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Health related quality of life in patient with type 2 diabetes: The role of household food insecurity on latent class membership

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ABSTRACT

Background and aims: Health related quality of life (HRQoL) is an important public health issue that mainly associated with a number of certain factors in medical sciences. This study, in particular, aimed to identify HRQoL latent subgroups among patients with type 2 diabetes and assess the role that household food insecurity (HFI) plays in classifying participants to each latent class.

Methods: At the present cross sectional study, all the diabetic patients of the rural regions of Neyshabur (a city in north-east of Iran) were recruited between April and July 2012 (N = 1847). Latent Class Analysis (LCA) was used to determine the latent subgroups of HRQoL. Finally, LCA was used to determine the effect of HFI on dedicating participants to each latent class after adjusting other covariates.

Results: Based on the subscales of HRQoL, three latent classes were identified, including: 1) poor HRQoL (34.6%), 2) moderate HRQoL (39.1%) and 3) good HRQoL (26.3%). After considering the possible confounders, having HFI decrease the odds of membership in latent class 2 (moderate HRQoL) (OR = 0.42, 95% CI: 0.29–0.60). Also having HFI show similar effect on latent class 3 (good HRQoL) and decrease the odds of membership in this class (OR = 0.13, 95% CI: 0.08–0.20) in compared to the first class (poor HRQoL).

Conclusions: Results from the present study show that HFI plays an important role in decreasing the odds of membership in moderate and good HRQoL classes compared to poor HRQoL.

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1. Introduction

Health-related quality of life (HRQoL) in adults who suffer from a chronic disease considered a major public health issue that has turned to be an important outcome measure in recent years [1]. Among chronic diseases, Diabetes Mellitus (DM) has a high prevalence rate among population of the world. This high prevalence increases the mortality rate of this disease [2]. Wild et al. estimated that the amount of people who have DM will reach 366

million in 2030 [3]. Getting DM is along with increased risk of developing cardiovascular, cerebrovascular disease, kidney inadequacy, etc.

Previously, some studies tried to evaluate the prevalence of HRQoL and identification of related variables to the HRQoL among patients with diabetes [4–6]. One of these factors, known as household food insecurity (HFI), has potential to impact diabetes [7] along with low quality diet. Having access to enough food and nutrition in daily life emphasized as a necessary related factor in HRQoL among people of low-income areas [8]. On the other hand, some studies indicated that HFI would leads to lower levels of HRQoL [9–11].

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In the prior variable-centered research, the relationship between HFI and HRQoL were documented [11–13]. But there is no information about this relationship in the person-centered analysis like Latent Class Analysis (LCA).

LCA is a useful method for classifying similar individuals into separated subgroups. These subgroups known as latent classes. These latent classes are categorized based on the response patterns investigated with relations to the sings [14]. In the case of HRQoL, considering this possibility that relationships between HRQoL subscales may meaningfully differ in subgroups of individuals, this person-centered analytic model strives to identify quantitatively and qualitatively distinct profiles of individuals on the basis of their response to the questions about HRQoL subscales.

In medical research, LCA approach was use only in some studies in comparison to mental health studies. To the best of our knowledge, this study is the first one that use LCA for identification of HRQoL subscales subgroups among diabetic people.

The hypothesis of this study was “identifying latent classes of HRQoL in diabetic persons and detecting the role of HFI on membership of these people in different classes”. Therefore, the purposes of the present study were to identify homogenous and similar existing subgroups within the data. Also, this study aimed to detect the effect of HFI on the membership of diabetic people in latent classes of HRQoL.

2. Methods

At the present cross-sectional study, all the diabetic patients of the rural regions of Neyshabur (a city in north-east of Iran) were recruited to the study between April and July 2012 (n = 2224). But, 377 patients were excluded from the study. The main reason of excluding was their lack interest for participation. As a result, the response rate was 83.5%. Therefore, 1847 patients with type 2 diabetes participated in this study. The study population was identified based on the lists of patients with diabetes who are available in the Neyshabur rural health centers. In the present study, informed consent was obtained from all participants, also all participants were assured that their answers would remain confidential.

