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Research Article

A Structural Equation Model Linking Health Literacy to Self-efficacy, Self-care Activities, and Health-related Quality of Life in Patients with Type 2 Diabetes

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SUMMARY

Purpose: Health literacy has been attracting increasing attention because low health literacy is considered an important predictor of adverse health outcomes in many chronic conditions, including diabetes. However, it is unclear how health literacy is associated with health outcomes. The purpose of this study was to formulate a hypothetical structural equation model linking health literacy to self-efficacy, self-care activities, and health-related quality of life (HRQOL) in patients with type 2 diabetes.

Methods: A cross-sectional survey design was employed, and 459 patients with type 2 diabetes were recruited from outpatient clinics in two university hospitals. The patients completed a pack of questionnaires. The hypothetical model was tested using structural equation modeling analysis.

Results: The values of multiple fit indices indicated that the proposed model provided a good fit to the data. Health literacy exerted not only a direct effect on self-care activities, but also an indirect effect on self-care activities via self-efficacy. However, health literacy exerted only an indirect effect on HRQOL. This structural model was invariant across hemoglobin-A1c-controlled and hemoglobin-A1c-uncontrolled groups. Based on R^2 values, the final model accounted for 20.0% of the variance in self-efficacy, 61.0% of the variance in self-care activities, and 16.0% of the variance in HRQOL.

Conclusions: This study suggests that self-care activities are crucial to the link between health literacy and HRQOL. Both health literacy and self-efficacy need to be considered in clinical practice for enhancing self-care activities in patients with type 2 diabetes. This approach may ultimately improve HRQOL in these patients.

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Introduction

Health literacy is “the cognitive and social skills that determine the motivation and ability of individuals to gain access to, understand, and use health information in ways that promote and maintain good health” [1]. This term has been attracting increasing attention because low health literacy is considered an important predictor of adverse health outcomes in many chronic conditions [2]. However, the pathway or mechanism underlying how health

literacy is associated with health outcomes is not well understood [3,4].

Health behaviors (e.g., exercise, and medication adherence) are commonly suggested as proximal health outcomes of health literacy [5]. Patients with type 2 diabetes need to perform specific multifaceted activities in their daily lives, such as consuming an appropriate diet, exercising regularly, and performing self-monitoring of blood glucose, foot care, and medication self-administration. Such self-care activities can be proximal outcomes of health literacy in patients with type 2 diabetes. Fransen and his colleagues [6] recently proposed that health literacy is not only directly related to diabetes self-care activities, but also indirectly related via volitional determinants, such as self-efficacy. Self-efficacy is a construct from social cognitive theory [7] that refers to an individual's confidence in his or her ability to perform health

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behaviors, and is widely known to be an important predictor for changes in health behaviors. Studies have documented a direct relationship between health literacy and self-efficacy in patients with type 2 diabetes [8,9]. Self-efficacy has also been empirically reported to be a strong predictor of diabetes self-care activities [10,11]. Together these findings suggest that health literacy is either directly related to self-care activities in patients with type 2 diabetes, or indirectly related via self-efficacy.

Diabetes self-care activities are reported to be positively related to the health-related quality of life (HRQOL) [10,12]. HRQOL was proposed as a distal health outcome of health literacy in patients with diabetes [13]. Empirical studies have found that higher levels of health literacy are associated with higher levels of HRQOL in patients with chronic disease, such as heart failure [14] or asthma [15], which suggests that there is a direct relationship between health literacy and HRQOL in patients with diabetes. On the other hand, von Wagner et al [16] proposed that health literacy and health outcomes could be associated via the self-management of illness. Those authors posited that health literacy might be associated with HRQOL indirectly via diabetes self-care activities.

Based on the above-mentioned literature, a model comprising the following hypotheses linking health literacy to self-efficacy, self-care activities, and HRQOL was developed: (a) that health literacy is directly related to self-efficacy and self-care activities [5,6,8,9], (b) that health literacy is indirectly related to self-care activities via self-efficacy [6,8–11], (c) that self-care activities and health literacy are directly related to HRQOL [10,12,13], and (d) that health literacy is indirectly related to HRQOL via self-care activities [16].

