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ASSOCIATION BETWEEN SOCIODEMOGRAPHIC CHARACTERISTICS AND MEDICATION ADHERENCE IN HOSPITALIZED PATIENTS WITH ACUTE CORONARY SYNDROME: A CROSS-SECTIONAL STUDY

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Medication adherence is a key component of secondary prevention in patients with acute coronary syndrome, yet it remains suboptimal in clinical practice. This study aimed to examine the association between sociodemographic characteristics and medication adherence in this population. A cross-sectional study was conducted among hospitalized patients with myocardial infarction or unstable angina at a tertiary care center. Medication adherence was assessed using the 9-item Hill-Bone Medication Adherence Scale, and sociodemographic data were collected using a structured questionnaire. A total of 109 patients were included in the analysis. The median adherence score was 32 (IQR 29–35). No statistically significant associations were observed between medication adherence and the examined sociodemographic characteristics, including sex, age, educational level, marital status, and employment status. Adherence levels were also similar between patients living alone and those living with others, although a tendency toward lower adherence was observed among patients living alone. The findings suggest that medication adherence in this population cannot be fully explained by the examined sociodemographic characteristics. It is likely influenced by a complex interplay of multiple factors, highlighting the need for more comprehensive approaches to its assessment and improvement. Future research should focus on identifying modifiable factors and developing targeted interventions to improve adherence in patients with acute coronary syndrome.

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Keywords: acute coronary syndrome, medication adherence, sociodemographic factors, hill-bone medication adherence scale

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Povezanost sociodemografskih karakteristika i stepena adherence prema terapiji kod hospitalizovanih pacijenata sa akutnim koronarnim sindromom: studija preseka

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Adherenca prema terapiji predstavlja ključnu komponentu sekundarne prevencije kod pacijenata sa akutnim koronarnim sindromom, ali u kliničkoj praksi često ostaje neadekvatna. Cilj ovog istraživanja bio je da se ispita povezanost sociodemografskih karakteristika i stepena adherence u ovoj populaciji. Sprovedena je studija preseka među hospitalizovanim pacijentima sa infarktom miokarda ili nestabilnom anginom pektoris u tercijarnoj zdravstvenoj ustanovi. Stepen adherence procenjen je primenom Hill-Bone skale (9 stavki), dok su sociodemografski podaci prikupljeni strukturisanim upitnikom. U analizu je uključeno ukupno 109 pacijenata. Medijana skora adherence iznosila je 32 (IQR 29–35). Nije uočena povezanost između adherence i ispitivanih sociodemografskih karakteristika, uključujući pol, starost, nivo obrazovanja, bračni i radni status. Takođe, nivoi adherence bili su slični među pacijentima koji žive sami i onima koji žive sa drugim osobama, pri čemu je uočena tendencija niže adherence kod pacijenata koji žive sami. Dobijeni rezultati ukazuju na to da adherenca u ovoj populaciji nije pretežno određena ispitivanim sociodemografskim faktorima, već je verovatno uslovljena složenim međudejstvom različitih faktora, što ukazuje na potrebu za sveobuhvatnijim pristupima u njenoj proceni i unapređenju. Buduća istraživanja trebalo bi da budu usmerena na prepoznavanje faktora na koje je moguće uticati, kao i na razvoj ciljanih intervencija u cilju unapređenja adherence kod pacijenata sa akutnim koronarnim sindromom.

