

# Inequalities in dental services use by older adults in Chile according to eligibility for a national dental programme

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## Abstract

**Objectives:** The objectives of this study were to determine the prevalence and trends in dental service use among Chilean older adults (60+ years) between 2006 and 2017; to assess the association between socioeconomic factors and dental service use and type (public/private) in 2017 and whether these differ by eligibility to a national dental programme (GES-60).

**Methods:** This study involved secondary data analysis of five nationally representative cross-sectional surveys between 2006 and 2017. Trends were assessed for use of dental services and types of services used among 60-79-year-olds. Logistic regression models examined the association between use of dental services in 2017 and socioeconomic variables (income and education), accounting for covariates (age, gender, residence, ethnicity, cohabiting status, employment and disability). Estimated marginal means and odds ratios (ORs) were calculated to assess the association between socioeconomic variables and the outcomes by GES-60 eligibility.

**Results:** Across surveys, the average prevalence of use of dental services in the last 3 months was 5.0%. There was a slight increase in dental visits between 2006 and 2017. This trend was higher among GES-60 eligible individuals using public dental services. Inequalities were observed in regression analyses. Compared to the poorest quintile and those with no formal education respectively, the ORs were 2.36 (95% confidence interval (CI) 1.79–5.68) for the richest quintile and ranged from 2.91 (95% CI 1.49–5.68) to 6.43 (3.26–12.68) for each higher level of educational attainment. Inequalities were wider among GES-60 non-eligible than GES-60 eligible older adults for both outcomes.

**Conclusions:** Socioeconomic inequalities were present among older adults regardless of GES-60 eligibility. However, these inequalities were more pronounced among non-eligible individuals. Our findings suggest a limited impact of GES-60 only among eligible older adults. Policies considering the needs of the whole older adult population are likely to have a stronger impact.

## KEYWORDS

Chile, dental services, inequalities, older adults, socioeconomic factors

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## 1 | INTRODUCTION

A demographic transition towards an ageing society is taking place in many countries worldwide.<sup>1</sup> The implications for oral health care systems are considerable, as older people are now more likely to retain their teeth and have increasingly complex oral health needs than previous generations.<sup>2</sup> Social inequalities in oral health are evident across countries and age groups. Compared to younger cohorts, older adults have worse oral health and greater inequalities in both clinical and subjective oral health outcomes.<sup>2,3</sup> Health services are intermediary determinants of oral health. They influence oral health outcomes while being influenced by overarching societal, economic and political factors.<sup>4</sup>

There are clear social inequalities in the utilization of dental services; older adults with higher income,<sup>5-11</sup> higher educational level<sup>9-11</sup> and professional occupations<sup>12,13</sup> tend to use dental services more frequently than those from more disadvantaged backgrounds. These inequalities become even greater for preventive dental visits.<sup>6,14</sup> Furthermore, a number of factors, such as gender,<sup>7,9,11,12</sup> age,<sup>12</sup> area of residence,<sup>5,7</sup> social support<sup>8,11</sup> and limiting health conditions,<sup>5,8</sup> have been associated with inequalities in dental service use. Moreover, inequalities in access to dental services have been suggested to explain oral health inequalities, although previous studies show that they do not fully explain them, partially because of their narrow impact on the structural determinants of oral health.<sup>15,16</sup> In Chile, oral health inequalities have been observed in relation to caries prevalence and tooth loss.<sup>17</sup> There are also inequalities in health care use, particularly in specialist dental services.<sup>18-20</sup> Therefore, monitoring and evaluation of programmes which aim to increase access to dental services is essential to assess their impact on oral health inequalities.<sup>21</sup> The health care system in Chile is divided into public and private sub-systems. Individuals must select one of the two sub-systems and contribute a proportion of their income to their respective funds. The public health system covered 78.0% of the population in 2017, mostly comprised of individuals of low to middle socioeconomic position (SEP) and vulnerable groups, while the private system covered 14.4% of individuals from mostly high SEP.<sup>22</sup> A small proportion of people were not insured (2.8%) or were covered by the army insurance scheme (2.8%). In 2005, a major health reform was implemented to increase equity in access and utilization of health services, primarily through the Explicit Guarantees in Health (GES) programme. GES is a national health plan covering a number of general and oral health conditions for the entire population. By law, GES guarantees minimum conditions for access and quality of services, establishes maximum waiting times to start treatment, and, until September 2022, co-payments in a tiered system (ranging from free treatment to co-payment of 20% of total fees according to individuals' income and insurance type) that is now free for all beneficiaries.<sup>23</sup> The 'GES of dental care for 60-year-olds' (GES-60) was implemented in 2007. It is the only dental policy of national reach for older adults in Chile that offers universal access to dental services as it covers people with public and private

