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Patient-perceived service needs and health care utilization in people with type 2 diabetes

A multicenter cross-sectional study

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Abstract

The aim of this study was to investigate service needs and health care utilization among people with type 2 diabetes, further to identify the relationship between service needs and health care utilization.

We used a self-reported questionnaire to collect data regarding demographic and diabetes characteristics, service needs toward self-management and follow-up care, and 4 health care utilizations during past year. Multiple linear regression and binary logistic regression were used to test the impacts of demographic and diabetes characteristics on service needs and health care utilizations, respectively. Spearman rank correlations were used to explore correlation between service needs and health care utilization.

We recruited 1796 participants with type 2 diabetes from 20 community health centers across 12 cities of Sichuan Province in China. Needs of self-management and follow-up had significant positive correlations with health care utilization. Participants rated that nutrition was the most needed aspects of self-management (78.5%), and out-patient visit was the most popular type of follow-up (66.8%). Educational level and treatment modality were predictors of self-management needs. Low educational level (elementary school or blow, $\beta = 0.11$, $P = .008$; middle school, $\beta = 0.10$, $P = .015$) and insulin treatment ($\beta = 0.08$, $P = .007$) were positive factors of self-management needs. Younger age (age < 45 years old, $\beta = 0.07$, $P = .046$), being employed ($\beta = 0.14$, $P < .001$), and underdeveloped region ($\beta = 0.16$, $P < .001$) were positive factors of follow-up care needs. Elementary educational level (OR: 0.53; *CI*: 0.30–0.96) and underdevelopment region (OR: 0.01; *CI*: 0.01–0.07) were protective factors of general practitioner visit, in contrast, those factors were risk factors of specialist visit (elementary educational level, OR: 1.69; *CI*: 1.13–2.5; underdevelopment region, OR: 2.93; *CI*: 2.06–4.16) and emergency room visit (elementary educational level, OR: 2.97; *CI*: 1.09, 8.08; underdevelopment region, OR: 6.83; *CI*: 2.37–14.65).

The significant positive relationship between service needs and health care utilization demonstrated the role of service needs in influencing health care utilization. When self-management education is provided, age, educational level, employment status, treatment modality, and region should be considered to offer more appropriate education and to improve health care utilization.

Abbreviations: CI = confidence interval, ER = emergency room, GP = general practitioner, HSNQ = health service needs questionnaire, OR = odds ratio, SD = standard deviation.

Keywords: care needs, community, follow-up care, health care utilization, self-management, type 2 diabetes

1. Introduction

The rising prevalence of diabetes has become a growing challenge for health care system. Approximately 425 million people worldwide have been diagnosed with diabetes, and this number is expected to exceed 629 million by 2045.[1] In China, the prevalence of diabetes has been conservatively reported to be approximately 10.9%.[2] Sichuan Province is the second highest prevalence region of diabetes in southwest China with a

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The data are available from the corresponding author upon request.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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prevalence of 10.3%.[3,4] Type 2 diabetes accounts for around 90% of all cases of diabetes, which is the most common type of diabetes.[5] Type 2 diabetes is a major risk factor for mortality and cardiovascular outcomes.[6] Results from cohort study suggested that target level of glycated hemoglobin, blood pressure and cholesterol could reduce the risk for death and cardiovascular outcomes on type 2 diabetes patients.[7] Steno-2 study showed the effects of behavior modification and pharmacologic therapy for reducing cardiovascular outcomes and complications of type 2 diabetes.[8] Self-management education and regular follow-up care are considered the most essential and cost-effective means of behavior modification for diabetes management.[9–12] So many researchers explored self-management and follow-up intervention among people with type 2 diabetes in different countries and cultures.[9,10,13]

