

ARTICLES

Is diabetes knowledge associated with health-related quality of life among subjects with diabetes? a preliminary cross-sectional convenience-sampling survey study among English-speaking diabetic subjects in Singapore

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[Abstract] Objective Health-related quality of life (HRQoL) has been increasingly used as an important outcome measure to assess efficacy of diabetes interventions. It was reported that diabetes knowledge contributes to better metabolic control, which is associated with better HRQoL. However, the relationship between diabetes knowledge and HRQoL hasn't been explored. The objective of the study was to evaluate if diabetes knowledge is associated with HRQoL among English-speaking subjects with diabetes in Singapore. To establish this relationship will not only fill in the knowledge gap, but more importantly would allow improving diabetic patients' HRQoL by enhancing their disease-related knowledge. **Methods** English-speaking subjects (aged >21) with self-reported diabetes were recruited by convenience sampling at a public event organized by Diabetic Society of Singapore to commemorate the World Diabetes Day. Correlation between diabetes knowledge (measured using the General Diabetes Knowledge Test (GD-KT), score range 0-100) and HRQoL (measured using the Audit of Diabetes-dependent Quality of life (ADDQoL), score range 0~100; EQ-5D, score range -0.594 to 1) were studied using Pearson correlation coefficients. The relationship between diabetes knowledge and HRQoL was studied using 3 separate multiple linear regression (MLR) models with HRQoL scores as dependent variable and GDKT score as independent variable. No adjustment was made in the first MLR model, while socioeconomic variable(s) and socioeconomic and medical status variables were adjusted respectively in the other 2 models. **Results** Data from 42 subjects with complete responses were analyzed (mean (SD) age: 53.0 (9.61) years, 45% female, 90% with >6 years of education, 64.3% with other chronic medical conditions, 40.5% with diabetes complications). Mean (SD) GDKT, ADDQoL and EQ-5D scores were 33.1 (3.53), 46.9 (18.56) and 0.9 (0.15) respectively. Correlations between diabetes knowledge and ADDQoL and EQ-5D scores were 0.26 and 0.30 respectively. A comparatively modest predictive power of diabetes knowledge was found to explain the variances in ADDQoL and EQ-5D of around 12% (Model II). **Conclusion** Our results showed diabetes knowledge to be modestly correlated with both diabetes-specific and generic HRQoL, indicating that diabetes knowledge may be useful as a predictor of HRQoL when modeled properly. Yet, further studies utilizing larger sample size would be required to confirm the observation.

[Key words] diabetes; knowledge; quality of life

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INTRODUCTION

Diabetes mellitus (DM) has become a growing public health concern not only for its increasingly high prevalence but also for its severe impairment on the quality of life of diabetic patients. It is estimated that there will be over 221 million people suffering from diabetes mellitus in the whole world by 2010 and the affected population in Asia alone will probably account for 61% of this total^[1]. From 1997 to 2010, prevalence rate is expected to increase by 111% in Asia due to predisposing factors such as obesity, sedentary lifestyle and population aging^[2].

Health-related Quality of life (HRQoL) is increasingly being used as an additional outcome measure to evaluate patient-perceived physical, emotional and social well-being, in assessing efficacy of interventions in diseases where conventional clinical outcomes (such as biochemical changes and physician assessment) alone might not assess health adequately. In real life practice, patients with diabetes mellitus have been reported to have worse quality of life compared with non-diabetic population because of the complications (e. g. blindness, dialysis, symptomatic neuropathy, foot ulcers, and congestive heart failure), physical (e. g. physical suffering, limited diet and actions, decreased energy) and psychological impacts (e. g. depression, loss of self-confidence) caused by the disease^[3,4].

Several published studies have shown that diabetes knowledge is positively associated with self-management of the disease. Knowledgeable patients are more likely to have better metabolic control measured using hemoglobin A1c (HbA1c) or glycosylated hemoglobin (GHb)^[5-8]. It has also been reported that better metabolic control is associated with better health-related quality of life of diabetic patients^[9-12]. Another study by Lau and co-workers indicated that lower HbA1c value is associated with improved HRQoL in the mental aspect but not in the physical domain, which could be explained by mental empowerment from proactive disease management and physical inconvenience of increased regimen complexity^[9]. However, relatively little is known regarding the impact of diabetes knowledge on health-related quality of life. The purpose of the present study was thus to investigate whether diabetes knowledge is associated with HRQoL. Two hypotheses to be

tested in the study were described as follows: (1) Patients with better diabetes knowledge would have better HRQoL; (2) Diabetes knowledge is better correlated with a disease-specific HRQoL measure, namely, Audit of Diabetes-Dependent Quality of Life (ADDQoL) than with generic measure (EQ-5D).