insurance, and covers oral health promotion, preventive, curative and rehabilitative services (e.g. dentures) with no out-of-pocket expenditure for beneficiaries.<sup>24</sup> However, it is restricted to those aged 60 years old only (i.e. covers only that specific year of age). More importantly, no evaluation of its impact on dental service use and oral health inequalities has been carried out to date. Indeed, the literature about inequalities in the use of dental services in Chile has focused mainly on adolescents,<sup>25</sup> the overall population,<sup>19,20,26</sup> or using region-specific samples.<sup>27</sup> These studies have documented the presence of a social gradient in oral health and dental services utilization favouring those with higher SEP. However, no study has focused on a nationally representative sample of older adults, despite the availability of data through national surveys.

The objectives of this study were to: (a) determine the prevalence and trends in dental service use among Chilean older adults (60+ years) between 2006 and 2017; and (b) assess the association between socioeconomic factors and dental services use and type (public/private) in 2017 and whether these differ by eligibility to a national dental programme (GES-60).

## 2 | METHODS

Data from the National Socioeconomic Characterization Surveys (CASEN) 2006, 2009, 2011, 2013, 2015 and 2017 were used for secondary analyses. CASEN is a series of cross-sectional surveys of people residing in Chile which are conducted to facilitate the design and evaluation of social policies. Its design allows to compare results between surveys from the 2006 version. The sample is selected based on the sampling frame created by the National Institute of Statistics for urban and rural areas.<sup>28-32</sup> The survey employs a multi-stage stratified cluster sample design by geographical area and has national, regional, rural and urban representation.<sup>28</sup> Response rates were 80.6% in 2009, 79.3% in 2011, 77.5% in 2013, 78.8% in 2015 and 73.4% in 2017.<sup>28-32</sup> Response rates for 2006 were not measured.<sup>33</sup>

Data were collected through an interviewer-led questionnaire from the head of non-institutionalized households. The questionnaire covered various aspects on housing and socio-demographic characteristics of household members, including questions on education, income and employment, as well as topics related to health.<sup>28</sup>

Consent for participation was verbal and participants could decide whether to participate or not. All collected information was anonymised at the time of the survey (i.e. no names or other identificatory elements were recorded by interviewers). Further details on the survey design can be found elsewhere.<sup>28-34</sup> This study did not require ethical approval as the anonymised dataset is openly available on the Chilean Ministry of Social Development website (<http://observatorio.ministeriodesarrollosocial.gob.cl/encuesta-casen>).

The main outcome variable was having a dental visit in the last 3 months. CASEN asked how many times participants visited the

dentist in the last 3 months. The variable was dichotomised as having visited the dentist or not.

Type of dental service used was chosen as a secondary outcome. This referred to the subsample of participants who reported having visited the dentist in the past 3 months. This variable was categorized into three groups: those who attended public; private; or other types of dental services, such as armed forces and alternative medicine centres. However, in the regression model for type of service used, this outcome was coded as a binary variable (public vs. private) excluding the 'other' category from the analysis. This was both a conceptual and pragmatic decision, as GES users can only attend public or private services and this research focuses primarily on GES eligibility. Moreover, the proportion of older adults that used other types of services was relatively low (9.7%).

Independent variables to assess participants' SEP were income and education. Income per capita was categorized into quintiles in CASEN. The variable was created based on self-report of sources of income such as salary, pensions, independent work, government support, rent utilities, etc. obtained within the last 12 months<sup>34</sup> while education was grouped as: no formal education; primary; secondary; and tertiary education.

A directed acyclic graph (DAG) was used to guide the analysis and identify confounders for the main association of interest (Figures S1 and S2). Age, gender (male/female), area of residence (urban/rural), ethnicity (indigenous/non-indigenous) and having a disability or physical limitation (yes/no) were considered as covariates for the models that had income and education as the independent variable; while cohabiting status (living with partner/not living with partner) was considered a covariate only in the income model. Chilean law defines older adults as those aged 60 years and above.<sup>35</sup> As such, the age range used to calculate trends was 60–79 years. For the regression analysis, and considering ways to reduce the likelihood of residual confounding, the age range 60–65 years was selected for better comparability between GES-eligible and non-eligible adults. Age was dichotomised to create a variable that determined eligibility for GES, as 'GES-60 eligible' (60–61-year-olds) and 'GES-60 non-eligible' (62–65-year-olds). As sensitivity analysis, regression analyses were repeated using the whole sample (60–79 years) and the results can be seen in Tables S2 and S3.

