

# Cost-Effectiveness Analysis of Oral Health Care Package of Services within a Comprehensive PhilHealth Benefit Package

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## ABSTRACT

**Background and Objective.** The burden of oral diseases is high in the Philippines. The global burden of disease study in 2019 estimated that 44 million Filipinos are affected by oral disorder. More specifically, 29 million Filipinos have untreated dental caries. Outpatients' dental health services are not covered by PhilHealth benefit package. There is a need to include key oral health interventions such as basic prevention and treatment in PhilHealth benefit package to be delivered at the primary health care settings (WHO TSA 153980). The study aimed to determine the incremental cost-effectiveness ratio (ICER) of a set of oral health care services to be delivered at different levels of health care within a comprehensive PhilHealth benefit package.

**Methods.** This study evaluates the cost-effectiveness of including basic oral health services in the PhilHealth benefit package using a Markov modelling approach. The target population consists of Filipino adults and children at risk for dental diseases who are potential beneficiaries of PhilHealth. The intervention under consideration includes dental consultation, oral prophylaxis, topical fluoride application, silver diamine fluoride application, dental filling, and tooth extraction. The comparator is the current standard of care, which involves out-of-pocket payments for oral health services or limited access to subsidized dental care. The primary outcomes assessed include the incremental cost-effectiveness ratio (ICER) per quality-adjusted life year (QALY) gained. A Markov model was constructed with a time horizon of 50 years to simulate the lifespan of Filipinos up to the average life expectancy of 70 years old, using a cycle length of one year to reflect disease progression and treatment effects overtime. Model parameters were derived from literature and expert opinion. Sensitivity analyses, including one-way and probabilistic sensitivity analyses, were conducted to assess uncertainty in model inputs. The analysis was carried out from a societal perspective incorporating direct medical and non-medical costs, and indirect costs.

**Results.** A Markov model showed that a subsidized package is a cost-effective approach compared to the current situation of no subsidy, with an ICER of PhP 75,636 (1,535.76 USD) per disability adjusted life year (DALY) averted. The computed ICER was considered good value for money as it was below 2021 GDP per capita of the Philippines of PhP 174,286 (3,538.80 USD). One-way sensitivity analysis showed that the cost of preventive treatment had the most significant impact on the model, and a price threshold of greater than PhP 3,062 (62.17 USD) for preventive treatment will render the subsidized package no longer cost-effective. The budget impact analysis showed a 1.63% increase in budget annually with the current situation of no subsidy. Rolling out a subsidized oral health package will entail a significant increase in government expenses during the first year but a decreasing trend of 1-2% annually for the following years as the program takes its effect.



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**Conclusion.** A subsidized oral health package is a cost-effective approach from a societal perspective. It will entail a significant increase in government expenditure during the start of its roll out but will eventually result in a decreasing trend of expenses as the years progress.

**Keywords:** oral health, insurance, cost-effectiveness analysis

## INTRODUCTION

The 2018 National Survey on Oral Health (NSOH) conducted by the Department of Health (DOH) revealed that dental caries and periodontal disease remain alarmingly prevalent among Filipinos. These conditions, often underestimated, carry significant consequences not just for individual health, but also for physical, mental, and social development.<sup>1</sup> Particularly among children, poor oral health can hinder learning and school performance, while also contributing to a host of other physical health issues. The economic burden is equally concerning – treatment costs far exceed those of prevention, and oral health problems in working-age adults contribute to loss of productivity due to absenteeism and decreased work efficiency.<sup>2</sup>

The NSOH highlighted the widespread presence of common oral diseases and conditions, placing special attention on dental caries, periodontal disease, and abnormalities such as oral cancer, fluorosis, and dental erosion, among others.<sup>1</sup>

Dental caries is recognized globally as a major public health issue due to its widespread nature and serious implications. The World Health Organization (WHO) estimates that 60–90% of school-aged children and nearly 100% of adults worldwide are affected, with particularly high rates in Latin American and Asian countries.<sup>3</sup> In the Philippines, the survey reported that 73% of the population suffer from dental caries. The prevalence is highest among 5-year-olds (85%) and lowest among individuals aged 65–74 (55%), indicating a significant burden across all age groups.<sup>1</sup>

Periodontal disease, another key concern, refers to conditions ranging from mild gingival inflammation (gingivitis) to more severe and irreversible stages that involve loss of tooth attachment and alveolar bone. Globally, signs of periodontal disease such as gum bleeding and the presence of periodontal pockets remain highly prevalent.<sup>4,5</sup> According to the 2018 NSOH, only about 50% of Filipinos were reported to have healthy periodontal status. Gingival bleeding with medium severity was seen in 44% of the population, while shallow periodontal pockets were present in 39%, and deep pockets in 4.7% of adults. Still, 54% of the population were found to have normal gingival attachment.<sup>1</sup>

Oral cancer presents another serious but often overlooked threat. Globally, an estimated 263,861 cases of oral cavity cancer were reported in 2008, with 65% of these cases occurring in developing countries, including the Philippines.<sup>6</sup> According to the *2010 Philippine Cancer Facts and Estimates*, oral cancer ranked as the 15<sup>th</sup> most common

cancer site when both sexes were combined. It was the 11<sup>th</sup> most common among men and 15<sup>th</sup> among women.<sup>7</sup> The disease often begins to show increased incidence at age 55 in men and age 60 in women. Because the oral cavity is accessible for examination, healthcare professionals have a valuable opportunity to detect abnormalities early through routine check-ups. Annual oral examinations starting at age 50 are recommended to aid in early detection and intervention.<sup>8</sup>

