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ORIGINAL ARTICLE

Self-care practices and barriers to compliance among patients with diabetes in a community in rural Bangladesh

Lana Vanderlee[1] · Shahnawaz Ahmed[2] · Farzana Ferdous[3] · Fahmida Dil Farzana[2] · Sumon Kumar das[2,4] · Tahmeed Ahmed[2] · David Hammond[1] · Abu Syed Golam Faruque[2]

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Abstract Diabetes is an emerging health threat in Bangladesh. The study objectives were to evaluate self-management practices among a population with diabetes in rural Bangladesh and to identify barriers to complying with prescriptions for diet, physical activity and drug use. In this cross-sectional study, 220 patients with diabetes were recruited from logs of diabetes clinics in Mirzapur, Bangladesh. Participants were asked about self-care practices and health complications and comorbidities associated with diabetes. Participants were also asked about treatments costs, barriers to diabetes treatment and socio-demographic characteristics. Almost half of the participants (49 %) were taking oral hypoglycemic agents (OHA), and 47 % were taking a combination of OHA and insulin; however, 30 % of those using insulin were not confident in their ability to self-administer the medication. The majority of participants (86 %) had complications that they attributed to diabetes, including vision impairments, poor wound healing and dizziness. The median monthly cost of diabetes maintenance was 725 taka (~US$9), approximately 8 % of the median monthly income. Common barriers to treatment included the high cost of medication, access and proximity to services, and feeling unwell as a result of prescribed treatments. Although the vast majority of participants managed their diabetes using OHA and insulin, there were common barriers that prevented patients with diabetes from complying with doctor's recommendations for diabetes management. Given the high incidence of self-reported diabetic complications among this population, addressing these barriers may improve self-care practices and overall quality of life among those with diabetes in rural areas in Bangladesh.

Keywords Diabetes mellitus · Diabetes complications · Self-care · Cost of illness · Bangladesh

✉ Abu Syed Golam Faruque
gfaruque@icddrb.org

[1] School of Public Health and Health Systems, University of Waterloo, Waterloo, Canada

[2] Nutrition and Clinical Services Division (NCSD), International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b), 68 Shaheed Tajuddin Ahmed Sarani, Mohakhali, Dhaka 1212, Bangladesh

[3] Graduate School of Comprehensive Human Sciences, University of Tsukuba, Tsukuba, Japan

[4] School of Public Health, The University of Queensland, Brisbane, Australia

Introduction

Diabetes is ranked ninth in the world as a leading cause of death [1]. Although previously regarded as a condition predominantly affecting high-income countries, the burden of diabetes has now transitioned to many low- and middle-income countries, with particularly high rates among Asian populations [2]. In Bangladesh, diabetes is considered an emerging health threat, with an estimated overall prevalence of 7 % among the general population ranging from 5 % in rural areas to 10 % in urban areas, which has almost doubled over the past decades [3]. The prevalence of those 'at risk' of diabetes with impaired fasting glucose or impaired glucose tolerance is also high, estimated at 7 and 8 %, respectively [3].

Proper management can decrease the risk of diabetes-associated complications and comorbidities, with implications for both the economical and psychological burden of the condition and overall quality of life [4]. Self-care practices are essential to increase the likelihood of maintaining appropriate blood glucose, lipid levels and insulin sensitivity, in order to

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control or reduce the likelihood of developing complications associated with diabetes, including neuropathy, nephropathy, retinopathy and cardiovascular disease [5, 6]. The extent to which patients with diabetes are able to follow this advice in Bangladesh is not well described in the literature. In a study sampling Asian countries including Bangladesh, overall glycemic control was 'poor' in more than half of the study sample, and poor glycemic control was associated with increased microvascular complications [7]. Additional research found that approximately 90 % of patients with diabetes in urban clinics did not test their blood sugar levels regularly [8].

The objectives of the present study were to evaluate the self-care practices and frequency and type of clinical management among a population of individuals with diabetes in rural Bangladesh and to identify potential barriers in adhering to prescribed recommendations for diet, physical activity and drug use.

