

Research Article

Self-care Practices of Type 2 Diabetes Patients by Socio-demographic and Clinical Factors: An Ordered Probit Model

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Abstract

Background: Diabetes prevalence has risen more rapidly in middle- and low-income countries and has emerged as the seventh highest cause of death in such countries. Socio-demographics, patient knowledge and clinical factors, such as family history of diabetes, have a vital effect on the disease outcomes. This study assessed self-care practices among patients with type 2 diabetes to determine the probability of self-care by predictor variables, including socio-economic and clinical factors, and quantify the marginal effects of these independent variables on different self-care practices among diabetic patients.

Methods: This exploratory study collected data from 200 type 2 diabetes patients at a branch of private pharmacy in Pakistan using a convenient sampling technique and a semi-structured questionnaire. An ordered probit regression model was used to analyze the different self-care practices among diabetic patients. With self-practices ordered in four classes from poor to good, the marginal effects of each socio-economic and clinical factors were also calculated on the likelihood of aforesaid self-care practices among diabetic patients.

Results: Results showed that the relationships of household income, patient's choice of private or public hospital for treatment, and patient's weight with self-care probability were statistically significant. These socio-demographics and clinical indicators significantly influenced each category of self-care practices.

Conclusion: Socio-demographic and clinical factors played a decisive role in the healthcare practices among type-2 diabetes patients. Monthly household income, patient's choice of private or public hospital for treatment, and patient's weight influenced different levels of self-care practices. Income had a negative contribution in poor and fair self-care levels of practices, whereas it had a positive role in average and good self-care levels of practices.

Keywords: type 2 diabetes; self-care practices; socio-economic factors; developing country

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1. Introduction

Worldwide, diabetes is a chronic disease affecting 450 million people [1]. The global prevalence of diabetes among adults over 18 years of age was 8.5% in 2014 [2]. In 2015, complications related to diabetes resulted in 1.5 million deaths worldwide, and high blood glucose was the cause of another 2.2 million deaths in 2012 [3]. Diabetes prevalence has been rising more rapidly in middle- and low-income countries and has emerged as the seventh highest cause of death in such countries [4]. The prevalence rate of diabetes in Pakistan is 9.8%, with the disease affecting males (10.0%) and females (9.7%) nearly equally [5]. In 2017, there were 7,474,000 cases of diabetes in Pakistan [1].

Pakistan has a high prevalence of diabetes and is expected to experience further rises in the disease with advancing urbanization and associated factors of unhealthy lifestyles, genetic predisposition, maternal and fetal malnutrition, reduced physical activity, obesity, increased caloric intake and increased smoking rates [6–8]. In addition, management of diabetes and its risk factors remains suboptimal in Pakistan [9, 10]. In 2016, complications related to diabetes were responsible for 7,210 male and 9,180 female deaths among persons aged 30–69 years and 9,560 male and 12,800 female deaths among persons aged 70 years and older [11].

Diabetes is not a curable disease, but it is controllable; however, if the disease is not controlled, it can lead to poor health, multiple systematic complications and premature death [11]. Appropriate self-care practices are critical if individuals with the condition are to minimize their risk of diabetes complications and ensure improved overall health outcomes irrespective of the type of diabetes [12]. These self-care practices relate to age, gender, marital status, education, rural background, family system and socio-economic status among persons with diabetes [13–16]. Socio-demographics, patient knowledge and culture have a vital effect on the disease outcomes [17]. Moreover, clinical factors also affect the self-care management among diabetes patients, including glycated hemoglobin levels, treatment received according to the type of diabetes, proper compliance to medication, proper follow-up visits to diabetes clinics and presence of risk factors [18].