Performing optimal self-management behavior and regular follow-up care were difficult and complex.[14] Studies have reported that patients perceived many barriers to engaging in active self-management and follow-up care.[13,15–17] One important reason for these barriers was that people with diabetes were a heterogeneous group with comprehensive and personalized needs of self-management and follow-up care varying by diabetes characteristics, including complications, treatment modality, and socio-economic characteristics.[18–20] As Carolan et al described, patients had different needs at different stage of their diabetes.[15] For the highly personalized needs of management, policy makers support patient-centered approach as a key component of health service to improve quality of care.[21] One of the most important domains of patient-centered care is emphasizing the assessment of health service needs from the distinctive perspective of patients.[22] Studies found that healthcare providers identified and prioritize patients' needs that were different from patients themselves.[23] Therefore, assessing needs of an individual patient was the premise to deliver patient-centered and tailored care.[22] Furthermore, this assessment helped healthcare providers to identify who these vulnerable patients were and better understanding of warrants special attention.[24] Sadly, little researches reported patient-perceived needs of self-management and follow-up care and explored underling factors affecting these needs.

A number of studies have shown that patients with type 2 diabetes were associated with higher levels of health care utilization such as out-patient visit, emergency room (ER) visit or hospitalization.[25] Health care systems were under pressure in many countries due to increasing people with diabetes.[26,27] Identifying the patients who are mostly in need of care can promote to allocate healthcare resources efficiently.[28] Past researches explored factors that affected health care utilization, most of which were socio-demographic factors, however, health service needs, including self-management and follow-up care, were seldom considered. Andersen's behavioral model indicated that patient needs were associated with health care utilization behavior,[29–31] however, the empirical evidences was limited in people with type 2 diabetes.

The aim of the study were to

(a) assess needs of self-management and follow-up care and health care utilization in participants with type 2 diabetes;
(b) identify the main sociodemographic and diabetes factors related to needs of self-management and follow-up care and health care utilization; and
(c) further to identify the relationship between needs and health care utilization.

2. Methods

2.1. Design and sample

This study is a cross-sectional study. Convenience sampling was used to recruit participants of Sichuan Province in China. Geographically, Sichuan Province is divided into 5 economic regions: the provincial capital city, the central, southern, western, and northeastern. Each region consists of 1 to 7 cities. First, convenience sampling was used to select 1 to 4 cities from each region, and then selected community centers from those cities. Finally, convenience sampling was employed to recruit study participants from selected community centers. A total of 20 community centers from 12 cities were selected in this study, of which 2 community centers came from the provincial capital city, 4 from the central region, 6 from the southern region, 2 from the western region, and 6 from the northeastern region. The inclusion criteria of participants were:

1) being diagnosed with type 2 diabetes;
2) aged 35 years or older (governmental requirement for management in community centers);
3) voluntary participation in the study.

The exclusion criteria were:

1) mental disorders;
2) simultaneous participation in other research studies.

The required sample size to examine the relationship between service needs and health care utilization based upon correlation test using G * power 3.1[32] was 374 with alpha 0.05, power 0.90, and effect size 0.15. The research team distributed 1812 questionnaires to participants, of which 1796 completed the questionnaire (response rate = 99.1%).

2.2. Data collection

Data were collected using self-reported questionnaires between October 2015 and June 2016. For those participants who were not able to write or read, trained investigators who were nurses read the questions to them one by one without any hint, and participants answered according to their actual feelings, then trained investigators wrote their answers on the questionnaires. The survey was anonymous, and the completed questionnaires were kept in sealed envelopes.

Before the survey, the verbal informed consent was obtained from the nurse manager of community, and the written informed consent was obtained from each participant. This study was approved by the ethics committee of West China Hospital of Sichuan University (no. 2015–110).

2.3. Measures

2.3.1. Service needs. Survey participants were asked the service needs towards self-management and follow-up care measured by Health Service Needs Questionnaire (HSNQ). The HSNQ was formed from the Health Education Needs Scale by Lay and Ding,[33,34] which original language was Chinese. Health Education Needs Scale consisted of 33 items measuring needs of disease knowledge, diet, exercise, blood glucose self-monitoring, complication, medicine, and hospital discharge guidance. The Cronbach's alpha was 0.99 for Health Education Needs Scale.[33] For this study, research team revised Health Education