Methods

Sample description

Participants were recruited from the Mirzapur sub-district in the Tangail district of Bangladesh, located approximately 60 km north-west of the capital city Dhaka. All participants were members of a previously established pool of individuals (N = 255,000) from the Demographic Surveillance System (DSS), maintained by the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b). Data collection took place in March, 2013.

Study patients were identified through registers of all patients with diabetes who had attended the Kumudini Hospital outpatient clinic or the clinic of the Diabetic Association of Bangladesh (DAB) in Mirzapur in 2012. This list was then cross-referenced with DSS participants, to obtain contact information for these individuals. Participants were recruited via telephone or in-person home visits by research staff from icddr,b. Interviews were conducted at Kumudini Women's Medical College and Hospital, a tertiary-level hospital serving the Mirzapur sub-district and adjacent sub-districts.

Participants were considered eligible for the study if they were over 18 years of age, had been diagnosed with diabetes by a physician and were enrolled in the DSS. Pregnant or lactating women and seriously ill or bed-ridden individuals were excluded.

A total of 309 individuals were identified from registers, and the final sample size was 220. The recruitment has been described in detail in Fig. 1. According to response rate no. 1 of the American Association for Public Opinion Research, there was a response rate of 72.6 % [9].

Study protocol

Interviews were approximately 1 h in length and were conducted in Bengali by local, trained field research assistants from icddr,b. Interviews were conducted in an office on the hospital grounds, and information was recorded using a pen and paper. Take-home medical records from the DAB clinic were available for all participants and were reviewed by a medical doctor (co-author SA). During recruitment, participants were requested to bring their recent available medical records. Ethics approval was provided by the University of Waterloo Office of Research Ethics and the Research Review Committee and Ethical Review Committee of icddr,b.

Measures

Information on individual and household demographics was collected. Measures of socioeconomic status included monthly household income and information on personal assets to assess wealth quintiles (homestead land, cultivable land, household assets, livestock assets, as well as building materials of the house).

Self-care practices

Participants were asked if they had type 1 or type 2 diabetes, and medical records were checked to identify diagnosis of diabetes type. A series of questions examined when participants were diagnosed with diabetes, what treatments they were currently receiving or had received in the past for diabetes, and if they had ever been prescribed various behavioural treatments or used any traditional remedies to control diabetes. Ownership of a glucometer and frequency of testing blood sugar or urine at home were also examined. Recent medical records provided by patients were reviewed to collect data on recently performed diagnostic tests for diabetes, when available.

Health-related measures

Participants were asked to self-report if they had been diagnosed with a number of common comorbidities (heart disease, stroke, hypertension, hypercholesterolemia, cancer, kidney disease, depression, and an open-ended response for other comorbidities) and had experienced a number of health effects known to be complications of diabetes (dizziness/fainting/glucose shock, blindness or vision problems, foot problems/ulcers, swelling/edema, kidney problems, heart problems, stroke, poor wound healing, amputation of limbs, and an open-ended response for other complications). Weight was measured with light clothing and shoes removed, to the

