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Editorial Board Member of *World Journal of Diabetes*, Sze M Ng, MBBS, FHEA, FRCPC, SFFMLM, MSc, LL.M, MBA, PhD, Associate Professor, University of Liverpool, Consultant Paediatric Endocrinologist, Southport & Ormskirk NHS, Ormskirk L39 2AZ, United Kingdom. may.ng@nhs.net

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The primary aim of *World Journal of Diabetes* (*WJD*, *World J Diabetes*) is to provide scholars and readers from various fields of diabetes with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJD mainly publishes articles reporting research results and findings obtained in the field of diabetes and covering a wide range of topics including risk factors for diabetes, diabetes complications, experimental diabetes mellitus, type 1 diabetes mellitus, type 2 diabetes mellitus, gestational diabetes, diabetic angiopathies, diabetic cardiomyopathies, diabetic coma, diabetic ketoacidosis, diabetic nephropathies, diabetic neuropathies, Donohue syndrome, fetal macrosomia, and prediabetic state.

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Basic Study

Medication adherence and quality of life among type-2 diabetes mellitus patients in India

Rakhi Mishra, Suresh K Sharma, Rajni Verma, Priyanka Kangra, Preeti Dahiya, Preeti Kumari, Priya Sahu, Priyanka Bhakar, Reena Kumawat, Ravinder Kaur, Ravinder Kaur, Ravi Kant

ORCID number: Rakhi Mishra 0000-0003-1400-8196; Suresh K Sharma 0000-0003-1214-8865; Rajni Verma 0000-0002-0475-3507; Priyanka Kangra 0000-0003-1926-5394; Preeti Dahiya 0000-0003-1261-8652; Preeti Kumari 0000-0001-5857-8698; Priya Sahu 0000-0001-8526-1119; Priyanka Bhakar 0000-0002-9910-658X; Reena Kumawat 0000-0002-5248-1817; Ravinder Kaur 0000-0003-4912-7371; Ravinder Kaur 0000-0002-9397-7472; Ravi Kant 0000-0003-1144-4478.

Author contributions: Mishra R, Sharma SK, Kant R designed and coordinated the study; Verma R, Kangra P, Dahiya P, Kumari P, Sahu P, Bhakar P, Kumawat R, Kaur R, Kaur R acquired and analyzed data; Mishra R, Verma R, Kangra P, Dahiya P, Kumari P, Sahu P, Bhakar P, Kumawat R, Kaur R, Kaur R interpreted the data; Mishra R, Sharma SK, Kant R wrote the manuscript; All authors approved the final version of the article.

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Rakhi Mishra, Suresh K Sharma, Rajni Verma, Priyanka Kangra, Preeti Dahiya, Preeti Kumari, Priya Sahu, Priyanka Bhakar, Reena Kumawat, Ravinder Kaur, Ravinder Kaur, College of Nursing, All India Institute of Medical Sciences, Uttarakhand 249203, Rishikesh, India

Ravi Kant, Department of Medicine, All India Institute of Medical Sciences, Uttarakhand 249203, Rishikesh, India

Corresponding author: Rakhi Mishra, MSc, Assistant Professor, College of Nursing, All India Institute of Medical Sciences, Virbhadra Road Shivaji Nagar, Near Barrage, Uttarakhand 249203, Rishikesh, India. mishrarakhi92@gmail.com

Abstract

BACKGROUND

Diabetes mellitus (DM) is a progressively increasing metabolic disorder and a significant public health burden that demands immediate global attention. However, there is a paucity of data about adherence to antidiabetic drugs among patients with type-2 (T2)DM in Uttarakhand, India. Outpatient research reported that more than 50% of patients do not adhere to the correct administration and appropriate medicine dosage. It has been reported that patients with chronic diseases who adhere to treatment may experience improvement in quality of life (QoL) and vice versa.

AIM

To assess the adherence to antidiabetic medication and QoL among patients with T2DM.

METHODS

This cross-sectional descriptive study was conducted at a tertiary care hospital in Uttarakhand, India. The Medication Adherence Rating Scale and World Health Organization QoL-BREF scale were used to assess medication adherence and QoL.

