioral compliance and perceived self-efficacy in type II diabetic patient. Journal of Korean Academy Fundamental Nursing. 2000;7(3):453-465.
29. Karter AJ, Subramanian U, Saha C, Crosson JC, Parker MM, Swain BE, et al. Barriers to insulin initiation: The translating research into action for diabetes insulin starts project. Diabetes Care. 2010;33(4):733-735. http://dx.doi.org/10.2337/dc09-1184
30. Mbaezue N, Mayberry R, Gazmararian J, Quarshie A, Ivonye C, Heisler M. The impact of health literacy on self-monitoring of blood glucose in patients with diabetes receiving care in an inner-city hospital. Journal of the National Medical Association. 2010;102(1):5-9.