Both the immediate and life-long impact of diabetes represents a significant burden for healthcare settings. In Pakistan, current health expenditure per capita is US \$37, which is below the WHO recommended standard of US \$44; as a result, a number of ill persons struggle to accomplish healthy outcomes through the internationally recommended lifestyle modifications [19]. Given the rapidly increasing prevalence of diabetes in Pakistan, a focus on treatment is crucial. Unfortunately, only 58% of Pakistani

citizens have an education level of 10 years and above [19]. Indeed, diabetes is a chronic disease for which self-care and socio-demographic and clinical factors must be addressed. Therefore, the objectives of this study were to assess the self-care practices among diabetic patients, determine the probability of self-care among the target patients by socio-economic and clinical factors and quantify the marginal effects of these independent variables on different self-care practices among diabetic patients.

2. Methods

2.1. Ethical approval

The survey was approved by the Ethical Review Committee, Hussain College of Health Sciences/Hussain Memorial Hospital, Lahore (No. HCSC/18/ERC/105). All patients in the study provided written informed consent.

2.2. Study design and setting

This exploratory study was conducted between April and June 2018 at the Hussain Memorial Hospital pharmacy and a branch of Clinix Pharmacy, Lahore, Pakistan. Moreover, this study protocol adhered to international ethical guidelines for health-related research involving humans [18].

2.3. Inclusion/exclusion criteria

Inclusion criteria consisted of individuals who were 18 years of age or older, diagnosed with type 2 diabetes at least three years prior at the time of interview and able to provide informed consent. Patients who were unable to understand and speak English, Urdu, Saraiki or Punjabi were excluded from the study.

2.4. Sample size and sampling technique

All patients who fulfilled the inclusion criteria during the study period were included in the study using a purposive sampling technique.

2.5. Study instrument development

The multi-disciplinary team of authors developed a semi-structured questionnaire based on literature [20, 21]. The questionnaire was validated in two steps. First, the questionnaire was sent to a diabetes and endocrinology consultant of a private hospital situated in Lahore, who provided his expert opinion on the elements of the instrument with respect to importance, simplicity and relativity. Second, the survey instrument was pre-tested with 10 diabetic patients to assess presentation, acceptability and ease of understanding of the questions. According to feedback, the questionnaire was slightly modified prior to use.

2.6. Data collection

The instrument was consisted of three parts:

Demographic Characteristics: Eight survey items assessed demographic information of the target patients. Respondents were asked to describe their age in years (below 21, 21–30, 31–40, 41–50, 51 and above), gender (male, female), highest level of education (illiterate, literate with no formal education, high school/10th standard, intermediate/12th standard, graduate, post graduate/doctorate), marital status (married, unmarried), monthly household income in Pakistani Rupees (10,000–20,000, 20,001–30,000, 30,001–40,000, 40,001–50,000, above 50,000), patient family system (joint family system, nuclear family system), rural background of the patient (yes, no) and preferable patient care center (government hospitals, private hospitals, private clinics).

Medical Characteristics: Two open-ended questions assessed the medical characteristics of the patients: duration of diabetes mellitus in years and patient weight in kilograms.

Variables to Measure the Self-Care Practices of Diabetic Patients: Three survey items were included in the questionnaire to compute the self-care practices of diabetic patients by adding binary variables of regular exercise (yes = 1, otherwise 0), cereal foods intake (yes = 1, otherwise 0) and regular self-diabetes check at home (yes = 1, otherwise 0).

2.7. Statistical analysis

Descriptive statistics were rendered for the key variables by estimating frequencies, percentages and measures of central tendencies.

Econometric Model: An ordered probit model was used to analyze the different self-care practices among diabetic patients. This model accounted for interdependencies among explanatory variables, marginal effects and statistical significance of variables to demonstrate the comparative degrees to which different factors and combinations of factors account for the different levels of self-care practices of diabetic patients.