RESULTS

Two hundred seventy-seven patients suffering from T2DM participated in the study. Their mean age was 50.80 (± 10.6) years, 155 (56%) had a poor adherence level and 122 (44%) had a good adherence level to antidiabetic medications. After adjusting for sociodemographic factors, multiple linear regression analysis found

competing interests.

Data sharing statement: No additional data are available

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patients who were adherent to antidiabetic medications had significantly higher mean overall perception of QoL and overall perception of health, with beta scores of 0.36 and 0.34, respectively (both $P = 0.000$) points compared with nonadherent patients.

CONCLUSION

There was an association between medication adherence and QoL in patients with T2DM. Hence, there is a need to plan awareness and counseling programs followed by regular follow-up to motivate patient adherence to recommended treatment and lifestyle regimens.

Key Words: Medication adherence; Quality of life; Diabetes mellitus; Tertiary care hospital; India

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Core Tip: Many research articles have been published on the epidemiology, complications, therapies, comparisons of treatments, and healthcare strategies for diabetes mellitus (DM). The literature shows that patient adherence to antidiabetic medications and quality of life (QoL) are interrelated. Patients with diabetes who adhere to their treatment can experience an improvement in QoL and vice versa. This study focused on (1) adherence to antidiabetic medication and QoL among T2DM patients; (2) finding the relationship between adherence to antidiabetic medication and QoL; and (3) determining the association between adherence to antidiabetic medications and QoL and selected demographic variables.

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INTRODUCTION

Diabetes mellitus (DM) is a progressively increasing metabolic disorder that has become a significant public health burden. The World Health Organization has identified DM as an important noncommunicable diseases that demands immediate global attention[1]. The International Diabetes Federation has reported that 463 million adults between 20-79 years of age are living with diabetes and that the total will rise to 700 million by 2045[2]. This chronic disorder is rated among the top ten causes of death (4.2 million) globally and has attained pandemic proportions worldwide[2]. In addition to increased mortality, diabetes can lead to poor physical and mental health. Moreover, problems like increased blood glucose level and dietary and exercise limitations demand repeated insulin injections. However, musculoskeletal and vascular complication negatively affect the quality of life (QoL) of patients with DM [3]. To prevent the development of fatal complications associated with DM, glycemic control is required. To achieve that goal, it is necessary to encourage patients to adhere to therapeutic regimens, change their life style, and follow the recommendations of their clinicians[4]. Studies have shown that patient adherence to chronic-disease treatment is low[5]. Research involving outpatients reported that more than 50% do not adhere to the correct medicine administration and dosage[6]. The diabetes literature shows that patient QoL and medication adherence are interrelated. It has been reported that patients with chronic diseases who adhere to their treatment may experience improvement in QoL and vice versa[7]. However, there is a paucity of data about adherence to antidiabetic drugs among patients with T2DM, especially in Uttarakhand. Therefore, this study was conducted to assess the adherence to antidiabetic medication and QoL by patients with T2DM.

MATERIALS AND METHODS

Participants and settings

This cross-sectional descriptive study was conducted at a tertiary care hospital in Uttarakhand, India to assess adherence to antidiabetic medications and QoL by patients with T2DM. A sample size of 350 was calculated considering that an estimated 31.2% of the population would be nonadherent to antidiabetic medications, a margin of error of 5% with a 95% confidence interval (CI), a 10% study dropout rate, and entering potential confounders as covariates in the regression model[8,9]. Patients between 21 and 75 years of age who were diagnosed with T2DM and visited the outpatient department between February 10, 2020 and March 19, 2020 were eligible for inclusion. Those who were under treatment for T2DM for less than 6 mo or had cognitive and neurological impairment were excluded.

Ethical approval

Ethical permission was obtained from institution ethics committee, vide letter no. 368/IEC/STS/2019. Participants were informed about the purpose of research and ensured about anonymity and confidentiality of the information. A written informed voluntary participation consent was obtained from each study participant.