Needs Scale by extracting eight items and adding items for community settings. The Questionnaire was finally formed with 13 questions, including 7 questions toward self-management needs and 6 questions toward follow-up care needs. Needs of self-management were measured in the survey asking, respectively, whether the participants were in urgent need of self-management education on nutrition management, exercise, medicine, blood glucose self-monitoring, complications prevention, risk factor control, and emotion management. The answer was binary with "yes" or "no". The Cronbach's alpha was 0.83, and content validity was 0.92. Based on this answer, we calculated an additional variable, "the number of self-management education needs", which was the sum of items of self-management education needs. Needs of follow-up care were measured in the survey asking, respectively, whether the participant preferred the following type of follow-up care: out-patient visit, telephone follow-up, home visit, group follow-up, community club follow-up and others. The answer was binary with "yes" or "no". Based on this answer, we calculated an additional variable, "the number of follow-up type needs," which was the sum of items of follow up care needs.

2.3.2. Health care utilization. Four health care utilizations were extracted: general practitioner (GP) visit, specialist visit, ER visit and hospitalizations. Participants were asked whether they have GP visit, specialist visit, ER visit or hospitalizations because of type 2 diabetes during past year. To minimize the recall bias, trained investigators addressed medical visit specifically after participants finished all questions.

2.3.3. Demographic and diabetes variables. Participants' demographic variables included age, gender, marital status, education, employment status, medical insurance, monthly household income, and region. Diabetes variables consisted of diabetes complications and treatment modality. The order of economic development level from high to low was: the provincial capital city, the central, southern, western, and northeastern.

2.4. Analysis

Descriptive analysis, including frequency, percentage, mean and standard deviations, were conducted for the needs of self-management and follow-up care, health care utilization, and the general characteristics of individuals. To identify the influence of demographic and diabetes variables on self-management needs, follow-up care needs and health care utilization, multivariate analyses were carried out with stepwise multiple linear regression and binary logistic regression. In the multiple linear regression, the number of self-management education needs and the number of follow-up type needs were dependent variables, and demographic and diabetes characteristics were independent variables. In the binary logistic regression, GP visit (1 = yes, 0 = no), specialist visit (1 = yes, 0 = no), ER visit (1 = yes, 0 = no) and hospitalizations (1 = yes, 0 = no) were dependent variables, and demographic and diabetes characteristics were independent variables. Before performing multivariate regression, univariate analyses were first conducted. Only independent variables with $P < .25$ in the univariate analyses were entered into multivariate regression.[35,36] Categorical variables were transformed using dummy variables. To test the correlation between service needs and health care utilization, spearman correlation was carried out. All analyses were performed using the SPSS version 19.0 software (IBM Corporation, Armonk, NY).

3. Results

3.1. Characteristics of participants

A total of 1796 participants enrolled in this study and the mean age was 64 years old. The majority of them were female (53.5%), aged 60 years or older (67.7%), married (89.1%), retired (55.7%), having an education level of junior high school or above (68.7%), health insurance coverage (95.3%), and a household income of ¥1200 to ¥5000 (67.4%). About one-third participants reported diabetes complications, and only 12.2% of them neither taking oral hypoglycaemic medication nor accepting insulin therapy (Table 1).

3.2. Needs of self-management and follow up care

Table 2 shows the needs of self-management and follow-up care. Of the 1796 participants, the majority were urgently in need of nutrition management (78.5%), exercise (62.7%) and medication (65.1%). Regarding to the needs of follow-up care, most participants preferred out-patient visit (66.8%) and telephone follow-up (60.0%) instead of group (21.2%) and community club follow-up (21.9%).

The univariate and multivariate analysis of self-management and follow-up care needs are shown in Tables 1 and 3, respectively. The results showed that participants with low educational level (elementary school or blow, $\beta = 0.11$, $P = .008$; middle school, $\beta = 0.10$, $P = .015$) and on insulin treatment ($\beta = 0.08$, $P = .007$) expressed more self-management needs. Participants who were younger than 45 years old ($\beta = 0.07$, $P = .046$), being employed ($\beta = 0.14$, $P < .001$), and living in underdeveloped region (Northeastern region, $\beta = 0.16$, $P < .001$) expressed more follow-up care needs.