Ključne reči: akutni koronarni sindrom, adherenca, sociodemografski faktori, Hill-Bone skala

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Introduction

Cardiovascular diseases represent the leading cause of mortality worldwide (1) and one of the most significant public health challenges in Serbia (2). According to data from the Institute of Public Health of Serbia "Dr Milan Jovanović Batut", in 2023 a total of 48,277 deaths were attributed to diseases of the heart and blood vessels, highlighting the substantial burden of these diseases in the Serbian population (2). Acute coronary syndrome, which includes myocardial infarction and unstable angina pectoris, represents an important clinical manifestation of cardiovascular disease and is associated with an increased risk of recurrent cardiovascular events, rehospitalization, and mortality (3). Secondary prevention is a key component of long-term management in patients after acute coronary syndrome. According to the 2023 European Society of Cardiology (ESC) guidelines for the management of acute coronary syndromes, optimal pharmacological therapy is essential for reducing the risk of recurrent cardiovascular events and mortality (3). In addition, the 2021 ESC guidelines for cardiovascular disease prevention emphasize the importance of long-term adherence to guideline-recommended therapy as a fundamental element of secondary prevention (4).

According to the definition of the World Health Organization, adherence refers to the extent to which a patient's behavior with regard to taking medication and following recommendations corresponds with the advice provided by a healthcare professional (5). Low levels of medication adherence represent a common problem in clinical practice and are associated with unfavorable clinical outcomes. A meta-analysis has shown that low adherence is associated with a significantly higher risk of mortality compared with patients with high adherence (6). Among patients with acute coronary syndrome, patterns of insufficient adherence to recommended therapy have been associated with poorer clinical outcomes (7). In addition, a Cochrane systematic review indicates that patients prescribed medications for self-administration take on average only about half of the prescribed doses, highlighting the high prevalence of medication non-adherence in everyday clinical practice (8).

Adherence is a complex and multifactorial phenomenon influenced by socioeconomic, clinical, psychological, and demographic factors, as well as therapy-related factors such as regimen complexity.(5,9). Sociodemographic characteristics such as sex, age, and level of education have been investigated as potential determinants of medication adherence after myocardial infarction (10). In addition, social support represents an important factor associated with better adherence to therapy (11).

In this context, pharmaceutical care interventions may play an important role in supporting medication adherence. The role of pharmacists in clinical settings has been evolving, with

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pharmacist-led interventions increasingly recognized as beneficial for supporting medication adherence across different patient populations (12–18). Therefore, identifying factors associated with lower adherence may be important for guiding targeted interventions in patients with acute coronary syndrome.

In the local context, data on the association between sociodemographic characteristics and the level of medication adherence among patients with acute coronary syndrome are limited. Identification of sociodemographic factors associated with lower adherence may contribute to the early recognition of patients at risk and support the development of targeted interventions aimed at improving adherence within the framework of secondary prevention.

Aim

The aim of this study was to examine the association between sociodemographic characteristics (sex, age, level of education, marital status, employment status, and living arrangement) and the level of medication adherence prior to hospitalization among patients with acute coronary syndrome (myocardial infarction or unstable angina).

Materials and methods

Study design

The study was conducted as a cross-sectional study among hospitalized patients diagnosed with acute myocardial infarction (STEMI/NSTEMI) or unstable angina pectoris.

Data were collected during hospitalization using interviewer-administered questionnaires, with questions read aloud to participants and responses recorded by the interviewer. Patients were asked to report their medication-taking behavior prior to hospitalization, reflecting their usual adherence in the outpatient setting. Medication adherence was assessed using the Hill-Bone Medication Adherence Scale, while sociodemographic data were collected using a structured questionnaire. Data were collected during hospitalization between October 2025 and February 2026.

Participants

A total of 120 patients hospitalized at the Clinic of Cardiology, University Clinical Center Niš, with a diagnosis of acute myocardial infarction (STEMI/NSTEMI) or unstable angina pectoris were enrolled in the study, while 8 patients declined participation. Patients were recruited consecutively during the study period.

Of the enrolled patients, complete baseline adherence data were available for 109 patients, who were included in the final analysis.

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The inclusion criteria were: age ≥ 18 years, confirmed diagnosis of acute myocardial infarction or unstable angina pectoris, and the ability to provide informed consent.

Exclusion criteria included the presence of severe comorbidities significantly affecting survival, cognitive impairment or other conditions preventing adequate communication and understanding of the questionnaire items, as well as the absence of chronic therapy prior to hospitalization.