Instruments

Participant data were collected with a structured interview questionnaire that included sociodemographic characteristics (section I), the Medication Adherence Rating Scale (MARS, section II), and the WHOQoL-BREF scale (section III). Questionnaires were administered in the Hindi Language, which is the national language of India. MARS is a 10-item questionnaire with validated validity, and developed originally in English[10]. To avoid acquiescence bias, the items in the scale have a dichotomous response (yes/no). The minimum score was 0 and the maximum score was 10. The summed total score was categorized as non- or poor adherence (0-5) or adherence or good adherence (6-10). The WHOQoL-BREF is a generic instrument developed to measure QoL of patients suffering from T2DM by the WHO criteria and is a short version of the 100 item WHOQoL-100[11]. The WHOQoL-BREF consists of 26 items divided into four QoL domains, Physical health (seven items), psychological health (six items), social relationships (three items), and environmental health (eight items). The two remaining questions assessed an individual's overall perception of QoL and overall perception of health. All the questions in the instrument are scaled in a positive direction from 1 to 5, with a high score indicating good QoL, except for items three, four, and 26. The domain score was calculated from the mean score of all items within each domain. To make the domain scores comparable to WHOQoL-100 scores, the calculated mean scores were multiplied by 4[11]. Permission was obtained to use the MARS and WHOQoL-BREF tools, and a license agreement was signed by the appropriate authority. The validity and reliability of the tools were pre-established using Cronbach's alpha, $r = 0.70$ for the WHOQoL-BREF and $r = 0.75$ for MARS[10, 12]. A standardized pilot-tested collection form was used to collect data from participants. The average time taken to complete one interview was around 20 min.

Statistical analysis

Data were coded and then entered onto Excel worksheets. The Statistical Package for the Social Sciences (SPSS 21.0) was used for statistical analysis. Descriptive and inferential statistics were used for data analysis. Sociodemographic characteristics were reported as frequencies (n) and percentages (%). Adherence to antidiabetic medication- and health-related QoL was reported as means and standard deviation (SD). Multiple linear regression analysis was performed to assess the effect of adherence to antidiabetic medication within each QoL domain after adjusting the estimates for some sociodemographic variables. A P value of < 0.05 was considered statistically significant.

RESULTS

A total of 277 patients with T2DM were recruited during the study period. The mean \pm SD age was 50.80 ± 10.6 years. More than half of the patients were men (57%), residing in urban area (63.9%) with a distance of more than 10 km from hospital (66.1%), having joint family (65.3%), and suffering from T2DM for 1-5 years (54.2%). Nearly

one-third (32.9%) had an educational status up to the primary level. The majority had associated comorbidities, including thyroid (54.5%) and hypertension (41.5%). The clinical histories revealed that 47.3% were taking both insulin and oral hypoglycemic agents (OHAs) for treatment along with lifestyle modifications (Tables 1 and 2).

Of the 277 patients included in this study, 155 (56%) had poor adherence scores of 0-5 and 122 (44%) had good adherence scores of 6-10 for antidiabetic medications. The mean overall perception of QoL and health scores were 68.16 ± 14.69 and 63.97 ± 16.51 respectively. Tables 1 and 2 shows the mean scores of the four domains stratified by sociodemographic and clinical characteristics and the two individual questions assessing the overall perception of QoL and health. Higher mean QoL score were reported by those with postgraduate and above education, incomes > 30001 INR, residing < 5 km from the hospital, suffering with T2DM for more than 15 years, and on glimepiride.

Multiple regression analysis found that medication adherence was an independent predictor of QoL ($P < 0.05$) in the patients in this study after adjusting for various sociodemographic characteristics including age, marital status, educational qualification, type of family, and monthly income. Patients who were adherent to antidiabetic medications had significantly higher mean overall perception of QoL and health scores, ($P = 0.000$) compared with nonadherent patients. Their beta scores of 0.36 and 0.34 points, respectively (Table 3).

