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Structural determinants related to the rate of outpatient dental emergency consultation in a border area of Chile

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ABSTRACT

Objective: To analyze the structural determinants associated with outpatient dental emergency (ODE) consultation in a border area of Chile between 2021 and 2024. **Materials and methods:** An ecological study was conducted using secondary data from the Monthly Statistical Report (REM) of the Chilean Ministry of Health. The study population consisted of beneficiaries of the public health system who were treated by outpatient dental emergency (ODE). ODE consultation rate was estimated was estimated in the region by sex and by municipality (per 1,000 beneficiaries), as well as the annual percentage variation (APV). A correlational analysis was conducted to explore the relationship between the ODE rate and structural determinants at the geographic level: Income poverty (IP), multidimensional poverty (MP), rurality, mean years of schooling at the municipality level, and the proportion of the migrant population. In addition, the rate ratio (RR) was calculated to compare the different categories of these determinants. **Results:** The outpatient dental emergency (ODE) consultation rate increased significantly between 2021 and 2024 (APV: 17.61%). Rural areas showed a rate 1.56 times higher than urban areas ($p < 0.05$). A significant positive correlation was identified between the ODE rate and the income poverty (IP) (rho = 0.61), rurality (rho = 0.48), and municipality (rho = 0.55), and a significant negative correlation with the years of municipality schooling (rho = –0.45). Multidimensional poverty (MP) showed no significant correlation. The frequency of ODE consultations among the migrant population was higher in rural municipalities. **Conclusions:** Poverty, rurality, low educational level, and migration were identified as structural determinants that negatively impact oral health, as reflected in an increased demand for emergency care, possibly associated with barriers to accessing comprehensive dental services.

Keywords: emergencies; social determinants of health; poverty; rural areas; migration.

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INTRODUCTION

Oral health constitutes an essential component of overall health and general well-being, enabling individuals to communicate, enjoy a varied diet, and maintain an adequate quality of life, self-esteem, and social confidence (1). Despite advances in dentistry, oral diseases remain highly prevalent worldwide, imposing a significant burden in terms of morbidity, mortality, and economic costs to society (2). In this context, outpatient dental emergency (ODE) consultations represent a spontaneous demand for care, usually prompted by acute pain resulting from oral and maxillofacial pathologies such as inflammatory pulpal disease, pericoronitis, odontogenic infections, ulcerative-necrotizing gingivitis and periodontitis, dentoalveolar trauma, and post-extraction complications (3). These conditions not only affect patients' quality of life but also cause work absenteeism and increased treatment costs (4).

The distribution of oral diseases and access to oral healthcare services are inequitable, as they are strongly influenced by the social determinants of health (SDOH) (5), which include socioeconomic factors such as income level, education, occupation, and place of residence, as well as structural factors related to public policies, the organization of the healthcare system, and social inequalities. When these determinants are not adequately addressed, they can predispose certain populations and communities to a higher risk of developing oral diseases and facing barriers to timely access to care (6-8). Thus, poverty and social inequalities play a key role in the occurrence of oral diseases and in the likelihood of receiving appropriate treatment (9).

In Chile, the oral health situation reflects these social disparities, with a greater disease burden observed among groups with lower socioeconomic status. The Chilean healthcare system—which operates under a mixed model—exhibits equity gaps between the public and private sectors, with access to dental care historically prioritized for children and adolescents, as well as for specific groups—such as pregnant women and adults aged 60 and older—through programs like the Explicit Health Guarantees (GES, by its acronym in Spanish) initiative (10). However, dental care for the adult population in the public sector often focuses on addressing existing morbidity, following a model that is less oriented toward control and prevention. This generates a disconnect and a limited offer for this population, which may lead to an increased demand for emergency services (11).