Study variables

The primary variable of interest was the level of medication adherence.

Independent variables included the following sociodemographic characteristics: sex, age, level of education, marital status, employment status, and living arrangement (living alone, living with a partner, living with family, or other forms of shared living).

Instruments

Medication adherence was assessed using the 9-item Hill-Bone Medication Adherence Scale (HB-MAS). The scale is a previously validated instrument originally developed to assess adherence to antihypertensive therapy and has since been applied in different populations and clinical settings. Its reliability and validity have been established in previous studies (19,20).

The scale consists of nine statements assessing the frequency of non-adherence to prescribed therapy. Responses are recorded on a four-point Likert scale:

1 – “Always”

2 – “Most of the time”

3 – “Sometimes”

4 – “Never”

The total score is obtained by summing responses to all nine items and ranges from 9 to 36 points. Higher scores indicate a higher level of medication adherence.

Sociodemographic data (sex, age, level of education, marital status, employment status, and living arrangement) were collected using an interviewer-administered structured questionnaire. The questionnaire included items designed to capture key sociodemographic characteristics of the study participants.

Translation and cultural adaptation of the instrument

The Hill-Bone Medication Adherence Scale was translated into Serbian using a forward–backward translation procedure. Two independent translators whose native language was Serbian performed the forward translation. After comparison of the translated versions, a consensus version was developed.

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The consensus version was then back-translated into English by a third independent translator whose native language was English and who was blinded to the original version of the instrument. The back-translated version was compared with the original to ensure semantic and conceptual equivalence. The final version of the questionnaire was adapted to the linguistic and cultural context of the target population without modification of the original structure and content.

Ethical considerations

The study was approved by the Ethics Committee of the University Clinical Center Niš (approval number 26249/11, dated September 3, 2025).

The study was conducted in accordance with the principles of the Declaration of Helsinki. All participants provided written informed consent prior to inclusion in the study.

All data were anonymized and used exclusively for research purposes.

Statistical analysis

Statistical analysis was performed using IBM SPSS Statistics, version 20. Continuous variables were presented as mean ± standard deviation (SD) or median with interquartile range (IQR), depending on their distribution, while categorical variables were expressed as frequencies and percentages.

The normality of data distribution was assessed using the Shapiro–Wilk test. As adherence scores were not normally distributed ($p < 0.001$), non-parametric tests were used.

Differences in medication adherence between two groups were assessed using the Mann–Whitney U test. This test was applied for sex (male/female).

Comparisons among multiple groups were performed using the Kruskal–Wallis test. This test was applied for level of education (primary/secondary/college/university), marital status (single/married/divorced/widowed), employment status (unemployed/employed/retired), and living arrangement (living alone/living with family/living with a partner/other).

Correlations between continuous variables, including age and adherence score, were evaluated using Spearman's rank correlation coefficient due to the non-normal distribution of adherence scores.

A p-value of less than 0.05 was considered statistically significant. All statistical tests were two-tailed.

Results

Characteristics of the study population

A total of 120 patients with acute coronary syndrome were initially included in the study. Baseline adherence data were available for 109 patients, who were included in the analysis.

The mean age of the participants was 65.39 ± 11.22 years (range 38–89 years). The study population consisted of 65 (59.6%) men and 44 (40.4%) women.

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Regarding educational level, 20 (18.5%) participants had primary education, 68 (63.0%) had secondary education, 8 (7.4%) had higher vocational education, and 12 (11.1%) had university education.

According to marital status, 65 (60.2%) participants were married, 3 (2.8%) were single, 17 (15.7%) were divorced, and 23 (21.3%) were widowed.

In terms of employment status, 38 (34.9%) participants were employed, 9 (8.3%) were unemployed, and 62 (56.9%) were retired.

Concerning living arrangements, 23 (21.1%) patients lived alone, 53 (48.6%) lived with family members, 31 (28.4%) lived with a partner, and 2 (1.8%) reported other living arrangements.

The detailed sociodemographic characteristics of the study population are presented in Table 1.