3.3. Health care utilization

Table 2 shows the health care utilization regarding GP visit, specialist visit, ER visit, and hospitalization. The majority of the participants had GP visit (83.4%), and a few participants had ER visit (8.0%) during past year. Participants with elementary school educational level or blow showed less GP visit proportion (OR: 0.53; *CI*: 0.30–0.96), while they had nearly 2 times higher odds of specialist visit (OR: 1.69; *CI*: 1.13–2.51), and 3 times higher odds of ER visit (OR: 2.97; *CI*: 1.09, 8.08) than those with college educational level or above (Table 4). Participants who came from the least developed region (Northeastern) showed the lowest GP visit proportion (OR: 0.01; *CI*: 0.01–0.07), however, they had 3 times higher odds of specialist visit (OR: 2.93; *CI*: 2.06–4.16), nearly 7 times higher odds of ER visit (OR: 6.83; *CI*: 2.37–14.65), and 5 times higher odds of hospitalization (OR: 5.26; *CI*: 3.19–8.64) than participants came from the provincial capital city (Table 4). Participants with diabetes complications had 2 times higher odds of specialist visit(OR: 2.55; *CI*: 2.05–3.16), 5 times higher odds of ER visit (OR: 5.63; *CI*: 3.79–8.37), and 3 times higher odds of hospitalization (OR: 3.68; *CI*: 2.84–4.73) than participants without diabetes complications (Table 4). Participants with insulin therapy or combination of oral and insulin therapy had 2 times higher odds of specialist visit (OR: 2.36, *CI*: 1.58–3.52; OR: 1.66, *CI*: 1.06–2.59), 3 times higher odds of hospitalization (OR: 3.79, *CI*: 2.42–5.94; OR: 3.02, *CI*: 1.81–5.05) than those only with diet or exercise therapy (Table 4).

Table 1

Demographic and diabetes characteristics of patients with type 2 diabetes and their relationship with health service needs and health care utilization.

