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CLINICAL RESEARCH:

Sociodemographic Factors in University-Based Dental Care: A Study at the School of Dentistry, University of Costa Rica (2019-2024)

Factores sociodemográficos en la atención odontológica universitaria: Estudio en la Facultad de Odontología de la Universidad de Costa Rica (2019-2024)

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ABSTRACT: Equitable access to dental care remains a challenge in Costa Rica. The School of Dentistry at the University of Costa Rica (FODO-UCR) addresses this issue by providing clinical services integrated with academic training, supported by the SMILE digital health record system. To analyze the sociodemographic profile of patients treated at FODO-UCR between 2019 and 2024, based on data recorded in the SMILE System. This was a quantitative, descriptive, and cross-sectional study. Clinical and sociodemographic data from all patients registered in the SMILE System between 2019 and 2024 were analyzed. Descriptive statistics and Chi-square tests were used to assess differences in categorical variables. A total of 25,465 patients received care. The majority were female (58.5 %), aged 18-30 and 31-40, and resided in San José (65.2 %). The primary reason for seeking care was self-initiative (64.3 %). Most patients were Costa Rican and had incomplete primary or secondary education. The study identified consistent patterns of access based on gender, age, and place of origin. These findings can inform institutional strategies aimed at promoting equity and guiding planning efforts in university-based oral healthcare.

KEYWORDS: Health services accessibility; Demography; Universities; Electronic health records; Costa Rica.

RESUMEN: El acceso equitativo a la atención odontológica continúa siendo un desafío en Costa Rica. La Facultad de Odontología de la Universidad de Costa Rica (FODO-UCR) brinda servicios clínicos integrados con la formación académica, mediante el uso del sistema digital SMILE. Analizar el perfil sociodemográfico de los pacientes atendidos en la FODO-UCR entre 2019 y 2024, con base en los datos registrados en el Sistema SMILE. Estudio cuantitativo, descriptivo y transversal. Se analizaron los datos clínicos y sociodemográficos de todos los pacientes registrados en el Sistema SMILE durante el periodo

2019-2024. Se aplicaron estadísticas descriptivas y pruebas de Chi-cuadrado para evaluar diferencias en variables categóricas. Se atendieron 25.465 pacientes. Predominó el género femenino (58.5 %), los grupos etarios de 18 a 30 años y de 31 a 40 años, y la procedencia de San José (65.2 %). El principal motivo de ingreso fue por iniciativa propia (64.3 %). La mayoría eran costarricenses, con escolaridad primaria o secundaria incompleta. El estudio evidenció patrones consistentes de acceso según género, edad y procedencia, útiles para orientar estrategias institucionales de equidad y planificación en salud bucodental universitaria.

PALABRAS CLAVE: Acceso a los servicios de salud; Demografía; Universidades; Registros electrónicos de salud; Costa Rica.

INTRODUCTION

Equitable access to dental care in Costa Rica remains a challenge, particularly for populations experiencing socioeconomic vulnerability (1). Since 1942, the School of Dentistry at the University of Costa Rica (FODO-UCR, by its Spanish acronym) has played a fundamental role in delivering dental services to the community by integrating academic training with clinical care. As part of its social commitment, the school has provided care to children, adolescents, and adults, including individuals with disabilities and others experiencing social vulnerability (2).

This local experience reflects a broader global trend. International research highlights the critical role university-affiliated dental clinics play in delivering accessible, high-quality care to underserved populations (3). This model is especially relevant in Costa Rica, where significant barriers to dental care access remain.

The care provided by dental schools to vulnerable populations is part of a broader issue. According to the World Health Organization (4), inequity in access to oral health services is a global concern, with a higher prevalence of oral diseases among low-income populations. Within this framework, FODO-UCR has developed strategies focused on education, prevention, and treatment, aiming to expand its service coverage.

The dental care provided to vulnerable populations by academic institutions is part of a broader global challenge. According to the World Health Organization (4), inequitable access to oral health services remains a widespread issue, with oral diseases disproportionately affecting low-income populations. In response, FODO-UCR has implemented strategies centered on education, prevention, and treatment, aiming to expand its reach and improve service coverage.

Recent data indicate that patients treated at university dental clinics report high levels of satisfaction, reflecting the quality and positive impact of the care provided. A study conducted at the undergraduate clinics of FODO-UCR found that 98.5% of patients were satisfied with the services they received, according to an institutional survey (5). This finding underscores the importance of continuously evaluating service quality, identifying areas for improvement, and ensuring comprehensive, patient-centered dental care. However, a more detailed analysis of the patient population is necessary to better understand their characteristics and specific needs.