DISCUSSION

DM is a chronic disease that requires patients to be on long-term drug therapy. Poor treatment adherence and lifestyle habits are significant barriers in the treatment of DM. The primary objective of diabetes management is to improve patient health-related QoL which is now a growing area of interest and has emerged as a significant chronic-disease outcome. In developed nations, approximately 50% of diabetes patients do not adhere to the recommended therapies[13]. The literature has shown that medication adherence is associated with improved disease control[6]. This study was conducted to assess adherence to antidiabetic medications and QoL in patients with T2DM attending the outpatient department of a tertiary care hospital. Medication adherence is a key factor because it is directly related to the disease outcome. However, nonadherence may alter all QoL dimensions. This study found that 155 of the participants (56%) were nonadherent and 122 (44%) were adherent to antidiabetic medications. Worldwide studies using various research assessment instruments and systematic reviews have addressed issues of poor medication adherence by diabetes patients[14]. Our findings are similar to those of Ahmad *et al*[15], who reported that 53% of their respondents were nonadherent to medications. However, much lower rates of nonadherence have been seen in studies conducted by Bagonza *et al*[16], Pascal *et al*[17], and Elsous *et al*[18] who reported rates between 16.7% and 42%. The difference in adherence might be explained by variations in healthcare services, socioeconomic status, and the metrics used for assessment of adherence across the study settings. However, a study conducted in Oman reported overall good patient adherence to the medication regimen (80%), which is higher than our finding[19]. A study in 129 patients by Fadare *et al*[20] reported 40.6% good, 32.8% medium, and 26.6% poor adherence to medication regimens.

This study found a statistically significant relation ($P < 0.05$) between age and monthly income and good adherence to antidiabetic medications. Similarly, Gelaw *et al*[21] reported that increased age was significantly associated ($P < 0.05$) with good adherence to treatment. It is expected that patients with high education levels would have better adherence to medication regimen, and that was confirmed by Ahmed *et al* [22], who found that patients with graduate-level educations were highly adherent. Contrary to our findings, Fadare *et al*[20] did not find significant differences in adherence ($P < 0.05$) between levels of education and adherence. Our findings are similar to those of Gelaw *et al*[21] who reported that married patients had a higher rate of therapeutic adherence (48.6%) than single, widowed, or divorced patients, but Khan *et al*[23] did find a significant impact of marital status on patient adherence.

Gelaw *et al*[21] reported that 82.07% of patients with a duration of diabetes ≤ 5 years were more compliant to medication than those with diabetes for > 5 years, and the difference was statistically significant. Similar to our finding that 155 (56%) of patients were nonadherent to antidiabetic medications, Bezie *et al*[24] reported that patients who had been on diabetic treatment for < 5 years were poorly adherent to treatment. It is likely that patients who have been on treatment for a short duration are less aware

Table 1 Quality of life scores, sociodemographic characteristics, and medication adherence of the study participants