A structural equation modeling (SEM) approach has been recommended for analyzing the direct and indirect relationships of health literacy with health outcomes [6,13], because this is a multivariate regression technique capable of investigating direct and indirect effects among variables [17]. Therefore, the aim of this study was to use SEM to determine the hypothetical relationships among health literacy, self-efficacy, self-care activities, and HRQOL in patients with type 2 diabetes in a complete model. This study may be used as the basis for developing or applying an intervention program for improving the health outcomes of patients with diabetes.

Methods

Study design and sample

A cross-sectional survey design was employed, and 459 participants with type 2 diabetes were recruited from outpatient clinics at two university hospitals in South Korea from July 2014 to February 2015. The sample included in an SEM analysis needs to be larger than 10 times the number of estimated parameters [18]. The number of free parameters to be estimated in this study was 33. As such, the study sample of 459 participants clearly satisfied the minimum sample size of 330. Participants were eligible if they were aged 19 years and over, diagnosed with type 2 diabetes, and articulate in the Korean language. Patients with gestational diabetes were excluded.

Measurements

Health literacy

Health literacy was assessed using the Health Literacy Scale (HLS) that was developed by Ishikawa, Takeuchi, and Yano in 2008 for Japanese patients with diabetes [9]. The HLS comprises 14 items in functional, communicative, and critical subscales. The functional subscale assesses the reading level for hospital instructions or

leaflets, the communicative subscale evaluates the degree to which patients can extract and communicate diabetes-related information, and the critical subscale assesses the abilities to perform critical analyses of information and to use this information to make decisions. Each item is rated on a 4-point scale, with higher scores indicating higher health literacy. The HLS satisfied the criteria for internal consistency (Cronbach $\alpha = .78$), factorial construct validity, and convergent validity. In this study the HLS was translated into Korean using a translation and back-translation technique, and its Cronbach α of .92 indicated that it exhibited excellent internal consistency.

HRQOL

HRQOL was measured using the diabetes-specific quality of life (D-QOL) questionnaire developed by Lee and her colleagues in 2012 [19]. The D-QOL is a self-report questionnaire comprising 16 items that require responses on a 5-point Likert scale, with a higher score indicating a better HRQOL. This scale comprises the following four subscales with four items each: emotional suffering, social functioning, adherence to the treatment regimen, and diabetes-specific symptoms. The following psychometric properties of the D-QOL have been established in 402 Korean patients with diabetes: content validity, factorial construct validity (using exploratory factor analysis & confirmatory factor analysis), concurrent validity with a generic type of HRQOL scale, known-groups validity with the levels of depression, and internal consistency reliability. In this study, Cronbach α ranged from .73 to .93 for the D-QOL subscales, and was .92 for the overall D-QOL.

Self-care activities

Self-care activities were assessed using the public-domain instrument of the Summary of Diabetes Self-Care Activities (SDSCA) scale developed by Toobert, Hampson, and Glasgow [20]. This instrument measures the frequency of self-care activities over the last 7 days in six subscales related to diabetes: general diet, specific diet, physical exercise, self-monitoring of blood glucose, foot care, and smoking. Based on confirmatory factor analysis, Choi and colleagues [21] found that the SDSCA was divided into the following four subscales in Korean patients: diet (3 items), physical exercise (2 items), self-monitoring of blood glucose (2 items), and foot care (2 items). Therefore, 9 of the 11 original items were confirmed as the Korean version of the SDSCA (K-SDSCA). We polished the statements of the Korean version, using a further translation and back-translation technique. Cronbach α of the K-SDSCA was .76 in this study, indicating adequate internal consistency.

Self-efficacy

The Diabetes Management Self-Efficacy Scale (DMSES) is an instrument measuring the confidence of patients with type 2 diabetes in their ability to perform self-care behaviors [22]. Cronbach α of this original DMSES was .81. The present study used the culturally validated Korean version of the DMSES that was produced by Lee and coworkers in Korea, Netherlands, and the United States in 2015 [23] after modifying items to ensure consistency with the SDSCA. The modified scale used in this study comprised 12 items in three subscales: nutrition (6 items), medical treatment (3 items), and blood glucose (3 items). Each item is rated on an 11-point scale, with higher scores indicating higher self-efficacy. Cronbach α of the scale was .91 in this study, indicating excellent internal consistency.

Data collection

Data collection commenced after approval was granted by the institutional review boards of the two university hospitals (IRB-

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