In 2019, in line with its commitment to continuous improvement and technological innovation, FODO-UCR implemented the SMILE System-a digital clinical record that allows for the structured registration of clinical, radiographic, administrative, and sociodemographic data. This system supports data analysis and informs decision-making (6). The digitalization of clinical records not only streamlines information management but also helps reduce disparities in care by enabling more precise analysis of the populations served. Additionally, it has been recognized as a key tool for implementing evidence-based clinical protocols in academic settings (7), and its use has become increasingly prevalent in dental education worldwide (8).

The use of electronic systems, such as SMILE, has proven to be a crucial tool in both educational and clinical contexts. Several studies show that digital records improve information management, patient safety, continuity of care, and resource optimization (9). At FODO-UCR, the system facilitates the storage of diagnostic, treatment, and care planning data, as well as essential sociodemographic information for characterizing the patient population.

Moreover, numerous studies have demonstrated that social determinants play a significant role in shaping oral health outcomes and the utilization of dental services, particularly in settings characterized by structural inequalities (11, 12). In this context, conducting a detailed analysis of the patient population can support the development of strategies that promote more equitable and contextually responsive care.

This study aims to analyze the sociodemographic data recorded in the SMILE System at FODO-UCR between 2019 and 2024, with the goal of gaining deeper insight into the dynamics of access to dental care within this university-based setting. The findings are intended to inform academic and administrative planning at the School, support the development of more equitable public health policies, and contribute to advancing research in the field of oral health.

MATERIALS AND METHODS

STUDY DESIGN

A quantitative, descriptive, cross-sectional study was conducted to analyze the sociodemographic profile of patients treated at FODO-UCR between 2019 and 2024. The analysis was based on data retrieved from the SMILE System, a digital platform that stores clinical, radiographic, administrative, and sociodemographic information on patients treated across the School's clinical services.

POPULATION AND INCLUSION CRITERIA

The study population included all patients registered in the SMILE System during the defined study period. These records reflect individuals who received care at various clinics within FODO-UCR, a public academic institution located in San José, Costa Rica. No exclusion criteria were applied, allowing for a comprehensive and representative overview of the patient population.

It is important to note that the study did not involve the collection of new data, as it relied exclusively on the analysis of previously recorded information. Quality control procedures were implemented to ensure data accuracy and to minimize potential biases during the processes of extraction, cleaning, and analysis.

DATA PROCESSING AND ANALYSIS

All data were processed anonymously and confidentially, in accordance with current ethical standards for health research. The variables analyzed included age, sex, place of residence, nationality, educational level, marital status, point of entry into the system, and type of clinical care received.

Descriptive statistical methods were used: measures of central tendency and dispersion were calculated for quantitative variables, while absolute and relative frequencies were determined for categorical variables. Data processing and statistical analysis were conducted using Microsoft Excel 365 and Stata v17, enabling the identification of key patterns and trends in the dental care provided by the School.

ETHICAL CONSIDERATIONS

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and complied with national regulations on personal data protection. All patient information was anonymized and used solely for scientific and academic purposes, with no compromise to individual identities. The research protocol received approval from the Scientific Ethics Committee of UCR (approval number CEC-785-2024), ensuring alignment with national guidelines for health-related research.

RESULTS

Between 2019 and 2024, FODO-UCR provided care to a total of 25,465 patients. In most years analyzed, a higher proportion of patients were female, with the exception of 2021, when the number of male patients slightly surpassed that of females (51.2% *vs*. 48.8%). Statistical analysis showed significant gender differences in all years except 2021 ($p>0.05$), highlighting a consistent trend of greater female participation in clinical care (Figure 1). The lowest number of patients was recorded in 2020 (n=1,431), followed by a steady increase in subsequent years (Table 1).

Regarding age, the groups with the highest cumulative representation during the study period were those aged 18-30 years (27.3%), 51-60 years (13.2%), and 31-40 years (11.3%). Notably, despite the reduction in clinical activity in 2020, these groups maintained relatively high proportions. Additionally, patients under 12 years of age accounted for 21.1% of the total, while those aged 61 and above represented 13.0%, highlighting the participation of both pediatric and older adult populations in the university's clinical services (Table 2).

