

INCOME, EDUCATION, AND BARRIERS TO DENTAL CARE ACCESS IN RURAL COMMUNITIES. A CROSS-SECTIONAL STUDY

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INCOME, EDUCATION, AND BARRIERS TO DENTAL CARE ACCESS IN RURAL COMMUNITIES. A CROSS-SECTIONAL STUDY (Abstract): Access to dental services in rural areas is often limited by socio-economic and structural barriers, contributing to a high prevalence of dental caries and persistent oral health inequalities. **Aim:** This study aimed to assess access to dental services in a rural population and to analyze the associations between socio-economic factors, perceived barriers to care, and oral health status, measured using the DMFT index. **Materials and methods:** A cross-sectional observational study was conducted in 2025 among 72 adults living in rural areas of Bacău County, Romania. Participants underwent a standardized dental examination based on ICDAS criteria, and caries experience was assessed using the DMFT index. A structured questionnaire collected socio-demographic data and evaluated perceived financial, educational, and geographic barriers to dental care using a five-point Likert scale. **Results:** A very high prevalence of dental caries was identified, with DMFT values ranging from 0 to 25. Only 1.39% of participants were caries-free, while 22.22% presented DMFT \geq 13. Higher DMFT scores were significantly associated with lower educational level ($r = -0.342$, $p = 0.003$), perceived financial constraints, and the perception that household income influences dental attendance ($r = 0.260$, $p = 0.027$). Geographic barriers also contributed, as perceived distance to the dental office was positively correlated with DMFT ($r = 0.340$, $p = 0.003$). Financial barriers were strongly interrelated and linked to delayed care and emergency-only visits ($p < 0.001$). Lower educational attainment was further associated with reduced understanding of medical advice and limited access to preventive information. **Conclusions:** Oral health disparities in rural populations are driven by interconnected socio-economic, educational, and geographic factors, underscoring the need for targeted preventive strategies, improved rural dental infrastructure, and enhanced public support. **Keywords:** RURAL POPULATION; DENTAL CARIES; ACCESS TO DENTAL CARE.

INTRODUCTION

Access to dental services in rural areas is significantly affected by household income levels. Evidence shows that individuals with low income and without dental insurance access dental care less frequently, particularly preventive services, which

increases the risk of complications (1). In Romania, regional economic studies indicate a significant association between income level and the frequency of dental visits, with higher-income individuals being more engaged in preventive care and regular treatments (2). Consequently, lim-

ited financial resources in rural settings lead to a reliance on emergency treatments and delays in necessary oral healthcare.

Another essential factor is educational level and health literacy. Rural populations generally have lower levels of formal education and limited knowledge regarding oral hygiene, which negatively influences preventive attitudes. For example, a study conducted in Romania showed that only 38.8% of 12-year-old children in rural areas brush their teeth twice daily, and 11.2% have never attended a dental check-up (3). At the international level, an analysis of data from 27 countries confirmed that low educational attainment and reduced income are major predictors of infrequent dental visits and untreated oral health problems (4).

Deficient medical infrastructure and the unequal distribution of dental professionals represent additional major barriers. In the United States, more than 4,600 rural areas are classified as Dental Health Professional Shortage Areas, reflecting a chronic lack of specialized dental personnel in these regions (5). In Romania, although the overall number of dentists is relatively high, most practice in urban and private settings, while rural areas remain underserved and face difficulties in accessing care through the public system (6). This situation forces rural patients to travel long distances for dental treatment, resulting in increased time and financial costs and discouraging the utilization of dental services. Therefore, the aim of this study is to identify and analyze the socio-economic factors influencing access to dental services among the rural population, with particular emphasis on the roles of income level, education, and available healthcare infrastructure. The study seeks to highlight the main barriers con-

tributing to inequalities in oral healthcare utilization and to propose potential intervention strategies to reduce these disparities.

The aim of the study was to assess access to dental services and to analyze associated socio-economic factors, based on clinical data and responses to a standardized questionnaire.

The study population consisted of adults aged 18 years and older who were permanent residents of rural localities in Bacău County. Participants were selected using simple random sampling, in accordance with predefined eligibility criteria, including provision of informed consent and the absence of severe systemic diseases.

For the clinical component, all participants underwent a standardized dental examination performed according to the criteria of the International Caries Detection and Assessment System (ICDAS), which was used to identify and record carious lesions (7). Caries experience was quantified using the DMFT index (Decayed, Missing, and Filled Teeth), in line with World Health Organization recommendations (8). All clinical assessments were performed in a dental clinic by a calibrated examiner.