Variables	N = 1796 n (%)	Number of self-management education needs Mean ± SD	Number of follow-up type needs Mean ± SD	GP visit (%yes / %no)	Specialist visit (%yes / %no)	ER visit (%yes / %no)	Hospitalization (%yes / %no)
Demographic characteristics							
Age (yr)							
<45	78 (4.3)	3.36 ± 1.84	2.87 ± 1.98	91.0/9.0	51.3/48.7	9.0/91.0	33.3/66.7
45–<60	502 (28.0)	3.55 ± 1.91	2.59 ± 1.94	82.1/17.9	45.0/55.0	8.8/91.2	26.5/73.7
60–<75	1001 (55.7)	3.70 ± 1.87	2.86 ± 2.00	83.2/16.8	44.0/56.0	7.5/92.5	23.9/76.1
≥75	215 (12.0)	3.65 ± 1.86	2.45 ± 1.80	84.7/15.3	47.4/52.6	7.9/92.1	30.2/69.8
P value		.318†	.015†	.242‡	.531‡	.837‡	.086‡
Gender							
Male	835 (46.5)	3.64 ± 1.87	2.77 ± 1.96	81.8/18.2	45.6/54.4	8.7/91.3	26.0/74.0
Female	961 (53.5)	3.64 ± 1.88	2.71 ± 1.97	84.8/15.2	44.4/55.6	7.3/92.7	25.6/74.4
P value		.999*	.595*	.087‡	.611‡	.255‡	.851‡
Marital status							
Married	1601 (89.1)	3.65 ± 1.86	2.74 ± 1.96	82.6/17.4	44.5/55.5	7.7/92.3	25.2/74.8
Never married/ Divorced/Widow	195 (10.9)	3.55 ± 2.02	1.68 ± 1.92	89.7/10.3	48.7/51.3	9.7/90.3	30.3/69.7
P value		.529*	.681*	.012‡	.268‡	.330‡	.130‡
Educational level							
Elementary school or blow	563 (31.3)	3.77 ± 1.85	2.79 ± 2.02	79.9/20.1	53.3/46.5	12.6/87.4	34.5/65.5
Middle school	640 (35.6)	3.72 ± 1.92	2.76 ± 1.93	83.4/'6.6	43.0/57.0	6.4/93.6	23.8/76.2
High school	391 (21.8)	3.47 ± 1.88	2.71 ± 1.94	86.2/13.8	40.9/59.1	6.6/93.4	21.0/79.0
Some college or above	202 (11.2)	3.31 ± 1.79	2.59 ± 1.99	87.6/12.4	35.6/64.4	2.5/97.5	17.3/82.7
P value		.006†	.685†	.021‡	<.001‡	<.001‡	<.001‡
Employment status							
Employed	546 (30.4)	3.59 ± 1.88	3.18 ± 1.96	83.5/16.5	52.0/48.0	10.4/89.6	30.8/69.2
Unemployed/ Retired	1250 (69.6)	3.66 ± 1.88	2.55 ± 1.94	83.4/16.6	41.9/58.1	6.9/93.1	23.6/76.4
P value		.476*	<.001*	.935‡	<.001‡	.010‡	.001‡
Basic medical insurance							
Yes	1711 (95.3)	3.26 ± 1.88	2.74 ± 1.96	84.0/16.0	44.0/56.0	7.9/92.1	25.3/74.7
No	85 (4.7)	3.26 ± 1.87	2.77 ± 1.98	70.6/29.4	65.9/34.1	9.4/90.6	35.3/64.7
P value		.107*	.894*	.001‡	<.001‡	.613‡	.040‡
Household income							
¥<1200	408 (22.7)	3.43 ± 1.84	2.84 ± 2.09	77.2/22.8	46.9/53.1	12.8/87.2	30.1/69.9
¥1200–3500	851 (47.4)	3.88 ± 1.86	2.65 ± 1.93	84.6/15.4	42.7/57.3	6.1/93.9	26.0/74.0
¥3500–5000	360 (20.0)	3.36 ± 1.89	2.97 ± 2.00	83.9/16.1	54.2/45.8	8.9/91.1	27.5/72.5
¥>5000	177 (9.9)	3.46 ± 1.87	2.48 ± 1.74	91.5/8.5	34.5/65.5	4.0/96.0	11.9/88.1
P value		<.001†	.02†	<.001‡	<.001‡	<.001‡	<.001‡
Region†							
Provincial capital	260 (14.5)	3.59 ± 1.87	2.14 ± 1.71	99.6/0.4	25.0/75.0	1.5/98.5	9.6/90.4
Central	185 (10.3)	2.30 ± 1.46	1.89 ± 1.59	83.8/16.2	52.4/47.6	5.9/94.1	18.9/81.1
Southern	163 (9.1)	3.67 ± 1.97	2.88 ± 1.98	81.6/18.4	56.4/43.6	9.2/90.8	42.3/57.7
Western	281 (15.6)	4.11 ± 1.75	2.85 ± 2.10	99.3/0.7	27.8/72.2	4.6/95.4	11.7/88.3
Northeastern	907 (50.5)	3.76 ± 1.86	3.03 ± 1.97	74.0/26.0	52.5/47.5	11.0/89.0	33.2/66.8
P value		<.001†	<.001†	<.001‡	<.001‡	<.001‡	<.001‡
Diabetes characteristics							
Diabetes complications							
Yes	617 (34.4)	3.68 ± 1.93	2.68 ± 2.02	83.8/16.2	60.3/39.7	16.4/83.6	42.0/58.0
No	1179 (65.6)	3.61 ± 1.85	2.77 ± 1.94	83.2/16.8	37.0/63.0	3.6/96.4	17.3/82.7
P value		.436*	.365*	.751‡	<.001‡	<.001‡	<.001‡
Treatment modality							
Diet/exercise	219 (12.2)	3.43 ± 1.89	3.10 ± 2.17	84.0/16.0	39.7/60.3	9.1/90.9	21.9/78.1
Oral medication	1160 (64.6)	3.62 ± 1.86	2.68 ± 1.90	83.6/16.4	42.2/57.8	6.1/93.9	19.7/80.3
Insulin therapy	243 (13.5)	3.87 ± 1.90	2.83 ± 1.98	79.8/20.2	62.1/37.9	14.8/85.2	51.0/49.0
Oral medication and Insulin therapy	174 (9.7)	3.64 ± 1.88	2.54 ± 1.88	86.2/13.8	46.6/53.4	9.2/90.8	35.6/64.4
P value		.112†	.027†	.344‡	<.001‡	<.001‡	<.001‡

SD = standard deviation; Region†, the order of economic development level from high to low: the provincial capital city, the central, southern, western, and northeastern.