A set of demographic and medical indicators was chosen as explanatory variables, including age, gender, marital status of the diabetic patients, household income, dummy of rural background of patients (rural area = 1, otherwise 0), patient's family system (joint family = 1, otherwise 0), duration of diabetes mellitus (in years), patient's weight (in kilograms), duration of diabetes in other family members (in years), dummy of private hospital treatment (yes = 1, otherwise 0), dummy of private clinic treatment (yes = 1, otherwise 0), dummy of government hospital treatment (yes = 1, otherwise 0), which were denoted by X_1 , X_2 , X_3 , X_4 , X_5 , X_6 , X_7 , X_8 , X_9 , X_{10} , and X_{11} , respectively. Different self-care practices of diabetic patients were taken as the dependent variable (Y) that showed different self-care practices. The levels of self-care were scored as the following: poor self-care practices = 0, fair self-care practices = 1, average self-care practices = 2 and good self-care practices = 3. Self-care practices were computed by adding dummy variables of regular exercise (yes = 1, otherwise 0) cereal foods intake (yes = 1, otherwise 0) and regular self-diabetes check (yes = 1, otherwise 0) at home.

Stata 10 (StataCorp LLC Texas, USA) was employed to render econometric analysis to achieve the results of the study.

3. Results

Table 1 shows that 64.5% of the diabetic patients were females. Fifty-five per cent of patients were 41–50 years of age, followed by 31–40 years (34.5%), 51 years and above (7.5%), 21–30 years (2.5%) and below 21 years (0.5%). Sixty-five per cent of patients were married, and 74% patients were living in joint family systems. Fifty-six per cent of patients' families had rural backgrounds, and patients had been suffering from diabetes for 7.46 years on average ($SD = 2.75$) at the time of data collection.

Table 2 shows the ordered probit regression results, which describe the impact of independent variables on the probability of self-care practice levels. There were insignificant relationships of demographic indicators, including age, gender, marital status, rural background of patients and family system, with the probabilistic change in self-care practices among diabetic patients. Income was statistically significant at the highest level (less than 1%) and positively affected the probability of self-care practices

TABLE 1: Demographic/clinical characteristics of diabetes patients [N = 200].

Variable		Frequency	Percent [%]	Mean	Standard Deviation
Age [in years]	Below 21	1	0.5	–	–
	21 – 30	5	2.5	–	–
	31 – 40	69	34.5	–	–
	41 – 50	110	55	–	–
	51 and above	15	7.5	–	–
Gender	Male	71	35.5	–	–
	Female	129	64.5	–	–
Marital status	Unmarried	71	35.5	–	–
	Married	129	64.5	–	–
Educational qualification [in years]	Illiterate	51	25.5	–	–
	Literate with no formal education	37	18.5	–	–
	High school / 10th standard	41	20.5	–	–
	Intermediate / 12th Standard	40	20	–	–
	Graduate	21	10.5	–	–
Household income [in Rs.]	Post Graduate / Doctorate	10	5	–	–
	10,000 – 20,000	5	2.5	–	–
	20,001 – 30,000	21	10.5	–	–
	30,001 – 40,000	53	26.5	–	–
	40,001 – 50,000	51	25.5	–	–
Patient family system	Nuclear Family System	52	26	–	–
	Joint Family System	148	74	–	–
Rural background of patient	–	111	55.5	–	–
Preferable patient care center	Government Hospital	70	35	–	–
	Private Hospital	84	42	–	–
	Private Clinic	46	23	–	–
Duration of diabetes mellitus [in years]	–	–	–	7.46	2.75
Patient weight [in kilograms]	–	–	–	71.63	14.66

among the diabetic patients. Specifically, a rise in income by one Pakistani Rupee (PKR) increased the probability of self-care practices by 0.23%.

TABLE 2: Probability of self-care practices change due to demographic and medical factors [$N = 200$] using [statistical procedure].