In parallel, participants completed a structured questionnaire addressing access to dental care. The questionnaire included demographic and socio-economic variables (age, sex, educational level, occupational status, and monthly household income), as well as 15 items assessed on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). These items explored perceived barriers to accessing dental services, the influence of economic, educational, and geographic factors, and overall satisfaction with available dental care.

MATERIALS AND METHODS

This cross-sectional study was conducted as a descriptive, observational investigation between January and April 2025 among the adult population living in rural areas of Bacău County, Romania.

Collected data were processed and statistically analyzed using *SPSS software version 26.0*. Descriptive statistics included frequencies, means, and standard deviations for socio-demographic variables, questionnaire responses, the DMFT index, and ICDAS scores.

Correlation analyses

(Pearson or Spearman, depending on data distribution) were applied to examine associations between socio-economic variables (income, educational level, occupational status), caries experience (DMFT), and perceived access to dental services. Group differences were assessed using Student's *t* test or ANOVA for continuous

variables (DMFT), and chi-square tests for categorical variables (perception frequencies across educational levels). Statistical significance was set at $p < 0.05$.

RESULTS

The study sample included 72 participants from rural areas, with a mean age of 39.13 ± 13.16 years. Sex distribution was balanced (52.78% men and 47.22% women). Most respondents had completed upper secondary education (62.50%), followed by those with post-secondary or higher education (31.94%), indicating a relatively high level of literacy. Regarding occupational status, 69.44% were employed, while the remainder belonged to socio-economically vulnerable groups. Monthly household income was predominantly between 2001-3000 RON (43.06%) or above 3000 RON (31.94%). With respect to dental care financing, 56.94% of participants benefited from reimbursed dental services (tab.1).

TABLE I.

Socio-demographic and economic characteristics of the study sample

Characteristic	Category	n	%
Area of residence	Rural	72	100
Age (years)	Mean \pm SD	-	39.13 ± 13.16
	Dominant age groups	-	25-35; 45-50
Sex	Male	38	52.78
	Female	34	47.22
Education level	No formal education	1	1.39
	Lower secondary (gymnasium)	3	4.17
	Upper secondary (high school)	45	62.50
	Post-secondary / higher education	23	31.94
Occupational status	Employed	50	69.44
	Unemployed	10	13.89
	Retired	5	6.94
	Student	7	9.72
Monthly household income	< 1000 RON	5	6.94
	1001-2000 RON	13	18.06
	2001-3000 RON	31	43.06
	> 3000 RON	23	31.94
Payment method for dental treatments	Reimbursed by the National Health Insurance (NHI)	41	56.94
	Out-of-pocket payment	31	43.06

The analysis of DMFT scores indicates an extensive caries experience among participants, with values ranging from 0 to

25. The most frequent scores were 9 (13.89%), 6 and 12 (12.50% each), while only 1.39% of respondents presented no caries experience (DMFT = 0), highlighting

a very high prevalence of the condition. Additionally, 22.22% of participants recorded DMFT values ≥ 13 , suggesting advanced oral impairment and underscoring the need for analyses correlated with socio-economic factors, as well as for preventive interventions in rural settings.

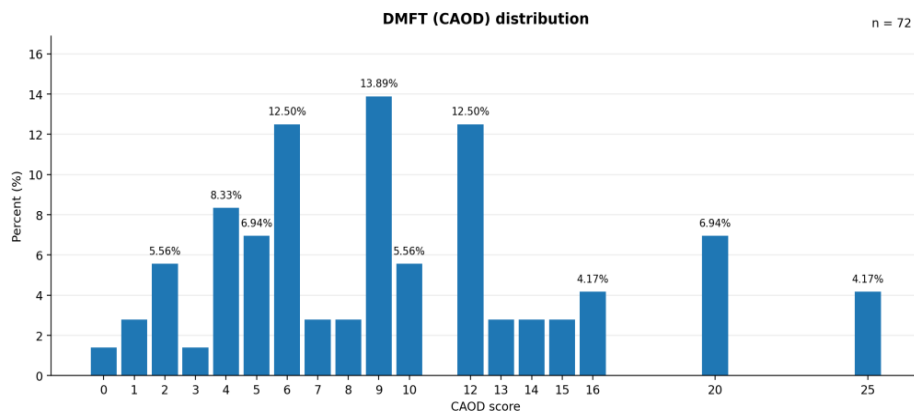


Fig. 1. Distribution of participants according to DMFT values perceptions regarding access to dental services and perceived barriers analysis