Fluorosis, caused by excessive fluoride intake during enamel formation, had an overall prevalence of 8%. Of this, 1.61% had questionable fluorosis, 2% had very mild cases, 1% mild, 0.11% moderate, and 0.05% severe. Dental erosion, the irreversible loss of dental hard tissue due to acid exposure, was also prevalent in 8% of the surveyed population. Within this group, 4% had enamel lesions, 3% experienced erosion reaching the dentin, and 2% had lesions extending to the pulp. Traumatic dental injuries were reported in 3% of the population, reflecting the need for both prevention and prompt treatment of dental trauma. Additionally, abnormalities of the oral mucosa were noted in 12% of those surveyed. Specific conditions included oral mucosal lesions (12%), ulceration (1%), acute necrotizing ulcerative gingivitis (0.27%), oral abscesses (8%), and other abnormalities (6%).<sup>1</sup>

The Philippine Constitution (1987) acknowledges the right to health of all Filipinos and directs the State to protect this right and oral health is not an exception to this. Section II, Article XIII of the 1987 Constitution of the Republic of the Philippines declares that the State shall adopt an integrated and comprehensive approach to health development which shall endeavor to make essential goods, health and other social services available to all the people at affordable cost. Priority of the needs of the underprivileged, sick, elderly, disabled, women, and the children shall be recognized. Likewise, it shall be the policy of the State to provide free medical care to paupers.<sup>9</sup> Five administrations had passed since the ratification of the 1987 Constitution and still, providing healthcare to the majority of the Filipinos, especially the needy, remains a goal.

In 1995, a law creating the National Health Insurance Program (NHIP) was passed, with the aim of achieving universal health insurance coverage by 2010. The law also created the Philippine Health Insurance Corporation, otherwise known as PhilHealth, which was designated as the agency in charge of the program's implementation.<sup>10</sup> Though there have been reported improvements in the health coverage of Filipinos, the goal of universal health care is still far from being achieved.<sup>11</sup> More so with oral health wherein very minimal and non-routine dental procedures are covered by PhilHealth that results in out-of-pocket expenditures for Filipinos (87.1%) who would seek dental care.<sup>12</sup> Though there are private insurance companies and Health Maintenance Organizations (HMO) in the country and dental coverage is commonly given as benefits for the working class, they only cover few and limited dental procedures and individuals still co-pay for the additional dental services that are not covered

by the private insurance.<sup>13,14</sup> More individuals, especially those in low-income families, may need to pay for dental services out-of-pocket but could not afford to avail these dental services due to financial and/or geographical barriers.<sup>14</sup>

In February 2019, President Rodrigo R. Duterte signed Republic Act No. 11223 or the Universal Health Care (UHC) Act into law which will initiate extensive reforms in the Philippine health sector. Equitable access for all Filipinos to quality and affordable healthcare services suitable to their needs is the goal of UHC. In addition, there should be assurance that every citizen, under the UHC, is protected against financial risk when availing health services.<sup>15</sup>

Under the National Health Insurance Act of the Philippines (RA 7875), different guiding principles will be adopted to be able to create the National Health Insurance Program to serve the people and develop Universal Health Care (UHC) for all.<sup>10</sup> At present, the current scheme being used in the Philippines is PhilHealth with the funding varying based on the type of population covered. Primary source of funding is from general government revenues, with the central government cost-sharing percentage depending on the income level of the local government, but on average, the local governments contribute 25% and the national government contributes 75%. With the passing of the UHC Act, this financing scheme will be transferred through the Special Health Fund and presumes that the province-level integration of the health system will alter the landscape of health service delivery, as well as the oral health services.<sup>16</sup>

Thus, there is a need for an economic evaluation of the true costs and benefits of oral health interventions so that decision makers in the Department of Health (DOH) and PhilHealth can be empowered to make better informed decisions as to the creation of comprehensive oral health services benefit packages. The study aimed to determine the Incremental Cost Effectiveness Ratio of a set of oral health care services to be delivered at different levels of health care within a comprehensive PhilHealth benefit package.

## MATERIALS AND METHODS

Systematic review of relevant literature from existing health technology assessment, clinical practice guidelines, research, and government documents in the Philippines was conducted. Standard critical appraisal method was applied in the systematic review. The references were searched on credible databases including an online repository of published journal articles such as PubMed, JSTOR, and Google Scholar, and a repository of public documents from government websites.

Key informant interviews were conducted to initially analyze the Philippine oral health situation and to identify possible oral health interventions to be included in a package of oral health services within a comprehensive PHIC benefit package. Fourteen participants were purposively selected from a comprehensive list of stakeholders from different dental specialty groups and affiliate societies

currently registered and/or accredited by the Philippine Dental Association (PDA) and Professional Regulation Commission (PRC). The list identified seven specialty groups recognized by PRC and 37 affiliate societies accredited by PDA, as of 2022. Invitations were sent to the presidents or heads of the selected groups. Seven out of fourteen invitees agreed to participate. The interviews were conducted either in-person or virtual through Zoom Meetings. Each interview lasted for approximately 1 to 1.5 hours. A hybrid round-table discussion was conducted at Sheraton Manila Bay, Malate, Manila on August 4, 2022. Seven participants attended the in-person meeting while 17 participants attended the online meeting through Zoom Meetings.