Indicators	Coefficient	Standard Error	P-value	95% Confidence Interval	
Age	0.06	0.12	0.611	-0.17217	0.29307
Gender	0.31	0.33	0.344	-0.33203	0.95190
Dummy-marital status	-0.27	0.32	0.405	-0.91055	0.36740
Household income	0.23	0.07	0.001	0.10398	0.39458
Rural background of patient	0.18	0.16	0.265	-0.13575	0.49301
Family system	0.05	0.18	0.760	-0.29609	0.40520
Duration of diabetes mellitus	-0.05	0.03	0.057	-0.11131	0.00167
Patient's weight	0.01	0.01	0.048	0.00010	0.02143
Duration of diabetes to other family members	0.03	0.14	0.818	-0.24415	0.30911
Dummy-private hospital treatment	0.50	0.18	0.006	0.14635	0.85385
Dummy-private clinic treatment	0.18	0.21	0.395	-0.23754	0.60244

LR χ^2 [11] = 25.62; Prob > χ^2 = 0.0074; and Pseudo R^2 = 0.0500

Table 2 also shows the impact of clinical attributes of the diabetic patients on the probability of change in self-care practices. The relationships of diabetes of other family members ($p = 0.818$) and dummy of patient's choice of private clinic for treatment compared with public sector hospitals ($p = 0.395$) with self-care practices were statistically insignificant, and the relationship of duration of diabetes with self-care practices ($p = 0.057$) was near to significant. In contrast, household income ($p = 0.001$), patient's weight ($p = 0.048$) and dummy of patient's choice of private hospitals for treatment compared with public sector hospitals ($p = 0.006$) with the probability of change in self-care practices were statistically significant. Moreover, there was a negative relationship between duration of diabetes and probability of self-care practices (*coefficient* = -0.05), which showed that an increase of one year in the duration of diabetes resulted in a decline of 0.05% in the probability of self-care practices by the targeted patients. On the other hand, there was a positive relationship between patient's body weight and probability of self-care practices (*coefficient* = 0.01) by the patients, which was witnessed as significant at 5%.

Table 2 further shows that a rise of self-care practices by approximately 0.01% augments the probability of an increase in the patient's body weight by approximately 1 kg. Regression analysis used the dummy of patients' choice of private clinic and private hospitals for treatment reference to public sector hospitals. Patients who visited

private hospitals had a higher probability of self-care practices as compared with the patients seeking treatment from public sector hospitals. Furthermore, the regression model showed acceptable goodness of fit and was statistically significant as per given values of probability of chi square ($\text{Prob} > \chi^2 = 0.0074$).

TABLE 3: Marginal effects of predictors on different self-care practices of diabetic patients [$N = 200$].

Indicators	dy/dx	S. Error	Z	P-value	95% Confidence Interval	
<i>Poor self-care practices of diabetic patients</i>						
Age	-0.0143	0.0281	-0.51	0.611	-0.06930	0.04072
Gender	-0.0767	0.0848	-0.90	0.366	-0.24286	0.08948
Dummy-marital status	0.0616	0.0710	0.87	0.386	-0.07761	0.20076
Household income	-0.0589	0.0182	-3.24	0.001	-0.09462	-0.02323
Rural background of patient	-0.0426	0.0387	-1.10	0.271	-0.11856	0.03330
Family system	-0.0131	0.0434	-0.30	0.764	-0.09819	0.07206
Duration of diabetes mellitus	0.0130	0.0069	1.88	0.060	-0.00054	0.02645
Patient's weight	0.0025	0.0013	-1.95	0.051	71.60800	0.00001
Duration of diabetes to other family members	76774	0.0334	0.23	0.818	-0.07310	0.05775
Dummy-private hospital treatment	-0.1133	0.0403	-2.81	0.005	-0.19228	-0.03442
Dummy-private clinic treatment	-0.0410	0.0457	-0.90	0.370	-0.13053	0.04858
<i>Fair self-care practices of diabetic patients</i>						
Age	-0.0097	0.0192	-0.51	0.612	-0.04747	0.02797
Gender	-0.0464	0.0456	-1.02	0.309	-0.13576	0.04298
Dummy-marital status	0.0457	0.0571	0.80	0.424	-0.06626	0.15758
Household income	-0.0402	0.0141	-2.85	0.004	-0.06785	-0.01257
Rural background of patient	-0.0284	0.0256	-1.11	0.268	-0.07852	0.02181
Family system	-0.0086	0.0279	-0.31	0.756	-0.06328	0.04599
Duration of diabetes mellitus	0.0088	0.0049	1.79	0.074	-0.00085	0.01853
Patient's weight	-0.0017	0.0009	-1.86	0.063	-0.00357	0.00009
Duration of diabetes to other family members	-0.0052	0.0228	-0.23	0.818	-0.04987	0.03940
Dummy-private hospital treatment	-0.0827	0.0333	-2.49	0.013	-0.14788	-0.01747
Dummy-private clinic treatment	-0.0311	0.0387	-0.80	0.422	-0.10700	0.04478
<i>Average self-care practices of diabetic patients</i>						
Age	0.0126	0.0249	0.51	0.612	-0.03611	0.06136
Gender	0.0677	0.0745	0.91	0.364	-0.07838	0.21377
Dummy-marital status	-0.0534	0.0602	-0.89	0.375	-0.17126	0.06455
Household income	0.0521	0.0176	2.95	0.003	0.01751	0.08663
Rural background of patient	0.0376	0.0345	1.09	0.276	-0.03003	0.10530
Family system	0.0116	0.0386	0.30	0.764	-0.06406	0.08721
Duration of diabetes mellitus	-0.0115	0.0063	-1.82	0.069	-0.02380	0.00090