METHODS

Subjects and Study Design

The cross-sectional study was undertaken at the World Diabetes Day 2004 commemorative event organized by Diabetic Society of Singapore at the exhibition hall of a major shopping center in Singapore on October 17, 2004. The aim of the event was to enhance people's knowledge of diabetes, preventive methods and other disease-related information as well as to provide free screening tests of cholesterol, blood pressure, body fat, HbA1c etc. Participants were approached by research assistants to identify whether they were eligible for the current study. Inclusion criteria were English-speaking diabetic patients aged 21 and above, who were able to complete questionnaires in English without any assistance. The purpose of the study was explained to potential subjects by the research assistants. All subjects who agreed to participate in the study were asked to sign a written informed consent.

Subjects were then asked to complete a booklet containing a background datasheet, diabetes knowledge test sheet and a battery of HRQoL instruments. The background datasheet collected information on patient information including socioeconomic variables (age, gender, ethnicity, years of education, dwelling type, and working status) and related medical conditions (smoking history, presence of acute medical conditions in the past 4 weeks, presence of other chronic medical conditions and presence of DM complications). Patients' knowledge was tested by the General Diabetes knowledge test (GDKT). Their HRQoL was assessed by the Audit of Diabetes-dependent Quality of life (ADDQoL) and EQ-5D.

Instruments

The General Diabetes Knowledge Test (GDKT)

General Diabetes Knowledge Test is a 36-item questionnaire covering 6 content areas in diabetes preven-

tion and control, namely, general knowledge of diabetes, risk factors of diabetes, symptoms of diabetes, complications of diabetes, treatment and management of diabetes and monitoring of diabetes. It was a newly developed questionnaire with the aim to evaluate outcomes of diabetes education among general public including patients and non-patients, as such tool was lacking before. It has proven to be a valid and reliable measure. Internal consistency of GDKT was high (Kuder-Richardson Formula 20 or KRF20 = 0.9289). Item difficulty ranged from 0.59 to 0.97 and was significantly different between subjects with and without diabetes for 8 items ($P < 0.05$). Test-retest reliability was moderate ($ICC = 0.54$)^[22]. Construct validity was demonstrated using a known-group approach where subjects with diabetes were expected to have better knowledge of diabetes (*i. e.* higher GDKT scores) than subjects without diabetes (shown in Appendix I). Here, any response of "yes" is regarded as a correct answer and marked as 1 point, "no" or "unsure" is regarded as wrong answer and marked as 0. A raw score is obtained based on the sum of correct responses. Then it is converted to a final score of 0-100 according to percentage. A higher score indicates better general knowledge of diabetes.

The ADDQoL

ADDQoL-13.3.03 is a 19-item disease-specific instrument designed to measure individual's perception of the impact of diabetes on their health status. These 19 items are related to physical functioning, symptoms, psychological well-being, social well-being, role activities and personal constructs^[13,14]. Each item is scored on a 5-point scale (from -3 to 1) and the importance of each particular item is rated on a 4-point scale (0-3). A weighted rating is then calculated as the raw score, which is converted to a final score on a 0-100 scale. A higher score indicates a better health status. This instrument has been validated in Singapore^[14].

The EQ-5D

The EQ-5D questionnaire is a 5-item (mobility, self-care, usual activities, pain/discomfort and anxiety/depression) questionnaire for respondents to self-classify and rate their health on the day of administration of the

instrument^[15,16]. For each item, there are three response levels (namely, with no problem, with some problems, and with extreme problems). Theoretically, 243 unique health states could be identified by the descriptive system of the instruments. Scoring methods have been developed to assign each of these health states a utility score in which 1 represents full health (no problem with all 5 items) and 0 represents being dead^[17,18]. The range of the final score is from -0.594 to 1.00.