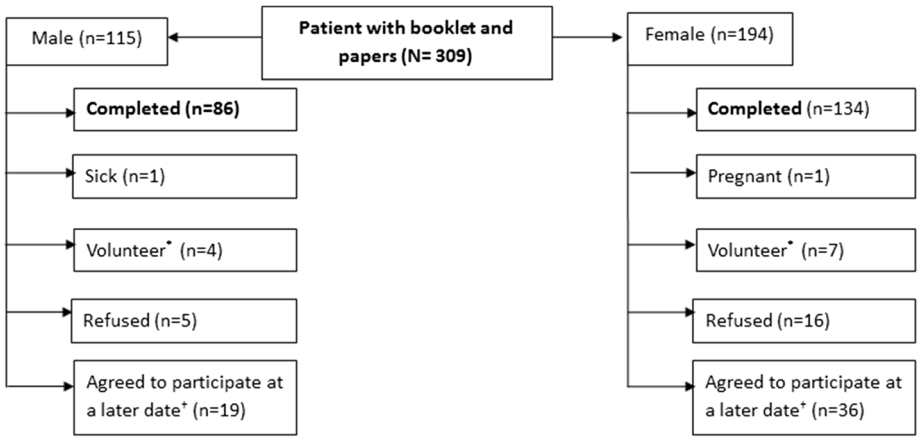

Fig. 1 Sample recruitment flow chart. *Asterisk* indicates that the participant was not contacted by the study staff, but heard of the study through word of mouth and asked to participate. The *cross* indicates that the participant agreed to be contacted at a later date, and the study was completed before re-contact occurred

*Volunteer = participant was not contacted by the study staff, but heard of the study through word of mouth and asked to participate.
† Agreed to participate at a later date = participant agreed to be contacted at a later date, and the study was completed before re-contact occurred.

nearest 100 g using a digital scale (TANITA, HD-308). Height was measured with shoes removed, standing straight with heels together using locally produced wooden height scales with 0.1 cm precision. Body mass index (BMI) was categorized using the World Health Organization cut-offs (underweight, BMI <18.5 kg/m^2; normal, 18.5–24.9 kg/m^2; overweight, 25.0–29.9 kg/m^2; obese ≥30.0 kg/m^2) and further categorized into a binary measure of BMI < 25.0 kg/m^2 and BMI of 25.0 kg/m^2 or greater [10]. Waist circumference (WC) was measured at a level midway between the lower rib margin and iliac crest in the midaxillary line, taking the measurement at the end of expiration while the participant was standing. Hip circumference (HC) was measured at the widest part of the hip across both greater trochanters. 'Central obesity' was defined using the International Diabetes Foundation (IDF) cut-off points for South Asian populations (>90 cm WC for men, >80 cm for women) and waist-to-hip ratio (WHR) cut-off points of 0.90 for men and 0.85 for women [11].

Adherence and barriers to compliance

Treatment-seeking behaviours and self-reported compliance to physician advice were also assessed. Participants were asked if they had visited a health clinic in the previous month; open-ended questions about barriers to clinic use; how often they are able to follow their doctor's recommendations for drugs and insulin, diet, and physical activity; and open-ended questions regarding what barriers they face in following these recommendations.

Cost of illness

An estimated cost of illness over the previous 30 days was also adapted from the DSS survey [12]. Participants were asked to estimate their out-of-pocket expenses in the past 30 days for the following: pharmacy expenses/drugs (including insulin, oral medication, glucose strips, etc); traditional healer/village doctor; visit to a license practitioner/private doctor; visit to the DAB clinic (excluding lab and diagnostic fees); medicine bought at a shop/market; hospital admission fees (excluding lab and diagnostic fees); lab and diagnostic fees; food and diet during clinic or hospital visits; transportation to and from the clinic/hospital; food during the clinic/hospital visits; and any other fees relating to management or care for their diabetes or related complications.

Analysis

Descriptive statistics were used to describe sample attributes. When distributions of variables were skewed, median and ranges were provided. Statistically significant differences in proportions were determined using chi-square tests. Analyses were conducted using SPSS v. 22 (Armonk, NY), and results were considered statistically significant at $p < 0.05$.

Results

Sample characteristics can be found in Table 1. The sample was composed of more women than men (61 vs. 39 %).

The average age of diagnosis of diabetes was 43.4 years (SD = 11.5 years), and the average duration of diabetes was 5.9 years (SD = 5.2 years). Of the sample, 1 % reported that they had type 1 diabetes, 11 % reported that they had type 2 diabetes and 88 % did not know which type of diabetes they had and that information was not available in the medical records. Overall, 86 % (n = 189) of participants reported at least