Analyses were based on complete cases and were weighted to account for sampling strategy and non-response bias. The statistical software package STATA/IC 14.2 (StataCorp) was used to perform analyses.

Descriptive statistics were used to determine the prevalence of study measures within each survey. Trends over time were explored for both outcomes (dental service used and type of service received) by age using graphs. For comparability across survey years, direct age standardization was done using the 2017 Chilean Census data as the standard population. Differences in outcome measures by GES-60 eligibility were assessed through two-sample test of proportions (z-test).

Unadjusted associations between independent variables and outcome measures were assessed through multiple logistic

regression to estimate the association between the outcomes (dental service used and type of dental service) and each socioeconomic indicator (income and education) using CASEN 2017. Analyses were carried out separately for each of the outcomes due to collinearity. Initially, the crude association between the outcome and each SEP marker was assessed. This was followed by the fully adjusted models, respectively. Interaction between socioeconomic indicators and GES eligibility (age groups: 60–61 vs. 62–65 years) was assessed. Estimated Marginal Means and their 95% CI were calculated to measure absolute inequalities for the predicted outcomes among GES-60 eligible and GES-60 non-eligible participants. Odds ratios (OR) and their 95% CI were also calculated to assess relative inequalities and presented in Table S4.

### 3 | RESULTS

The overall sample ranged from 29 560 60–79-year-old individuals in CASEN 2013 to 36 006 in 2017. Missingness was low in all surveys (1.2% in 2006, 1.3% in 2009, 1.0% in 2011, 2.3% in 2013, 1.84% in 2015 and 1.0% in 2017).

Gender and age distributions were similar across all surveys; around 55% were women and the mean age was 68 years. Overall, the proportion of adults using dental services in the last 3 months was 5%, yet a gradual increase was noticed from 2006 (5.7%) to 2017 (6.7%).

When exploring trends in dental service use by age (Figure 1), a significantly higher proportion of GES-60 eligible than non-eligible adults visited the dentist, across all survey years. The absolute difference was 1.6% in 2006, reached its peak in 2011 (4.6%), and then gradually narrowed to 2.8% in 2017 (Table S1).

Figure 2 illustrates that the overall proportion of GES-60 eligible individuals who used public services increased over time (i.e. across surveys). Prior to the implementation of GES-60 (2007) the use of public services and private services was similar (6.2% absolute difference in proportions), but became statistically different from 2009 (45.7% absolute difference) to 2017 (21.1% absolute difference). Among GES-60 non-eligible participants, the differences remained similar (53.2% vs. 37.1% in 2006 to 50.5% vs. 42.9% in 2017) and from 2009, smaller than those observed in the GES-60 eligible group.

Table 1 shows the distribution of dental service use by socioeconomic and demographic characteristics across surveys. Social gradients in the prevalence of dental service use were present and similar over time. The lower the income or educational category, the lower the proportion of older adults visiting the dentist. Gradients in the prevalence of use of public services by income and education were present in all CASEN surveys. At each higher income quintile and educational level there were proportionately fewer older adults using public services.

Unadjusted logistic regression models showed a clear gradient in the use of dental services for education; that is, the higher the educational attainment, the higher the likelihood of visiting the