Comparisons between groups were performed with.

* Two independent sample *t* test.

† Analysis of variance (ANOVA).

‡ Chi-squared test.

Table 2

Patient-perceived health service needs toward self-management and follow-up care and health care utilization (N = 1796).

Variables	n	%
Needs of self-management education		
Nutrition management	1409	78.5
Exercise	1126	62.7
Medication	1170	65.1
Blood glucose self-monitoring	947	52.7
Complications prevention	854	47.6
Risk factor control	689	38.4
Emotion management	70	
Number of self-management education needs (Mean, SD)	3.64 (1.88)	
Needs of follow-up type		
Out-patient visit	1200	66.8
Telephone follow-up	1077	60.0
Home visit	753	41.9
Group follow-up	381	21.2
Patient Club follow-up	394	21.9
Others	34	1.9
Number of follow-up type needs (Mean, SD)	2.71 (1.97)	
Health care utilization		
GP visit (%yes / %no)	83.4/16.6	
Specialist visit (%yes / %no)	55.0/45.0	
ER visit (%yes / %no)	8.0/92.0	
Hospitalization (%yes / %no)	25.8/74.2	

ER = emergency room, GP = general practitioner, SD = standard deviation.

3.4. Correlations between needs and health care utilization

Correlations between needs and health care utilization are shown in Table 5. The number of self-management needs showed significant relationships with GP visit. The number of follow-up care needs showed significant relationships with GP visit, specialist visit, ER visit, and hospitalization. However, the correlations were weak, with the correlation coefficients between 0.1 and 0.2.

4. Discussion

This study examined the needs of self-management and follow-up care from patients' perspective, further identified the correlation between patient-perceived service needs and health care utilization, in order to decide how to best deliver self-management and follow-up care. To our knowledge this is the first published research to describe the needs of self-management and follow-up care in a large, regional diversity sample of people with type 2 diabetes recruited from multiple community centers. Self-management towards nutrition was the most needed aspects, and outpatient service was the most popular type of follow-up care. The needs of self-management and follow-up care were associated with health care utilization. These findings highlight the importance of assessing patient needs for improving health care utilization, which are essential for health care providers, administrators and healthcare leaders.

Our study sought to uncover patient preferences of aspects of self-management education and follow up care. We found that participants expressed needs related to a variety of aspects of diabetes self-management education, especially nutrition management, exercise and pharmacologic therapies. Similar results were seen by Eh et al in a cross-sectional survey of Chinese immigrants in the Australia, where dietary self-management was most needed.[37] The difficulty in diet management may be attributable to Chinese food culture, that the freedom to enjoy food implied the pursuit of quality of life.[37,38] Therefore, it was challenging for patients, as well as healthcare providers to restrict diet during diabetes management.

Participants expressed a much stronger preference to outpatient and telephone follow-up care rather than patient club or group interaction. However, our findings were not consistent with previous studies, which reported the patients' strong desire of participates for sharing experiences with other patients.[39,40]

Table 3

Multiple linear regression analyses relationship between demographic or diabetes characteristics and health service needs.

Variables	B (95% CI)	β	t	*P* value
Number of self-management education needs (adjusted $R^2 = 0.102$)				
Educational level (ref: some college or above)				
Elementary school or blow	0.45 (0.12,0.78)	0.11	2.649	.008
Middle school	0.39 (0.08,0.70)	0.10	2.434	.015
High school	0.12 (−0.21,0.44)	0.03	0.697	.486
Treatment modality (ref: diet/exercise)				
Oral medication	0.22 (−0.06,0.49)	0.06	1.571	.116
Insulin therapy	0.47 (0.13,0.82)	0.08	2.705	.007
Oral medication and Insulin therapy	0.26 (−0.12,0.63)	0.04	1.333	.183
Number of follow-up type needs (adjusted $R^2 = 0.082$)				
Age (yr) (ref: ≥75)				
≤45	0.28 (0.01,0.55)	0.07	1.997	.046
45–60	0.14 (0.02,0.83)	0.04	1.355	.176
60–75	0.26 (0.14,0.84)	0.06	1.953	.051
Employment status (yes)	0.59 (0.37,0.82)	0.14	5.247	<.001
Region (ref: the provincial capital city)				
Central	−0.21 (−0.43,0.01)	−0.05	−1.880	.060
Southern	0.47 (0.06,0.88)	0.07	2.246	.025
Western	0.49 (0.15,0.83)	0.09	2.806	.005
Northeastern	0.64 (0.35,0.93)	0.16	4.312	<.001

