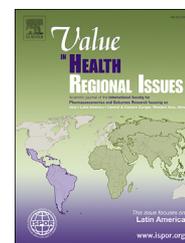


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Economic Evaluation

Budgetary Impact of Oral Rehabilitation With Complete Dentures: An Economical Evaluation From São Paulo State, Brazil



Antonio Carlos Pereira, PhD¹, Luciana Ribeiro Bahia, PhD², Denise de Fátima Barros Cavalcante, PhD³, Marcelo de Castro Meneghim, PhD¹, Yuri Wanderley Cavalcanti, DDS, PhD^{4,*}, Glaucia Maria Bovi Ambrosano, PhD¹, Livia Fernandes Probst, PhD³

¹Social Dentistry Department, State University of Campinas, Piracicaba, SP, Brazil; ²School of Medicine, Rio de Janeiro State University, Rio de Janeiro, RJ, Brazil; ³Social Dentistry Department, State University of Campinas, Piracicaba, SP, Brazil; ⁴Clinical and Social Dentistry Department, Federal University of Paraíba, Joao Pessoa, PB, Brazil

ABSTRACT

Objective: To develop a budgetary impact analysis regarding the possibility of offering complete upper and lower dentures to an eligible population of elderly people (above 65 years) in the São Paulo state, Brazil. **Methods:** The proportion of eligible population was calculated by assessing the prevalence of edentulous (upper and lower arch) and by defining the eligible group (public health system users). The budgetary impact analysis was designed under the following scenario: 5-year time horizon (2018–2022), prospect of municipal expenses with prostheses, and additional progressive incorporation of technology (upper and lower dentures) at an annual rate of 10%, 15%, 20%, 25%, and 30%. Sensibility analysis was performed in 3 different situations (reference, more pessimistic, and more optimistic) based on the calculation of spending through assessed demand and epidemiological demand. **Results:** The municipal cost for each denture, already discounted the value transferred by the union for this procedure, was R\$50.97. The

incremental impact on the budget measured by the epidemiological demand relative to assessed demand was approximately R\$59 141 510 over 5 years, meaning an impact of 0.08% (0.01% more optimistic; 0.13% more pessimistic) of the “medium and high complexity care” budget and 0.09% (0.03%–0.14%) of the primary care budget. **Conclusion:** The budgetary impact of increasing the oral rehabilitation with complete dentures for elderly population in the São Paulo state is low relative to the expenses with primary or specialized care budgets. In addition, incorporation of denture rehabilitation would be feasible, according to the financial availability and priorities of each municipality. **Keywords:** budget impact, complete dentures, dental loss, prosthetic rehabilitation

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Introduction

The use of health services has been a point of emerging interest, mainly in the field of dental care.¹ In Brazil, the use of dental services has been increased after implementation of the National Oral Health Policy (the Smiling Brazil Program) in 2004, from which impacts on the organization of work, on the number of oral health teams, and on the provision of oral services at different levels of care have been shown.^{2–5} Although Smiling Brazil has been positive in many perspectives, the population access to dental services is still considered exclusive and selective.^{6,7}

Therefore, many challenges still need to be addressed, and one of these is related to the high demand for complete dentures, in

both dental arches. The last national epidemiological surveys on oral health, SB-Brasil 2003 and 2010,^{8,9} have shown that there was a decrease in prosthetic rehabilitation needs among adolescents (52% decrease) and adults (70% decrease), but 13.7% and 68.8% of those still need some kind of prosthesis, respectively. The condition of the elderly remained precarious.⁹ In a survey carried out in the São Paulo state in 2015, it was verified that the majority of the elderly above 65 needed some denture, with 41.1% missing upper dentures and 37.3% lower dentures. Thus, the demand for oral rehabilitation with dentures among the elderly was very high.²

This is particularly important if we take into account health effects on the elderly.^{10,11} Regarding oral health, many

Conflict of interest: The authors have indicated that they have no conflicts of interest with regard to the content of this article.

* Address correspondence to: Yuri Wanderley Cavalcanti, DDS, PhD, Joao Pessoa, Paraíba 58051-900, Brazil.

Email: yuri.wanderley@yahoo.com.br

2212-1099/\$36.00 - see front matter © 2019 ISPOR–The professional society for health economics and outcomes research. Published by Elsevier Inc.

