

Original Scientific Article

INFLUENCE OF SOCIO-DEMOGRAPHIC FACTORS ON ADHERENCE OF PATIENTS WITH TYPE 2 DIABETES IN A PRIMARY HEALTHCARE SETTING IN WESTERN BOSNIA AND HERCEGOVINA

Marijana Jandrić-Kočić^{1,2*}, Snežana Knežević^{3,4*}

¹Health center Krupa na Uni, Republic of Srpska, Bosnia and Hercegovina

²University of Banja Luka, Faculty of Medicine, Banja Luka, Republic Srpska, Bosnia and Hercegovina

³Health center Kraljevo, Serbia

⁴University of Kragujevac, Faculty of Medical Sciences, Kragujevac, Serbia

Abstract. *Diabetes mellitus, including type 2 diabetes, is a global health issue with less than 50% of individuals achieving optimal glycemic control. A study at Health Center Krupa na Uni, Republic Srpska, assessed adherence in 159 adults with type 2 diabetes, during the study conducted during 2019–2020. The research used a general and specific questionnaire The Adherence in Chronic Diseases Scale. Findings showed 72.9% had moderate adherence, 16.4% had low adherence, and only 10.7% had high adherence. The female gender predicted higher adherence ($p=0.048$). The type of oral hypoglycemic agents ($p=0.520$) was not associated with adherence. Older age ($p=0.316$) and lower education level ($p=0.182$) were associated with lower adherence, but not significantly. Age over 60 years and level of education had no significant effects on adherence. Although there was no statistical significance, employed respondents ($p=0.076$) and those living in rural areas had a higher level of adherence ($p=0.064$). Some respondents took medications based on their physical needs and beliefs, indicating the need to address beliefs and behaviors influencing adherence. Poor adherence remains a significant issue, and addressing adherence barriers, particularly those related to gender, can improve health outcomes for individuals with type 2 diabetes. Ongoing research and interventions are crucial to improve adherence rates and health outcomes in individuals with type 2 diabetes.*

Key words: *Diabetes Mellitus, adherence, sociodemographic factors, primary healthcare*

Introduction

Diabetes mellitus (DM) is a chronic metabolic condition characterized by elevated blood glucose levels, leading to long-term damage to various organs [1]. It is classified into three types: type 1 diabetes, type 2 diabetes, and gestational diabetes [1, 2]. Type 2 diabetes accounts (T2DM) for 95% of cases and is characterized by insulin resistance and deficiency [3]. The global prevalence of diabetes has been steadily increasing over the past few decades, with an estimated prevalence of 10.5% (536.6 million people) in 2021, with the majority in low- and middle-income countries [1, 4, 5]. Diabetes is responsible for 1.5 million deaths annually [1]. Projections indicate that the prevalence of diabetes will continue to rise, reaching 10.2% (578 million) by 2030 and 10.9% (700 million) by 2045 [6]. Urban areas and high-income countries have higher diabetes prevalence compared to rural areas and low-income countries, as reported in 2021 estimates [5].

In the European Region, there are currently an estimated 59.3 million adults aged 20–79 years with diabetes, accounting for 8.9% of the population in this age group

[5]. This includes 24.2 million adults with undiagnosed diabetes [5]. Some Member States already have high diabetes prevalence rates of 10–12% due to factors such as overweight and obesity, unhealthy diets, physical inactivity, and socioeconomic disadvantage [1]. Between 1990 and 2019, rates of T2DM have increased in all EU countries, with the highest increases observed in Luxembourg, Ireland, and the UK [7]. However, T2DM mortality has generally decreased in most countries, with the UK showing the highest decrease in males and Cyprus in females [7]. Disability-adjusted life years (DALYs) associated with T2DM have increased in most countries, with higher rates in males [7]. The most significant projected increase in diabetes occurrence from 2021 to 2045 is expected to happen in middle-income countries (21.1%), surpassing the expected increases in high-income (12.2%) and low-income (11.9%) countries [5]. The prevalence of diabetes in adults in Bosnia and Herzegovina (B&H) is 12.2%, with a total of 305,900 cases of diabetes in adults [8]. Globally, the cost of diabetes amounts to 825 billion dollars per year, with the largest costs in individual countries being in China (\$170 billion), the United States

Correspondence to: Marijana Jandrić-Kočić
Health center Krupa na Uni, Banjaluka, Republic of Srpska, Bosnia and Hercegovina
E-mail: marijanajandrickocic@gmail.com

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*Ph.D student

(\$105 billion), and India (\$73 billion) [9]. The losses in the gross domestic product (GDP) in Europe from 2011 to 2030, including both direct and indirect costs of diabetes, are projected to be 89 billion euros [10]. The annual economic burden associated with diabetes in B&H is approximately 189 million Euro (739 Euro per patient), which makes up 1.11% of the GDP of B&H in 2020 according to World Bank data [11].