B = unstandardized coefficients, CI = confidence interval, ref = reference category, β = standardized coefficients.

Table 4

Binary logistic regression analyses relationship between demographic or diabetes characteristics and 4 health care utilizations.

Variables	*B*	OR (95%*CI*)	*P* value
GP visit ($R^2=0.218$)			
Educational level (ref: some college or above)			
Elementary school or blow	−0.63	0.53 (0.30, 0.96)	.037
Middle school	−0.09	0.91 (0.72, 1.15)	.774
High school	−0.05	0.94 (0.66, 1.361)	.949
Region (ref: the provincial capital city)			
Central	−4.06	0.12 (0.01, 0.13)	<.001
Southern	−4.21	0.02 (0.01, 0.11)	<.001
Western	−070	0.49 (0.04, 5.52)	.568
Northeastern	−4.62	0.01 (0.01, 0.07)	<.001
Specialist visit ($R^2=0.180$)			
Educational level (ref: some college or above)			
Elementary school or blow	0.52	1.69 (1.13, 2.51)	.010
Middle school	0.19	1.21 (0.83, 1.76)	.314
High school	0.23	1.25 (0.85, 1.85)	.254
Employment status (yes)	0.31	1.36 (1.08, 1.70)	.007
Basic medical insurance (yes)	−0.71	0.49 (0.30, 0.81)	.005
Region (ref: the provincial capital city)			
Central	0.92	2.51 (1.63, 3.86)	<.001
Southern	1.16	3.20 (2.03, 5.05)	<.001
Western	0.11	1.12 (0.74, 1.69)	.60
Northeastern	1.07	2.93 (2.06, 4.16)	<.001
Diabetes complications (yes)	0.93	2.55 (2.05, 3.16)	<.001
Treatment modality (ref: diet/exercise)			
Oral medication	0.16	1.17 (0.85, 1.61)	.341
Insulin therapy	0.86	2.36 (1.58, 3.52)	<.001
Oral medication and Insulin therapy	0.51	1.66 (1.06, 2.59)	.026
ER visit ($R^2=0.207$)			
Educational level (ref: some college or above)			
Elementary school or blow	1.09	2.97 (1.09, 8.08)	.033
Middle school	1.72	2.05 (0.76, 5.53)	.159
High school	1.02	2.77 (1.01, 7.61)	.061
Region (ref: the provincial capital city)			
Central	1.01	2.73 (0.83, 9.03)	.990
Southern	1.38	3.96 (1.23, 12.70)	.021
Western	1.37	3.92 (1.21, 12.69)	.023
Northeastern	1.92	6.83 (2.37, 14.65)	<.001
Diabetes complications (yes)	1.73	5.63 (3.79, 8.37)	<.001
Hospitalization ($R^2=0.276$)			
Region (ref: the provincial capital city)			
Central	0.58	1.79 (0.98, 3.27)	.059
Southern	1.79	5.98 (3.36, 10.64)	<.001
Western	0.48	1.63 (0.89, 2.96)	.112
Northeastern	1.66	5.26 (3.19, 8.64)	<.001
Diabetes complications (yes)	1.30	3.68 (2.86, 4.73)	<.001
Treatment modality (ref: diet/exercise)			
Oral medication	−0.08	0.93 (0.63, 1.36)	.692
Insulin therapy	1.33	3.79 (2.42, 5.94)	<.001
Oral medication and Insulin therapy	1.11	3.02 (1.81, 5.05)	<.001

B = regression coefficient, CI = confidence interval, ER = emergency room, GP = general practitioner, OR = odds ratio, ref = reference category.