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Table 1. Sociodemographic characteristics of patients with acute coronary syndrome (N=109)

Variable	Value
Age (years)	65.39 ± 11.22
Male	65 (59.6%)
Female	44 (40.4%)
Education level (N=108)	
Primary education	20 (18.5%)
Secondary education	68 (63.0%)
Higher vocational education	8 (7.4%)
University education	12 (11.1%)
Marital status (N=108)	
Single	3 (2.8%)
Married	65 (60.2%)
Divorced	17 (15.7%)
Widowed	23 (21.3%)
Employment status (N=109)	
Unemployed	9 (8.3%)
Employed	38 (34.9%)
Retired	62 (56.9%)
Living arrangement (N=109)	
Living alone	23 (21.1%)
Living with family	53 (48.6%)
Living with partner	31 (28.4%)
Other	2 (1.8%)

** Continuous variables are presented as mean ± standard deviation (SD), while categorical variables are presented as number (percentage).*

† Percentages are based on valid cases; missing data were excluded from the analysis.

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Medication adherence

Medication adherence, assessed using the HB-MAS scale, had a median score of 32 (IQR 29–35), with values ranging from 9 to 36.

The distribution of HB-MAS scores is presented in Table 2.

Table 2. Distribution of HB-MAS scores

Variable	Value
Median (IQR)	32 (29–35)
Min–Max	9–36

Association between adherence and demographic characteristics

The association between medication adherence and sociodemographic characteristics was examined. No difference in adherence was observed between male and female patients (Mann–Whitney U test, $p = 0.931$).

Age was not correlated with medication adherence (Spearman's rho = −0.065, $p = 0.504$).

Adherence levels were comparable across different educational groups (Kruskal–Wallis $\chi^2 = 0.130$, $df = 3$, $p = 0.988$) and marital status categories (Kruskal–Wallis $\chi^2 = 0.710$, $df = 3$, $p = 0.871$).

Similarly, adherence did not vary across employment status groups (Kruskal–Wallis $\chi^2 = 1.029$, $df = 2$, $p = 0.598$), although employed participants showed a tendency toward higher mean ranks compared to unemployed individuals.

No differences in adherence were observed across living arrangement categories (Kruskal–Wallis $\chi^2 = 1.951$, $df = 3$, $p = 0.583$). However, patients living alone demonstrated a tendency toward lower mean ranks of adherence compared to those living with family members or a partner.

The results of the statistical analysis are presented in Table 3.

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Table 3. Association between adherence and sociodemographic variables

Variable	Category	Mean rank	p-value
Sex	Female	55.32	0.931
	Male	54.78	
Age	-	rho = -0.065	0.504
Education	Primary	53.45	0.988
	Secondary	54.57	
	Higher vocational education	52.69	
	University	57.04	
Marital status	Married	55.64	0.871
	Single	58.00	
	Divorced	48.76	
	Widowed	55.07	
Employment	Unemployed	50.72	0.598
	Employed	59.08	
	Retired	53.12	
Living arrangement	Living alone	49.28	0.583
	Living with family	57.36	
	Living with partner	53.89	
	Other	75.5	

Multivariable linear regression analysis was performed to assess independent associations between sociodemographic characteristics and medication adherence. The overall model was not statistically significant (R^2 = 0.045, p = 0.951). None of the examined sociodemographic variables were significantly associated with medication adherence in the multivariable model.

Discussion

Medication adherence represents a complex, dynamic, and multifactorial phenomenon, particularly in patients with acute coronary syndrome, where long-term pharmacotherapy is essential for

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effective secondary prevention (3,4). Previous evidence has consistently demonstrated that suboptimal adherence to cardiovascular therapy is common and associated with an increased risk of adverse clinical outcomes and mortality (21).