It is crucial to consider the existing disparities between urban and rural areas in terms of oral health and access to care. Several studies have shown that rural populations have poorer oral health status and lower engagement in preventive practices than urban populations. These differences may be associated with factors such as geographic accessibility to healthcare services, socioeconomic characteristics of rural communities, and social representations of oral health that are specific to these contexts (12-14). In the case of Chile, the likelihood of children aged 6 to 12 being caries-free is significantly higher in urban areas than in rural ones (15, 16).

The region of Tarapaca, located in northern Chile, presents sociodemographic characteristics. Of its seven municipalities, five are classified as rural, encompassing a vast territorial area that, nevertheless, houses a smaller proportion of the regional population, which is predominantly concentrated in the urban communes of Iquique and Alto Hospicio. The rural communes of this region feature a higher proportion of male residents and a large concentration of indigenous populations, which in some cases exceeds 80% (17). These rural areas exhibit significant socioeconomic gaps in education and access to basic services (drinking water, electricity, internet), in addition to higher levels of poverty—both in terms of income and multidimensional indicators. These factors could negatively affect oral health and access to emergency dental care. For instance, the lack of access to fixed internet, which is particularly acute in rural communities such as Camiña, Colchane, and Huara, may limit access to information on oral health and tele-dentistry in cases where this service is available (18). Therefore, assessing the structural determinants that influence the demand and utilization of outpatient emergency dental services is essential for designing more effective and equitable oral health interventions and policies capable of improving the oral health of the population in the region of Tarapaca.

Considering the context of oral health inequities, the relevance of social determinants, and the specific characteristics of the region of Tarapaca, the objective of this study was to analyze the structural determinants associated with ODE consultations in this border area of Chile during the years 2021 and 2024.

MATERIALS AND METHODS

An ecological study design was used to examine the relationship between structural determinants and ODE consultations based on data available on the Monthly Statistical Record (REM, by its acronym in Spanish) of the Chilean Ministry of Health. This record compiles information on activities carried out in public health facilities, consolidates it at the national level, and serves as a key tool for monitoring health programs, agreements, and compliance with public health targets. At the same time, this design is appropriate for examining trends and associations in the population.

The study population consisted of all beneficiaries who were treated for an ODE within the public health system. This type of care features the need for immediate and urgent dental treatment, and it is provided on demand if it meets the criteria established in the GES (19). As this was a secondary analysis of administrative data, no sample calculation was performed, since all available records for the study period were considered, allowing for a representative estimate of the behavior of ODE in the region. The inclusion criteria encompassed all ODE consultations recorded in the institutional database of primary healthcare (PHC) centers in the region during 2021-2024. Data from the year 2020 were excluded due to the restrictions imposed by the COVID-19 pandemic on both the population and health centers, which significantly disrupted routine dental care, making it non-representative for the analysis.

The main data source for this study was the REM from the Department of Health Statistics and Information (DEIS, by its acronym in Spanish), under the Ministry of Health of Chile. In particular, the database corresponding to the REM A-09 series for the period 2021-2024, available on the DEIS website, was used. This series provides detailed statistics on dental care delivered in PHC centers, specialty care services, and mobile dental clinics. The registry includes various clinical activities performed on patients, which are categorized as morbidity consultations, dental check-ups, ODE consultations, and records of missed appointments. ODE consultations are recorded once per event and are identified according to the criteria defined by the GES program, which is based on the reason for the patient's visit (19).

Another data source used in this study corresponds to the records of the population enrolled in the public health system, available on the website of the National Health Fund (FONASA, by its acronym in Spanish), the insurance entity of Chile's public healthcare network. This public institution annually publishes statistics on its beneficiary population, including sociodemographic variables such as sex, age group, and commune of residence. For this study, information corresponding to the population enrolled in FONASA in the region was used, disaggregated by sex and commune for each year included in the analysis.

The dependent variable corresponds to the rate of ODE consultations, which was estimated by dividing the total number of ODE consultations recorded in the REM A-09 series in the region of Tarapaca during the study period by the number of beneficiaries of the public health system in the same region, expressed as the number of consultations per 1,000 beneficiaries.