Socioeconomic factors further shaped access to care, as 86.11% of participants acknowledged that household income influences the decision to seek dental treatment. More than half of respondents (59.73%) perceived free or reimbursed dental services as insufficient, indicating limited public financial support. Preventive care was also considered inadequate: 56.94% believed that dental prevention is not a community priority, while 59.72% reported a lack of oral health information

campaigns. Educational level influenced communication with healthcare providers for 59.73% of participants, emphasizing the role of health literacy. In contrast, waiting time was not viewed as a major barrier, with only 13.89% considering it problematic. Notably, all respondents (100%) agreed that greater investment by authorities in rural dental infrastructure is necessary, underscoring the need for systemic interventions to improve oral healthcare access in rural populations (tab. II).

TABLE II.
Participants' perceptions regarding access to dental services and perceived barriers (questionnaire)

Assessed statement	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)
Distance to the dental office influences the decision to seek dental care	4.17	5.56	1.39	41.67	47.22
Cost of dental treatments represents a barrier	-	4.17	16.67	58.33	20.83

Assessed statement	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)
Lack of adequate transportation hinders access to dental services	-	26.39	30.56	37.50	1.39
Household income influences the decision to visit the dentist	-	4.17	9.72	56.94	29.17
Information on dental prevention is insufficient in the community	-	19.44	20.83	48.61	9.72
Own education level influences the ability to understand the dentist's advice	-	19.44	18.06	55.56	4.17
Free or reimbursed dental services are insufficient	-	6.95	4.17	55.56	34.72
Local dental services are of good quality	-	29.17	41.67	27.78	1.39
Waiting time for a dental appointment is too long	13.89	37.50	34.72	11.11	2.78
Dental treatments have been postponed due to financial reasons	4.17	8.33	26.39	45.83	15.28
Visiting the dentist only in emergency situations due to financial reasons	2.78	4.17	4.17	41.67	47.22
Dental prevention is not a priority in the community	-	22.22	18.06	47.22	9.72
There is a lack of oral health information campaigns in the community	-	19.44	20.83	48.61	11.11
Access to dental services is more difficult in rural than in urban areas	-	12.50	20.83	45.83	20.83
Authorities should invest more in rural dental infrastructure	0	0	0	58.33	41.67

Correlations between socio-economic variables and clinical scores

Correlation analysis revealed several statistically significant relationships between the variables examined. Monthly household income was positively and significantly correlated with education level ($r = 0.336$; $p = 0.004$) and negatively correlated with occupational status ($r = -0.464$; $p < 0.001$), indicating that individuals with higher incomes generally have higher educational attainment and are more frequently employed, whereas lower income levels are associated with more vulnerable occupational statuses. Education level showed a significant negative correlation with the DMFT score ($r = -0.342$; $p = 0.003$), suggesting that higher educational attainment

is associated with a lower caries experience. In contrast, no significant correlations were observed between the DMFT score and occupational status ($r = -0.080$; $p = 0.502$) or monthly household income ($r = -0.043$; $p = 0.721$) (fig. 2).

The statistical analysis highlighted two significant relationships between the DMFT score and perceived barriers to accessing dental services. A positive correlation was observed between DMFT and the perception that distance to the dental office influences the decision to seek care ($r = 0.340$, $p = 0.003$), indicating that individuals who perceive distance as a barrier tend to have poorer oral health status. In contrast, the perception that access to dental services is more difficult in rural areas than

in urban settings was negatively correlated with the DMFT score ($r = -0.322$, $p = 0.006$), possibly suggesting that individuals with lower DMFT scores are more aware of access inequalities. Other variables, such as lack of transportation or waiting time for appointments, did not show significant correlations (fig. 3).

The relationship between caries experience and perceived barriers to dental care was explored using Pearson correlation analysis. The results revealed a significant positive association between the DMFT score and the perception that household income influences dental attendance ($r = 0.260$, $p = 0.027$). In contrast, no significant correlations were observed between DMFT and other cost-related variables, despite the strong intercorrelations among financial barriers themselves ($p < 0.001$). Furthermore, DMFT showed a positive correlation with the perception that educational level affects the understanding of medical advice ($r = 0.389$, $p = 0.001$), indicating a higher caries experience among

individuals with lower educational attainment. Although DMFT was not directly associated with other prevention-related perceptions, these factors were significantly interrelated, emphasizing the central role of education in oral health outcomes and preventive behaviors (figs. 4, 5).