In terms of geographic origin, the province of San José accounted for the majority of visits each year, averaging 65.2% of all care provided. This was followed by the provinces of Cartago (14.4%) and Heredia (8.9%). In contrast, Guanacaste (0.5%), Puntarenas (0.9%), and Limón (1.2%) had the lowest representation. For instance, in 2019, 64.1% of patients treated were residents of San José, and this trend remained relatively stable throughout the study period, reaching 65.6% in 2024. However, Chi-square analysis revealed statistically significant changes in the distribution of patients by province over time ($\chi^2=146.73$; $df=30$; $p<0.001$), indicating notable variability in geographic origin across the study years (Table 3).

The most common patient referral source to FODO-UCR's clinical services was self-initiated care, accounting for 64.3% of all patients. This entry method steadily increased over the years, rising from 27.3% in 2019 to 79.9% in 2024.

Referrals from School of Dentistry students (9.3%) and university students themselves (8.9%) were the next most frequent. Other entry routes, such as through oral or written media (7.6%) and the university's website (4.0%), had lower but variable annual representation. Institutional agreements and referrals from private dental practitioners consistently accounted for less than 1% of patients throughout the study period (Table 4).

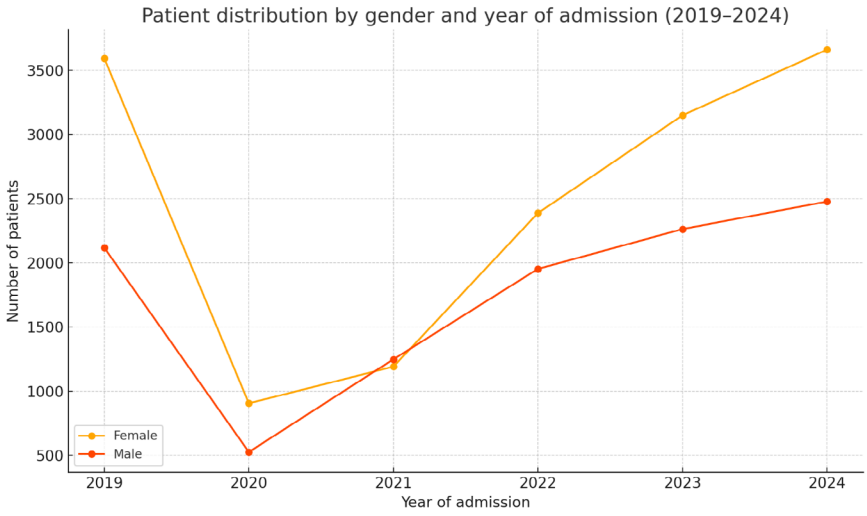
Regarding nationality, the majority of patients treated were Costa Rican (94%), followed by Nicaraguan nationals (4.2%), with smaller proportions of patients from Venezuela, Colombia, and Honduras.

In terms of educational level, the most represented groups were those with incomplete primary education (21.4%), incomplete university studies (18.5%), and completed secondary education (15.3%). Complete university education was observed in 12.8% of cases.

As for marital status, the most common category was single (59.3%), followed by married individuals (24.1%) and divorced individuals (8.1%).

According to the classification recorded in the SMILE system, an institutional mechanism used to determine differentiated clinical fee conditions, the majority of patients (82.1%) fell under the standard care category. An additional 7.0% were students receiving type 4 and 5 socioeconomic scholarships from the University of Costa Rica (UCR), who accessed care under a preferential payment scheme. Furthermore, 8.0% were older adults, 2.3% were university staff members or their family members, and 0.5% were individuals with disabilities, all of whom qualified for special fee conditions. It is important to note that the category for individuals with disabilities may be underrepresented, as some patients with disabilities do not formally request classification within the clinical system.

Finally, analyzing the intersection of age and gender, a higher proportion of female patients was observed across all age groups. For example, in the 18 to 30-year age group in 2019, 782 women were treated, compared to 469 men. A similar pattern emerged in the 51 to 60-year age group, where 606 women and 276 men received care.



A sustained trend of higher female participation in clinical care is observed, except in 2021, when the proportion of male patients was slightly higher.

Figure 1. Percentage of patients treated by gender per year (2019–2024) at FODO-UCR.

Table 1. Annual distribution of patients treated by gender at FODO-UCR (2019-2024).