Statistical Analysis

Data were entered into an Excel spreadsheet (Microsoft Corporation, Redmond, Washington) and analyzed using the Statistical Package for the Social Sciences, version 12.0 (SPSS Inc, Chicago, Ill). Subjects with ≥ 10 missing values in GDKT or ≥ 6 missing items in ADDQoL or ≥ 1 missing value in EQ-5D were excluded from all analyses.

The Pearson correlation coefficients were used to study the correlation between diabetes knowledge (measured using the GDKT) and HRQoL (measured using the ADDQoL and the EQ-5D). Three separate multiple linear regression models (MLR) were used to investigate the relationship between diabetes knowledge and HRQoL with HRQoL scores as the dependent variable and GDKT score as an independent variable. Dummy variables were created for ethnicity, education and dwelling type. There was no adjustment of any other variable in the first MLR model. Univariate analyses were performed to select significant socioeconomic variables (if any) to be included in the second MLR, and significant socioeconomic together with related medical condition variables (if any) for the third MLR. For all data analyses, statistical significance was set at ($P < 0.05$).

RESULTS

Characteristics of the Subjects

Altogether 56 eligible subjects participated in the study, among which 14 were dropped due to incomplete responses as defined previously, leaving 42 subjects with complete responses for analysis. 90% of the eligible subjects had more than 6 years of education. Apart

from diabetes, 64.3% had at least one other chronic medical condition (including hypertension, heart diseases, stroke, lung diseases including asthma, cancer, musculoskeletal diseases, mental illness, etc.), and with 40.5% suffered from diabetes complications (including eye disease, foot problems, kidney disease, heart disease, stroke, erectile dysfunction and neuropathy). Compared with the scores in generic HRQoL

questionnaire like EQ-5D, respondents had a lower score in the disease-specific questionnaire as ADDQoL, which may prove that ADDQoL is more sensitive to change and responsive to differences than generic QoL measure^[13]. Other general characteristics of the study subjects and scores of GDKT and HRQoL are shown in Table 1.

Table 1 Characteristics of study subjects and scores of GDKT and HRQoL

Subject characteristics (N = 42)	N (%) unless specified otherwise
Mean (SD) age in years	53.0(9.61)
Female gender	18(45.0)
Ethnicity	
Chinese	36(85.7)
Indian	5 (11.9)
Types of diabetes mellitus	
Type I	13(31.0)
Type II	29(69.0)
Dwelling type	
Lower cost public housing	1(2.4)
Public housing	32(76.2)
Private housing	9(21.4)
Years of education	
≤ 6	4(10.0)
7 ~ 10	18(45.0)
≥ 11	18(45.0)
Working	23(54.8)
Smoking	3(7.1)
Presence of acute medical conditions *	23(54.8)
Presence of at least another chronic medical condition +	27(64.3)
Prevalence of DM complications ++	17(40.5)
Mean General Diabetes Knowledge Test (SD) scores	92.1(9.81)
Mean (SD) ADDQoL scores	46.9(18.56)
Mean (SD) EQ-5D scores	0.9(0.15)

Note: * :Acute medical conditions included running a nose ,sore throat or cough ,vomiting or diarrhea ,headache lasting more than one day ,sleeping problems and body injuries . + :Chronic medical conditions included hypertension ,heart diseases ,stroke ,lung diseases including asthma ,cancer ,musculoskeletal diseases (including rheumatism or back pain) ,mental illness and others . ++ :DM complications included eye disease ,foot problems ,kidney disease ,heart disease ,stroke ,erectile dysfunction and neuropathy

Table 2 Multiple linear regression models to investigate the impact of diabetes knowledge on HRQoL

Model I			Model II		Model III
Dependent variable	Independent Variable	Adjusted R square	Independent variable	Significant external variable (s) adjusted	Adjusted R square
ADDQoL score	Diabetes knowledge score	0.050	Diabetes knowledge score	age	0.125
EQ-5D score	Diabetes knowledge score	0.065	Diabetes knowledge score	age, education	0.115
					Same as model II

Note: Model I: no adjustment; Model II: adjusting for socioeconomic variables that cause significant difference in HRQoL scores ; Model III: adjusting for medical conditions and sociodemographic variables ,which cause significant difference in HRQoL scores

Relationship between Diabetes Knowledge and HRQoL

The correlation between diabetes knowledge and AD - DQoL,EQ-5D scores were 0.27 ($P=0.08$) and 0.30 ($P=0.06$) respectively. Diabetes knowledge score seemed to be modestly correlated with the two HRQoL measures. Yet, none of correlations has been shown to be statistically significant in the study.