<https://doi.org/10.1016/j.vhri.2019.01.008>

dimensions are affected, such as psychological, physical, and social, which can be evaluated through some psychometric instruments.¹² Nevertheless, all technology embodied by society requires an economic sacrifice because needs are greater than resources. In this way, studies of economic efficiency are of great worth for decision-making managers. In this context, the budget impact analyses aim to quantify the financial effects of the incorporation of a specific technology in a health system, suggesting the incorporation or not of this technology by the system.¹³

Nevertheless, there are no reports in the literature about the impact of the financing of complete dentures for the municipalities in Brazil, which is carried out by the Smiling Brazil Program, since 2004. This is particularly important if we take into account the demand for the service and consider that roughly 70% of the population is dependent on the public health system in Brazil. However, the percentage of people with access to dental health plans is even lower, that is, 47.3 million (24.5 %) have health plans with or without dentistry and 22.9 million (11.6%) have exclusively dental health plans in Brazil.¹⁴ In this context, the aim of this study was to evaluate the budgetary impact of increasing the oral rehabilitation service with complete dentures for edentulous individuals in the São Paulo state, Brazil.

Methods

The Health Technology: Complete Dentures

Since 2005, the Ministry of Health has been allocating resources to the municipalities for the supply of complete dentures. In 2012, the system update resulted in an increase of the global resources for this purpose.¹³ Clinical and laboratory protocols should follow strict methods.¹⁵ It is worth to account that oral rehabilitation has high abandonment rates to lower dentures because the denture user reports difficulty in adapting, which generates waste of public resources.

Study Design

This is a budgetary impact analysis structured from the Methodological Guidelines for Budgetary Impact Analysis of the Ministry of Health.¹³ Epidemiological data, estimates of population participation, and treatment costs were combined to predict the eligible population and the need for total investment to increase the offer of rehabilitation treatment with complete dentures for the public health system users of the São Paulo state in Brazil. Data referenced for analysis were obtained through public data obtained from Brazilian Institute of Geography and Statistics (IBGE; www.ibge.gov.br), DATASUS (www.datasus.saude.gov.br), SIOPS (<http://siops-asp.datasus.gov.br>), and the national Price Register website (www.portaldelicitacao.com.br/

site). The perspective of this study considered the public health system managers from the São Paulo state municipalities.

Discount Rate and Time Horizon

No discount rate was considered for this study. The time horizon consisted of 5 years, starting in 2018, until 2022, as supported by the Brazilian Network in Health Technologies (REBRATS; <http://rebrats.saude.gov.br/>). The gradual diffusion of complete denture supply was assumed for the respective time horizon by setting annual rates of 10%, 15%, 20%, 25%, and 30%. The assumption of gradual diffusion was determined because several variables can interfere in the diffusion process of a technology, such as training and human resources, besides the number of individuals looking for access this technology.¹³

Population of Interest

We assumed 2 methods for calculating the population of interest for oral rehabilitation with complete dentures in the public health system. The age group considered was that of the elderly above 65 years old in both scenarios (reference and hypothetical); that is, the impact of the hypothetical scenario focuses specifically on the size of the assisted population.

In the reference scenario, we estimated the assessed demand from the number of upper and lower dentures offered between 2013 and 2017 in the São Paulo state (Table 1). For this first scenario, considering the assessed demand, the number of upper dentures was 254 107, whereas lower dentures consisted of 192 389 within the last 5 years. These numbers were used for the time horizon from 2018 to 2022 (5 years).

In the hypothetical scenario, we estimated the epidemiological demand to calculate the impact of progressive technology implementation. Based on the epidemiological survey conducted in 2015 in the São Paulo state, the prevalence of mandibular edentulism in elderly above 65 years was 37%, and the prevalence of maxillary edentulism was 40%. This would initially be our population of interest.

In addition to this, we calculated the epidemiological demand. Elderly population (above 65 years) in the São Paulo state is equivalent to 3 883 104 (8.74%), including 2 245 348 women and 1 637 756 men. Data presented in Table 2 show the eligible population based on the epidemiological demand and type of dentures within the public health system from the São Paulo state.

Considering that approximately 70% of the population is dependent on the public health system and roughly about 15% of the patients cannot perform the complete denture placement (owing to lack of mandibular bone, nonadherence to treatment, and so on),¹⁶ we set 55% as the epidemiological demand, which means that the epidemiological demand is equivalent to 1 610 659 complete dentures including 874 615 upper dentures and 795 691 lower dentures.