Demographic variables	n (%)	QoL domains, mean \pm SD				Overall perception on QoL	Overall perception of Health
		Physical domain	Psychological domain	Social domain	Environmental domain		
Age, yr							
21-46	77 (27.8)	59.67 \pm 15.88	53.12 \pm 17.76	69.97 \pm 12.07	55.14 \pm 11.68	67.79 \pm 15.61	64.45 \pm 16.74
47-71	193 (69.7)	56.29 \pm 15.03	52.64 \pm 14.35	69.98 \pm 14.66	57.99 \pm 11.95	68.50 \pm 14.23	63.73 \pm 16.28
< 71	07 (2.50)	41.86 \pm 10.73	44.71 \pm 18.98	62.57 \pm 21.75	56.28 \pm 13.35	62.86 \pm 17.99	54.29 \pm 19.02
Gender							
Male	158 (57)	57.30 \pm 14.93	53.59 \pm 14.48	70.33 \pm 14.72	58.02 \pm 11.32	69.24 \pm 13.66	66.33 \pm 15.82
Female	119 (43)	56.29 \pm 16.05	51.23 \pm 16.68	69.07 \pm 13.47	56.01 \pm 12.65	66.72 \pm 15.89	60.84 \pm 16.95
Marital status							
Married	254 (91.7)	57.09 \pm 15.63	52.82 \pm 15.39	70.36 \pm 12.75	57.13 \pm 11.95	68.35 \pm 14.86	64.33 \pm 16.64
Single	23 (8.30)	54.48 \pm 12.61	49.83 \pm 16.48	63.52 \pm 24.72	57.48 \pm 11.95	66.09 \pm 12.70	60.00 \pm 14.77
Educational qualification							
Illiterate	51 (18.4)	54.18 \pm 17.35	49.18 \pm 16.08	67.72 \pm 11.86	53.65 \pm 11.05	64.31 \pm 15.13	59.22 \pm 16.95
Primary school	91 (32.9)	55.91 \pm 16.04	51.32 \pm 15.83	67.91 \pm 14.39	54.15 \pm 12.10	67.03 \pm 15.88	62.86 \pm 18.27
Secondary school	71 (25.6)	58.17 \pm 15.86	54.83 \pm 14.78	72.19 \pm 14.39	58.98 \pm 10.34	69.30 \pm 13.87	65.92 \pm 14.89
Graduate school and above	64 (23.1)	58.94 \pm 11.82	54.56 \pm 14.90	71.45 \pm 16.72	62.19 \pm 12.08	71.56 \pm 12.75	67.19 \pm 14.42
Type of family							
Nuclear	96 (34.7)	60.42 \pm 16.10	56.05 \pm 15.51	71.03 \pm 13.18	58.26 \pm 11.21	68.54 \pm 15.01	65.00 \pm 16.42
Joint	181 (65.3)	54.99 \pm 14.72	50.73 \pm 15.18	69.14 \pm 14.69	56.57 \pm 12.29	67.96 \pm 14.56	63.43 \pm 16.58
Monthly income, INR							
< 20000	127 (45.8)	54.20 \pm 15.40	51.24 \pm 15.48	67.58 \pm 14.86	54.59 \pm 12.14	66.61 \pm 15.54	60.94 \pm 16.88
20000-30000	91 (32.9)	56.37 \pm 15.68	52.77 \pm 15.56	69.77 \pm 14.57	57.77 \pm 11.44	67.69 \pm 13.91	63.74 \pm 15.47
> 30001	59 (21.3)	63.39 \pm 13.14	55.13 \pm 15.28	74.59 \pm 10.69	61.71 \pm 10.87	72.20 \pm 13.40	70.85 \pm 15.46
Residence							
Urban	177 (63.9)	59.80 \pm 15.25	54.29 \pm 15.79	71.48 \pm 12.61	57.60 \pm 12.09	69.04 \pm 14.29	66.10 \pm 15.63
Rural	100 (36.1)	51.68 \pm 14.32	49.54 \pm 14.49	66.80 \pm 16.26	56.36 \pm 11.66	66.60 \pm 15.32	60.20 \pm 17.41

Adherence level							
Nonadherent	155 (55.96)	52.32 ± 14.59	48.94 ± 14.56	69.73 ± 13.91	56.17 ± 12.32	64.90 ± 15.35	60.65 ± 16.50
Adherent	122 (44.04)	62.65 ± 14.48	57.19 ± 15.44	69.87 ± 14.59	58.40 ± 11.35	72.30 ± 12.71	68.20 ± 15.59

Data are *n* (%) or mean ± SD. INR: Indian rupee; QoL: Quality of life.

Table 2 Quality of life scores and clinical characteristics of the study participants