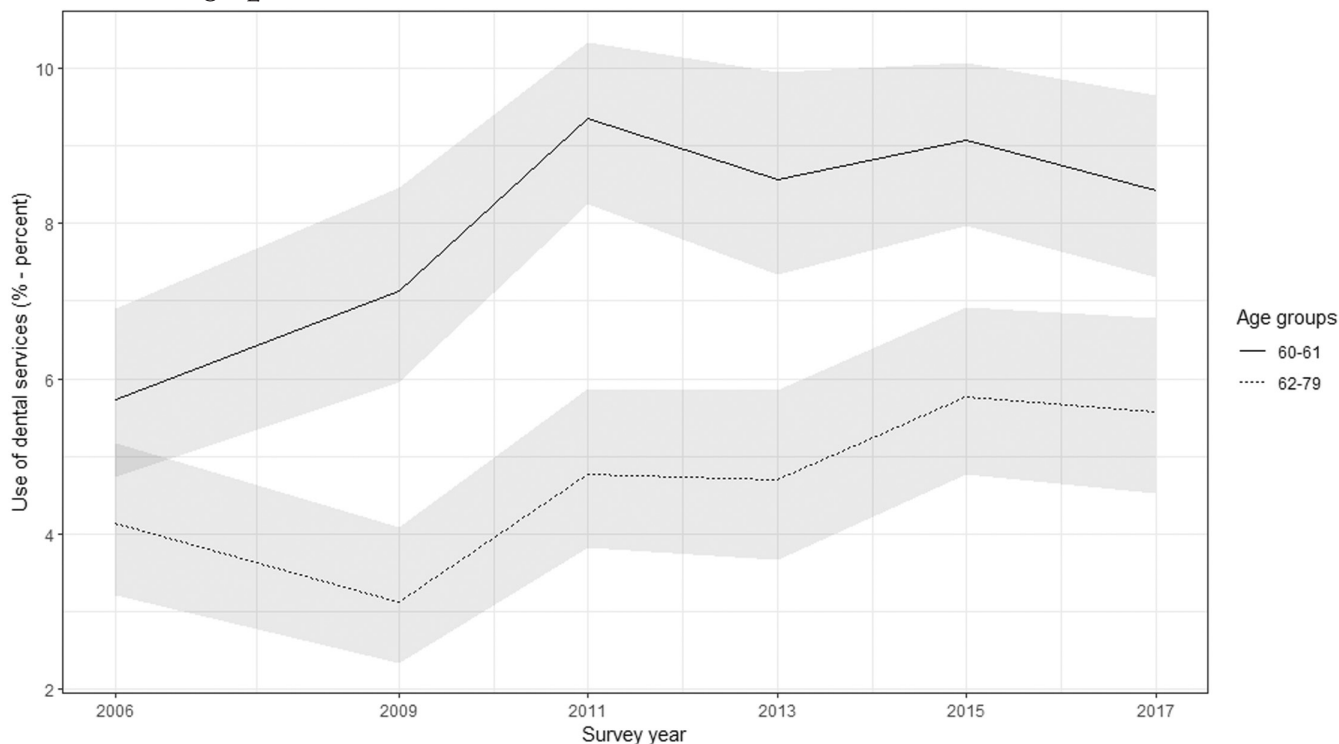


FIGURE 1 Age-standardized use of dental services in the past 3 months among Chilean older adults (aged 60–79 years) in 2006–2017, by age.