A proposed inclusion to the oral health benefits package developed from the review of literature and consultations/key informant interviews was presented during the discussion to identify possible oral health interventions to be included in a package of oral health services within a comprehensive PHIC benefit package. Standard round-table discussion was implemented including obtaining informed consent, use of a standard discussion tool, recording and transcription of the discussion, and recording of agreements. The study protocol was reviewed and approved by the UP Manila Research Ethics Board.

## Model

A Markov model was created to evaluate the costs and outcomes of having a subsidized oral health package versus no subsidized treatment. The procedures that are included in the subsidized oral health package include dental consultation, oral prophylaxis, topical fluoride application, silver diamine fluoride application, dental filling, and tooth extraction. The health states in the model include healthy state, having dental caries, developing cellulitis, tooth loss or extraction, and dead state from natural causes or complications. The model follows the clinical course of patients (Figure 1). They will start with the healthy state and transition to different states after one cycle according to the risks that they have. The cycle length is one year, and the time horizon is set to 50 years to simulate the lifespan of an adult up to the average life expectancy in the Philippines of 70 years old.<sup>17</sup> Discount rate is set at 5.33% as recommended by the Philippine HTA Methods Guide.<sup>18</sup> Review of literature, guidelines, data from government agencies, and interviews with dental society representatives and experts were done to determine the parameters to be included, outcome rates, costs of interventions, and disability weights.

## Health Outcomes

The model simulates the clinical course of patients who will undergo interventions that result in health outcomes. The annual rates and probabilities of these health outcomes were derived from journal articles, government agencies, specialty societies and expert interviews (Table 1).<sup>1,19-23</sup> The available data on age-specific mortality rate was taken from the Philippine Statistics Authority.<sup>24</sup>

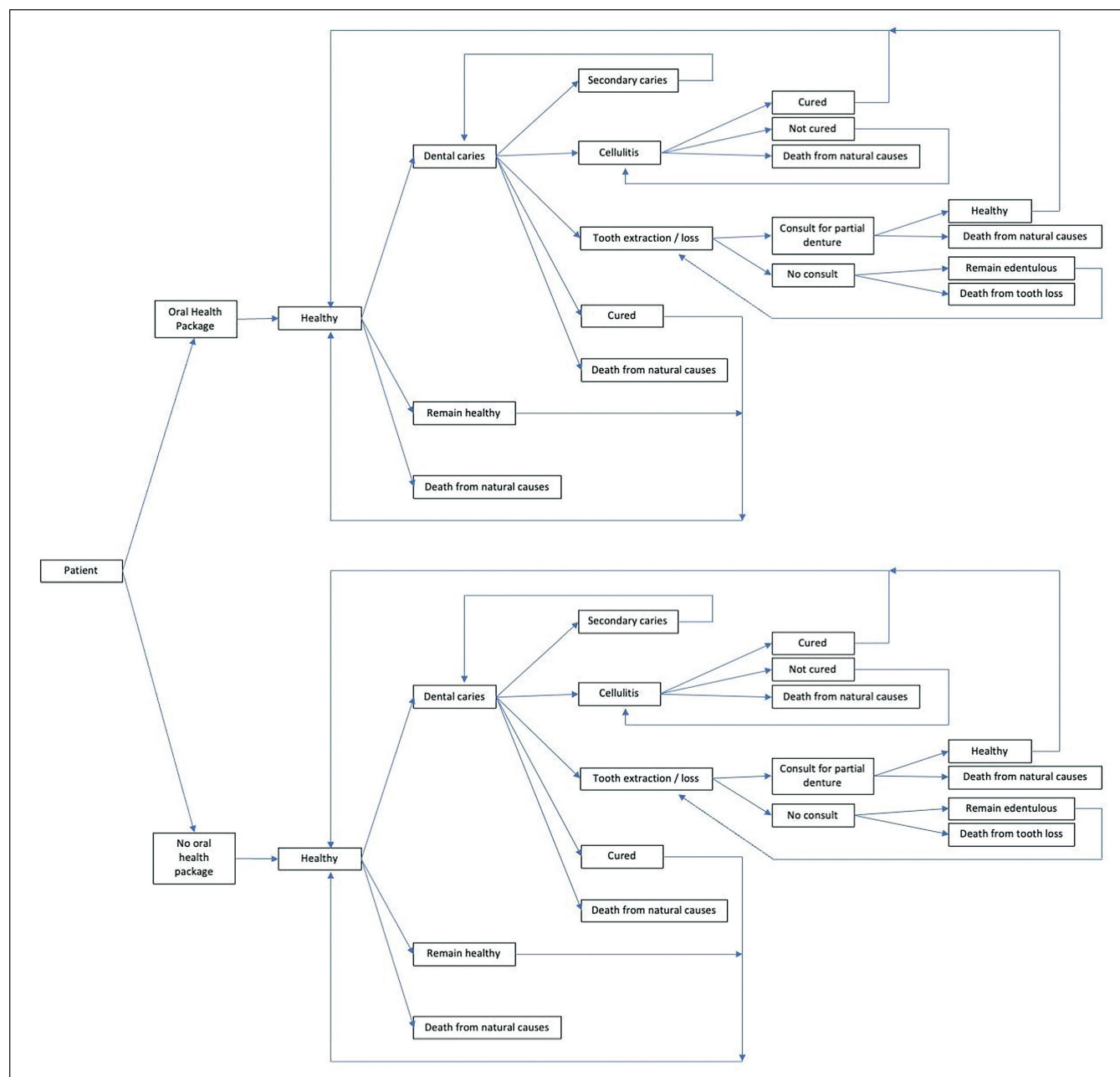


Figure 1. Markov model of oral health package versus no oral health package.