To better understand the determinants of access to dental services, Pearson correlation analysis was conducted to examine the role of educational and economic factors. The results showed that lower educational level was significantly associated with perceiving distance to the dental office as a barrier ($r = -0.308$, $p = 0.009$) and with reporting longer waiting times ($r = -0.392$, $p = 0.001$). In addition, lack of transportation was significantly linked to distance, waiting time, and difficulties in accessing dental care in rural areas ($p \leq 0.032$). The negative correlation between rural access difficulties and distance ($r = -0.236$, $p = 0.046$) suggests that barriers in rural settings extend beyond simple geographic proximity (fig. 6).

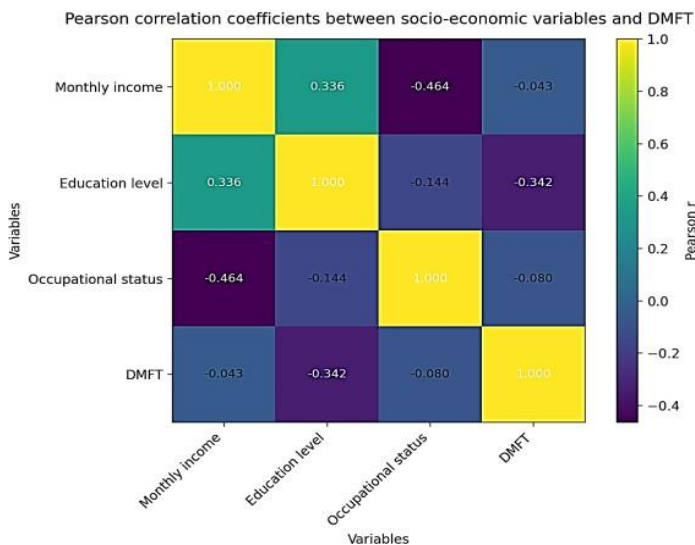


Fig. 2. Correlations between DMFT and monthly income, occupational status, and education level

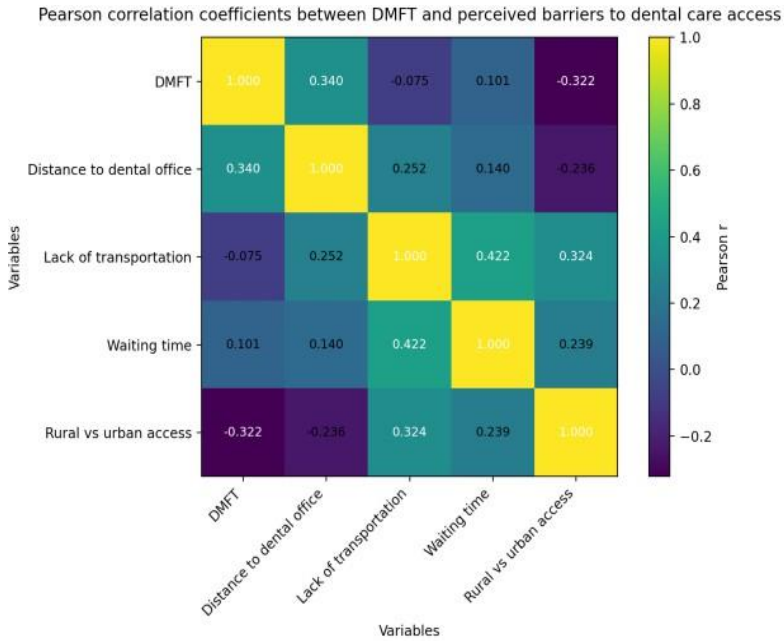


Fig. 3. Correlations between DMFT and perceived barriers to access to dental services