In the present study, no statistically significant association was observed between baseline medication adherence and sociodemographic characteristics, including sex, age, educational level, marital status, and employment status. These findings are consistent with previous evidence suggesting that the relationship between sociodemographic factors and medication adherence is heterogeneous and context-dependent across different populations and settings (22,23). Similar findings have also been reported in patients with acute coronary syndrome, where baseline characteristics were not consistently associated with medication adherence (24). Taken together, these results suggest that sociodemographic characteristics alone may have limited predictive value for medication adherence in this study population. Multivariable analysis did not identify any independent predictors of medication adherence.

Although no statistically significant association was identified, patients living alone demonstrated a tendency toward lower adherence compared to those living with family members or a partner, suggesting a potentially clinically relevant trend.

In this context, living alone may be considered an objective indicator of limited day-to-day support in medication management. Evidence from previous studies suggests that living alone may be associated with a higher likelihood of medication non-adherence (25). In addition, individuals living alone may be at increased risk of drug-related problems, including potentially suboptimal medication adherence (26).

The observed tendency toward lower adherence among patients living alone may help identify a subgroup of patients who could benefit from additional support. Early identification of such patients during hospitalization may be important for optimizing long-term therapy management. Previous studies have shown that pharmacist-led interventions can improve medication adherence and clinical outcomes in patients with chronic disease (12,27). This may be particularly relevant for patients living alone, who may be at increased risk of suboptimal adherence. Further research is needed to evaluate the potential impact of targeted pharmacist-led interventions specifically in this patient population.

The absence of statistically significant associations across sociodemographic variables in this study may be partially explained by the relatively high baseline adherence observed in the study population, suggesting a possible ceiling effect. Limited variability in adherence scores may have partially limited the ability to detect differences between subgroups, which represents a recognized

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methodological challenge in adherence research (23). Although data were collected during hospitalization, medication adherence was assessed based on patients' self-reported medication-taking behavior prior to admission. Nevertheless, this approach may still be subject to recall bias and may not fully reflect long-term adherence patterns after discharge. Previous studies have shown that adherence in patients with acute coronary syndrome tends to decline over time, particularly in the months following the acute event, suggesting that early adherence assessed during hospitalization may not fully reflect long-term adherence behavior (28).

Overall, the findings of this study suggest that medication adherence cannot be fully explained by sociodemographic characteristics alone. Instead, adherence appears to be influenced by a complex interplay of behavioral, social, and healthcare-related factors. From a clinical perspective, these results highlight the potential importance of more comprehensive and patient-centered approaches, including multidisciplinary strategies aimed at supporting long-term adherence in patients with acute coronary syndrome.

Limitations

Several limitations of this study should be acknowledged. First, the cross-sectional design precludes any conclusions regarding causal relationships between sociodemographic characteristics and medication adherence. Second, the study was conducted in a single tertiary care center, which may limit the generalizability of the findings to other populations and healthcare settings.

Third, the relatively small sample size and the high level of baseline adherence observed in the study population may have reduced the statistical power to detect significant differences between subgroups.

In addition, medication adherence was assessed through interviewer-administered questionnaires, based on patients' self-reported medication-taking behavior prior to hospitalization. This approach may be subject to recall bias, as well as social desirability bias, with participants potentially overreporting adherence due to the presence of an interviewer. Interviewer-related bias cannot be excluded. However, this method may have improved data completeness and ensured a better understanding of the questionnaire items.

Finally, adherence was evaluated during hospitalization and therefore may not reflect long-term adherence behavior following discharge, which is known to decline over time in patients with acute coronary syndrome (28).

Conclusion

In this cross-sectional study of patients with acute coronary syndrome, no statistically significant associations were found between medication adherence and sociodemographic characteristics,

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including sex, age, educational level, marital status, employment status, and living arrangement. These findings suggest that sociodemographic factors alone may be insufficient to identify patients at risk of poor adherence.

Medication adherence appears to be influenced by multiple interacting factors, underscoring the need for more comprehensive approaches to its assessment and management. Future research should focus on identifying modifiable determinants and developing targeted interventions to improve adherence and clinical outcomes in this patient population.

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