Table 1. Annual Rates and Probabilities of Health Outcomes

Outcome	Value (Range)	Source
<i>Dental caries without Oral Health Package</i>	0.7262 (0.7-0.87)	DOH 2019; expert opinion
<i>Dental caries with Oral Health Package</i>	0.6173 (0.4262-0.581)	Crozer 2011; expert opinion
<i>Secondary caries after treatment</i>	0.03 (0.015-0.045)	Demarco et al. 2017; expert opinion
<i>Tooth extraction</i>	0.01 (0.005-0.015)	Expert opinion
<i>Cellulitis / abscess secondary to dental caries</i>	0.064 (0.044-0.084)	Azodo et al. 2012; expert opinion
<i>Recovery after cellulitis / abscess treatment</i>	0.995 (0.95-0.999)	Kim et al. 2012; expert opinion
<i>Death among edentulous patients</i>	0.0378 (0.01-0.05)	Yu et al. 2021; expert opinion
<i>Consult for denture application</i>	0.5 (0.25-0.75)	Expert opinion



## Estimation of Costs

Cost computations were based on estimated frequencies of basic dental procedures derived from standard oral health service delivery patterns, available international and national oral health program data, health maintenance organizations (HMOs) schedule of fees, private clinics, expert consultation with dental specialty groups and government agencies providing oral health services (e.g., DepEd). In the absence of clinical practice guidelines, standard care guidelines were assumed. For procedures with multiple available modalities, including permanent restorations utilizing composite resin or glass ionomer cement (GIC), proportional distribution estimates were based on existing utilization data, reported clinical practice patterns, or where unavailable, expert consensus and assumed equal distribution. These proportions were applied to appropriate weights for the associated costs of each method.

Direct medical costs included procedures that were directly connected to the treatment of patients.<sup>25,26</sup> Direct non-medical cost included roundtrip transportation to

dental facilities. The average distance to dental facilities was estimated by using the average distance of barangays or municipalities to healthcare facilities.<sup>27</sup> The roundtrip cost was then derived by multiplying the distance by the cost of public transportation fares based on the Land Transportation Franchising and Regulatory Board Fare Guide.<sup>28</sup> Indirect costs included income loss derived from the minimum wage rates of the Philippines.<sup>29</sup> (Table 2)

The oral health package aims to subsidize direct medical costs except dentures. Cellulitis treatment is already being subsidized by Philhealth.<sup>26</sup> Several procedures overlap depending on the type of intervention being done. In order to closely simulate the clinical pathway in the model, these procedures were grouped into interventions and the costs were recalculated for input into the model (Table 3).

## Disability Weights

Disability or disability weights range from 0 to 1 and represent the degree at which the disease or symptoms affect an

**Table 2.** Cost Estimates and Sources

Cost	Amount (PhP)	Range	Source
<b>Direct Medical Cost</b>			
Consultation fee	400	150–700	Medina et al.; PDA – South Cotabato Chapter; Expert opinion
Oral prophylaxis	600	250–1000	
Topical fluoride application	500	340–1000	
Silver diamine fluoride application	700	500–1500	
Dental filling	600	250–800	
Tooth extraction	500	150–700	
Dentures	20,000	14,000–50,000	
Cellulitis treatment	8,300	5,000–25,000	Philhealth case rate, expert opinion
<b>Direct Non-medical Cost</b>			
Transportation cost	50	24–66	Flores 2020; LTFRB 2018
<b>Indirect Cost</b>			
Income loss	438	306–570	National Wages and Productivity Commission

**Table 3.** Computation of Costs per Intervention

Intervention	Procedure	Cost (Range)	Total Amount (Range)	Source
<b>Preventive check-up</b>	Consult	400 (150-700)	2,200 (1,240-4,200)	Medina et al.; PDA – South Cotabato Chapter; Expert opinion
	Oral prophylaxis	600 (250-1,000)		
	Topical fluoride application	500 (340-1000)		
	Silver diamine fluoride application	700 (500-1,500)		
<b>Caries treatment</b>	Consult	400 (150-700)	1,700 (900-3,000)	Medina et al.; PDA – South Cotabato Chapter; Expert opinion
	Dental filling	600 (250-800)		
	Silver diamine fluoride application	700 (500-1,500)		
<b>Tooth extraction</b>	Consult	400 (150-700)	900 (350-2,200)	Medina et al.; PDA – South Cotabato Chapter; Expert opinion
	Tooth Extraction	500 (200-1,500)		
<b>Cellulitis treatment</b>			8,300	Philhealth case rates
<b>Denture application</b>	Consult	400 (150-700)	20,400 (14,150-50,700)	Medina et al.; PDA – South Cotabato Chapter; Expert opinion
	Dentures	20,000 (14,000-50,000)		