As independent variables, structural determinants reflecting social and economic disparities at the geographic level were considered. Among these, the type of area (urban/rural) was included, classified according to population density criteria, to assess the frequency of ODE consultations according to the territorial context (17). Since the study was conducted in a border region of Chile, the proportion of the migrant population who accessed ODE consultations was also incorporated as a proxy for social vulnerability, considering that their presence could represent a relevant structural determinant. For each year of study and commune, the proportion of ODE consultations recorded in this population was calculated.

The socioeconomic level was estimated using two indicators: income poverty (IP) and multidimensional poverty (MP), according to the municipality where the ODE consultation took place. These data were obtained from the National Socioeconomic Characterization Survey (CASEN, by its acronym in Spanish), prepared by the Ministry of Social Development and Family (20). Another determinant considered was the average number of years of education in the commune, given that it may be related to the level of knowledge and practices in oral health. This variable was estimated by the Office of Agrarian Studies and Policies (ODEPA, by its acronym in Spanish), based on data from the 2017 Census and CASEN 2017 (17).

In the statistical analysis, the rates of ODE consultations were described at the regional level, disaggregated by sex and municipality. In addition, as a summary measure, the average annual percentage variation (APV) of these rates was calculated to synthesize the overall trend in ODE consultations into a single indicator, while mitigating the effect of annual fluctuations (21). APV, commonly used in economics and epidemiology, allows for the measurement of the percentage change in time series and was estimated using the following formula for each year of study:

$$\frac{(\text{Final ODE consultation rate}) - (\text{Initial ODE consultation rate})}{\text{Initial ODE consultation rate}} \times 100$$

The Shapiro-Wilk test was applied to assess compliance with the assumption of normality in the distribution of ODE consultation rates, both overall and disaggregated by sex. Since this assumption was not met, the non-parametric Kruskal-Wallis test was used to determine statistically significant differences in the mean rates of ODE consultations across the years of the study. Similarly, to compare consultation rates between urban and rural areas, the Mann-Whitney test was applied.

In addition, the frequency of ODE consultations among migrant individuals was estimated by dividing the number of ODE consultations in migrants by the total number of ODE consultations performed in each year of the study, and the result was expressed per 1,000 consultations. To assess differences in these frequen-

cies among the various years, the chi-square test was applied. To explore the relationship between ODE consultation rates and structural determinants, a correlation analysis was conducted. Since the dependent variable (ODE rate) did not exhibit a normal distribution, the Spearman correlation coefficient was used.

Additionally, the average ODE consultation rate was described for each commune in the region of Tarapaca, corresponding to the arithmetic mean of the annual consultation rates recorded during the study period. The female-to-male ODE consultation rate ratio was also calculated as a measure to compare the relative behavior between both groups. A value greater than 1 indicates that Group A (women) has a higher mean rate than Group B (men), which may be interpreted as an indicator of health disparities (22).

Each of these measures serves distinct analytical objectives: The APV assesses the temporal evolution of the ODE consultation rate. The average ODE consultation rate describes the mean level of service utilization in each commune. The female-to-male ODE rate ratio compares the relative use of consultations between women and men. And the consultation frequency reflects the relative care burden represented by the migrant population within the health system of each commune.

Data analysis was performed using STATA software v. 19, with a significance level of 5% ($p < 0.05$).

Finally, this study was based on a secondary analysis of anonymized data from the REM A-09 series, collected for administrative purposes by the public healthcare system. According to current national health research regulations, individual informed consent and approval by a Scientific Ethics Committee were not required, as the dataset contained no personally identifiable information and was used solely for population-level analysis.