Costs

For the cost analysis, the amount effectively spent by the municipality for each denture (upper and lower) was taken into account. For this, we considered the following calculation: (1) average value paid by the municipalities from the São Paulo state for the fabrication of upper and lower dentures; and (2) transfer amounts by the Ministry of Health for each procedure involved on denture fabrication. The amount considered as effectively paid by the municipal manager was calculated by the difference between the average value paid and the value of the federal transfer.

The federal government incentive amounts for financing denture services were based on the SIGTAP table—System of

Table 1 – Number of upper and lower dentures supplied in the São Paulo state by the public health system between 2013 and 2017.

Denture type	Year					Total
	2013	2014	2015	2016	2017	
Upper dentures	49 231	52 397	52 081	52 253	48 145	254 107
Lower dentures	38 579	40 896	39 240	38 889	34 785	192 389
Both	87 810	93 293	91 321	91 142	82 930	446 496

Table 2 – Eligible population based on the epidemiological demand and type of dentures, within the public health system from the São Paulo state.

Denture type	Female population needing dentures (n%), average, [%min-%max]	Male population needing dentures (n%), average, [%min-%max]	Epidemiological demand	Number of people eligible for complete dentures in the public health system (55% from population)
Upper dentures	(906 447 / 40.37%) 830 779-997 159 [37.00%-44.41%]	(683 763 / 41.75%) 587 954-779 408 [35,90%-47.59%]	1 590 210	874 615
Lower dentures	(839 760 / 37.40%) 763 867-915 653 (34.02%-40.78%)	(606 952 / 37.06%) 524 901-688 840 (32.05%-42.06%)	1 446 712	795 691
Total	1 746 207	1 290 715	2 928 471	1 610 659

Management of the Table of Procedures of the public health system.¹⁷ The cost data are presented in Table 3 and expressed in Brazilian currency (R\$—reais; year 2018; 1 US\$ = R\$ 3.70 on January 1, 2019).

The average value paid for the prosthetic procedures by the municipalities was defined according the Bidding Price Panel.¹⁸ Based on that, the average value paid per denture (upper or lower) by the municipalities from the São Paulo state is R\$210.00 (\$56.76). Therefore, the additional value paid per denture, under accountability of the municipal managers, is R\$ 50.97 (\$13.78) (as a result of R\$210.00 minus R\$ 159.03).

These following was assumed because the aim of this study was to provide an budgetary impact view only for municipal managers: (1) only the amounts spent on technology were considered (therefore, monthly incomes paid to the dentist and auxiliary, in addition to molding materials and others, were not considered because the objective of the work was to establish the budgetary impact on increasing the supply of technology and, therefore, only specific expenses were used); (2) the average value for the São Paulo state was taken into account for the amounts spent on the bids (and this can vary among different places in Brazil); (3) the amounts actually spent on oral healthcare were considered as a reference for the budget, although some cities do not offer this service to the population.

Reference Scenario and Hypothetical Scenario Owing to Technology Incorporation and Different Scenario Analysis

The budgetary impact described in this study was based on the epidemiology and economic information from the year 2018. Then, a hypothetical scenario was drawn based on the 2018 scenario. The following assumptions were adopted: (1) in the hypothetical scenario, the epidemiological demand was predicted based on data from the state survey of oral health (Saúde Bucal São Paulo 2015²); (2) all eligible patients (55% of the elderly population needing a prosthesis) would receive the treatment and

not abandon it. The different scenario for reference is presented in Figure 1.

Static sensibility analysis (SSA) was performed because the possibility of the following parameters and assumptions generate uncertainties in the results: (1) variation in the number of patients to be rehabilitated; (2) variation of the value of municipal expenditure (costs of dentures in the bids).

Budgetary Impact Calculation

The total cost of rehabilitation was calculated by multiplying the municipal unit cost with each denture (upper and lower) by the number of individuals needing treatment. From this total value, the federal incentive value (MS) for the denture fabrication was subtracted (Table 1). Analyses were constructed on the Microsoft Office Excel.