**Table 4.** Disability Weights of Health States

Variable	Value Range	Source
Dental caries	0.01 (0.005–0.019)	Salomon et al., 2015
After tooth extraction	0.067 (0.045–0.095)	
Cellulitis	0.051 (0.032–0.074)	

individual. A disability score of 0 means perfect health while a score of 1 is given to a person who is dead. A higher score is associated with a greater burden of the disease. The disability weights used in the model were taken from the study by Salomon et al. on the Global Burden of Disease (Table 4).<sup>30</sup>

**Analysis**

Descriptive statistics based on responses in the key informant interviews and consultative meetings were generated. Mean values of costs of dental procedures were determined. Microsoft Excel was used in sorting, cleaning, and analysis of quantitative data. Thematic analysis was performed to explore other emerging points of interest during key informant interviews and round-table discussions.

The cost-effectiveness analysis using Markov modelling was performed from a societal perspective over a 50-year time horizon. TreeAge Pro was used to conduct the Markov modelling. All costs were discounted at 5.33% annually. The willingness-to-pay or the threshold at which the proposed program is considered cost-effective was set at US\$ 3,538.80 (PhP 174,286) which is equivalent to the average GDP per capita of the Philippines in 2021.<sup>31</sup> The average 2021 US dollar to Philippine peso exchange rate of US\$ 1 = PhP 49.25 was used to convert for the peso equivalent.

**Sensitivity Analysis**

A multiple one-way sensitivity analysis was done through a tornado diagram to assess the impact of varying the parameters while holding the other variables fixed. This is to determine which parameter has the most influence on the cost-effectiveness of the treatment options. Probabilistic sensitivity analysis was undertaken to address sampling uncertainty using 1000 Monte Carlo simulations. This attempts to simulate real life situations since it tests the uncertainty surrounding multiple parameters simultaneously.

**Budget Impact Analysis**

A budget impact analysis was done using direct medical costs to compute the theoretical change in annual expenditure if the program will be rolled out.

**RESULTS**

The threshold for cost-effectiveness was set at PhP 174,286 (US\$ 3,538.80) which is equivalent to the average GDP per capita of the Philippines as of 2021. If the incremental cost-effectiveness ratio (ICER) or the cost per disability adjusted life year (DALY) averted of an intervention

is lower than this threshold, it is considered to be cost-effective. Using the societal perspective, the subsidized oral health package is considered cost-effective with an ICER of PhP 75,636 per DALY averted.

Multiple one-way sensitivity analysis using a tornado diagram shows that the cost of preventive treatment is the parameter that affects the cost-effectiveness of the intervention the most (Figure 2). If the cost of preventive treatment increases beyond PhP 3,062.32, the ICER of the Oral Health Package crosses the threshold and no longer becomes cost-effective. Based on the tornado diagram, the rest of the parameters do not affect the cost-effectiveness of the Oral Health Package as they do not cross the willingness-to-pay (WTP) threshold even if they are increased to their maximum or decreased to their minimum values.

Probabilistic sensitivity analysis using 1000 Monte Carlo simulations shows that all possible combinations of changes in parameters would still result in the Oral Health Package being cost-effective. This is shown in the Incremental Cost-effectiveness scatter-plot having all the simulations below the WTP threshold (Figure 3).

Budget impact analysis shows the expected expenditures of the government as they roll out a certain program or intervention. Currently, the government only subsidizes the treatment of cellulitis. With this scenario, the government is expected to spend PhP 42,061,194,785 with an annual increase of 1.63% (Table 5).

In contrast, when the oral health package is implemented after year 1, the government would expect to spend an estimated amount of PhP 598,754,380,814 or a 1423.53% budget increase from the previous year (Table 6). However, as the years progress and the incidence of dental caries decreases as the program takes its effect, the expenditure for the program also decreases annually by 1–2%.

**DISCUSSION**

After the extensive review of literature, key informant interviews and round table discussions, the procedures that were included in the subsidized oral health package include dental consultation fee, oral prophylaxis, topical fluoride application, silver diamine fluoride application, dental filling, and tooth extraction as shown in Table 3.

The findings underscore the importance of comprehensive dental services in the prevention and management of oral diseases throughout the lifespan. Given that all individuals with teeth are inherently at risk for dental diseases, prioritizing preventive strategies is essential, particularly in settings with limited access to dental care. The early initiation of dental consultations is vital.<sup>32–34</sup> The American Academy of Pediatrics (AAP) advocates for the establishment of a dental home by 12 months of age, emphasizing early screening and risk assessment.<sup>35</sup> Regular dental visits beginning in infancy, as well as during pregnancy, are essential steps in mitigating the onset and progression of oral diseases.<sup>36</sup>