According to the World Health Organization (WHO), patient adherence refers to the extent to which a person follows recommended healthcare provider's instructions, including taking medication, following a diet, and making lifestyle changes [12]. Poor adherence, on the other hand, implies refusal or inadequate use of medications, failure to adapt to recommended lifestyle or diet, or intentional violation of agreed recommendations due to various factors such as demographic, social, psychological, or clinical variables [13–15]. Adherence to anti-diabetic medication means consistently taking the prescribed medication regimen as directed by a healthcare professional [16]. Despite optimal glycemic control being achieved by only 86% of patients, poor adherence is common among patients with T2DM [17–20]. Adherence can be negatively influenced by factors such as prolonged treatment duration, treatment complexity, drug side effects, conflicting beliefs with medical guidelines, communication issues with healthcare providers, patient dissatisfaction with the healthcare system, socioeconomic factors, limited health literacy, lack of medical insurance, cognitive and functional limitations [18–21]. Socioeconomic factors such as income, education, and occupation are associated with diabetes prevalence and complications [4].

Aim

The research aimed to examine the adherence of adults with T2DM and to determine the influence of sociodemographic factors on the adherence of subjects with T2DM.

Patients and Methods

The research was conducted as a cross-sectional study at the Health Center Krupa na Uni, Republic Srpska, Bosnia, and Hercegovina over 24 months, from February 1, 2019, to January 2, 2021. There are 1,053 registered adult individuals at the Krupa Health Center na Uni. The individuals attending the Family Medicine Clinic in Krupa na Uni primarily reside in a border municipality, which mainly consists of returning residents after war aged 40 and above. A considerable portion of the population under the age of 40 either works outside the municipality, and only could visit the Clinic on weekends when it is not open. The study population consisted of all adult individuals with Type 2 diabetes mellitus (T2DM) who were using oral hypoglycemic agents. Data were collected through routine questionnaire distribution during the patient's initial visit to family doctors for regular check-ups. Inclusion criteria for study participants were: diagnosis of T2DM, absence of cognitive disorders, and ability to independently complete questionnaires.

Patients with cognitive disorders, inability to independently complete questionnaires, and those who refused to participate were excluded from the study. Before the commencement of the survey, participants were informed that their participation was anonymous and voluntary. Data were collected using a general and specific questionnaire, with socio-demographic characteristics (such as age, gender, place of residence, level of education, and employment status) and duration of T2DM as independent variables.

The Adherence in Chronic Diseases Scale (ACDS) was developed by a group of authors from Poland as a tool for assessing therapeutic adherence in patients with chronic diseases [22–25]. It has been previously used in studies assessing adherence to treatment in patients with T2DM [26–28]. The ACDS scale has been validated and found to have satisfactory reliability, with a Cronbach coefficient of 0.75 [22, 24, 25]. The scale consists of 7 questions, including 5 questions related to adherence and 2 questions related to doctor-patient communication [22–25]. The initial translation of the scale from English to Serbian language was conducted by two independent translators, followed by a back-translation from Serbian to English to ensure translation accuracy. Respondents are provided with five answer options for each question, rated on a scale of 0-4. A total score of less than 21 indicates low adherence, a score of 21-26 indicates moderate adherence and a score higher than 26 confirms high adherence of the respondents [22–25].

The study protocol was approved by the Ethics Committee of the Health Center Krupa na Uni, Republic Srpska, Bosnia, and Hercegovina. The statistical analyses were conducted using descriptive and analytical statistical methods. Descriptive statistics, such as mean, frequency, and measures of variation, were used to summarize and describe the data. Nonparametric tests were employed to compare the two groups, as the data did not follow a normal distribution according to the Kolmogorov-Smirnov and Shapiro-Wilk tests of normality. The Mann-Whitney test was used for factors with two levels, while the Kruskal-Wallis test was used for factors with three or more levels. The significance level was set at 0.05 for determining statistical significance. The data analysis was performed using IBM SPSS Statistics, Version 26.0 (IBM Corp., Armonk, NY, USA).