Results

The incremental impact on the budget measured by the epidemiological demand relative to the assessed demand was approximately R\$59 141 510 (\$15 984 191; period of 5 years). The amount to be spent ranged from R\$5 914 151 (\$1 598 419) to R\$17 742 453 depending on the incorporation percentage (10%-30%). The total value was obtained by calculating the amount to be spent by the municipality (R\$82 078 010/\$22 183 245) and subtracting from the amount actually spent by these same municipalities in the previous period from 2013 to 2017 (R\$22 936 500/\$6 199 054) to calculate what would be the budgetary impact in case of using the epidemiological demand. Number of dentures was influenced by the percentage of incorporation of the technique, the type of demand (assessed or epidemiologic), and the scenario (more optimistic or less optimistic).

Static sensibility analysis showed that the budgetary impact could vary from R\$33 267 099 (\$8 991 107) to R\$92 408 610

Table 3 – Federal government incentive amounts for financing denture services in the public health system in Brazil, based on SIGTAP table (\$1.00 = R\$3.70).

Complete denture costs					
Procedures	Reference	Competence	Value (R\$)	Quantity	Total
Panoramic radiography	SIGTAP	March 2018	9.03	1	9.03
Complete dentures (upper or lower)	SIGTAP	March 2018	150.00	1	150.00
Total					159.03

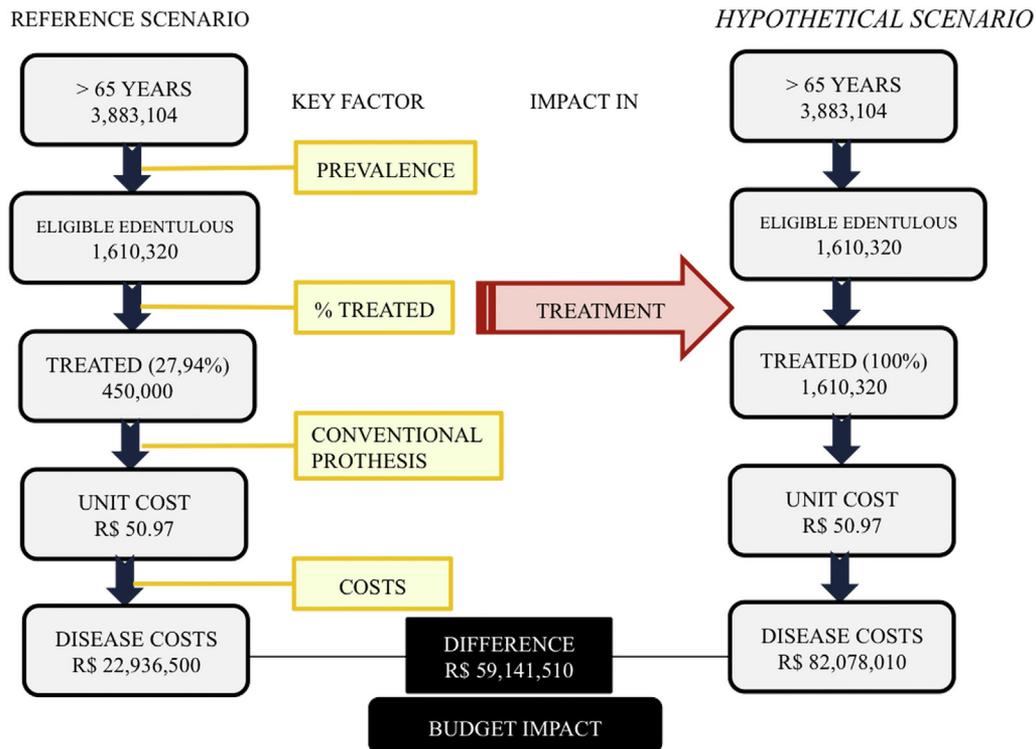


Fig. 1 – Flowchart describing the parameters for calculation of budgetary impact (design based on Mauskopf et al.¹⁷) (\$1.00 = R\$ 3.70).

(\$24 975 300) million, taking into account a more optimistic or more pessimistic scenario (25% or more or less).

It is also verified that the increase of prostheses to be made would be 1 160 320 for eligible edentulous (Table 2).

Table 4 presents a flowchart of the parameters for calculating the budgetary impact. It shows that out of the total population of more than 3.8 million elderly people over 65, only 1.61 million are eligible. The number of people who would receive the total denture would increase from 450 000 (previous period) to 1.61 million (eligible population).