During April and June 2012, in order to collect the data, Farsi version of WHOQOL-BREF along with short version of HFI questionnaires were administered to measure the HRQoL and HFI, respectively [15,16]. Once a trained person explained the proper manner of filling the questionnaires, they were answered by the participants except illiterates and people with special needs. The WHOQOL-BREF questionnaire was derived from the WHOQOL-100. This questionnaire has two items for assess overall HRQoL and general health. Furthermore, it has 24 items that assess four subscales of health including. These subscales are listed below:

Subscale 1 (physical health) that measured by seven items, subscale 2 (psychological health) that measured by six items, subscale 3 (social relationship) that measured by three items, and finally subscale 4 (environmental health) that measured by eight items. The five-point Likert scale was used for response to each item Based on the guidelines, the raw subscale scores of the WHQOL-BREF were changed to the other scoring range between 4 and 20 [17], as a result the subscales were transformed to a 0-100-scale [18,19].

The analysis was performed according to the quartiles of each subscale of WHOQOL-BREF. In this study, LCA was used to detect the latent subclasses of WHQOL-BREF. This approach is a set of structural equation that used in determining latent classes or groups in multivariate classified data. LCA, assumes that with considering measurement errors, possible existed correlation among indicator variables (observed variables) could be revealed

by categorizes of the latent variable. With conducting different iterations for each model, LCA can calculate some indices that are useful in selecting the best model. These indices are G [2], Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). It should be noted that AIC and BIC calculate based on G [2] index. For these indices, the smaller quantity shows a more goodness of model. Thus, a model with the minimum AIC or BIC might be selected [14,20,21]. To run LCA, four-level indicator variables (i.e. quartiles) were used to detect subclasses of HRQoL as a latent variable. These indicator variables were physical health, psychological health, social relationship and environmental health (all four subscales of HRQoL). After finding the best model, HFI and other covariates (age, gender (male versus female), education status (illiterate versus literate), marital status (married versus single\widow\divorce), income level (<200\$ versus ≥200\$) and employment status (unemployment versus employment)) were entered into the LCA model. All analysis was done by using PROC LCA in SAS 9.2 (SAS Institute Inc. Cary, NC, USA). The Ethics Committee of Iran University of Medical sciences approved the study protocol and its questionnaires (ID-number: IR.IUMS-REC.1394.94-02-193-26156).

3. Results

Our findings showed that the mean age of the participants was 59.65 ± 12.3 years. Most of the participants were female (69.8%), and most of them were married (80.1%).

Table 1 indicates the percentage of each four-level subscales of HRQoL by HFI status. In all subscales, most of the participants were in quartile 2 and only a few numbers were in quartile 4. Besides, it was found that there is a strong significant association between HFI and all subscales of HRQoL.

The authors fit different LCA models to find the best model. We fitted these models from one to eight classes (Table 2). LCA calculated some indices to each model. These indices were G [2] AIC and BIC. Based on the results of Table 2 and interpretability of the models, we selected three latent class model to subgrouping of the participants. Table 3 shows the results of the selected model. This

Table 1
HRQoL subscales by HFI in study population.

Subscales	HFI				P-Value	Total (n = 1847)	
	no		yes			N	%
	N	%	N	%			
Physical health							
Quartile 1	186	37.8	306	62.2	<0.001	492	26.6
Quartile 2	454	53.8	390	46.2		844	45.7
Quartile 3	307	68.4	142	31.6		449	24.3
Quartile 4	48	77.4	14	22.6		62	3.4
Psychological health							
Quartile 1	171	37.7	283	62.3	<0.001	454	24.6
Quartile 2	590	55.6	471	44.4		1061	57.4
Quartile 3	196	70.3	83	29.7		279	15.1
Quartile 4	38	71.7	15	28.3		53	2.9
Social relationships							
Quartile 1	142	41.9	197	58.1	<0.001	339	18.4
Quartile 2	432	52.2	395	47.8		827	44.8
Quartile 3	379	60.7	245	39.3		624	33.8
Quartile 4	42	73.7	15	26.3		57	3.1
Environmental health							
Quartile 1	71	24.6	218	75.4	<0.001	289	15.6
Quartile 2	510	53.0	452	47.0		962	52.1
Quartile 3	381	68.6	174	31.4		555	30.0
Quartile 4	33	80.5	8	19.5		41	2.2

Abbreviations: HRQoL = Health-related quality of life; HFI= Household Food Insecurity.