RESULTS

Throughout the study period, a total of 32,181 ODE consultations were recorded in the region of Tarapaca, with the majority corresponding to women (60.30%). Table 1 shows that in 2021, the ODE consultation rate was 29.69 per 1,000 beneficiaries, increasing to 34.92 in 2024. On average, the APV during the analyzed period was +10.26%, suggesting a general trend of moderate growth in ODE consultation rates.

The mean ODE consultation rate over the years of the study did not show statistically significant differences at the global level ($p = 0.242$). During the period, the rate was consistently higher in women than in men, although the latter exhibited a slightly higher APV. However, for both men ($p = 0.572$) and women ($p = 0.359$), no statistically significant differences were observed in ODE consultation rates over the years analyzed (Table 1).

Table 1. Outpatient dental emergency consultation rate by sex and study year in the region of Tarapaca, 2021-2024.

ODE rate		Study years				Period	AVP**	p-value*
		2021	2022	2023	2024	2021-2024	$\bar{x}$ (%)	
Men	Consultations	2518	2888	3642	3734	12782	+7.89	0.572
	Rate per 1,000	27.27	25.59	35.73	32.23	30.21		
	95% CI	18.75-35.79	12.63-38.55	18.10-53.36	17.92-46.55	24.54-35.87		
Women	Consultations	3585	4432	5566	5816	19399	+7.41	0.359
	Rate per 1,000	32.00	27.41	37.57	37.39	33.59		
	95% CI	21.01-42.99	17.95-36.86	26.45-48.69	24.32-50.45	28.85-38.33		
Total	Consultations	6103	7320	9208	9550	32181	+10.26	0.242
	Rate per 1,000	29.69	26.64	42.13	34.92	33.35		
	IC 95 %	20.12-39.27	15.63-37.65	22.57-61.68	22.91-46.94	27.49-39.20		

*Significance according to the Kruskal–Wallis test. **Average annual percentage variation for 2021-2024.

The urban/rural area represents one of the structural determinants that reflect social and economic disparities of the population in geographical terms, and it may be associated with the frequency of ODE consultations in the region of Tarapaca. Figure 1 shows that the average consultation rate was lower in urban areas (23.74 per 1,000 beneficiaries) compared to rural areas (37.19 per 1,000 beneficiaries), a difference that proved to be statistically significant ($p = 0.030$). In relative terms, the average rate in rural areas was 1.56 times higher than that observed in urban areas.