Year of Admission	Female (N,%)	Male (N,%)	Total	Statistically significant difference (p<0.05)	Z	p-value
2019	3592 (62.9%)	2117 (37.1%)	5709 (22.4%)	Sí	27,607	0
2020	905 (63.2%)	526 (36.8%)	1431 (5.6%)	Sí	14,169	0
2021	1191 (48.8%)	1248 (51.2%)	2439 (9.6%)	No	-1,632	0,1026
2022	2387 (55.0%)	1952 (45.0%)	4339 (17%)	Sí	9,339	0
2023	3148 (58.2%)	2262 (41.8%)	5410 (21.2%)	Sí	17,035	0
2024	3660 (59.6%)	2477 (40.4%)	6137 (24.1%)	Sí	20,257	0
TOTAL	14883 (58.5%)	10582 (41.5%)	25465 (100%)	-		

Table 2. Annual distribution of patients treated by age group at FODO-UCR (2019-2024).

Year of Admission	Age group (years)								
	0-5	6-12	13-17	18-30	31-40	41-50	51-60	> 61	TOTAL
2019	129 (2.3%)	1156 (20.2%)	153 (2.7%)	1251 (21.9%)	592 (10.4%)	725 (12.7%)	882 (15.4%)	821 (14.4%)	5709 (22.4%)
2020	38 (2.7%)	199 (13.9%)	38 (2.7%)	414 (28.9%)	152 (10.6%)	151 (10.6%)	216 (15.1%)	223 (15.6%)	1431 (5.6%)
2021	111 (4.6%)	384 (15.7%)	60 (2.5%)	727 (29.8%)	293 (12.0%)	271 (11.1%)	330 (13.5%)	263 (10.8%)	2439 (9.6%)
2022	254 (5.9%)	738 (17.0%)	102 (2.4%)	1293 (29.8%)	519 (12.0%)	459 (10.6%)	529 (12.2%)	445 (10.3%)	4339 (17%)
2023	223 (4.1%)	836 (15.5%)	110 (2.0%)	1653 (30.6%)	638 (11.8%)	629 (11.6%)	664 (12.3%)	657 (12.1%)	5410 (21.2%)
2024	264 (4.3%)	1039 (16.9%)	128 (2.1%)	1605 (26.2%)	676 (11.0%)	784 (12.8%)	749 (12.2%)	892 (14.5%)	6137 (24.1%)
TOTAL	1019 (5.3%)	4352 (22.5%)	591 (3.1%)	6943 (35.9%)	2870 (14.8%)	3019 (15.6%)	3370 (17.4%)	3301 (17.1%)	25465 (100%)

Table 3. Annual distribution of patients treated by province of residence (2019-2024).

Year of Admission	Province of residence							
	San Jose	Cartago	Alajuela	Heredia	Limon	Puntarenas	Guanacaste	Total
2019	3660 (64.1%)	979 (17.1%)	456 (8.0%)	494 (8.7%)	53 (0.9%)	52 (0.9%)	15 (0.3%)	5709 (22.4%)
2020	936 (65.4%)	223 (15.6%)	121 (8.5%)	116 (8.1%)	18 (1.3%)	8 (0.6%)	9 (0.6%)	1431 (5.6%)
2021	1598 (65.5%)	383 (15.7%)	207 (8.5%)	188 (7.7%)	26 (1.1%)	30 (1.2%)	7 (0.3%)	2439 (9.6%)
2022	2935 (67.6%)	583 (13.4%)	371 (8.6%)	330 (7.6%)	54 (1.2%)	34 (0.8%)	32 (0.7%)	4339 (17%)
2023	3444 (63.7%)	704 (13.0%)	559 (10.3%)	526 (9.7%)	90 (1.7%)	45 (0.8%)	42 (0.8%)	5410 (21.2%)
2024	4024 (65.6%)	792 (12.9%)	547 (8.9%)	612 (10.0%)	72 (1.2%)	62 (1.0%)	28 (0.5%)	6137 (24.1%)
TOTAL	16597 (85.9%)	3664 (19.0%)	2261 (11.7%)	2266 (11.7%)	313 (1.6%)	231 (1.2%)	133 (0.7%)	25465 (100%)

Table 4. Annual distribution of patients treated according to point of entry at FODO-UCR (2019-2024).