Indicators	dy/dx	S. Error	Z	P-value	95% Confidence Interval	
Patient's weight	0.0022	0.0012	1.89	0.059	-0.00009	0.00459
Duration of diabetes to other family members	0.0068	0.0295	0.23	0.818	-0.05103	0.06460
Dummy-private hospital treatment	0.0964	0.0352	2.74	0.006	0.02733	0.16545
Dummy-private clinic treatment	0.0126	0.0249	0.51	0.612	-0.03611	0.06136
<i>Good self-care practices of diabetic patients</i>						
Age	0.0114	0.0225	0.51	0.611	-0.03259	0.05541
Gender	0.0554	0.0558	0.99	0.321	-0.05395	0.16473
Dummy-marital status	-0.0539	0.0681	-0.79	0.429	-0.18737	0.07962
Household income	0.0471	0.0149	3.15	0.002	0.01781	0.07631
Rural background of patient	0.0334	0.0298	1.12	0.264	-0.02514	0.09185
Family system	0.0101	0.0327	0.31	0.757	-0.05399	0.07426
Duration of diabetes mellitus	-0.0103	0.0056	-1.86	0.063	-0.02125	0.00055
Patient's weight	0.0020	0.0011	1.93	0.054	-0.00003	0.00410
Duration of diabetes mellitus to other family members	0.0137	0.0267	0.23	0.818	-0.04612	0.05838
Dummy-private hospital treatment	0.0996	0.0392	2.54	0.011	0.02283	0.17644
Dummy-private clinic treatment	0.0365	0.0455	0.80	0.422	0.05267	0.12576

Table 3 shows the marginal effects of different independent variables on the individual self-care levels of the target patients. It showed that household income ($p = 0.001$) and dummy of patient's choice of private hospitals for treatment compared with public sector hospitals ($p = 0.005$) were significantly influencing each category of the patients with poor self-care practices. Income had a negative contribution in poor ($dy/dx = -0.0589$, $Z = -3.24$) and fair ($dy/dx = -0.0402$, $Z = -2.85$) self-care level of practices, whereas it had a positive role in average ($dy/dx = 0.0521$, $Z = 2.95$) and good ($dy/dx = 0.0471$, $Z = -0.79$) self-care levels of practices. Table 3 further shows the marginal effects of different independent variables on the fair, average and good self-care practices of diabetic patients.