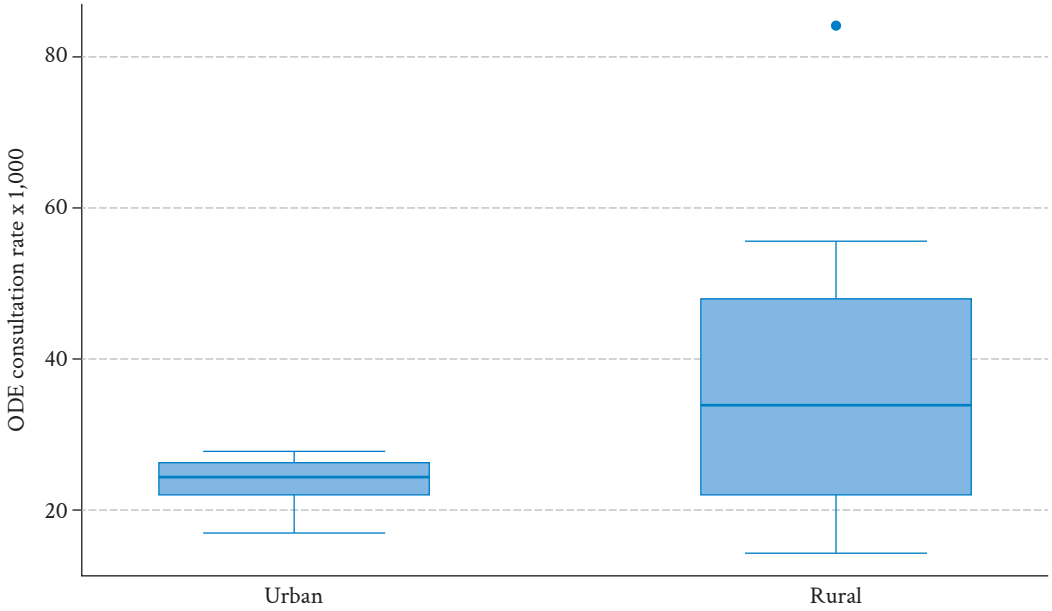

Figure 1. Box-and-whisker plot of the average rate of outpatient dental emergency consultations in urban/rural areas of the region of Tarapaca during the 2021-2024 period.

The migrant population constitutes a vulnerable group in this border region of Chile and may represent a relevant structural determinant associated with differences in the frequency of ODE consultations. Figure 2 shows that, in 2021, there were 2.3 consultations per 1,000 total consultations (95% CI: 0.93-3.82) corresponding to migrant individuals. This figure increased to 3.6 (95% CI: 2.06-5.31) in 2023 and remained at 3.0 (95% CI: 2.08-3.95) in 2024. No statistically significant differences were observed over the study years (p = 0.636).

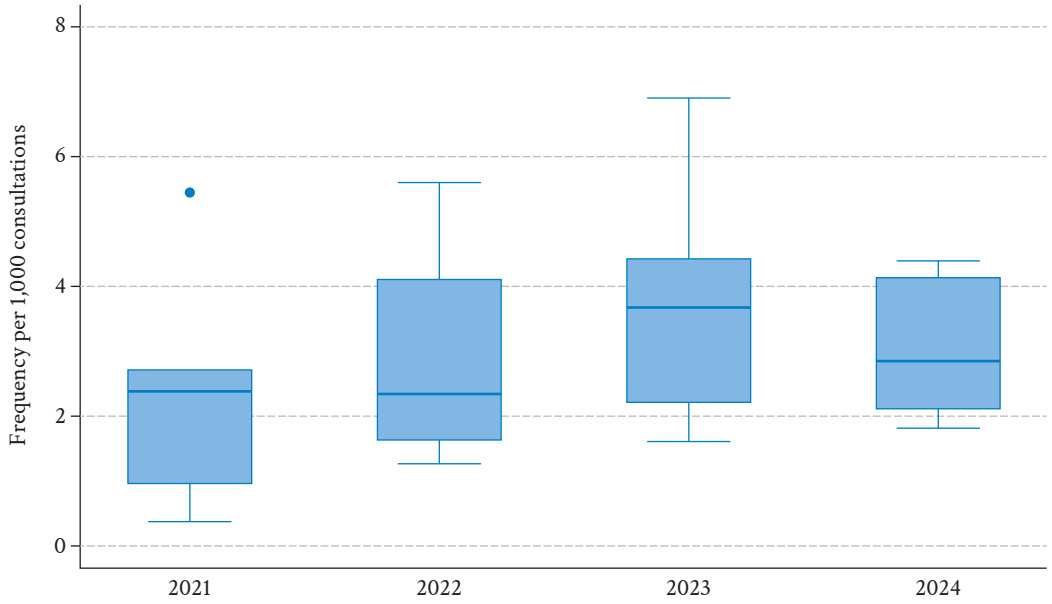

Figure 2. Box-and-whisker plot of the frequency of outpatient dental emergency consultations among the migrant population per study year in the region of Tarapaca during the 2021-2024 period (per 1,000 consultations).

To estimate the relationship between the structural determinants analyzed and the ODE consultation rate, the Spearman correlation was applied, given that the variables did not meet the normality assumption based on value distribution (Shapiro-Wilk test, $p < 0.05$). As a result, a positive and statistically significant correlation was observed with IP (rho = 0.61; $p < 0.001$), rurality (rho = 0.48; p = 0.008), and commune of residence (rho = 0.55; p = 0.002). Conversely, a significant negative correlation was identified with the average number of years of education in the commune (rho = –0.45; p = 0.016). In contrast, MP showed a weak but non-significant correlation with the ODE consultation rate (Table 2).