Patient Referral Source	Year of Admission						
	2019	**2020**	**2021**	**2022**	**2023**	**2024**	**Total**
Self-initiated	1560 (27.3%)	512 (35.8%)	1612 (66.1%)	3384 (78.0%)	4407 (81.5%)	4901 (79.9%)	16376 (64.3%)
Referred by dental school student	1549 (27.1%)	289 (20.2%)	230 (9.4%)	146 (3.4%)	124 (2.3%)	42 (0.7%)	2380 (9.3%)
University student	625 (10.9%)	174 (12.2%)	305 (12.5%)	307 (7.1%)	467 (8.6%)	384 (6.3%)	2262 (8.9%)
Oral or written media	764 (13.4%)	241 (16.8%)	43 (1.8%)	263 (6.1%)	116 (2.1%)	521 (8.5%)	1948 (7.6%)
University website	758 (13.3%)	121 (8.5%)	57 (2.3%)	13 (0.3%)	29 (0.5%)	50 (0.8%)	1028 (4%)
Relative of a faculty student	76 (1.3%)	19 (1.3%)	84 (3.4%)	110 (2.5%)	100 (1.8%)	60 (1.0%)	449 (1.8%)
University employee	127 (2.2%)	30 (2.1%)	41 (1.7%)	59 (1.4%)	56 (1.0%)	43 (0.7%)	356 (1.4%)
Relative of a university employee	97 (1.7%)	23 (1.6%)	39 (1.6%)	50 (1.2%)	40 (0.7%)	32 (0.5%)	281 (1.1)
Referred through a Institutional agreement	33 (0.6%)	4 (0.3%)	7 (0.3%)	1 (0.0%)	65 (1.2%)	93 (1.5%)	203 (0.8%)
Referred by a private dentist	74 (1.3%)	11 (0.8%)	12 (0.5%)	3 (0.1%)	5 (0.1%)	9 (0.1%)	114 (0.4%)
Referred by a healthcare institution	46 (0.8%)	7 (0.5%)	9 (0.4%)	3 (0.1%)	1 (0.0%)	2 (0.0%)	68 (0.3%)
Total	5709 (22.4%)	1431 (5.6%)	2439 (9.6%)	4339 (17%)	5410 (21.2%)	6137 (24.1%)	25465 (100%)

DISCUSSION

This study presents a detailed sociodemographic characterization of patients treated at FODO-UCR between 2019 and 2024, revealing patterns that are consistent with those reported in the international scientific literature. A key finding was the higher proportion of female patients, which aligns with studies indicating that women are more likely to seek dental care for both preventive and aesthetic reasons (12,13). This behavior has been linked to a greater perceived need for treatment and a more positive attitude toward oral health care compared to men (14).

It is important to note that, according to data from the National Institute of Statistics and Censuses (INEC, by its Spanish acronym), the proportion of men in the general population slightly exceeds that of women in most provinces of the country (15). This discrepancy underscores the need to strengthen awareness campaigns aimed at encouraging men to seek dental care, ultimately promoting more equitable gender access to oral health services.

The marked decrease in the number of patients treated in 2020 can be attributed to the direct impact of the COVID-19 pandemic, which led to the temporary closure of clinical services beginning in March of that year. The gradual reopening in 2021, under strict biosafety protocols, physical distancing, and reduced appointment capacity, significantly limited operational capabilities. This situation, also reported by institutions in other countries (16, 17, 18), explains the sharp drop in dental visits in 2020, followed by a progressive recovery in the subsequent years.

In terms of age, the highest proportion of patients was concentrated in the 18-30, 31-40, and 51-60-year groups. This trend has been described in the literature as characteristic of young and middle-aged adults, who typically demonstrate greater autonomy and demand for restorative, prosthetic, and preventive treatments (19, 20, 21). In contrast, the low representation of adolescents (13-17 years) may be linked to specific barriers, such as limited perceived need, dependence on adult accompaniment, or the prioritization of other age-related activities (22).

The significant involvement of individuals over 61 years of age is a notable finding in the context of Costa Rica's aging population. This trend, which aligns with global projections, underscores the need for health institutions to develop targeted strategies for this age group, with an emphasis on both prevention and oral rehabilitation. Maintaining adequate masticatory function and overall health of the stomatognathic system can greatly enhance the quality of life for this population (23).

Regarding geographic origin, the high concentration of patients from the Central Valley, particularly San José, can be attributed to the proximity of the School and the region's high population density. This trend has been observed in other Latin American university clinics, where geographic proximity plays a significant role in access to dental services (3,5). In contrast, the lower participation from more distant provinces suggests that logistical challenges, including distance, continue to impede access. This unequal distribution underscores the need to strengthen institutional outreach and community engagement strategies to promote geographic equity in oral health (1,4).