4. Discussion

The results of our study showed that household income was the only socio-economic indicator that was statistically significant and positively affected the probability of self-care practices among diabetic patients. Additionally, patient's choice of hospital for treatment and clinical factors, including duration of diabetes, as well as patients' weight all showed a statistically significant relationship with self-care probability. Moreover, household income, duration of diabetes, body weight of the patients and patient's choice

of private hospitals for treatment in comparison to public sector hospitals significantly influenced each category of self-care practices exercised by the patients. Income had a negative contribution in poor and fair self-care practices, whereas it positively affected average and good self-care practices.

The results of our study were consistent with previous studies that showed a positive and significant relationship between probability of self-care practices and household income [22–24]. The economic foundation of health and self-care practices (i.e. monthly household income) conforms to Maslow's hierarchy of needs that places meeting basic physiological needs ahead of the pursuit of higher-level health needs [23]. Therefore, patients with higher income might have better self-care health practices owing to better education, access to healthcare resources, economic capacity to develop their own way of life actively and nutritive diets [23, 25]. Conversely, the self-reported poor self-care practices of low-income patients might be due to low-education and a high dependency on the household breadwinner with their main consumption focused on clothing, food and other physiological needs, which leads them to pay less attention to their health [22, 23].

Although patients have reported low quality of services and longer wait times in public hospitals for appointments, treatment and follow-up, these disadvantages did not lead them to distrust public hospitals [26]. On the other hand, patients who provided positive feedback related to shorter wait times and higher quality of healthcare services in private hospitals generally indicated a distrust of public hospitals [26]. These results were consistent with a previous study conducted in Lahore, which showed that private hospitals were delivering better quality of services to their patients as compared to public hospitals [27]. However, contradictory results from a study conducted in Islamabad indicated that patients felt public hospitals were providing better services concerning lethal diseases, such as diabetes, when compared with private hospitals [28].

In the systematic review by Xiaoping et al., although many studies found that patients with longer duration of disease managed diabetes better [29], this was not supported by others [29, 30]. It is an established fact that diabetes can be controlled by taking various cautionary measures but is not curable. The reason behind this negative relationship might be due to the persistency and chronicity of diabetes [31]. Owing to longer duration of diabetes, patients might become frustrated and relax their cautionary attitude towards self-care practices [31]. Moreover, a previous study also showed that patients with chronic type 2 diabetes who administered insulin as part of their good self-care practices were more likely to gain weight [32].

Generally, the intelligent quotient and decision power of two people is thought to be higher when compared with an individual [34]. Thus, married people may have better level of self-care practices as compared with those who are single. As far as self-care practices and gender nexus is concerned, the probability of good self-care practices is expected to be higher in males compared with females. As Pakistani society is male-centric with relatively high education and free mobility afforded to males only, they might have better opportunities to interact with various community members, understand, learn and practice good self-care [34]. It might be the reason for better self-care levels of male patients than their women counterparts. A previous study showed significant relationship between socio-economic indicators including age, gender and marital status with different levels of self-care practices [29]. However, the results of our study showed contradictory results in line with the results of previous studies regarding age [22]. Another study showed that there was no significant relationship between quality of life of diabetic patients and their age, gender and marital status [24].

The strengths of this study include its use of well-validated measures of different levels of self-care practices to cope with diabetes. Another strength is using the interview method for data collection, which is a more appropriate method compared with self-completion of a questionnaire method due to the low literacy level of the participants. However, the limitations of this study include the cross-sectional nature of the study, which makes us cautious about causal relations. This study may be supplemented in the future with larger-scale surveys to strengthen the conclusions drawn about the socio-economic and clinical factors influencing self-care practices of diabetic patients.

5. Conclusion

In conclusion, socio-demographics and clinical indicators, including monthly household income, patient's choice of private hospitals for treatment in comparison to public sector hospitals and patient's weight, influence different levels of self-care practices among diabetic patients. Briefly, socio-demographic and clinical indicators played a decisive role in the health and self-management among type 2 diabetes patients. Income had a negative contribution in poor and fair self-care levels of practices, whereas it had a positive role in average and good self-care levels of practices.

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