Clinical characteristics	<i>n</i> (%)	Physical domain	Psychological domain	Social domain	Environmental domain	Overall perception of QoL	Overall perception of health
Duration of T2DM, yr							
1-5	150 (54.2)	57.19 ± 14.61	52.77 ± 15.54	70.98 ± 12.06	57.03 ± 12.39	68.67 ± 14.91	64.13 ± 15.77
6-10	90 (32.5)	54.98 ± 14.91	51.07 ± 14.11	67.74 ± 17.02	57.12 ± 12.21	66.67 ± 14.06	63.78 ± 16.93
11-15	31 (11.2)	60.35 ± 19.86	56.06 ± 18.94	70.42 ± 14.96	57.16 ± 10.03	69.03 ± 15.35	63.23 ± 19.39
> 15	06 (2.2)	59.33 ± 15.86	52.17 ± 14.69	67.67 ± 12.13	60.67 ± 03.61	73.33 ± 16.33	66.67 ± 16.33
Drug used							
Metformin	80 (28.9)	56.27 ± 14.55	51.00 ± 13.68	69.77 ± 14.09	56.46 ± 11.91	67.75 ± 13.31	64.25 ± 15.49
Glimepiride	66 (23.8)	61.20 ± 15.54	56.64 ± 15.21	71.44 ± 12.32	56.38 ± 12.10	71.82 ± 14.45	66.36 ± 16.14
Other OHA	131 (47.3)	55.05 ± 15.53	51.49 ± 16.37	68.98 ± 15.12	57.97 ± 11.90	66.56 ± 15.38	62.60 ± 17.26
Chronic comorbid illness							
Hypertension	115 (41.5)	56.31 ± 15.46	51.94 ± 15.54	67.27 ± 15.44	56.81 ± 10.94	65.91 ± 14.74	61.74 ± 17.28
Thyroid	151 (54.5)	57.62 ± 15.48	53.54 ± 15.01	71.87 ± 13.11	57.39 ± 12.87	69.93 ± 14.21	65.70 ± 15.89
CAD	11 (4.00)	52.36 ± 13.91	46.00 ± 20.00	67.64 ± 10.76	57.54 ± 08.85	67.27 ± 18.49	63.64 ± 15.01

CAD: Coronary artery disease; DM: Diabetes mellitus; OHA: Oral hypoglycemic agent, QoL: Quality of life; T2DM: Type-2 diabetes mellitus. Data are *n* (%) or mean ± SD.

of the disease condition and are thereby nonadherent to the antidiabetic medications. However, patients with a longer disease duration are likely to have had more contacts with their healthcare providers, may have a better understanding of their regimen, are more likely to be self-motivated to take prescribed medications. However, the association of treatment adherence and the number of years with diabetes was not statistically significant.

Table 3 Multiple linear regression analysis of predicting variables for quality of life domains

Demographic variable	Physical domain		Psychological domain		Social domain		Environmental domain		Overall perception of QoL		Overall perception of health	
	β	P value	β	P value	β	P value	β	P value	β	P value	β	P value
Age, (ref ≤ 71 yr)	-4.84	0.009	-1.12	0.56	-0.28	0.87	2.62	0.08	0.04	0.65	-0.15	0.14
Gender (ref = male)	-0.42	0.83	-1.48	0.47	2.38	0.21	1.52	0.34	-0.003	0.98	-0.18	0.09
Marital status (ref = single)	-1.13	0.47	-1.77	0.29	-5.98	0	-0.24	0.85	-0.04	0.64	-0.07	0.41
Educational qualification (ref = illiterate)	-0.04	0.96	1.27	0.19	0.92	0.3	2.75	0	0.09	0.06	0.03	0.5
Type of family (ref = nuclear)	-2.96	0.08	-4.32	0.02	-1.45	0.37	-2.03	0.14	-0.03	0.71	-0.02	0.84
Monthly income (ref $\leq 20,000$)	3.57	0.005	0.35	0.79	2.86	0.02	2.13	0.04	0.05	0.39	0.16	0.02
Habitat (ref = rural)	-3.37	0.06	-0.57	0.76	-1.88	0.27	1.57	0.21	-0.02	0.82	-0.11	0.26
Years with DM (ref ≥ 15)	0.75	0.5	0.27	0.82	-1.26	0.31	-0.12	0.89	0	0.99	0.004	0.96
Drug used (ref = other OHA)	-1.84	0.07	-0.29	0.79	-0.74	0.46	0.52	0.54	-0.06	0.28	-0.09	0.12
Chronic comorbid illness (ref = hypertension)	-0.73	0.63	-0.4	0.8	2.47	0.09	0.58	0.64	0.13	0.08	0.07	0.41
Adherent level (ref = nonadherent)	8.91	0	7.59	0	-0.55	0.74	1.72	0.22	0.36	0	0.34	0

β -Standardized regression coefficient; DM: Diabetes mellitus; OHA: Oral hypoglycemic agent; QoL: Quality of Life; Ref: Reference group.