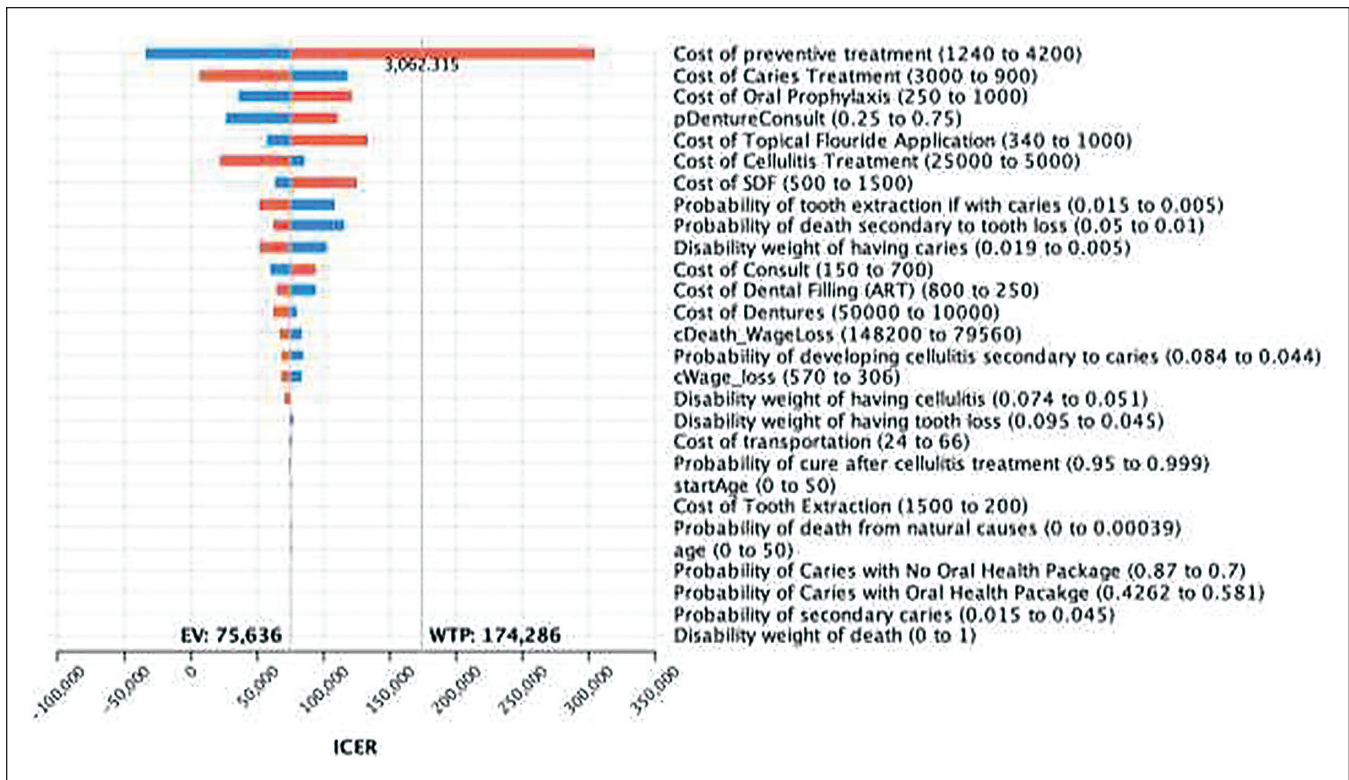


Figure 2. Tornado diagram of oral health package vs no oral health package.