Table 1 Sample characteristics

	Overall (n = 220)	Male (n = 86)	Female (n = 134)	X^2 or t test	p value
Age, mean (SD)	49.3 years (11.9)	52.6 years (13.1)	47.2 years (10.6)	3.3	0.005
Religion, % (n)					
Muslim	80 (177)	70 (60)	87 (117)	10.3	<0.001
Hindu/other	20 (43)	30 (26)	13 (17)		
Education, % (n)					
Illiterate/no education	31 (67)	14 (12)	41 (55)	51.2	<0.001
Primary school (1–5 years)	27 (59)	16 (14)	34 (45)		
Secondary school (6–12 years)	28 (62)	38 (33)	22 (29)		
Graduate or more	14 (32)	31 (27)	4 (5)		
Occupation, % (n)					
Homemaker	56 (123)	0 (0)	92 (123)	184.9	<0.001
Business	16 (36)	41 (35)	1 (1)		
Retired	7 (15)	16 (14)	1 (1)		
Office non-executive	6 (14)	11 (9)	4 (5)		
Farmer	5 (11)	13 (11)	0 (0)		
Other	10 (21)	20 (17)	3 (4)		
Income (median) (BD taka) (US$)	(~$139)	(~$181)	(~$139)		
Number of people in household, % (n)					
4 or less	51 (111)	49 (42)	52 (69)	0.15	0.7
5 or more	49 (109)	51 (44)	49 (65)		
BMI, % (n)					
BMI <18.5	6 (13)	11 (9)	3 (4)	8.3	0.04
BMI 18.5–24.9	64 (140)	63 (54)	64 (86)		
BMI 25.0–29.9	28 (62)	27 (23)	29 (39)		
BMI 30+	2 (5)	0 (0)	4 (5)		
WHR, mean (SD)	92.1 (0.078)	94.9 (0.076)	90.3 (0.073)	4.5	0.001
At risk, % (n)[a]	81 (178)	80 (69)	81 (109)	0.042	0.838
Waist circumference, mean (SD)	86.0 cm (9.4)	88.2 cm (9.0)	84.7 cm (9.4)	2.7	0.53
At risk, % (n)[b]	59 (130)	47 (40)	67 (90)	9.2	0.002

[a] Waist–hip ratio greater than 90 for men and 85 for women

[b] Waist circumference greater than 90 cm for male and 80 cm for women

one health effect known to be a complication of diabetes. A breakdown of self-reported complications and comorbidities can be found in Table 2. The most commonly reported health effect was vision impairments such as blurring, dim vision or blindness (66 %), followed by poor wound healing (29 %) and dizziness (28 %). Sexual dysfunction was reported among 13 % of men (5 % of the entire sample). In examining comorbidities, hypertension was most commonly self-reported in 45 % of participants, followed by heart disease and depression (19 and 16 %, respectively).

See Table 1 for full details on anthropometric measures. Of the entire sample, 30 % were 'overweight' or 'obese' with a BMI of 25 kg/m^2 or greater; the average BMI was 23.6 kg/m^2 (SD 3.3). The average WHR was 94.9 (SD 0.076) among men and 90.3 among women (SD 0.073). For men, 80 % had a WHR greater than 0.90 and for women 81 % had a WHR greater than 0.85, the respective cut-offs indicating central obesity for this population.

Self-care and diabetes management

The most commonly prescribed treatment was the use of both insulin and oral hypoglycaemic agents (OHA) (49 %), followed by use of OHA only (47 %), only insulin therapy (4 %) and no treatment prescribed (0.5 %). Of the 53 % of the sample that had been prescribed insulin for their diabetes (n = 116), only 64 % (n = 74) expressed that they felt confident that they could properly administer insulin. Among the OHA that patients were taking, metformin hydrochloride was the most commonly prescribed, followed by gliclazide and pioglitazone, either alone or as combination therapy. Of the entire sample, few participants were using alternative methods of treatment such as visiting a traditional healer (10 %) or using traditional remedies (6 %) to treat their diabetes. Overall, 90 % had been prescribed a special diet for their diabetes and 89 % had been prescribed physical activity, while 36 % had been advised to lose weight.