Table 2. Correlation between structural determinants and the average rate of outpatient dental emergency consultations in the region of Tarapaca, 2021-2024.

Structural determinants	rho*	p-value**
% population in income poverty (IP)	0.614	<0.001
% population in multidimensional poverty (MP)	0.360	0.060
Average years of education in the commune	–0.452	0.016
Rurality	0.489	0.008
Commune of the region	0.557	0.002

*rho: Spearman's correlation coefficient; **p-value < 0.05.

Table 3 shows the average rate of consultations per ODE recorded in public health centers by commune in the region of Tarapaca. The rural communes of Camiña and Huara show the highest rates, with 53.61 and 43.13 consultations per 1,000 beneficiaries, respectively, while the urban commune of Iquique shows the lowest rate, with 22.93.

Regarding sex-based differences, in the commune of Alto Hospicio, the ODE consultation rate among women is 1.47 times higher than that among men, a pattern similar to that observed in Iquique (1.38 times). In contrast, in the commune of Huara, the rate is higher among men. Regarding the migrant population, the frequency of ODE consultations is the highest in the rural communes of Pica (5.3) and Colchane (3.6), while the urban commune of Iquique shows the lowest frequency (1.7).

Table 3. Average rate of outpatient dental emergency (ODE) consultations, average consultation rate ratio, and frequency of consultations among migrant patients by commune in the commune of Tarapaca, 2021-2024.

Communes	Average consultation rate (per 1,000 beneficiaries)	Average ODE consultation average rate ratio (Female/Male)	Frequency of consultations among migrants (per 1,000 consultations)
Iquique	22.93	1.38	1.7
Alto Hospicio	24.55	1.47	2.3
Colchane	33.24	1.12	3.6
Pica	31.60	1.07	5.3
Pozo Almonte	24.37	1.37	2.2
Huara	43.13	0.90	2.6
Camiña	53.61	1.13	2.9
Total	33.35	1.21	3.0

DISCUSSION

The SDOH are factors that significantly influence oral health indicators across different communities. They reflect the social determination of diseases and are associated with structural conditions arising from inadequate social policies and programs, unequal economic arrangements, or deficiencies in public policies. This study focused on analyzing the structural determinants related to ODE consultations in a border region of Chile, recognizing that addressing these conditions is essential to advancing toward more equitable oral health and improving health outcomes across all population groups.

Oral health is a clear marker of social disadvantage and reflects broader health inequities (10). Inadequate social, epidemiological, and organizational conditions within health services limit access to timely dental care for the population as a whole. Similarly, ODE consultations often become the main point of entry into the healthcare system, with pain being the leading cause of demand (23). In this context, lower-income populations face a disproportionately higher burden of oral diseases, resulting from structural discrimination and persistent barriers to equitable access to healthcare services.

Poverty and social inequality are key factors in the onset of oral health problems and in the barriers that hinder

access to timely treatment (24). In this study, a significant association was observed between higher rates of ODE consultations and a higher percentage of the population living in income poverty in the region of Tarapaca. Limited income restricts access to both preventive and curative dental care, increasing the prevalence of untreated oral diseases that ultimately lead to emergency consultations (25). It is worth noting that this region ranks third nationally in poverty levels, and much of its territory consists of rural communes, where gaps in access to healthcare services have historically been concentrated (17). This situation reinforces the need for public policies aimed at reducing structural inequalities in oral health.