Although the FODO-UCR has made significant efforts to expand its services to rural areas or locations far from the Greater Metropolitan Area (GAM, by its Spanish acronym), these efforts are not fully reflected in this study's findings, as many of these areas lack access to the SMILE digital clinical record. This limitation not only reveals a gap in data collection but also prompts reflection on unequal access to clinical information in different regions of the country, an issue that is crucial for informed institutional decision-making.

The analysis of patients' entry routes reveals that self-initiative is the primary mode of access, followed by referrals from university students. This finding underscores the role of interpersonal communication in patient acquisition, a trend increasingly linked to the use of social media to promote dental services in academic settings (23). However, access to information via electronic platforms, print or broadcast media, and digital networks has had limited impact on attracting new patients. Recent studies indicate that while social media generates high levels of engagement, strategies such as search engine optimization (SEO) and Google Ads campaigns are more effective for patient conversion, while email marketing is particularly effective in fostering loyalty (24). Furthermore, factors like educational level, perceived access, and anxiety play a significant role in the decision to seek dental care, especially among university populations (25). These findings highlight the need to enhance institutional communication strategies to raise awareness of the high-quality, cost-effective services offered by the School.

From a sociodemographic perspective, the majority of patients were Costa Rican, with a smaller proportion from other nationalities. Primary or incomplete secondary education was the most common level of education, indicating a greater reliance on subsidized public services. This aligns with studies documenting socioeconomic inequalities in access to dental care (26). The institutional classification recorded in the SMILE system facilitated the identification of varying economic access conditions, making it a valuable tool for understanding healthcare coverage and equity dynamics. Beyond internal analysis, this system supports the development of targeted strategies to improve access based on socioeconomic criteria. Notably, students receiving socioeconomic scholarships (types 4 and 5) from UCR stood out, as they benefit from a preferential access scheme.

Although older adults accounted for 8% of all patients treated, this proportion may be considered low, especially given Costa Rica's steadily aging population. This finding aligns with studies that advocate for integrating dental care into general health systems for older adults, thereby promoting inclusive and sustainable care models (27). Consequently, there is a need to strengthen targeted outreach, education, and follow-up strategies to ensure more equitable access to dental care (28, 29).

Similarly, the low proportion of patients officially classified as individuals with disabilities is concerning, as it may stem from underreporting due to non-enrollment in this category. This omission limits their visibility in clinical and administrative analyses and poses a barrier to ensuring equity and full inclusion in university-based dental services (30).

Overall, the findings of this study lay a strong foundation for the academic and administrative planning at FODO-UCR. The analysis can inform strategies to enhance the coverage and quality of services offered, while also guiding the development of more equitable oral health policies at both the institutional and national levels. Additionally, it serves as a starting point for future research on access, territorial equity, and patient engagement dynamics within university settings.

However, some limitations must be acknowledged. As a retrospective analysis based on clinical records, the quality and completeness of data may have varied across cases. Some sociodemographic variables had missing values, which could have impacted the depth of certain analyses. Furthermore, this study did not address clinical outcomes or patient perceptions-important aspects that could be explored in future research using qualitative methods or structured surveys. Finally, given that the data originate from a single

institution, caution should be exercised when generalizing the findings to broader national contexts.

CONCLUSION

This study characterizes the sociodemographic profile of patients treated at FODO-UCR between 2019 and 2024. It reveals consistent patterns of access based on gender, age, geographic origin, and place of residence. The findings indicate a higher proportion of female patients, a concentration of individuals in young and middle-aged groups, and a predominantly Central Valley-based patient population, particularly from the province of San José.

The analysis also highlights the impact of factors such as geographic accessibility, affiliation with the university community, and external events-especially the COVID-19 pandemic-on the use of university-based dental services. These insights are valuable for institutional planning, advancing territorial equity, and expanding service coverage.

Moreover, the data derived from the SMILE system provides a robust foundation for future research on access, quality, and clinical outcomes in academic dental care settings. This, in turn, supports evidence-based decision-making in public oral health.

AUTHOR CONTRIBUTION STATEMENT

Conceptualization and design: A.G.F. and A.H.M.
Literature review: A.G.F. and A.H.M.
Methodology and validation: A.G.F. and A.H.M.
Formal analysis: A.G.F. and A.H.M.
Research and data collection: A.G.F. and A.H.M.
Resources: A.G.F. and A.H.M.
Data analysis and interpretation A.G.F. and A.H.M.
Original draft preparation and writing: A.G.F. and A.H.M.
Writing, review, and editing: A.G.F. and A.H.M.
Supervision: A.G.F. and A.H.M.
Project administration: A.G.F. and A.H.M.
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