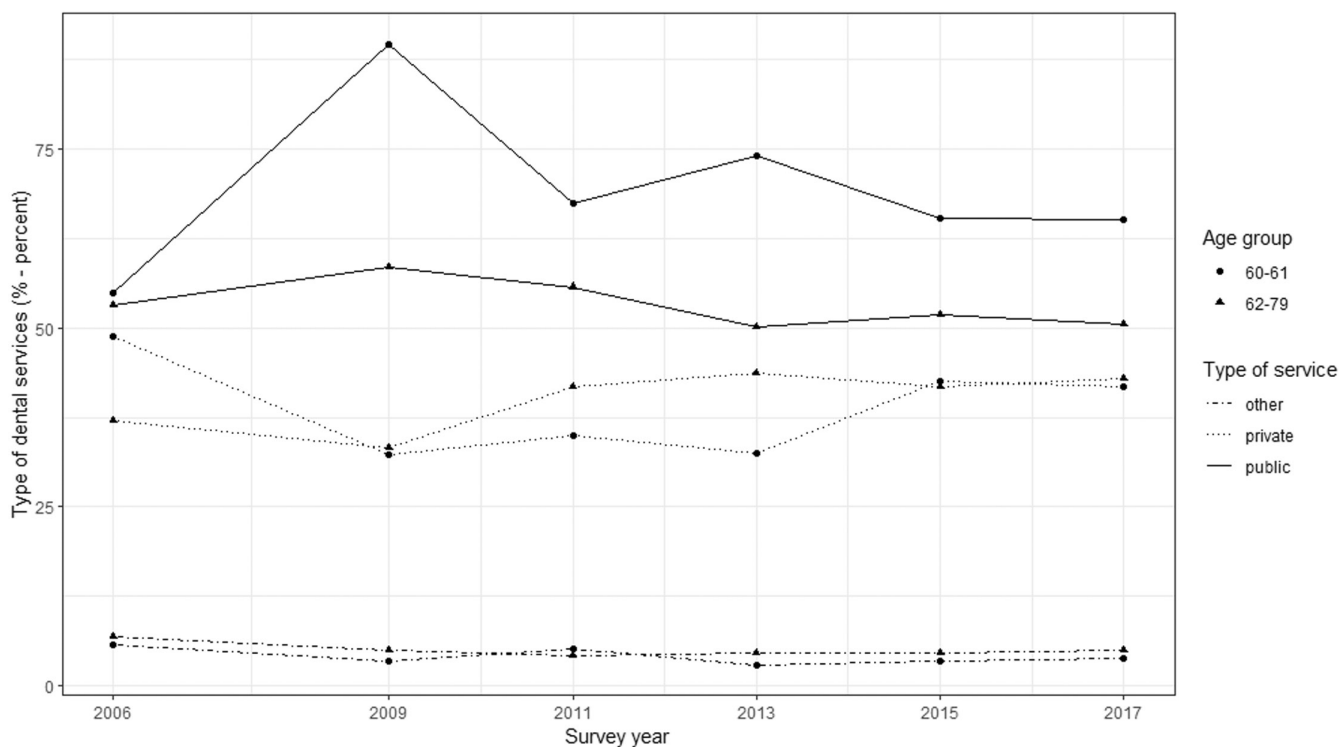


FIGURE 2 Age-standardized type of dental care service (public, private and other) received by Chilean older adults (60–79 years) in 2006–2017, by GES-60 eligibility.

dentist. While for income, a threshold effect was observed where older adults from the richest quintile only were more likely to use dental services while there were no differences between the lowest

and the other income quintiles. These estimates remained almost unchanged in the fully adjusted models. Compared to those from the lowest quintile, older adults from the highest income quintile

TABLE 1 Prevalence of use of dental services and use of public services in the last 3 months by socio-demographic characteristics of 60–79 year-olds.<sup>a</sup>

Variable	Category	CASEN 2006		CASEN 2009		CASEN 2011		CASEN 2013		CASEN 2015		CASEN 2017	
		Use of dental services (%)	Public service Use <sup>b</sup> (%)	Use of dental services (%)	Public service Use <sup>b</sup> (%)	Use of dental services (%)	Public service Use <sup>b</sup> (%)	Use of dental services (%)	Public service Use <sup>b</sup> (%)	Use of dental services (%)	Public service Use <sup>b</sup> (%)	Use of dental services (%)	Public service Use <sup>b</sup> (%)
Income	Quintile I <sup>c</sup>	3.9	72.5	3.1	79.6	3.6	86.0	4.5	83.1	4.6	80.3	4.4	80.8
	Quintile II	4.3	75.4	3.5	76.5	4.3	74.6	5.3	62.5	5.7	79.5	5.0	75.5
	Quintile III	4.7	62.1	3.5	67.1	5.3	67.2	4.7	65.5	5.7	71.6	5.2	61.8
	Quintile IV	6.4	42.0	5.2	53.8	7.0	47.7	6.5	41.5	7.3	47.6	6.6	47.2
	Quintile V	9.7	13.6	8.4	17.6	10.5	15.5	11.5	18.7	11.0	14.7	11.5	16.4
Education	No education	2.8	70.7	2.0	95.2	3.1	83.8	2.9	77.0	3.0	86.2	3.2	80.7
	Primary	4.2	68.1	3.5	75.9	4.0	71.9	4.0	74.6	5.2	77.6	4.2	80.2
	Secondary	7.0	41.3	5.0	50.7	7.4	49.7	6.7	51.3	7.1	53.5	6.7	50.5
	University	13.1	10.8	10.7	9.3	12.6	17.4	15.1	17.8	11.8	16.2	11.5	18.8
Gender	Male	5.2	44.4	4.4	47.2	5.4	50.5	5.3	50.0	5.5	50.5	5.2	48.3
	Female	6.1	49.7	4.9	52.8	6.5	51.4	7.0	48.5	7.6	55.1	6.9	54.4
Residence	Urban	6.2	46.1	4.9	50.7	6.5	49.5	6.8	47.2	7.1	52.0	6.6	49.0
	Rural	2.9	63.4	3.1	56.8	3.3	68.0	3.3	68.7	4.4	66.6	4.2	70.3
Ethnicity	Non-Indigenous	5.8	46.6	4.7	50.7	6.0	49.6	6.4	48.3	6.7	52.2	6.3	51.0
	Indigenous	3.2	77.0	3.5	67.1	5.6	74.2	4.4	64.1	6.8 <sup>b</sup>	71.1	4.5	67.4
Cohabiting status	Living with partner	5.6	49.2	4.7	47.4	6.1	52.2	5.7	49.3	6.7	50.0	6.1	49.9
	Living alone	5.7	44.9	4.6	58.3	5.9	49.1	7.2	50.7 <sup>b</sup>	6.6	58.9	6.1	55.8
Disability	Yes	4.8	57.7	5.5	64.4	5.5	72.8	6.9	66.5	7.5	65.9	6.2	65.6
	No	5.9	45.5	4.5	47.2	6.1	46.8	6.1	45.4	6.5	49.6	6.0	47.8

<sup>a</sup>Proportions weighted to allow comparison.

