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# Treatment adherence status among diagnosed type 2 diabetics residing in rural and urban areas of district Amritsar – A cross-sectional study

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## Abstract

**Background:** Treatment adherence is a pivotal factor in achieving and maintaining glycemic control in diagnosed diabetic patients. The present study was planned to assess the treatment adherence among diagnosed diabetic patients and find it's association with socio-demographic variables and glycemic control

**Materials and methods:** A cross-sectional study was conducted among diagnosed type 2 Diabetic patients residing in urban and rural field practice area of Government Medical College, Amritsar. Data was collected for period of one year. Pre-tested, validated questionnaire Morisky Medication Adherence (MMAS) was used. Qualitative variables were compared using Chi-square test. P value <0.05 was considered to be statistically significant.

**Results:** Overall, 41% and 42% of study participants had high adherence and low adherence to medication, respectively. Increasing age, male gender, was found to be significantly associated with high adherence. High adherence was significantly more in participants with controlled glycemic status. Educational and occupational status were found to be significantly associated with adherence. Place of residence and religion were not found to be associated with adherence status.

**Conclusions:** Overall, 41% of the study participants showed high adherence. Failure to remember to take medication (28%) and lack of knowledge (27%) were the main reasons for medium/low adherence. Therefore, health education and counselling sessions stressing the importance of medication adherence for achieving glycemic control needs to be regularly conducted to improve adherence.

**Keywords:** Type 2 diabetes, Adherence, Medication

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**Introduction:**

Globally, there has been a shift in the causes of illness and death from infectious diseases to non-communicable diseases (NCDs). This changing pattern has been a result of an (ongoing) epidemiologic transition.[1] In recent years, NCDs, such as cardiovascular diseases (CVD), diabetes, chronic obstructive pulmonary diseases (COPD) and cancers have become an emerging pandemic globally with disproportionately higher rates in developing countries.[2]

Diabetes is a serious, chronic disease that occurs either when the pancreas does not produce enough insulin (a hormone that regulates blood sugar, or glucose), or when the body cannot effectively use the insulin, it produces.[1] In 2016, WHO declared diabetes as the seventh leading cause of death and estimated 1.6 million deaths occurred directly due to diabetes.[3] In diabetes, patients are expected to follow a complex set of behavioral actions to care for their diabetes on a daily basis. These actions involve engaging in positive lifestyle behaviors, including following a meal plan and engaging in appropriate physical activity; taking medications (insulin or an oral hypoglycemic agent) when indicated; monitoring blood glucose levels; following foot-care guidelines; and seeking individually appropriate medical care for diabetes or other health-related problems. [4]

Treatment adherence is indirect indicator of glycemic control (higher the treatment adherence, better will be glycemic control). Adherence to medication is one of the cornerstones of better diabetes management besides self-monitoring of blood glucose levels and following lifestyle habits like regular physical activity and including fruits and vegetables in diet.

**Material and Methods:**

This was a cross-sectional study conducted on already diagnosed patients of type 2 diabetes mellitus aged >40 years residing in field practice area (urban and rural) of Department of Community Medicine, Government Medical College, Amritsar. Patients with diabetes for period of $\geq$ 6 months were included in the study. Patients with type 1 diabetes, those suffering from any mental illness, hearing and speech impairment and those who failed to give written informed consent were not included. Time period for study was 1 year (1$^{st}$ March 2021 to 28$^{th}$ February 2022).

**Sample size and sampling technique**-sample size was calculated using formula[5] for single proportion: $N > Z^2 \times P \times Q/D^2 \times Deff$ where N=required sample size. Z = 1.96, P (proportion of interest) =0.08314 (prevalence of diabetes in Punjab was 8.3% in state-wise NCD STEP survey conducted in 2014-2015[6]), Q= 1-P = 0.917, D (absolute precision) =0.05, Deff= design effect for cluster sampling =2. Assuming power of the study to be 80% and Confidence Interval of 95% the required sample size came out to be 234. Probability proportionate to size sampling (PPS) technique was used where each ward/village was considered to be cluster in itself. Assuming the non-response rate to be 10% for study population, sample size of 258 was calculated. In order to increase the validity of study, a total of 300 participants, 150 each from rural and urban area were included for this study.