Table 2 Prevalence of self-reported complications and comorbidities

	Number	Percentage
Complications		
Vision impairments	145	66
Poor wound healing	63	29
Dizziness/glucose shock	61	28
Foot problems	42	19
Swelling/edema in legs	42	19
Sexual dysfunction	11	5
Kidney problems	8	4
Other complications	37	17
Comorbidities		
Hypertension	99	45
Heart disease	41	19
Depression	35	16
Hypercholesterolemia	33	15
Stroke	24	11
Kidney disease	7	3

Multiple responses were permitted for complications and comorbidities

Overall, 11 % of the sample owned glucometers, for whom the median glucose self-monitoring frequency was 12 times per year, ranging from 4 to 156 times; 2 % of the sample reported testing their urine at home at least once in the previous year.

Medical records were reviewed from all but one participant to examine medical tests each patient had undergone. The most commonly available test result was blood glucose measures 2 h post-breakfast, available from 86 % of participants, followed by 63 % with records for fasting plasma glucose, 19 % with records for random glucose tests and 13 % with records for serum creatinine levels. Measures of HbA1c were only available from 3 % of patients. Other measures were available for less than 10 % of the sample.

Clinic visits and barriers to visiting clinics

Participants visited the diabetes clinic on average six times per year. The average trip to the nearest clinic for diabetes treatment was approximately 1 h (63 min), by walking in combination with various forms of public and private transport. The most commonly reported barriers to visiting a clinic were the high cost of tests and fees for clinic visits (28 %), being too busy or having to work during the hours the clinic was open (14 %), and distance from home or transportation problems in accessing the clinic (12 %). Other common barriers included not being able to visit the clinic alone and having no one to take them, as well as being too ill or unwell to visit.

Barriers to diabetes management

Participants were asked how often they are able to follow a doctors' advice for insulin or OHA treatment, diet and physical activity and what were things that made it difficult to follow those instructions. More than half (58 %) of the sample reported that they are always able to follow instructions from their doctor for insulin or medication, while 21 % could usually follow instructions and 21 % could sometimes or never follow the instructions. For prescribed medication, the most commonly cited barriers were cost of the drugs or treatment (18 %), the participants felt unwell after the prescribed behaviour (11 %), being too busy (7 %) and forgetting to take medication (6 %).

Of the entire sample, 39 % always followed the nutrition advice from their doctor, while 24 % usually followed this advice and 44 % sometimes or never followed that advice. Barriers to following advice for diet were that they did not like the diet or were still hungry after they ate the prescribed amount (26 %), they were too busy to prepare the appropriate meals (19 %), it was too expensive (14 %) and it made the participants feel unwell (10 %). For physical activity, 53 % of the sample reported that they always followed doctor's advice, 20 % usually followed this advice and 25 % sometimes or never followed recommendations for physical activity. Common barriers to meeting physical activity recommendations included being too busy or not having time (26 %), other health problems (18 %) and physical activity makes them feel unwell (12 %).

Cost of illness

Participants were asked about various costs associated with their illness in the previous 30 days. The median cost of participants was 725 taka (Tk—Bangladesh currency) (slightly less than US$10), ranging from no costs (among 26 participants) to a maximum of 16,200 Tk (slightly more than US$200) among only one participant. The most significant contributor to expenses was the cost of drugs and pharmaceuticals to manage diabetes, followed by the cost of lab and diagnostic fees while visiting clinics and then the cost of transportation to and from the clinic. Indirect costs of illness due to losses in earnings were apparent in 5 % of the sample, with a median of 1190 Tk (approximately US$15) for those participants.

Discussion

Self-management using OHA and insulin was very high. However, a third of participants reported that they were not confident in their ability to administer insulin adequately. The lack of this type of skill may contribute to non-compliance with doctor's recommendations for drug or insulin treatment

and may lead to poor glycaemic control. Few participants (<1 %) were prescribed only behavioural interventions, significantly less than a previous study of Asian countries including Bangladesh [7]. Given the cost barriers to some drug interventions, behavioural interventions may be an area that warrants further attention and greater emphasis in the rural Bangladeshi context.