<sup>b</sup>Subsample of those who did attend dental services.

<sup>c</sup>Most deprived quintile.

had 2.36 (95% CI 1.79–3.10) times higher odds of visiting the dentist after adjusting for gender, age, residence, ethnicity, cohabiting status and disabilities. Regarding educational attainment, those with primary education were 2.91 (95% CI 1.49–5.68) times more likely to use dental services, individuals with secondary education had an OR=3.40 (95% CI 1.73–6.68) and those with tertiary education an OR=6.43 (95% CI 3.26–12.68) than older adults without formal education in the fully adjusted model.

The sample for type of dental service used referred to only those that reported visiting the dentist in the past 3 months. There was a clear income gradient where the higher the income, the lower the likelihood of using public dental services (in both unadjusted and fully adjusted models); while for education, only those with university education were less likely to use public services than those with no education. Compared to those in the lowest quintile, those in middle quintile had an OR=0.30 (95% CI 0.16–0.58), the second highest quintile had an OR=0.15 (95% CI 0.08–0.29) and the highest quintile had an OR=0.03 (95% CI 0.01–0.73) of using

public dental services in the fully adjusted models. Regarding educational attainment, individuals with tertiary education were less likely (OR: 0.13; 95% CI 0.03–0.73) to use public dental services than older adults without formal education after adjusting for all covariates (Table 2).

Regarding absolute inequalities, estimated use of dental services was higher among eligible than non-eligible individuals in all quintiles except for the richest, and among all educational levels except for university education. Social gradients in the use of dental services were present for both GES-60 eligible and non-eligible participants and were more marked for the latter group. For type of dental service used, income and education gradients were observed irrespective of GES eligibility (Table 3).

Regarding relative inequalities, only those in the richest quintile were more likely to use dental services, particularly among non-eligible individuals. Regarding education, only GES-60 eligible individuals with university studies were more likely to use dental services. In addition, a steep social gradient was observed among

**TABLE 2** Association of use of dental services ( $n=14\,818$ ), and use of public dental services ( $n=1\,004$ ) of older adults in 2017 with income and education: unadjusted and fully adjusted models.

Variable	Category	Use of dental services in the last 3 months ( $n=14\,818$ )		Use of public dental services in the last 3 months ( $n=1\,004$ )	
		Unadjusted model			
		OR <sup>b</sup>	95% CI <sup>c</sup>	OR <sup>b</sup>	95% CI <sup>c</sup>
Income	Quintile I <sup>d</sup>	1	1	1	1
	Quintile II	1.18	0.87–1.58	0.51	0.27–0.96
	Quintile III	0.99	0.76–1.32	0.25	0.13–0.47
	Quintile IV	1.33	0.99–1.79	0.14	0.07–0.26
	Quintile V	2.35	1.80–3.06	0.02	0.01–0.04
Education	No education	1	1	1	1
	Primary	2.89	1.48–5.64	2.43	0.49–12.02
	Secondary	3.51	1.79–6.87	0.51	0.10–2.50
	University	6.50	3.31–12.74	0.11	0.02–0.53
Fully adjusted models <sup>a</sup>					
		OR <sup>b</sup>	95% CI <sup>c</sup>	OR <sup>b</sup>	95% CI <sup>c</sup>
Income	Quintile I <sup>d</sup>	1	1	1	1
	Quintile II	1.17	0.87–1.58	0.55	0.29–1.04
	Quintile III	0.99	0.75–1.31	0.30	0.16–0.58
	Quintile IV	1.32	0.98–1.80	0.15	0.08–0.29
	Quintile V	2.36	1.79–3.10	0.03	0.01–0.73
Education	No education	1	1	1	1
	Primary	2.91	1.49–5.68	2.57	0.47–14.10
	Secondary	3.40	1.73–6.68	0.57	0.10–3.10
	University	6.43	3.26–12.68	0.13	0.03–0.73

<sup>a</sup>Adjusted for gender, age, residence, ethnicity, cohabiting status (income model only), disability.