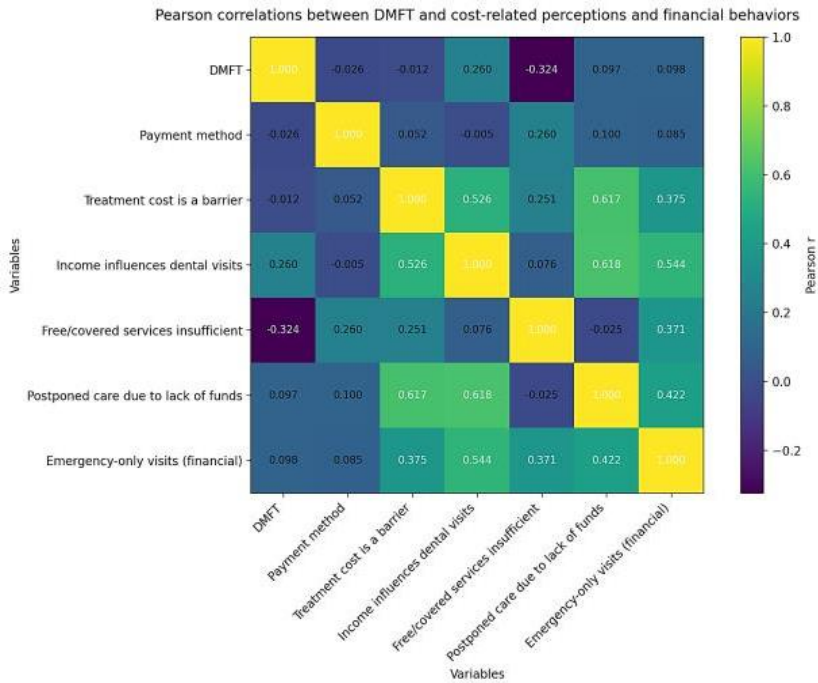


Fig. 4. Pearson correlations between the DMFT score and cost-related perceptions and financial behaviors associated with access to dental care

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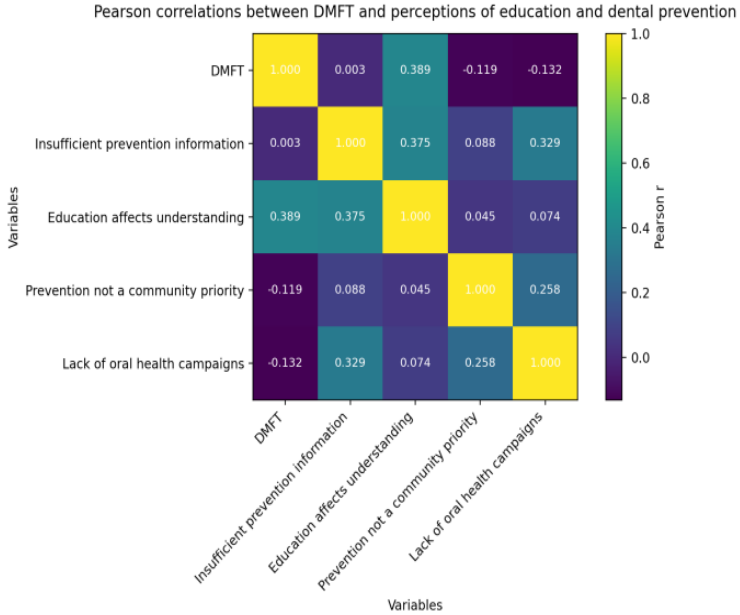


Fig. 5. Pearson correlations between the DMFT score and perceptions related to education and dental prevention

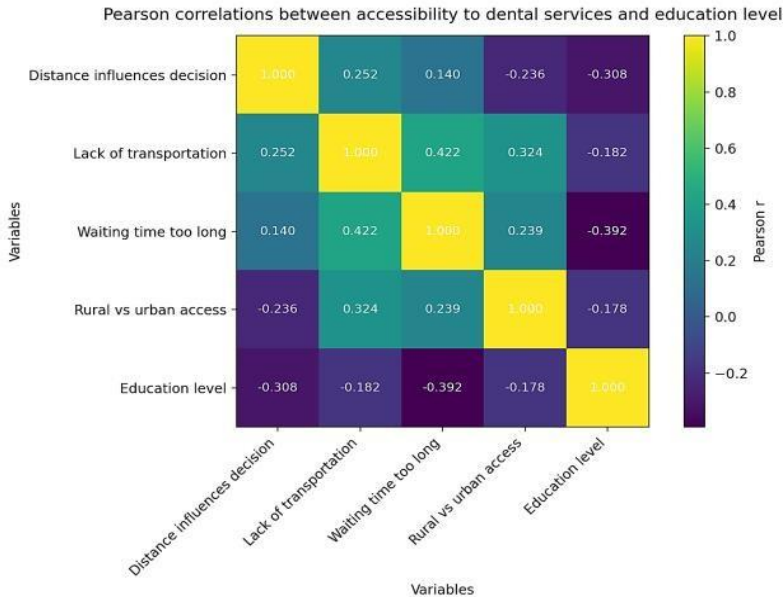


Fig. 6. Pearson correlations between accessibility to dental services and educational level