Participants who do not have diabetes-related complications had a high level of adherence. In contrast, poor medication adherence may result in comorbidities. Participants with no diabetes-related complications requires fewer medications. Thus, their adherence to antidiabetic medication might increase, and the risk of developing comorbidities might decrease[25]. This study did not find a significant association between comorbidities and the level of adherence. Considering the multifactorial nature of poor medication adherence, it is understood that only a sustained, coordinated effort will ensure optimal medication adherence. This study has clearly shown that diabetes impaired the physical and psychological QoL domain. QoL measurements should thus become routine in the clinical management of diabetic patients. Another factor which was found to be positively associated with adherence was knowledge of DM and its medications. Keeping in mind the high prevalence of both diabetes and nonadherence to the treatment regimen, additional nurses should be trained to run special diabetic clinics at rates that patients can easily afford to pay. Creating awareness and educating the patients regarding the disease and its management will definitely help to improve the adherence level and QoL.

CONCLUSION

This study found that more than 50% of the participants were nonadherent to antidiabetic medications and that QoL scores were associated with the level of patient adherence. There is a need to plan and implement awareness and counseling programs and regular follow-up to motivate patients to improve adherence to recommended treatment and lifestyle regimens.

Scope for future work

The study was limited by a small patient sample, but the findings can be expanded by machine-learning analysis and statistical methods designed to extract information from large data samples. Specifically, random forest algorithms and artificial neural networks can be used to determine which predictors are more important for the prediction of medication adherence or quality of life (QoL).

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ARTICLE HIGHLIGHTS

Research background

Diabetes mellitus (DM) is a progressive metabolic disorder that has become a significant public health burden that demands immediate global attention. However, there is a paucity of data on adherence to antidiabetic drugs by patients with type-two (T2)DM in Uttarakhand, India. Current research in outpatients has shown that more than 50% of patients do not adhere to the correct administration and appropriate dosage of antidiabetic medications. It has been reported that patients with chronic diseases who adhere to treatment may experience improvement in quality of life (QoL) and vice versa.

Research motivation

DM is a progressively increasing metabolic disorder that has become a significant public health burden and demands immediate global attention. The paucity of data on adherence to antidiabetic drugs by patients with T2DM in Uttarakhand, India prompted this study.

Research objectives

The study was conducted to assess the adherence to antidiabetic medications and QoL in patients with T2DM.

Research methods

This cross-sectional descriptive study was conducted at a tertiary care hospital in Uttarakhand, India. The Medication Adherence Rating Scale and World Health Organization QoL-BREF scale were used to assess medication adherence and QoL.

Research results

A group of 277 outpatients with T2DM participated in the study. Their mean age was 50.80 ± 10.6 years, 155 (56%) had poor, and 122 (44%) had good antidiabetic medication adherence. After adjusting for sociodemographic variables, multiple linear regression analysis found that patients who were adherent to antidiabetic medications had significantly a higher overall mean perception of QoL and health, with beta scores of 0.36 and 0.34 points, respectively (both $P = 0.000$) compared with nonadherent patients.

Research conclusions

Adherence to medications by patients with T2DM was correlated with QoL. Hence, there is a need to plan and implement awareness and counseling programs followed by regular follow-up to motivate patient adherence to recommended treatment and lifestyle regimens.

Research perspectives

Many research articles have been published about the epidemiology, complications, therapies, comparisons of treatments, and healthcare strategies for DM. The literature shows that patient adherence to antidiabetic medications and QoL are interrelated. Patients with diabetes who adhere to their treatment can experience an improvement in QoL and vice versa. This study focused on (1) adherence to antidiabetic medications and QoL in T2DM; (2) finding the relationship between adherence to antidiabetic medications and QoL; and (3) determining the association between adherence to antidiabetic medications and QoL and selected demographic variable.

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