<sup>b</sup>OR: odds ratio.

<sup>c</sup>95% CI: 95% confidence interval.

<sup>d</sup>Most deprived quintile.

**TABLE 3** Estimated use of dental services ( $n = 14\,818$ ) and type of dental service ( $n = 1004$ ) by income and education among GES-60 eligible and GES-60 non-eligible older adults in 2017.<sup>a</sup>

Variable	Category	Estimated use of dental services in the last 3 months ( $n = 14\,818$ )			
		GES-60 eligible		GES-60 non-eligible	
		% <sup>b</sup>	95% CI <sup>c</sup>	% <sup>b</sup>	95% CI <sup>c</sup>
Income	Quintile I <sup>d</sup>	7.10	4.80–9.40	4.68	3.43–5.94
	Quintile II	7.87	5.75–9.99	5.35	4.00–6.69
	Quintile III	5.84	4.01–7.62	5.17	3.92–6.42
	Quintile IV	8.35	6.99–10.72	6.34	4.94–7.74
	Quintile V	10.67	7.85–13.49	11.54	9.41–13.66
Education	No education	3.34	0.12–6.55	1.54	0.19–2.89
	Primary	7.61	5.82–9.40	4.90	3.96–5.83
	Secondary	7.43	5.83–9.03	5.94	5.00–6.89
	University	10.34	7.59–13.09	11.58	9.52–13.64
Variable	Category	Estimated use of public dental services among those attending in the last 3 months ( $n = 1004$ )			
		GES-60 eligible		GES-60 non-eligible	
		% <sup>b</sup>	95% CI <sup>c</sup>	% <sup>b</sup>	95% CI <sup>c</sup>
Income	Quintile I <sup>d</sup>	86.52	76.65–96.39	86.31	77.21–95.41
	Quintile II	85.88	76.54–95.22	72.78	63.53–82.04
	Quintile III	73.42	60.12–86.71	62.11	50.53–73.69
	Quintile IV	60.71	46.69–74.74	43.17	32.46–53.89
	Quintile V	18.35	8.94–27.76	14.84	8.76–20.92
Education	Primary or less	85.52	77.85–93.20	81.73	74.37–89.10
	Secondary	60.96	49.61–72.31	49.43	41.06–57.80
	University	27.42	14.22–40.62	19.17	12.60–25.74

<sup>a</sup>Models adjusted for gender, residence, ethnicity, cohabiting status (income model only) and disability.

<sup>b</sup>Calculated using estimated marginal means.

<sup>c</sup>95% CI: 95% confidence interval.

<sup>d</sup>Most deprived quintile.

GES-60 non-eligible adults where each higher level of educational attainment was more likely to use dental services (Table S4).

## 4 | DISCUSSION

Older adults increased their use of dental services since 2006. This increase was higher among GES-60 eligible than GES-60 non-eligible individuals. Moreover, this study showed the presence of pronounced income and education inequalities in the use and type of dental services among older adults in Chile that disproportionately affected more deprived individuals. These inequalities were greater among older adults who were non-eligible for GES-60 than eligible ones.

The inequalities observed in this study are in line with findings from previous studies on inequalities in dental service utilization among older adults in other contexts, such as in Europe,<sup>10,17</sup> the US,<sup>36</sup> Australia,<sup>37</sup> Brazil<sup>38</sup> and Peru.<sup>39</sup> Studies conducted in Chile

on oral health inequalities among the general population reported a slight decrease in inequalities since implementation of the health reform. However, they also highlighted that inequalities in the use of dental services still prevailed.<sup>19,20,26</sup> This is the first study to examine the issue among a group predominantly affected by the GES-60 (i.e. 60–61 older adults) and we observed the presence of stark inequalities in the year studied (2017).

The estimated marginal means analysis showed an increase in the use of dental services by eligible lower SEP individuals, and the presence of inequalities regardless of GES eligibility for both use of dental services and type of service used. However, inequalities in dental service use were steeper for GES-60 non-eligible individuals than their counterparts. This suggests that the GES-60 policy may have had a slight impact in reducing inequalities by increasing access for eligible individuals.