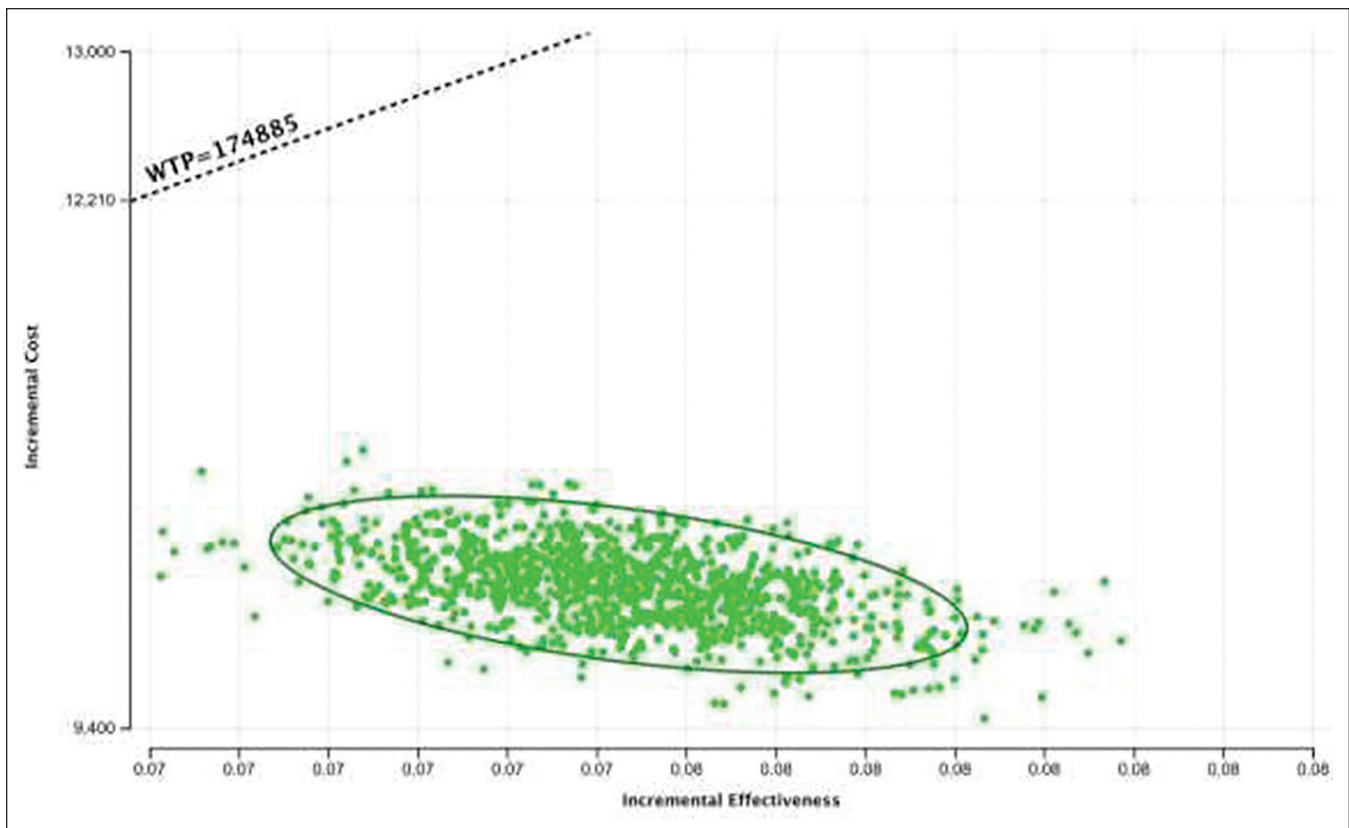


Figure 3. Incremental cost-effectiveness scatterplot of oral health package vs no oral health package.

**Table 5.** Budget Impact Analysis of a Scenario with No Oral Health Package

		Year 1 100% vs 0%	Year 2 100% vs 0%	Year 3 100% vs 0%	Year 4 100% vs 0%	Year 5 100% vs 0%
<b>POPULATION / HEALTH OUTCOME</b>						
<b>Philippine Population</b>		109,035,343	110,812,619	112,618,865	114,454,552	116,320,161
<b>No Oral Health Package</b>	Healthy population	29,853,877	30,340,495	30,835,045	31,337,656	31,848,460
	Population with caries	79,181,466	80,472,124	81,783,820	83,116,896	84,471,701
	Population with extracted tooth	791,815	804,721	817,838	831,169	844,717
	Population with cellulitis	5,067,614	5,150,216	5,234,164	5,319,481	5,406,189
<b>Oral Health Package</b>	Healthy population	-	-	-	-	-
	Prevalence of caries	-	-	-	-	-
	Population with caries	-	-	-	-	-
	Population with extracted tooth	-	-	-	-	-
	Population with cellulitis	-	-	-	-	-
<b>Population increase by 1.63%</b>		1,777,276	1,806,246	1,835,687	1,865,609	1,896,019
<b>BUDGET IMPACT</b>						
<b>No Oral Health Package</b>	Cost of prevention	-	-	-	-	-
	Cost of caries treatment	-	-	-	-	-
	Cost of tooth extraction	-	-	-	-	-
	Cost of cellulitis treatment	42,061,194,785	42,746,792,260	43,443,564,974	44,151,695,083	44,871,367,713
<b>Oral Health Package</b>	Cost of prevention	-	-	-	-	-
	Cost of caries treatment	-	-	-	-	-
	Cost of tooth extraction	-	-	-	-	-
	Cost of cellulitis treatment	-	-	-	-	-
<b>Total Cost</b>		42,061,194,785	42,746,792,260	43,443,564,974	44,151,695,083	44,871,367,713
<b>BUDGET CHANGE</b>						
<b>On old and new treatment</b>			685,597,475	696,772,714	708,130,109	719,672,630
<b>Percentage change</b>			1.63%	1.63%	1.63%	1.63%

Oral prophylaxis, which includes scaling and polishing procedures, remains a foundational preventive measure. These interventions effectively reduce harmful deposits such as plaque and calculus, as well as extrinsic stains.<sup>37</sup> Evidence supports the benefit of routine biannual prophylaxis in decreasing calculus accumulation and potentially reducing the incidence of periodontal disease and caries over time.<sup>38</sup>

Topical fluoride therapy (TFT) continues to be a cornerstone of caries prevention. Various delivery methods – such as fluoridated toothpaste, rinses, gels, and varnishes – have demonstrated efficacy.<sup>39</sup> Community-based programs, such as North Carolina’s “Into the Mouth of Babies” and fluoride application initiatives in American Indian Head Start programs, have shown reductions in the need for caries-related treatments, reinforcing the population-level impact of fluoride.<sup>40</sup>

Silver diamine fluoride (SDF), particularly at a 38% concentration, has emerged as an effective agent for arresting and preventing caries in high-risk pediatric populations. Its application is particularly suited to patients facing barriers to routine care, including those with behavioral or medical complexities or limited access to dental services. Semiannual application of SDF has shown promise in managing active carious lesions in a non-invasive manner.<sup>34</sup>