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**Data collection tool**

A pre-tested semi structured questionnaire was used to collect the sociodemographic data and glycemic control and reasons for non-adherence to medication. To measure the adherence to medication "Morisky Medication Adherence Scale (MMAS)" [7] was used. This was an 8 itemed scale where each question had to be responded in either 'yes' or 'no'. For questions one through seven, score of zero for every "yes" response and one for every "no" response except for item 5, in which each 'yes' response was rated as one and each 'no' response was rated as zero while the eighth question was assessed on five-point scale where "never/rarely'=1, 'once in a while', 'sometimes', 'usually' and 'all the time' were given a score of zero. The scores of the scale ranged from 0-8. Based on total score, adherence of study participants to medication was classified into 3 categories, i.e., high adherence (score=8), medium adherence (score=6-7) and low adherence (score=<6).

**Methodology**

Prior to selection of study participants, a house-to-house visit was made to identify the households with a diabetic patient and a line-list of all the households where a person having type 2 DM for > 6 months and aged > 40 years was made. From this line list, the required study participants of both urban and rural area were selected using Simple Random Sampling. During house-to-house visit, one to one interview was conducted with study participants after obtaining a written informed consent using study tool. If the selected participant failed to give consent or his/her house was found to be locked, a repeated attempt was made but if the study participants was not available on the second visit too, then immediately next participant in line list were included to complete the sample size.

**Operational definitions:**

**Controlled diabetes**: if RBS < 180mg/dl.[8]

**Uncontrolled diabetes**: if RBS $\geq$ 180mg/dl.

**Statistical Analysis**

Data was compiled using Microsoft Excel and analyzed using Epi-info 7 (CDC USA) freely available online. The distribution of categorical/nominal variables was represented through frequencies and proportions whereas, for continuous variables mean ± standard deviations were calculated. To find the association between different variables the relevant tests of significance were applied, i.e., chi-square for categorical/nominal variables and t-test for continuous variables. Chi-square test and t-test where p-value was less than 0.05 was considered to be statistically significant. If any of the expected cell value of <5 was found then Fisher's exact test was used.

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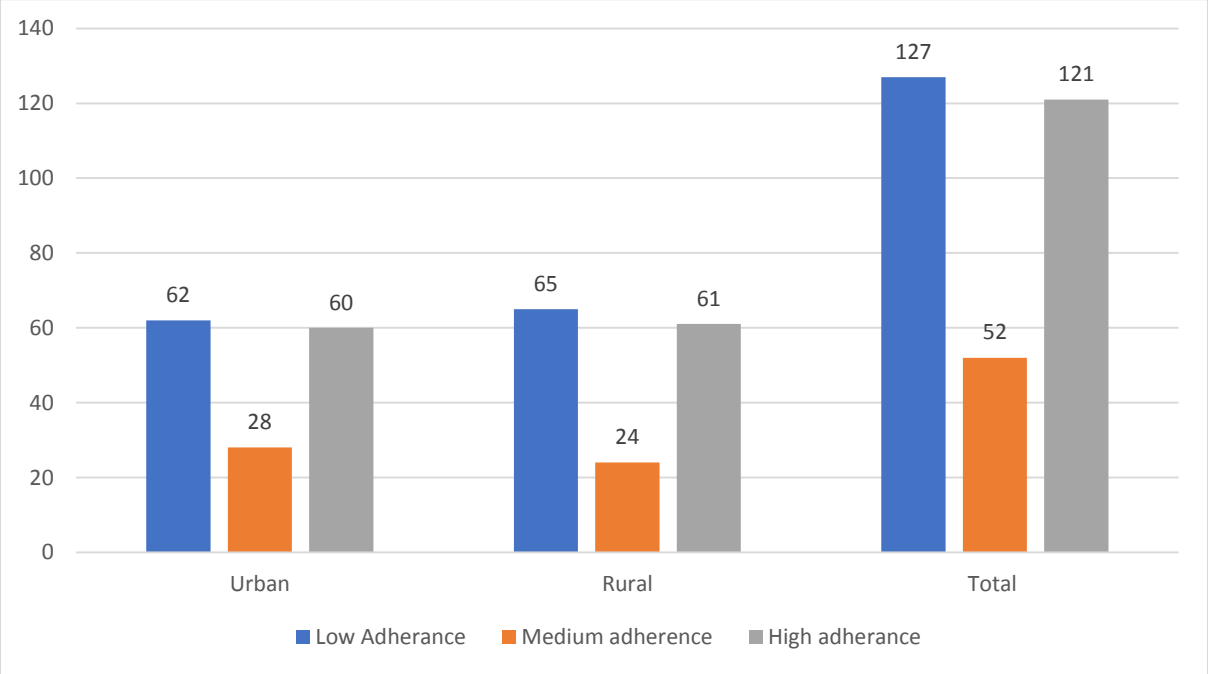
**Results**