Univariate analysis showed that age was the only significant external variable to be adjusted in the MLR II for the ADDQoL score. As for the EQ-5D score, both age and education was identified as the significant external variables to be adjusted in the MLR II. It was also found that no more medical-related external variables need to be adjusted in the MLR III for both AD-DQoL and EQ-5D scores. Hence, the results of MLR III were actually the same as in MLR II. Table 2 shows the power of 3 separate MLRs in explaining the variances in HRQoL scores. As for ADDQoL and EQ-5D, model II has the highest explanative power of 12.5% and 11.5% respectively. Hence, it was suggested that when adjusted properly ,diabetes knowledge was one of the predictors of HRQoL scores.

DISCUSSION

In this preliminary study among English-speaking diabetic patients, we found that diabetes knowledge was modestly correlated with both diabetes-specific and generic HRQoL, though not statistically significant. Based on the multiple linear regression models ,it also suggested that diabetes knowledge could be one of the poten-

tial predictors of HRQoL.

The lack of statistical power could be possibly contributable to small sample size ,as it was a cross-sectional study by convenience sampling at just one event on the same day. We fully recognized that the small sample size was actually a major limitation in this study, which might reduce the representativeness of the general diabetic population. Besides ,we were constrained to certain extent to perform further subgroup analyses to explore potential differences in the correlations between different subgroups. Another plausible explanation would be the health condition of the participants at the public event would be better than the average diabetic patients and hence a selection bias may have occurred.

Contrary to our hypothesis , the somewhat lower correlation between knowledge and ADDQoL might be explained by the characteristics of the questionnaires and the study subjects. GDKT was developed based on the findings of a public survey on general diabetes knowledge and was aimed to be used among the general population^[22-23]. Hence, its power to assess more specific diabetes knowledge might not be strong enough. Yet, ADDQoL is a disease-specific questionnaire. Hence, the association between the two might not be clearly demonstrated. Besides, our results showed that the correlation coefficients between diabetes knowledge and diabetes-specific and generic HRQoL are similar. Again, this might also be due to the characteristics of our study participants. As they were recruited from a public event rather than hospital or clinic ,their medical

condition may tend to be less severe. The above-mentioned points also apply to the results of MLR models, from which we observed a comparatively modest predictive power of diabetes knowledge in the variances of HRQoL scores.

To the best of our knowledge, this preliminary study may be the first to explore relationship between diabetes knowledge and health-related quality of life, as no published paper could be retrieved through an extensive literature search so far. As diabetes knowledge is less likely to be affected by cultural factors, a study on this topic would have potential wide applicability. Therefore, the results from this preliminary study, albeit with its limitations (that will be discussed) would contribute to the management of diabetes.

Besides being the possibly only study investigating the relationship between diabetes knowledge and HRQoL which could provide valuable information for future related studies, there are two additional reasons that we think why our study is important.

First, it may provide an alternative or a supplementary measure to predict health-related quality of life of diabetes patients other than metabolic control. There are two studies with large sample size (n of 1,348, and 1,522 respectively) showing that although metabolic control measured as HbA1c is associated with health-related quality of life, such association is not significant after adjusting for other variables^[19,20].

Second, although the adjusted correlation between diabetes knowledge and HRQoL was modest, it suggested that the increase in diabetes knowledge still have a role to play in improving HRQoL. Moreover, apart from the usual aim of increasing disease knowledge, patient education programs could also incorporate other elements of the patient empowerment strategies such as communicating effectively with healthcare professionals, cultivating a positive attitude towards the disease management, etc.

CONCLUSION

Our results showed diabetes knowledge to be modestly correlated with both diabetes-specific and generic health-related quality of life. In addition, the current findings support diabetes knowledge may be useful as a

predictor of HRQoL when modeled properly. This would provide preliminary evidence that the level of diabetes knowledge may be a useful predictor of HRQoL among DM subjects. Yet, further studies utilizing larger sample size would be required to confirm the observation.

ACKNOWLEDGEMENT

The authors thank Dr. Hwee-Huan Tan for her kindly assistance with patient recruitment.

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(Editor Wu)