Discussion

Complete dentures are an example of health technologies already incorporated and financed by federal incentives^{5,9} and municipal resources. This budgetary impact analysis aimed to estimate the incremental amount needed for municipalities to offer such technologies to the eligible population defined in this study. The budgetary impact analysis aims to provide subsidies for managers to analyze the financial impacts that the increased supply of a given technology has on the health budget or a specific sector. These are important and are part of the theoretical-practical tools of the functions of a health manager in many countries in the world.^{19,20}

The present analysis has some limitations that need to be highlighted before the discussion, and we started by contextualizing the current status of oral health financing in the municipalities. The source of the resources for the health area is based on the constitution law and also in laws such as 8080/90, 8142/90, EC29, and EC95, corresponding to 3.6% of GDP with public

expenditure. Many laws and resolutions also support the oral health financing by the public budgetary.

The oral health financing in Brazil is sectorial, programmatic, and based on healthcare attention. Nevertheless, the amount of money spent on oral healthcare by the public health system is hard to be estimated because budget from primary care and from specialized care is used for that and there is no clear information about how much is spent specifically with oral health services. Thus, it would only be possible to obtain the amounts spent on oral health if the accounting documents of all the cities from the São Paulo state (645 municipalities) were carefully analyzed, which made this hypothesis unviable.

The expenditures on primary care by the municipalities from the São Paulo state totaled R\$13 835 344 431.66 in 2017, including the fund transfers from the federal government, state, and municipal resources. In view of Constitutional Amendment No. 95, dated December 15, 2016, we can consider that there will be no increase in the pass-through of the primary healthcare budget and thus assume that in 5 years the maximum spending limit of municipalities would be R\$69 176 722 158.30. Therefore, the budgetary impact of the increase in the supply of dentures to the population above 65 years in the São Paulo state would be 0.03% in the first year and 0.14% in the fifth year, with an average of 0.09%. In relation to specialized care—median and high health specialties (other financing line possible), the expenses were R\$15 398 824 384.47 in 2017, with a total of R\$76 994 121 922.35 in the period of 5 years. The financial impact would be 0.01% in the first year and 0.13% in the fifth year, with an average of 0.08%. These percentages would make the budget increase low in percentage terms and, taking full care of the situation of obscurity on oral health spending, the incorporation of this technology

Table 4 – Comparison between expenditures using assessed demand and epidemiological demand for upper and lower dentures for elderly above 65 years in the São Paulo state (reference, more pessimistic, and more optimistic scenarios) (\$1.00 = R\$3.70).

Year	Progressive increase	Assessed demand		Epidemiological demand		Budgetary impact	
		Number of dentures	Municipality expenditures (R\$)	Number of dentures	Municipality expenditures (R\$)	Number of dentures	Municipality expenditures (R\$)
Reference scenario							
2018	10%	45 000	2 293 650	161 032	8 207 801	116 032	5 914 151
2019	15%	67 500	3 440 475	241 548	12 311 701	174 048	8 871 226
2020	20%	90 000	4 587 300	322 064	16 415 602	232 064	11 828 302
2021	25%	112 500	5 734 125	402 580	20 519 502	290 080	14 785 377
2022	30%	135 000	6 880 950	483 096	24 623 403	348 096	17 742 453
2018-2022	100%	450 000	22 936 500	1 610 320	82 078 010	1 160 320	59 141 510
More pessimistic scenario (a)							
2018	10%	56 250	3 583 828	201 290	12 824 689	145 040	9 240 861
2019	15%	84 375	5 375 742	301 935	19 237 033	217 560	13 861 291
2020	20%	112 500	7 167 656	402 580	25 649 378	290 080	18 481 722
2021	25%	140 625	8 959 570	503 225	32 061 722	362 600	23 102 152
2022	30%	168 750	10 751 484	603 870	38 474 067	435 120	27 722 583
2018-2022	100%	562 500	35 838 281	2 012 900	128 246 891	1 450 400	92 408 610
More optimistic scenario (b)							
2018	10%	33 750	1 290 178	120 774	4 616 888	87 024	332 6709.96
2019	15%	50 625	1 935 267	181 161	6 925 332	130 536	4 990 064
2020	20%	67 500	2 580 356	241 548	9 233 776	174 048	6 653 419
2021	25%	84 375	3 225 445	301 935	11 542 220	217 560	8 316 774
2022	30%	101 250	3 870 534	362 322	13 850 664	261 072	9 980 129
2018-2022	100%	337 500	12 901 781	1 207 740	46 168 880	870 240	33 267 099

Different situations in the sensibility analysis according to the Brazilian Network in Health Technologies (REBRATS): (a) More pessimistic: Varied for more the value of the transfer in 25% and for less the eligible population in 25%. (b) More optimistic: Varied for less the value of the transfer in 25% and for more the eligible population in 25%.

would be feasible according to the financial availability and priorities of each municipality.