Total 300 study participants were included in the present study, with equal representation from both urban and rural areas (150 each). Approximately three-fourth of study participants (74%) were aged between 50-69 years. 63% of study participants were females. Overall, majority (87 %) of rural study participants belonged to SC/BC/OBC whereas in urban area, majority (62%) of study participants belonged to general caste. Overall, majority of study participants followed Sikh religion (69%). Almost half (52%) of study participants lived in nuclear families. Majority were married (88%).71% of urban belonged to upper class (according to BG Prasad's classification) whereas most of rural study participants belonged to middle class (40%). Overall, 44% of the study participants had controlled diabetes as their RBS levels were found to be < 180mg/dl. Following were the results:

Figure 1: Classification of study participants according to Morisky Medication Adherence Scale (MMAS) scores (N=300):




($\chi 2$ =0.38, p-value = 0.824, df=2)

Treatment adherence was assessed using MMAS where the scores ranged from 0-8. Overall mean score was 5.29 $\pm$ 2.98, whereas mean score for urban study participants was 5.54 $\pm$ 2.66 and for rural study participants was 5.03 $\pm$ 3.24.

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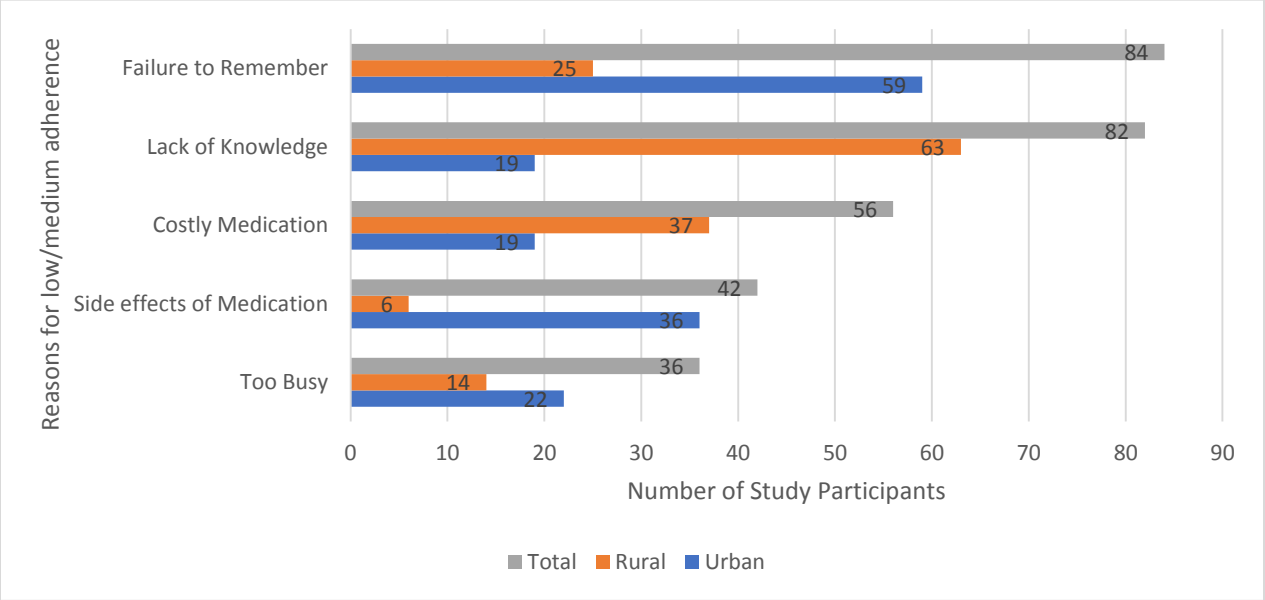
Based on individual scores, Adherence was classified as low, medium and high. Overall, 41% and 42% of study participants had high adherence and low adherence to medication, respectively. Urban-rural difference was not found to be statistically significant (figure 1).