Table 2
Comparison of LCA models with different latent classes based on model selection statistics.

Number of latent class	Number of parameters estimated	G [2]	df	Entropy	AIC	BIC	Maximum log-likelihood
1	12	2599.39	243	1.00	2623.39	2689.64	−9657.14
2	25	890.50	230	0.76	940.50	1078.54	−8802.70
3	38	400.58	217	0.71	476.58	686.39	−8557.74
4	51	325.77	204	0.67	427.77	709.35	−8520.33
5	64	271.24	191	0.65	399.24	752.60	−8493.07
6	77	239.89	178	0.63	393.89	819.03	−8477.40
7	90	212.50	165	0.71	392.50	889.42	−8463.70
8	103	191.32	152	0.65	3977.32	966.02	−8453.11

Abbreviations: LCA = latent class analysis; AIC = Akaike information criterion; BIC = Bayesian information criterion.

table has two sections. The first row indicates latent class prevalence and the second part shows the item-response probabilities.

The three latent classes have own special features:

The first class, named “Poor HRQoL,” described 34.6% of subjects, and was characterized by individuals located in Quartile 1 in all subscales. The second class, named “Moderate HRQoL,” described 39.1% of the subjects, and was characterized by individuals located in Quartile 2 in the social health and environmental health subscales. The third class, named “Good HRQoL,” described 26.3% of the individuals. In this class, locating in quartile 4 of the psychological health and social health subscales as well as quartile 3 of the environmental health subscale has high probabilities.

The item-response probabilities of each subscales of HRQoL are listed in Table 3. These probabilities used to express the properties and interpretation of each latent class. We labeled latent classes based on these probabilities. It should be noted that above 0.5 probabilities are in bold to reflect the characteristics of each latent class.

Table 4 shows the odds ratios for HFI and other covariates. These odds ratios indicated the odds of membership in each latent class compared to the first class. Table 4 shows, with increasing the age

of participants, the odds of membership in latent class 2 and 3 decrease significantly. Being illiterate significantly decrease the odds of membership in latent class 3 in comparison to the latent class 1 ($p = 0.012$). Similarly, having low income significantly decreases the of membership in latent class 2 and 3 in comparison to the first class ($p = 0.003$). Also, being married significantly increase the odds of membership in classes 2 and 3 ($p < 0.001$). In the case of HFI, Table 4 indicates that having HFI decrease the odds of membership in latent class 2 (OR = 0.42, 95% CI:0.29–0.60) and latent class 3 (OR = 0.13, 95% CI: 0.08–0.20) in comparison to the latent class 1. Its shroud be noted that among all studied variables, HFI has the strongest effect on membership of participants in each latent class.

4. Discussion

The present study aimed to find the subgroups of HRQoL using LCA approach. We found and named that three distinct classes as follow: Poor HRQoL, moderate HRQoL, and good HRQoL. The probability of being in quartile 1 of HRQoL subscales is high between subjects of the first class. The second class has other characteristics. In this class the being in quartile 2 has high probability in social and environmental health subscales. Among the patients of the third class the probability of being in quartile 4 is high in psychological health and social health subscales. Also, in this class, the probability of being in quartile 3 is high in the environmental health subscale in HRQoL.