Economic constraints also played a major role: the perception that household income influences dental attendance was strongly associated with high treatment

costs ($r = 0.526$), postponement of dental care ($r = 0.618$), and reliance on emergency-only visits ($r = 0.544$). Conversely, higher educational attainment was negatively associated with these financial barriers,

indicating a protective effect of education (fig. 7). Overall, these findings emphasize the combined and interdependent impact of education and income on access to dental care.

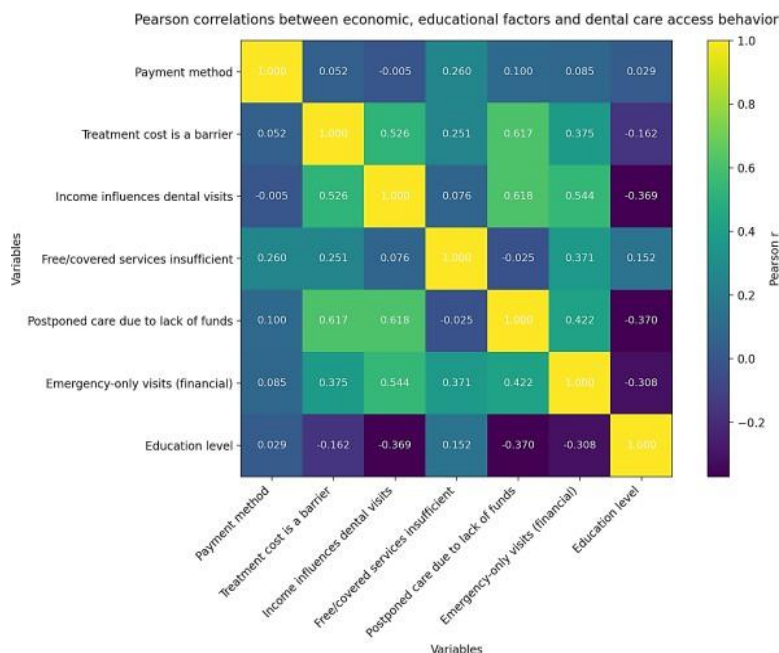


Fig. 7. Pearson correlations between economic and educational factors and dental care-seeking behavior

Lower educational level was significantly associated with difficulties in understanding dentists’ advice ($r = -0.557$, $p < 0.001$) and with the perceived lack of oral health information campaigns ($r = -0.268$, $p = 0.023$), while insufficient preventive information was linked to both limited understanding and absence of campaigns ($p \leq 0.005$) (fig. 8). Lower household income was associated with transportation barriers ($r = -0.255$, $p = 0.031$), rural access difficulties ($r = -0.290$, $p = 0.014$), and especially longer waiting times for appointments ($r = -0.592$, $p < 0.001$), underscoring the combined impact of education, income, and infrastructure on access to dental care

(fig. 9).

Correlation analysis of socio-economic factors revealed a significant influence of income and education on dental care-seeking behavior. Household income was strongly associated with perceived financial barriers, including the decision to seek dental care ($r = 0.526$, $p < 0.001$), postponement of treatments ($r = 0.618$, $p < 0.001$), and reliance on emergency-only visits ($r = 0.544$, $p < 0.001$), while treatment costs were also perceived as a major obstacle ($r = 0.617$, $p < 0.001$). Education level was negatively correlated with these barriers (postponement of care: $r = -0.370$, $p = 0.001$), indicating greater vulnerability

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among less educated individuals. Additionally, lower income was associated with the perception that dental prevention is not a community priority ($r = -0.509, p < 0.001$) and showed borderline negative associations with insufficient preventive infor-

mation and lack of campaigns. Difficulties in understanding medical advice were significantly related to perceived educational level ($r = 0.375, p = 0.001$), highlighting the role of health literacy in oral health prevention (figs. 10, 11).