The GES policy defined 60-year-olds as a priority group and aimed to improve the oral health of older adults in retirement age through increased access to dental services. GES-60 may be the

main opportunity for vulnerable older adults to visit the dentist free of charge. However, focusing on 60-year-olds only could have generated a detrimental side effect, particularly for the most vulnerable older adults that are over 60 years of age and therefore not entitled to GES-60. These vulnerable older adults depend on the public dental service for their dental care, but this is not straightforward as dental services allocate most of their time and limited resources to cover GES programmes and other priority groups, generating long waiting lists for non-eligible individuals.<sup>40</sup> Those from more economically advantageous backgrounds do not necessarily have to rely on this programme, as they might be able to afford private services and therefore might not feel limited to the restrictive GES age-eligibility criteria. There is no evidence-based rationale to explain why only 60-year-olds were selected for GES instead of other criteria, such as a wider age range, SEP, health status or condition-specific criteria, especially when older adults currently have a life expectancy of 76 years in Chile.<sup>41</sup>

In relation to trends in the use of dental services by age, GES-60 eligible individuals increased their use of services at a higher proportion than non-eligible older adults. A shift towards public service use among GES-60 eligible adults was observed between 2006 and 2009 surveys. This could be due to the policy implementation in 2007 facilitating access to dental services for 60-year-olds together with public services working as a safety net for vulnerable GES-60-eligible individuals. For non-eligible individuals, similar proportions of public and private services use were observed in every year studied, indicating that the policy may have a role in this shift towards public provision of dental services among the beneficiaries.

The study also demonstrated that the proportion of older adults that visited the dentist in the last 3 months was relatively low across all surveys (5.0%). Direct comparison with the global literature is not straightforward due to the different timeframes, but dental service utilization was 51.2% in Australia<sup>37</sup> and 53.1% in European countries in a 12-month period,<sup>14</sup> and 68.1% in a 2-year period in the US.<sup>36</sup> This low prevalence in Chile could partly be explained due to the narrow timeframe of 3 months used by CASEN which cannot be modified as this is a secondary data analysis. Other explanations might include inadequate dental service provision, and high costs of services or other access-related barriers. However, the slight increase from 2006 (5.6%) to 2017 (6.7%), which is similar to findings from another Chilean study,<sup>26</sup> could be partly attributed to a greater use of public services by GES-eligible individuals.

This is the only study to date that has investigated inequalities in use and type of dental services among a nationally representative sample of older adults living in Chile. Moreover, CASEN had high response rates (between 73.4% and 80.6%) and provided a large analytical dataset. In addition, we used a series of surveys to observe trends and indirectly explore the impact of the GES-60 policy. There are some limitations to this study. First, the cross-sectional survey design of CASEN did not allow to establish causal effects of the GES policy on the use of dental services of older

adults. More complex methodologies exist for causal inference in observational data.<sup>42</sup> Second, CASEN's short timeframe period for reporting dental visits (3 months) is not suitable to define the need of the population for dental service use, might also have underestimated the prevalence of use of services and hindered comparability with other studies. Third, the survey did not provide information about respondents' use of GES-60, thus age was used as a proxy to identify potential beneficiaries instead. Finally, self-reported measures like the ones used in this study are more susceptible to response bias.

The presence of social gradients in dental service use among older adults needs to be addressed with adequate oral health policies. A comprehensive evaluation of the GES-60 policy should expand from assessing only service use and focus also on its impact on the oral health of older adults, and specifically on its role in the reduction of inequalities in dental service utilization among older adults, considering the needs of the whole older adult population, not only of those aged 60 years.

This study found the presence of inequalities among older adults in Chile after the implementation of a major health reform. These inequalities were present among both GES-60 eligible and non-eligible adults. However, these were more pronounced among non-eligible individuals. The findings suggest a limited impact of GES-60 only among those eligible, but without any evidence that it also benefited those older than the 60-year-old arbitrary threshold for one-off provision of easier access to public dental services. There is potentially little to be gained by increasing dental service use at a specific age without maintaining this pattern and covering needs for dental care as older adults age further.

## AUTHOR CONTRIBUTIONS

Yanela Aravena-Rivas proposed the idea, drafted the article, and conducted the statistical analyses. Georgios Tsakos gave input for the design of the study, interpretation of results and revised the manuscript. Renato Venturelli and Michelle Stennett provided input for interpretation of results and revision of the manuscript. All authors have read and approved the final version of this manuscript.

## CONFLICT OF INTEREST STATEMENT

We certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

## DATA AVAILABILITY STATEMENT

The datasets analysed during the current study are openly available on the website of the Chilean Ministry of Social Development and Family (<http://observatorio.ministeriodesarrollosocial.gob.cl/encuesta-casen>).

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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