Our literature review indicated that there is no study that has used LCA to identify the latent classes of HRQoL in diabetic people. In Other diseases and disorders, this method was used, but researchers have used different questionnaires to find subgroups of HRQoL in their studies. Anywhere, some of the related studies that have used LCA in the field of HRQoL discussed here; Kim et al. identified four latent class of HRQoL among persons with disabilities, which were labeled as follows: a high stable HRQoL class, a high varied HRQoL class, a low and stable HRQoL class, and a low and varied HRQoL class. In this study, the authors indicated that some factors are associated with high and stable HRQoL class. These factors are degenerative type of disability, physical dependence, discrimination, emotional stability and self-esteem [22].

Yongsuk and Dong Moon used LCA to identify latent classes of health-related quality of life among middle-age males. They found three latent classes and named them as follow: serious (2.4% of the sample), threatened (15.5%) and stable types (82.0%). The authors indicated that employment status and socioeconomic status significantly affects the membership of the participants in different latent classes [23].

Gholami et al. employed LCA to detect the pattern of BMI, chronic diseases and physical component of quality of life in a population in north of Iran. They identified six latent classes and in one class (i.e. fifth class) the probability of having diabetes was high

Table 3
The three latent classes model of HRQoL subscales in study population.

Latent class prevalence	Latent class		
	Poor HRQoL	Moderate HRQoL	Good HRQoL
	0.346	0.391	0.263
Item-response probabilities			
Physical			
Quartile 1	0.651	0.092	0.021
Quartile 2	0.238	0.411	0.098
Quartile 3	0.099	0.470	0.404
Quartile 4	0.013	0.027	0.478
Psychological			
Quartile 1	0.918	0.308	0.025
Quartile 2	0.040	0.334	0.044
Quartile 3	0.033	0.324	0.311
Quartile 4	0.009	0.034	0.620
Social			
Quartile 1	0.626	0.162	0.116
Quartile 2	0.246	0.535	0.105
Quartile 3	0.083	0.161	0.221
Quartile 4	0.046	0.142	0.560
Environmental			
Quartile 1	0.658	0.140	0.015
Quartile 2	0.275	0.620	0.203
Quartile 3	0.055	0.230	0.582
Quartile 4	0.011	0.009	0.200

Note. The probability of a “No” response can be calculated by subtracting 0.the item-response probabilities shown above from 1.

*Item-response probabilities >.5 in bold to facilitate interpretation.

Abbreviations: HRQoL = Health-related quality of life.

Table 4
Predictors of membership in latent classes of HRQoL subscales.

Predictors	P-value	Poor HRQoL	Moderate HRQoL	Good HRQoL
		OR (95%CI)	OR (95%CI)	OR (95%CI)
Age (year)	<0.001	Reference	0.98 (0.96–0.99)	0.95 (0.94–0.97)
Gender (male)	0.906	Reference	0.92 (0.59–1.41)	0.97 (0.60–1.57)
Education (illiterate)	0.012	Reference	0.93 (0.61–1.44)	0.56 (0.35–0.89)
Marital (married)	<0.001	Reference	1.73 (1.15–2.60)	4.93 (2.53–9.61)
Income level (<200\$)	0.002	Reference	0.58 (0.37–1.03)	0.44 (0.27–0.70)
Being unemployment	0.004	Reference	0.56 (0.30–1.30)	0.19 (0.06–0.61)
Having HFI	<0.001	Reference	0.42 (0.29–0.60)	0.13 (0.08–0.20)

Abbreviations: HRQoL = Health-related quality of life; HFI= Household Food Insecurity.

along with having high BMI and having metabolic syndrome and digestive disease. In this class having moderate and good score of physical components of quality of life was almost high too [24].

Based on the findings of the present study and the literature reviewed it could be concluded that LCA can be a suitable method for detecting different latent classes of HRQoL in different chronic diseases. These latent classes were not previously detectable in the variable-centered study.

Food insecurity among diabetic populations of developing countries is a major increasing concern because of the prevalence of diabetes and rising number of hunger countries in these areas [25,26].