Results

The study enrolled a total of 159 participants, aged 40 to 69 years, selected through random sampling. These participants had type 2 diabetes mellitus (T2DM) and were using oral hypoglycemic agents (OHA) for their treatment. Among the respondents, 54 were taking biguanides, 19 were using sulfonylurea derivatives, 77 were on a combination of sulfonylurea and biguanide derivatives, and 9 were using inhibitors of the enzyme dipeptidyl peptidase 4 (DPP-4). The average duration of T2DM among the participants was 14.0 years.

In our study, 77 male respondents and 82 females were involved. A statistically significantly higher adherence score was recorded in female subjects. Participants in the study

were divided into three age categories: 40-49 years (28 respondents), 50-59 years (41 respondents), and 60-69 years (90 respondents). Even though there was no notable statistical significance, patients between the ages of 60 and 69 exhibited a slightly lower level of adherence (21.54 ± 5.43) compared to the other two age groups, which displayed roughly equivalent levels of adherence (21.64 ± 5.24 and 22.49 ± 5.04). The survey included 65 urban residents and 94 rural residents. Despite the absence of a statistically significant distinction, respondents living in rural areas (22.57 ± 5.29) demonstrated a slightly higher level of adherence compared to those living in urban areas (21.12 ± 5.44) (Mann-Whitney $U=2551.00$). Out of the total respondents, 45 were employed and 114 were unemployed. Although no statistical significance was observed, employed respondents displayed slightly higher adherence (22.73 ± 5.24) compared to unemployed (21.68 ± 5.45) (Mann-Whitney $U=2083.5$). Of the participants, 18 had completed primary school, 130 had completed secondary school, and 11 held a university degree. Despite the lack of statistically significant differences, respondents who completed primary school (20.33 ± 5.29) displayed a slightly lower level of adherence concerning patients who have completed high school (22.06 ± 5.43) and patients who have completed university (23.64 ± 5.20) (Kruskal-Wallis $\chi^2=3,402$) (Table 1).

A significant proportion of respondents (74.6%) reported skipping a dose of their medication when feeling well, and 15.1% reported completely discontinuing medication use. Additionally, a substantial portion of respondents (42.3%) expressed concerns about potential harm from long-term medication use, and 40.0% believed that they could achieve good disease control with fewer medications. Moreover, only a small proportion of respondents (11.5%) reported openly discussing their medication use with their healthcare provider.

The majority of respondents (72.9%) showed moderate adherence to their treatment regimen, while 16.4% had low adherence and only 10.7% had high adherence. The overall mean adherence score for all patients was 21.98 (Figure 1).

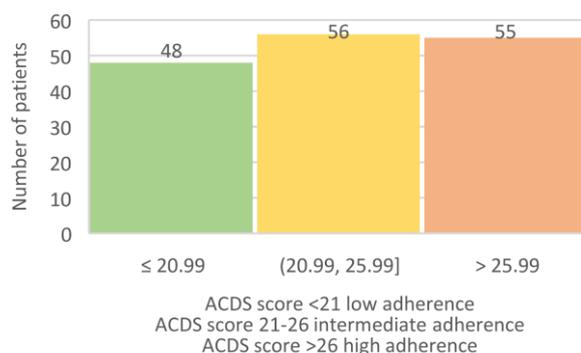


Fig. 1 Adherence score according to the number of patients

There was no statistically significant correlation between the duration of T2DM and the value of adherence ($p=0.766$). Pearson correlation coefficient ($r=0.024$) indicated that the duration of the disease had no influence on adherence in T2DM patients (Figure 2).

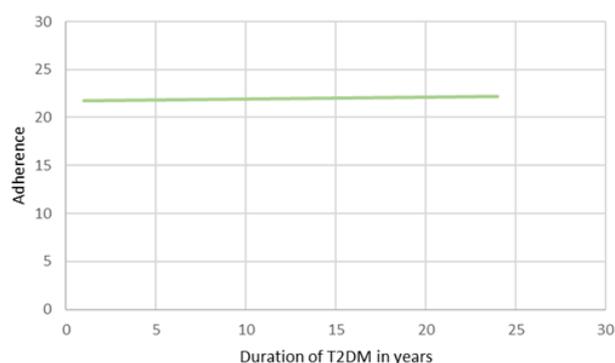


Fig. 2 Adherence according to the duration of T2DM

There were no statistically significant differences in the adherence of patients with type 2 diabetes mellitus between patients with different therapies (Kruskal-Wallis $\chi^2=2.260$, $p=0.520$). Although, patients using sulfonylurea derivatives and patients using sulfonylurea derivatives +