The self-reported prevalence of complications among the study population was high, suggesting that blood glucose control may be poor among this population. This is consistent with recent research suggesting that awareness, treatment and control of diabetes among Bangladeshi adults is low [13]. The prevalence of vision complications was overwhelmingly high. There may be other contributors to these high rates, and this deserves further investigation. In this study, the prevalence of depression among patients with diabetes was 16 %, slightly lower than a previous study examining the prevalence of depression in a rural Bangladeshi population with diabetes [14]. The present study only accounted for self-reported depression as compared to a diagnosis of depression, which may lead to differences in these outcomes. Interestingly, the reported prevalence of sexual dysfunction was fairly high among men, even when this condition was not particularly probed by interviewers. Additionally, not all participants were gender-matched with interviewers, which may have led to decreased reporting among male participants and actual rates may be higher than this study reveals. The psychological effects of diabetes may significantly influence quality of life among this sample, and the prevalence and impact of both depression and sexual dysfunction deserve further study.

There were several barriers that were consistent across the various types of self-care. Not surprisingly, cost was the main barrier to accessing medication, similar to another study on barriers to diabetes management access in a low-income country [15]. This is also demonstrated in the cost-of-illness assessment, in which the median cost of illness per month was equivalent to 8 % of the median monthly income for families. However, the proportion of those who reported that cost was a barrier to accessing insulin was lower in this study than previous research in Bangladesh, perhaps due to our sampling frame, which included patients who access a clinic for diabetes treatment and who may have improved socioeconomic status [16]. Cost barriers may also contribute to fewer clinic visits and decreased access to tests, which can lead to decreased monitoring of diabetes management among those who do not test glycaemic levels at home. For example, HbA1c is the gold standard for diagnosing and monitoring diabetes according to the WHO and is recommended every 2 to 6 months in standard care by the IDF; however, it had only been measured in 3 % of participants in this study [17]. The high cost of the test (approximately 700 Tk or US$9 at the time of the study—personal communications) is likely a barrier to using this assessment method. These results are aligned with previous research which has highlighted the increasing financial hardship due to non-communicable disease in Bangladesh, with implications for coping strategies for health-care-related expenses [18].

Another significant barrier was lack of time to purchase and prepare healthy food and participate in physical activity. Increasing accessibility to healthy food and promoting physical activity that is easily accessible, such as brisk walking, may improve these behaviours and may be a mechanism to improve blood sugar levels beyond medicinal interventions.

Strengths and limitations

There were several limitations to the study, including the use of self-report data of complications and comorbidities of diabetes and the collection of clinical data from diabetic records. Additionally, the study only collected information from those who attended a diabetes clinic in the previous year, who may have better health behaviours or improved socioeconomic status than those who did not attend the clinic. Therefore, the current findings may be more favourable than the general population with diabetes, and the results may be less generalizable to the overall population living with diabetes in rural Bangladesh. The sample contained more women than men; however, this is consistent with some studies of the prevalence of diabetes among women and men in Bangladesh [19]. Strengths of the study include high response rates and the examination of diabetes medical records to identify services accessed.

Conclusions

Individuals with diabetes in rural areas of low-income countries face unique challenges to adhere to lifestyle and clinical requirements in order to follow prescribed self-care practices. Improving access to clinics and testing, increasing patient knowledge and confidence surrounding techniques to manage blood sugar levels and decreasing the cost of treatment may improve compliance and decrease complications and comorbidities among this population. Additional education or counselling sessions, through clinics or community health workers, may help to improve self-efficacy around self-care practices, with implications for glycaemic control and incidence of complications among this rural population [20].

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Authors' contributions The study was conceptualized by LV, ASGF, SKD and DH. Study design was developed equally by all authors. Data collection was conducted by LV, FF, FDF, SA and ASGF. Data analysis, interpretation and writing were primarily conducted by LV. All authors contributed to writing and editing this paper, and have read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest The authors declare that they have no competing interests.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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