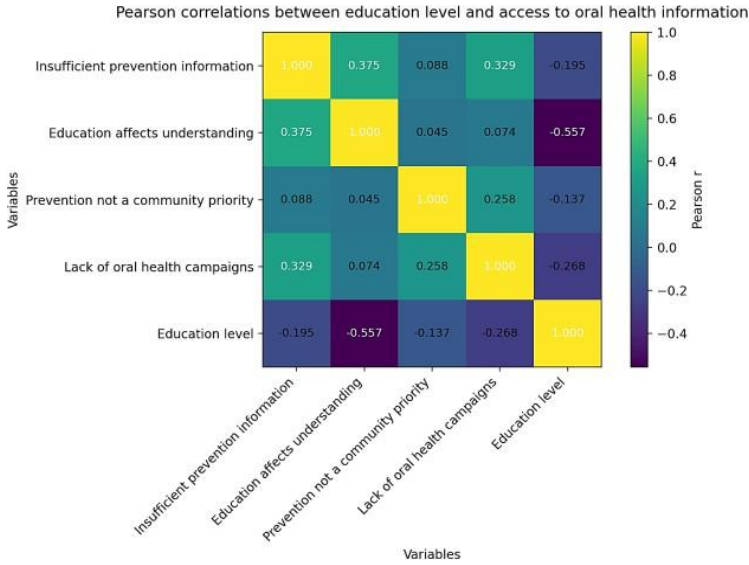


Fig. 8. Pearson correlations between educational level and access to oral health information

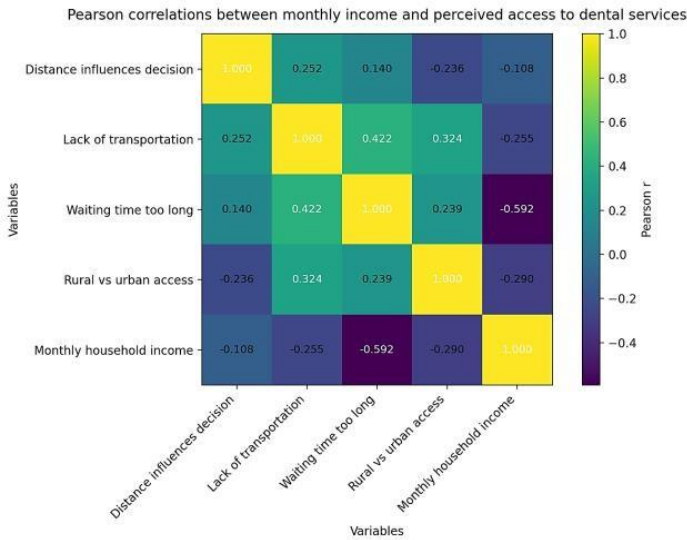


Fig. 9. Pearson correlations between monthly household income and perceived access to dental services

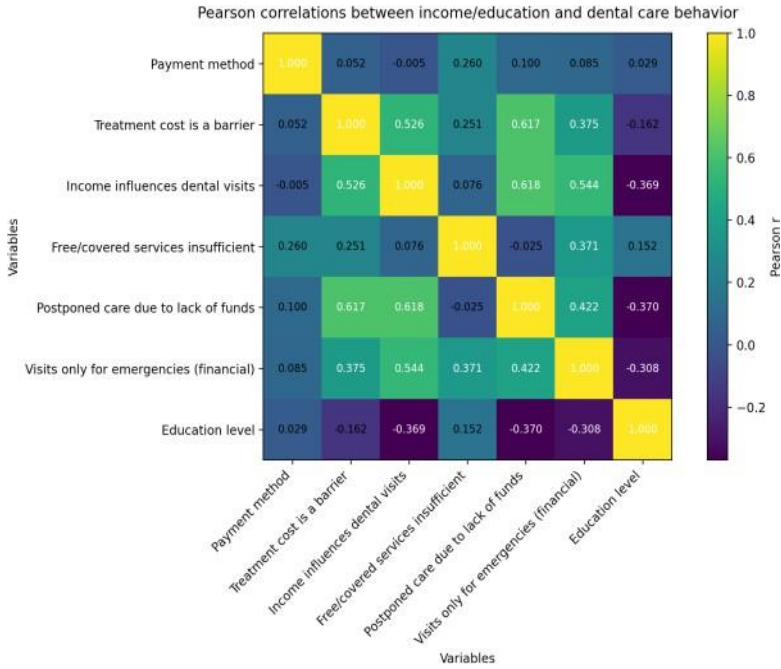


Fig. 10. Pearson correlations between income level and education in relation to dental care- seeking behavior