Table 1 Interrelation between the adherence according to the Adherence in Chronic Diseases Scale (ACDS) and sociodemographic variables of respondents

Sociodemographic variables		Number (%) of the respondents	Mean \pm SD	p-value
Gender	Male	77 (48.43%)	21.36 \pm 5.30	0.048
	Female	82 (51.57%)	22.56 \pm 5.44	
Age	40-49 years	28 (17.61%)	21.64 \pm 5.24	0.316
	50-59 years	41 (25.79%)	22.49 \pm 5.04	
	60-69 years	90 (56.60%)	21.54 \pm 5.43	
Place of living	City	65 (40.88%)	21.12 \pm 5.44	0.064
	Rural	94 (59.12%)	22.57 \pm 5.29	
Employment	Unemployed	114 (71.70%)	21.68 \pm 5.45	0.076
	Employed	45 (28.30%)	22.73 \pm 5.24	
Education	Primary school	18 (11.32)	20.33 \pm 5.29	0.182
	High school	130 (81.76%)	22.06 \pm 5.43	
	Faculty	11 (6.92%)	23.64 \pm 5.20	

biguanides had slightly higher adherence values (22.84 and 22.36) compared to patients using only biguanides and DPP-4 enzyme inhibitors + biguanides (21.26 and 21.22).

There was no statistically significant correlation between the number of medications taken by patients and the values of adherence ($p=0.588$). Pearson correlation coefficient ($r=0.043$) indicated that the number of medications taken does not affect adherence in T2DM patients (Figure 3).

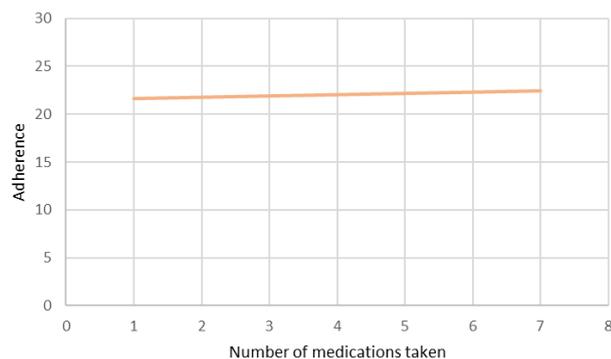


Fig. 3 Adherence according to the number of medications taken

Discussion

Over 60% of T2DM patients in Slovenia, Croatia, Serbia, Bulgaria, and Romania, mostly treated with oral antidiabetics did not achieve disease control [29]. Poor adherence to oral antidiabetic drugs in patients with type 2 diabetes T2DM can lead to therapy failure and risk of complications [30]. Studies indicated low adherence of patients as the main reason for high mortality from T2DM [3, 4, 27, 31]. The reasons are multiple and often not easy to identify [3, 4, 27, 31]. In our study, the majority of participants (72.9%), demonstrated moderate adherence to their prescribed medication regimen. Low adherence was observed in 16.4% of respondents, while high adherence was reported by only 10.7%. Findings from a study conducted in the United Arab Emirates indicated similar adherence [32]. It could be explained that in the absence of obvious and intense discomfort that clearly and unequivocally warns of T2DM progression, subjects took medications according to their physical needs and beliefs.

Lower levels of medication adherence were more commonly associated with a longer duration of diabetes, younger age, and male gender, while individuals with higher education and monthly income tended to exhibit higher adherence [32]. Socioeconomic status and social support may have a positive influence on adherence [33]. Co-payments, especially when set at higher amounts negatively affect adherence. Interestingly, factors related to the therapy regimen (e.g., intake schedule) and disease-related factors (e.g., duration of illness) did not consistently impact adherence [33], while pharmacotherapeutic education can [34]. In another study conducted in Bosnia and Herzegovina, utilizing a distinct methodological ap-

proach from the present study, it was found that nearly half of the patients exhibited non-adherence to antidiabetic medication. The study identified age, type of treatment, and co-payment as the most influential factors predicting poor adherence [35].

In the survey in Spain, 33.8% reported non-adherence to pharmacological treatment [36]. A study by a group of Iranian authors found that adults diagnosed with T2DM have low awareness of the importance of optimal blood glucose control but also significant distrust of medical team members [17]. As a result, the medication they take is according to their physical needs and beliefs [17]. Suboptimal adherence with 26.1% of subjects who fully adhere to the therapeutic regimen was found in a study by authors from Egypt [37]. The differences in results may be due to differences in policies and strategies adopted by different countries, but also awareness of the importance of optimal control of blood glucose levels in patients [37].