To reach the goal of 100% of the eligible population, although it is quite ambitious, we have to take into account that there would be a need to increase human resources (dentists and oral health assistants), material, and transfer of ministry (this is a study presupposition), and these expenses were not considered in the present study.

The oral rehabilitation with conventional dentures is likely to have a significant effect on the quality of life related to oral health according to several controlled clinical trials.²¹⁻²³ This effect has been demonstrated not only in independent and free elderly in the community,^{21,24} but also in individuals with a certain level of dependence owing to neuropathic diseases.^{22,24} Although cost reduction is not the purpose of this study, there is clear evidence that the increase in the supply of upper and lower dentures could reduce the intangible costs owing to the improvement in the social life of the beneficiaries with the treatment.

Rehabilitation with complete dentures is considered a low-cost treatment with few contraindications.²⁵ Nevertheless, in the case of severely resorbed jaws, conventional dentures present less stability and retention, which are related to lower masticatory efficiency and quality of life related to oral health.¹⁵ In these cases, rehabilitation with dental implants can provide additional retention and comfort to the patient and is recommended for the rehabilitation of atrophic jaws.¹⁵ Thus, it seems important to make a brief discussion about the possibility of, in some cases, being able to use an alternative technology (eg, removable dentures retained by dental implants, known as overdentures).

By comparing the satisfaction and quality of life related to oral health of individuals rehabilitated with conventional complete dentures and complete dentures retained by implants, the literature has demonstrated a significant advantage of rehabilitative treatments with overdentures.²⁶⁻²⁸ Although implant-supported rehabilitation results in higher initial costs, it is suggested that this is a more effective treatment than conventional total prostheses because a greater impact on the satisfaction and quality of life of the rehabilitated individuals is observed.^{28,29}

The superiority of rehabilitation with overdentures retained by implants compared with conventional dentures has been demonstrated by several randomized clinical trials.^{21,24} These studies demonstrate that rehabilitation with overdentures causes greater impact on the quality of life scores related to oral health (Oral Impacts on Daily Performance [OIDP], Oral Health Impact Profile [OHIP]-14, OHIP-edentulous individuals [EDENT]). In addition, greater satisfaction and improved performance and masticatory efficiency have been observed compared with conventional dentures.

In this sense, it seems logical to consider the treatment with overdentures from the public health system perspective. The construction of the conventional dentures can be considered a step in the preparation of the rehabilitation with overdentures retained by implants; that is, the eligibility of the cases for the rehabilitative treatment with implants can be defined, case by case, from the identification of the lack of retention and stability of conventional dentures. Thus, the budgetary impact is restricted in the installation of the implants, the prosthetic components (attachments), and in the maintenance phase.

This study presented some limitations that are especially related to the lack of specific data on oral health expenditure. In addition, assumptions on increased spending by the Ministry of Health and municipalities with funding with dental prostheses are theoretical and depend on political will and favorable budgetary conditions. In addition, because the model is static, we did not consider the epidemiological changes that would occur during the period from 2018 to 2022. Nevertheless, it must be remembered that in the last decades no important differences have been observed in the epidemiological profile regarding the percentage of elderly people with a need for total prosthesis in Brazil, and therefore it is possible that the proposed model is not so far from a real scenario.

Finally, it is important to emphasize the significance of the present study because of its novelty, the possibility of inducing health policy, the creation of technical conditions for new lines of research. This study also fosters new analyses based on a more realistic and practical approach, which would aid federative entities to make a political decision to increase access to oral health for the elderly by impacting their quality of life.

Conclusions

The budgetary impact regarding the increase in the supply of dentures for the elderly population from the São Paulo state is low relative to the expenses with primary and specialized care. Possible increase in the supply of complete dentures would be feasible according to the financial availability and priorities of each municipality.

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