Table 5

Spearman correlations between health service needs and health care utilization.

Variables	Number of Self-management education needs	Number of follow-up type needs
GP visit	0.108**	0.116**
Specialist visit	−0.040	0.160**
ER visit	−0.043	0.145**
Hospitalization	0.028	0.141**

*$P<.05$; **$P<.001$; GP = general practitioner, ER = emergency room.

Several explanations may underlie these results: First, majority participates in our study were older patients, they were used to accepting didactic type of follow-up care, thus, they may not accustomed to participatory learning.[41] Second, participates were more likely to trust in physicians or health care providers instead of other patients.[42] Third, participants were ashamed of expressing themselves in public due to the introverted characters influenced by Chinese traditional culture.[43]

Demographic and diabetes characteristics including educational level and treatment modality significantly influenced the needs of self-management. Previous studies noted that low level of education were predictors of knowledge deficit or poor self-management,[44,45] and patients with low education level were less capable to acquire and handling knowledge.[44] Because of lacking knowledge or skill, participants expressed more needs. Notably, participants who were on insulin treatment reported more self-management needs. A cross-sectional survey by Andersen et al uncovered that patients on insulin were likely to be more invested in their self-management.[46] Routinely and repeatedly testing injection skills were difficult to do for patients,[47] which contributed to more self-management needs. Our findings revealed that age, employment status and region significantly influenced the needs of follow-up care. Participants who were younger and employment reported more follow-up type needs. It could be explained that younger and employment people spent more time in careers or families,[48] and various type of follow up care, including telephone and internet, allowing them to schedule their follow-up flexibly. Those who were from underdeveloped region were likely to report more follow-up needs. A possible explanation for this might be that limited access to health service and resource in those area.[49]

A surprising finding was that participates with a lower-level education were less likely to use GP visit, in contrast, they were more likely to use specialist visit and ER visit, Possible explanation for the findings could be that people with a lower-level education were less likely to adhere to regular follow up in primary clinics leading to disease aggravation or deterioration and having no choice but to use specialist visit or admit ER.[50,51] Participates come from underdeveloped region exhibited less GP visit, but more specialist visit, ER visit and hospitalization, due to insufficient development of primary health care service in backward areas.[52] Those who with complications were more likely to be high healthcare users,[53] confirming the findings of the previous work that complications was a risk of health care utilization.[53,54] Consistent with the results of Wang et al,[55] we found that participants with insulin-treated reported more specialist visit and hospitalization. Insulin therapy was associated with high risk of hypoglycemia, resulting in hypoglycemia-related hospitalization,[56,57] which could explain this result.

A weak positive correlation was observed between patients' needs and health care utilization behavior, which confirmed the Andersen's behavioral model.[29–31] Predisposing, enabling, and need factors were predictors of health services utilization. Kim et al. analyzed the data of Korea Institute for Health and Social Affairs, and found that health services utilization was more

significantly explained by predisposing and need factors than enabling factor.[58] According to Andersen's behavioral model, needs factors were divided into perceived and evaluated needs,[29] and our study tested the patients-perceived needs. The reason for the weak correlation may be that there were many kinds of perceived needs, while we only considered self-management and follow-up due to this study nature. Therefore, further exploration of the relationship between service needs and health care utilization should draw more attention to more aspects of patient-perceived needs, and evaluated needs.

There were several limitations in our study. First, our study was not free from the possibility of recall bias, because all data about health care utilization were based on patient report instead of objective data. Second, data were collected from a cross-sectional study, our findings of the relationship between health service needs and health care utilization was not causal but correlational. Third, convenience sampling was used in this study; thus, results may not necessarily be representative. Finally, a series of statistical tests have been carried out hence Type I errors may increase.

5. Conclusion

This study provided empirical evidences regarding needs of self-managements and follow-up care, as well as the correlation between service needs and health care utilization among people with type 2 diabetes in China. In this study, some demographic (age, educational level, employment status, region) and diabetes variables (treatment modality, complications) were the predictors of service needs and health care utilization. The findings will be beneficial to help healthcare providers to identity the vulnerable patients, urgent service needs, and then guide the intervention to deliver tailored care, allocating limited healthcare resources.

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