Restorative approaches such as Atraumatic Restorative Treatment (ART) and the application of dental sealants provide further avenues for disease prevention and control. ART, employing glass ionomer cement (GIC), is especially relevant in low-resource settings due to its ease of application and sustained fluoride release, which enhances resistance of tooth structures to acidic challenges.<sup>41</sup> Similarly, dental sealants have proven effective in preventing and arresting pit-and-fissure caries in children and adolescents.<sup>42</sup> The American Dental Association (ADA) and American Academy of Pediatric Dentistry (AAPD) recommend sealants for reducing caries risk, citing their superiority in maintaining the integrity of occlusal surfaces over time compared to untreated or solely fluoride-treated surfaces.<sup>43</sup>

Despite the availability of preventive and restorative care, tooth extraction remains a commonly performed procedure, particularly in low- and middle-income countries.<sup>44-47</sup> In the Philippines, where the prevalence of dental caries reaches 72.62% and periodontal disease affects 50% of the population, extractions are often necessitated by advanced disease.<sup>1</sup> Dental caries predominantly leads to extractions among younger patients, while periodontal disease is the primary cause among older adults, particularly those over the age of 70.<sup>44</sup> This reflects a need for greater emphasis on



**Table 6.** Budget Impact Analysis of a Scenario with the Oral Health Package Implemented after One Year

		Year 1 100% vs 0%	Year 2 0% vs 100%	Year 3 0% vs 100%	Year 4 0% vs 100%	Year 5 0% vs 100%
<b>POPULATION / HEALTH OUTCOME</b>						
<b>Philippine Population</b>		109,035,343	110,812,619	112,618,865	114,454,552	116,320,161
<b>No Oral Health Package</b>	Healthy population	29,853,877	-	-	-	-
	Population with caries	79,181,466	-	-	-	-
	Population with extracted tooth	791,815	-	-	-	-
	Population with cellulitis	5,067,614	-	-	-	-
<b>Oral Health Package</b>	Healthy population	-	42,407,989	53,527,183	63,407,908	72,223,262
	Prevalence of caries	-	0.6173	0.5247	0.4460	0.3791
	Population with caries	-	68,404,630	59,091,681	51,046,644	44,096,899
	Population with extracted tooth	-	684,046	590,917	510,466	440,969
	Population with cellulitis	-	4,377,896	3,781,868	3,266,985	2,822,202
<b>Population increase by 1.63%</b>		1,777,276	1,806,246	1,835,687	1,865,609	1,896,019
<b>BUDGET IMPACT</b>						
<b>No Oral Health Package</b>	Cost of prevention	-	-	-	-	-
	Cost of caries treatment	-	-	-	-	-
	Cost of tooth extraction	-	-	-	-	-
	Cost of cellulitis treatment	42,061,194,785	0	0	0	0
<b>Oral Health Package</b>	Cost of prevention	-	487,575,524,000	495,523,005,041	503,600,030,023	511,808,710,513
	Cost of caries treatment	-	116,287,870,600	100,455,858,457	86,779,295,608	74,964,728,407
	Cost of tooth extraction	-	615,641,668	531,825,133	459,419,800	396,872,092
	Cost of cellulitis treatment	-	36,336,539,331	31,389,501,184	27,115,977,545	23,424,272,782
<b>Total Cost</b>		42,061,194,785	640,815,575,599	627,900,189,815	617,954,722,976	610,594,583,794
<b>BUDGET CHANGE</b>						
<b>On old and new treatment</b>		-	598,754,380,814	-12,915,385,784	-9,945,466,839	-7,360,139,183
<b>Percentage change</b>		-	1423.53%	-2.02%	-1.58%	-1.19%

early intervention and sustained oral health promotion across the life course.

The analysis shows that having a subsidized oral health care package is cost-effective using the 2021 GDP per capita as threshold. Subsidizing oral health services provides better value for money compared to the current situation of no subsidy. Financial considerations for funding the oral health package are important for its success. The budget impact analysis shows an increasing trend of spending by the government with the current situation of no subsidy. Rolling out a subsidized oral health package will entail a significant increase in government expenses, but the effect of the program is reflected on the decreasing trend of expected expenses as the years progress.

### Limitations

One of the primary limitations of this study lies in the reliance on model-based economic evaluation, particularly the Markov model, which simplifies real-world clinical scenarios and health-seeking behaviors. This modelling approach may not fully capture the complexity and variability of oral disease progression and patient adherence to treatment. Moreover, many parameters used in the model were derived from secondary data sources such as published

literature, government databases, and expert opinion, which may introduce bias or limit the generalizability of results. To address this, the study incorporated both one-way and probabilistic sensitivity analyses to test the robustness of the model and account for uncertainty in input parameters. Additionally, key informant interviews and roundtable discussions with stakeholders ensured that the interventions and cost estimates reflected the local context as accurately as possible. While these measures helped mitigate some of the limitations, future studies could benefit from real-world data collection and longitudinal tracking to validate model assumptions and projections.

### CONCLUSION

Subsidizing oral health services is a good value for money but costs significantly higher for the government to implement. A progressive roll out of the program may be more financially feasible compared to an immediate full implementation. Hence, we recommend a development of a subsidized oral health benefit package that would consist of dental consultation fee, oral prophylaxis, topical fluoride application, silver diamine fluoride application, dental filling, and tooth extraction.

To improve the delivery of oral health care services, we further recommend the development of clinical practice guidelines both for basic and advanced dental procedures.

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## Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

## Author Disclosure

All authors declared no conflicts of interest.

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