In our study, the female gender was an independent predictor of the high adherence of respondents. Statistically significantly higher adherence in women by authors from the Gaza Strip was explained by a more proactive role of women in prevention, seeking medical help, and adhering to complex treatment regimens as well as a slightly lower incidence of drug side [38]. A study in the United Arab Emirates found no significant relationship between the level of adherence to antidiabetic medications and factors such as sex, educational level, monthly income, exercise, smoking, and the duration of diabetes [32].

Subjects over the age of 60 in our study had a slightly lower adherence value, but not statistically significant, contrary to previous studies [14, 32, 38, 39, 40]. Research in Palestine, the United States, Rwanda, United Arab Emirates, and Sudan has identified age as an important predictor of respondents' level of adherence [14, 32, 38, 39, 40]. Lower adherence in the elderly occurs as a consequence of the presence of comorbidities but also doubts about the effectiveness of OHA in the presence of complications of T2DM [40]. Suboptimal adherence to them could be the result of multimorbidity accompanied by polypharmacy, lack of money, and limited support from family members [11]. The study by a group of authors from Poland found frailty syndrome and poorer acceptance of illness as independent predictors of lower adherence [27]. Although there was no statistical significance, respondents in our study living in rural areas demonstrated a slightly higher level of adherence. Respondents with a place of residence in a rural area, like in Northern Ethiopia, have a limited possibility of consulting a doctor and insufficient funding, so they had a 10.09 times higher probability of lower adherence [41, 42]. Our opposite findings among patients living in rural areas might potentially be attributed to historical population migrations within the region of Bosnia and Herzegovina and better living conditions than in mentioned study.

The research found a slightly lower value of adherence in respondents with completed primary school. Individuals

with a lower level of education may face challenges in comprehending the intricacies of the disease and recognizing the significance of adhering to a therapeutic regimen. On the other hand, ages over 60 and completed primary school had a negative impact. A study by authors from the Gaza Strip and Bangladesh had similar results [38, 43]. Although there was no statistical accuracy, the respondents in our study who were employed had slightly higher adherence values. This phenomenon could be attributed to the correlation between unemployment, financial instability, and the tendency to take inadequate medications or reduce/stop their usage altogether. [44].

The COVID-19 pandemic has had a profound impact on healthcare services, particularly for patients with chronic diseases, leading to disruptions in care and decreased adherence to therapies [44]. Many chronic patients have experienced gaps in their clinical care due to the unavailability of healthcare professionals, isolation measures, and disruptions in communication and services during the pandemic [45]. Reduced adherence to therapies for chronic conditions during the pandemic period was observed in different settings, with social restrictions and patient-related factors such as fear of infection being major reasons for non-adherence [44]. For example, a study by Romagnoli et al. showed that adherence to hypoglycemic treatment in 2020 was slightly lower compared to 2019, with adherence rates of 0.79 and 0.80, respectively, over 6 months [46].

The limitations of this study should be acknowledged. The sample size was relatively small, and the study spanned over a 2-year period, which may raise concerns about the generalizability of the findings. This study has limitations, such as a small sample size and a two-year study duration, affecting the generalizability of the findings. Selection bias may be present due to the exclusive inclusion of individuals seeking medical attention, potentially leading to an overestimation of ACDS scores. Fu-

ture studies should aim for a more diverse sample. The absence of participants aged 18-39 is another limitation that could bias the results. Caution is needed when applying the findings to the younger population. The study period coincided with the COVID-19 pandemic and lockdowns, which may have negatively impacted therapy adherence due to various COVID-19-related events. Retrospective data collection introduces recall bias and accuracy limitations.

Therefore, caution should be exercised when interpreting the findings of this study, and future research with larger sample sizes and prospective designs is needed to confirm the results. It is important to consider the potential impact of COVID-19 and other external factors on adherence to therapy in future studies.

Conclusion

Our study highlights low adherence among individuals with Type 2 Diabetes Mellitus. Females exhibited significantly higher adherence than males. Age groups did not show significant differences in adherence, although the 60-69 age group had slightly lower adherence. Adherence levels were slightly higher among rural residents compared to urban residents, but this difference was not statistically significant, as well as employment status and education levels. Further research is needed to understand adherence factors, and raising awareness among patients, families, and healthcare providers is crucial for enhancing diabetes management. Addressing low adherence requires a multidisciplinary, uniform approach from the patient, family, and all levels of the healthcare system. Knowledge about adherence factors can aid in implementing effective strategies to improve adherence and treatment outcomes in Bosnia and Herzegovina and similar regions.

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