It is widely recognized contribution of caloric over nutrition to the development of diabetes, however, evidentially the prevalence of food insecurity among diabetic people is high [25]. It is demonstrated that access to sufficient, safe and nutritious food can affect the health of people who experience food insecurity and their ability to manage health conditions such as diabetes [27]. The findings of our person-centered study indicated that after controlling possible confounders, having HFI decreases the odds of membership in the moderate HRQoL (OR = 0.42, 95% CI = 0.29–0.60) and good HRQoL (OR = 0.13, 95% CI = 0.08–0.20) classes in comparison to the poor HRQoL class. Similar to other studies, this study proves additionally evidence on the association of the HFI and HRQoL [9,28,29]. The association of HFI and HRQoL is complex because HRQoL is composed of a lot of factors combined with each, like exercise ability, self-management, daily activities, pain/discomfort and anxiety/depression. For this reason, some studies proposed that probably HFI has a relationship with some sub categorizes of HRQoL such as exercise ability and daily activities. HFI could affect these factors through low quality food intake, essential nutrient deficiencies and poor nutritional status [30–32].

The relationship between HFI and HRQoL demonstrated among different diseases such as HIV and cancers [33]. Food insecurity with along food shortage is associated with poor general, mental and physical health in adults [9]. Malnutrition is the most important outcome of food insecurity that can result in adverse health consequences in adults [34,35]. On the other hand, nutrition condition influences the current and future health condition of diabetic people [36].

Based on our findings it is necessary to enhance the food security of diabetic patients because of its reverse relationship with HRQoL. For this aim, it is needed to collaborative work among clinicians, nutrients, psychologists, and family members along with social support. But, the effect of HFI on the health consequences of patients with type 2 diabetes has been neglected with clinicians and other health experts [11].

in this study, because of employing LCA, the results indicated that HFI affects social and environmental subscales of HRQoL in latent class 2. Similarly, in latent class 3, HFI has more effects on psychological, social and environmental subscales of HRQoL.

Tesfaye et al. stated that probably individuals who suffer from food insecurity, it is likely this group also had some general deprivation and poverty [29]. This is supported by our findings that being illiterate (OR = 0.56), having the low income (OR = 0.44) and being unemployment (OR = 0.19) associated with good HRQoL class. As a result, it seems that programing some plans to enhance food support and financial support could be effective in improve HRQoL among patients with diabetes.

Findings of a systematic review denoted that the effects of demographic characteristics such as age, sex, SES status, educational level, marital status and income level on HRQoL are not specific for diabetes. Based on this review, there are some conflicting findings among different studies due to numerous factors [37]. For example, there are different questionnaires for evaluating HRQoL such as SF-12, SF-36, SWED-OUAL and so on. It is not ease to compare the finding of studies with board definitions or different used instruments for HRQoL. For example, in the case of the age, the below mentioned discuss presented; Studies have indicated that there is an association between age and HRQoL. Overall, most studies emphasized that having a higher age is related to low HRQoL [37–40]. However, other studies believed that the effect of age may disappear when controlled for other factors [37]. Findings of this study indicated that higher level age significantly decreases the odds of membership in the second (moderate HRQoL, OR = 0.98) and third (good HRQoL, OR = 0.95) latent classes. This finding pointing out to the fact that patients with diabetes with higher age need to excessive attention to elevate their HRQoL.

In conclusion, findings of the present study indicate that almost more than one-third of participants categorized under the poor HRQoL class. It also shows that HFI plays an important role in decreasing the odds of membership in moderate and good HRQoL classes in comparison to poor HRQoL class. These results show the high importance of design interventional programs for HRQoL among diabetic patients with considering potential risk factors. Considering household food accessibility, a part of programs to improve healthy food choices and good health, among these types of people, could be a pragmatic step.

Ethics approval

The protocol study was conducted according to the principles expressed in Declaration of Helsinki and was approved by the Deputy of Research and Ethics Committee of Iran University of Medical Sciences (ID-Number: IR.IUMS.REC 1395.95-03-27-29395).

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Declaration of competing interest

None declared.

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