Figure 2: Distribution of study participants according to reasons for low/medium adherence(n=179):




(Multiple responses allowed).

Figure 2 shows that failure to remember to take medication (28%) and lack of knowledge (27%) were the main reasons cited by study participants reporting medium/low adherence (according to MMAS).

Table 1: Association of treatment Adherence status (according to Morisky Medication Adherence Scale (MMAS) with socio-demographic profile of study participants (N=300):

| **Variables** | **High Adherence (n=121)** | **Medium/Low Adherence (n=179)** | **$\chi 2$ (p-value)** |
|---|---|---|---|
| Age (in years) | | | |
| 40-49 | 12(32) | 26(68) | 15.95 |
| 50-59 | 24(27) | 66(73) | (0.001) |
| 60-69 | 61(47) | 70(53) | df=3 |
| ≥70 | 24(59) | 17(41) | |

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| | | | |
|---|---|---|---|
| Sex | | | |
| Male | 56(50) | 56(50) | 6.31 (0.011) df=1 |
| Female | 65(35) | 123(65) | |
| Place of residence | | | |
| Rural | 64(41) | 91(59) | 0.05 (0.817) df=1 |
| Urban | 57(39) | 88(61) | |
| Religion | | | |
| Sikh | 89(43) | 119(57) | 2.12 (0.346) df=2 |
| Hindu | 25(37) | 43(63) | |
| Others | 07(29) | 17(71) | |
| Socio – economic status (as per BG Prasad's classification) | | | |
| Class I | 62(51) | 59(49) | 25.93 (0.000) df=4 |
| Class II | 26(52) | 24(48) | |
| Class III | 14(18) | 62(82) | |
| Class IV | 15(33) | 31(67) | |
| Class V | 04(57) | 03(43) | |

(Figures in parenthesis are percentages)

Table 1 shows association of treatment Adherence status (according to MMAS) with various socio-demographic variables. Increasing age was found to be significantly associated with high adherence to treatment for diabetes among study participants, where maximum adherence was reported among those aged $\geq$ 70 years (59%) and least by those aged 50-59 years (27%).

Half of the males (50%) reported high adherence in comparison to 35% of females.

Surprisingly, 57% of those belonging to lower socio-economic status reported high adherence in comparison to only 18% of those belonging to middle class. This variation was found to be statistically significant (class IV and V were merged for statistical purposes).

Place of residence and religion were not found to be associated with adherence status.

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Table 2: Association of treatment Adherence status (according to Morisky Medication Adherence Scale (MMAS) with education and occupation of study participants (N=300):

| **Variables** | **High Adherence (n=121)** | **Medium/Low Adherence(n=179)** | **$\chi 2$ (p value)** |
|---|---|---|---|
| Educational status | | | |
| Illiterate | 42(40) | 63(60) | 15.33 (0.009) df=5 |
| Primary | 01(08) | 11(92) | |
| Middle | 10(28) | 26(72) | |
| High | 30(37) | 50(63) | |
| Intermediate | 20(59) | 14(41) | |
| Graduate and above | 18(55) | 15(45) | |
| Occupation | | | |
| Clerical and Salaried (govt. + private) | 14(52) | 13(48) | 19.59 (0.000) df=4 |
| Business / Farmer | 28(57) | 21(43) | |
| Skilled/Unskilled laborer | 10(27) | 27(73) | |
| Unemployed / Housewife | 55(33) | 111(67) | |
| Retired | 14(67) | 07(33) | |

(Figures in parenthesis are percentages)

55% of those having an education of graduation and above reported high adherence to treatment in comparison to only 18% of study participants who had an education up to primary level (table 2).