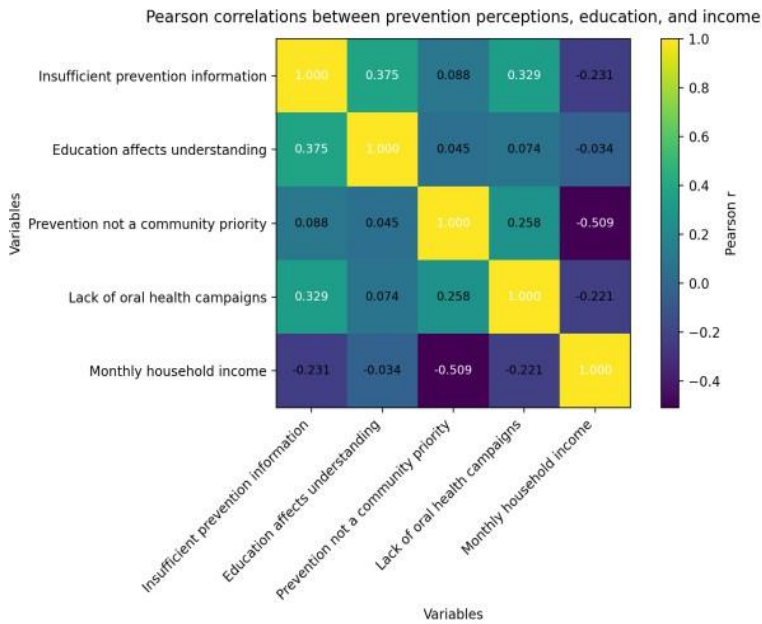


Fig. 11. Pearson correlations between monthly household income and perceptions of dental prevention

DISCUSSION

The present study provides evidence that access to dental services and oral health status in rural populations are strongly influenced by socio-economic and educational determinants. The high prevalence of dental caries observed in the study sample, reflected by elevated DMFT values, is consistent with previous research indicating that rural and socio-economically disadvantaged populations experience a disproportionate burden of oral disease (8, 9).

Educational level emerged as a key protective factor, showing a significant negative association with DMFT scores. Participants with higher educational attainment exhibited lower caries experience, likely due to improved oral health literacy, greater awareness of preventive practices, and more regular utilization of dental services. These findings are in line with international studies demonstrating that education strongly influences oral health behaviors and outcomes (10, 11).

Economic constraints also played a central role in shaping access to dental care. Although monthly household income was not directly correlated with DMFT scores, the perception that income influences the decision to seek dental care was significantly associated with higher caries experience. Financial barriers-including high treatment costs, postponement of care, and reliance on emergency-only visits- were strongly inter-related, suggesting a cumulative and systemic effect on dental care-seeking behavior. Similar patterns have been reported in both European and global studies, where cost-related barriers were identified as major determinants of delayed or avoided dental care (1, 13).

Geographic accessibility further compounded these inequalities. Perceived dis-

tance to dental clinics and lack of transportation were associated with poorer oral health outcomes, highlighting structural barriers faced by rural populations. These results align with evidence showing that rural residence is associated with reduced availability of dental professionals and increased travel distance, negatively affecting service utilization (14, 15).

Finally, the widespread perception of insufficient preventive information and lack of community-based oral health campaigns underscores the need for targeted public health interventions. Health promotion strategies focusing on oral health education, combined with improved access to publicly funded dental services, are essential to reduce inequalities and improve oral health outcomes in rural communities (16, 17).

CONCLUSIONS

The findings of this study demonstrate that oral health status in rural populations is strongly influenced by socio-economic and educational factors. Higher educational attainment was consistently associated with lower DMFT (CAOD) scores, while lower income, perceived financial barriers, and delayed care were linked to increased caries experience. Geographic accessibility, particularly perceived distance and lack of transportation, further contributed to poorer oral health outcomes. Limited health literacy and insufficient community-based preventive information were also associated with higher DMFT scores, underscoring the importance of education and preventive awareness. These results highlight a cycle of socio-economic disadvantage affecting access to dental care and oral health and support the need for targeted public investment in rural dental infrastructure, preventive programs, and health education to reduce oral health inequalities.

CONFLICTS OF INTERESTS

AND FUNDING

The authors declare no conflicts of in-

terest.

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