Rurality is a structural social determinant closely associated with poor oral health (7), possibly due to limitations in accessing comprehensive and timely dental care (26). In the communes analyzed, rural areas consistently showed higher rates of ODE consultations compared to urban areas. This finding is consistent with studies conducted in other Chilean regions. For example, in the southern Araucanía, the rate of ODE consultations was reported to be 2.2 times higher in rural areas than in urban ones (23), highlighting the persistence of structural inequalities in access to oral healthcare services. Among the barriers most perceived by the rural population are limited geographical accessibility, a shortage of specialized human resources, and the scarce availability of continuous dental services (27). These structural conditions reinforce the dependence on emergency care as the only point of access to dental services in many rural areas.

Education is a key structural determinant that directly influences people's health, as it shapes their ability to access, understand, and apply information to make informed decisions (28-30). In the field of oral health, a lower educational level may hinder the adoption of preventive practices, thereby facilitating the progression of oral diseases until they require care in the context of an ODE.

In this study, a gap was identified in the average years of schooling between rural and urban communes in the region of Tarapaca: while the former reported an average of 10.8 years, the latter reached 11.6 years. This difference is reflected in an observed trend in which communes with lower educational attainment tend to show higher average rates of ODE consultations. This finding aligns with the literature, which has consistently documented the relationship between low educational level, poorer oral health indicators, higher prevalence of dental caries, and more negative perceptions of oral health (15).

Migration is recognized as a social determinant with profound implications for public health, as it can give rise to complex health problems influenced by living and working conditions, as well as limited access to basic health services, including dental care (31). In border regions such as Tarapaca, the migrant population is likely to face significant structural barriers that affect oral health and access to timely dental care, which may result in greater reliance on emergency services as the only available option.

It was found that rural communes recorded a higher frequency of ODE consultations among the migrant population. This can be interpreted as a manifestation of the interaction between multiple structural determinants present in the territory, such as poverty and low educational levels. Additionally, factors such as social marginalization, cultural differences, and geographic distance from urban centers negatively affect oral health status, increasing the need for emergency care (32).

The data source used—the REM—constitutes the official registry of the Chilean Ministry of Health for healthcare activity in public facilities and represents a methodological strength of this study, as it provides robust and regionally representative information. Although the analysis covers only four years, the data makes it possible to identify relevant trends in the use of ODE services and to approximate the behavior of the phenomenon over time.

One of the main limitations of this study was that the analysis was conducted at a single level of aggregation—specifically, the communal level—which makes it susceptible to ecological bias. This may distort the true relationship between structural determinants and the rate of ODE consultations, preventing valid causal inferences at the individual level. Although the results show relevant associations, ecological design does not allow for the establishment of cause-and-effect relationships.

Another important limitation lies in the lack of access to information on the specific reason that motivated each emergency consultation, as well as other associated clinical or social factors that could influence the demand for this type of care. Furthermore, the absence of an internationally standardized definition of "outpatient dental emergency consultation" hinders direct comparisons with studies conducted in other countries, both in Latin America and globally.

Nevertheless, despite these limitations, findings make it possible to identify territories with a higher burden of ODE consultations and to highlight patterns associated with structural inequalities. This information is valuable for guiding public policies, designing targeted interventions, and moving toward a more equitable distribution of oral health services.

CONCLUSIONS

It was consistently demonstrated that poverty, low educational level, rurality, and migrant status operate as key structural determinants that negatively impact the oral health of the population in the region of Tarapaca in Chile. The higher rate of ODE consultations observed among these groups may reflect limited access to preventive and timely dental care services for this population. The results reveal persistent structural inequalities within the health system that must be addressed through comprehensive and territorially relevant public policies. Strengthening primary oral health care, improving service coverage in rural areas, and designing inclusive strategies for the migrant population are essential steps toward more equitable and efficient care.

Conflict of interest:
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The data source used in this study consists of publicly available records that do not include variables that allow the identification of individual cases, thereby preserving the confidentiality of the information.

Authorship contribution:
PMR: conceptualization, methodology, formal analysis, writing of original draft.
JCC: research, software, visualization.
SZV, NPI: methodology, writing – review & editing.

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