Surprisingly,40% of Illiterate reported high adherence. As far as occupation of study participants was concerned, housewives/unemployed and laborers reported lowest level of adherence, whereas 67% of retired study participants reported high adherence. Both occupation and educational status were found to be associated with treatment adherence level.

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Table 3: Association of adherence to Medication with glycemic control status (N=300):

| **Adherence status** | **Controlled** (n=131) | **Uncontrolled** (n=169) | **$\chi 2$ (p-value)** |
|---|---|---|---|
| High Adherence | 84(69) | 37(31) | 52.94 (0.000) df=1 |
| Medium/Low Adherence | 47(26) | 132(74) | |

(Figures in parenthesis are percentages)

A significantly higher glycemic control was reported among those who had high adherence to medication (according to MMAS) (table 3).

**Discussion:**

Treatment adherence is indirect indicator of glycemic control (higher the treatment adherence, better will be glycemic control). Therefore, we assessed treatment adherence using Morisky Medication Adherence Scale (MMAS), where the scores ranged from 0-8. Overall mean score was 5.29 + 2.98, with no significant urban (5.54 + 2.66) and rural (5.03 + 3.24) variation. Based on individual scores, adherence was classified as low (42%), medium (17%) and high (41%).

Higher MMAS scores were reported by a study conducted in South India (6.6 + 2) and proportion of study participants with high adherence was reported as 49.3%, this could be because of high literacy levels in that part of India which indirectly affect the awareness levels.[9] A study conducted in Chennai reported comparatively lower levels of adherence to medication (25%) were reported among study participants.[10] Failure to remember to take medication (28%) and lack of knowledge (27%) were the main reasons cited by study participants who reported medium/low adherence (according to MMAS). However, in a study conducted in South India poor family support was a significant factor which was associated with low adherence to medication.[9] This could be due to different family structure as people residing in joint families were found to be having better glycemic control in our study.

As discussed earlier, better glycemic control was associated with increasing age, male gender, socio-economic status and occupation. Similarly, considering adherence to be an indirect indicator of glycemic control, thus high adherence was found to be significantly associated with increasing age, male gender, educational status and occupation of study participants. This may be due to the fact that with increasing age, diabetic complications start appearing and therefore people start taking medication more regularly. Low level of adherence in females could be due to the fact that they remain busy in household chores and forget to take their medication.

Surprisingly, 57% of those belonging to lower socio-economic status reported high adherence in comparison to only 18% of those belonging to middle class. 55% of those having an education of

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graduation and above reported high adherence to treatment in comparison to only 18% of study participants who had an education up to primary level. Adherence in study participants improved with education which may be due to more awareness and realization of importance of treatment adherence and more chances of complications with non-adherence. Surprisingly,40% of Illiterate reported high adherence.

As far as occupation of study participants was concerned, housewives/unemployed and laborers reported lowest level of adherence, whereas 67% of retired study participants reported high adherence. No significant difference was found in levels of adherence with relation to place of residence and religion. In support to our study, a study conducted in South India reported age to be a positive and significant factor associated with medication adherence.[9]

**Conclusion:**

Adherence to medication was assessed using Morisky Medication Adherence Scale (MMAS) scores, in which adherence was classified as low, medium and high. Overall, 41% and 42% of study participants had high adherence and low adherence to medication, respectively. Urban-rural difference was not found to be statistically significant. A significantly higher glycemic control was reported among those who had high adherence to medication (according to MMAS). The importance of adherence to medication needs to be mainstreamed through various health education and counselling sessions.

**Conflict of interest -** – the authors declare that there is no conflict of interest

**Source of funding** – no funding

**Ethical clearance** –from Institutional Ethics Committee (IEC) vide letter no. 3367/D-26/2020

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