

# Epidemiological Survey of the Elderly Removable Denture Subsidy Program in Taiwan, 2015–2018: A Cross-sectional Study

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## Research article

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# Abstract

**Background:** Taiwan's population is aging rapidly. Elderly adults with missing teeth require dental rehabilitation to maintain good oral health, which is important for proper nutrition and overall health and life quality. Removable dentures are an economical option for these individuals, for which many county and municipal governments in Taiwan provide subsidies. In this cross-sectional study, we investigated the demographic characteristics of older Taiwanese adults who received a removable denture subsidy, as well as the type of denture obtained and related factors.

**Methods:** We administered a survey and conducted oral examinations among elderly patients of the Geriatric Dentistry clinic of Taoyuan Hospital who had participated in a removable prosthesis subsidy program during 2015–2018. We investigated patients' demographic characteristics using descriptive statistics and used logistic regression to determine whether age and sex were independent predictors of edentulous status and a need for complete dentures. We also examined the relationships between denture type and related factors.

**Results:** In total, 423 participants (mean age 76.3 years, standard deviation 7.55; 54.4% men) completed the subsidy application process and obtained a removable dental prosthesis. In total, 150 (35.5%) participants applied for single-arch restoration. A removable partial denture (RPD) was the most common type for single jaws, and an RPD and full dentures were the most common for both arches. Logistic regression indicated an effect of age, but not sex, on denture type and edentulous status among 273 subsidy applicants for both arches (odds ratio: 1.041 per year of age, 95% confidence interval: 1.004–1.080,  $P=0.032$ ).

**Conclusions:** This study confirms that there is a great need for dental rehabilitation among elderly Taiwanese adults. County and municipal governments in Taiwan should regularly review and improve dental subsidy programs, to lift barriers to obtaining removable dentures among older people who need them.

## Background

Population ageing is increasing in both developed and developing countries. [1] Concerns about population aging are mainly owing to the large number of older people who require more medical services while the working population is relatively small. [2] Economic analyses have focused on the financial impact of aging, which is expected to increase the burden of health and welfare services. [3] Oral and dental care is an important part of health and wellness. Low rates of dental rehabilitation in an aging population means that older people will have a special need for dental services. [4] Severe tooth loss and edentulism in older individuals is very common. [5] Missing teeth without restoration affects nutrition status and quality of life. [6, 7] Removable dentures are an economical and affordable option for older people to replace missing teeth. [8]

According to the 2012 National Health Interview Survey of the United States, 17.5% of people age 65–74 years were missing teeth; this rate was 25.8% for those over 75 years old. [9] Tsai reported that the edentulous rate in Taiwan among people over 65 years old was 21.5% and overall, women had higher rates than men (24.3% and 18.7%, respectively). In terms of the number of remaining teeth (RT), this was  $18.1 \pm 7.0$  among people in that study over 65 years old, and the largest proportion of remaining teeth were canine. [10] Huang reported that the prevalence of missing teeth (MT) among those age 65–74 years is 97.6% and the average number of MT is 11.18; in those over 75 years old, the prevalence of MT is 99.6% and the average number of MT is 15.29; the prevalence of MT among women was also greater than that among men, [11] the same as in a US study. [9] Tsai pointed out that more than half of people over 65 years of age in Taiwan need new dental prostheses. [12]

Taiwan became an aged society in 2018; at the end of December 2019, the proportion of the population over age 65 years was 15.28% or about 3.6 million. The municipality of Taoyuan is relatively young, with 12.11% of the population (about 272,000 people) over age 65 years. [13]

Taiwan's 2016 oral condition survey indicated that approximately 6.4% of people over 65 years old were edentulous. [11] Like in other countries, Taiwan has non-commercial health insurance under which dental dentures are not covered. [14] A low number of functional remaining teeth is related to low socioeconomic status and insufficient social support. Likewise, the prevalence of full dentures and fixed bridges is closely related to higher socioeconomic status. [15] Financial considerations may be an obstacle for older people seeking medical treatment and dentures, forming a gap in equitable medical treatment. [16]

In Europe and the United States, the availability of dental services and price subsidies for dental treatments are important factors affecting access to dental care services for older adults. [17] Evidence shows that older people are more willing to use dental services if government subsidies are available. [18] A removable partial denture (RPD) is a type of denture that partially edentulous patients can remove and reinsert, to replace teeth for functional or aesthetic reasons. An RPD is appropriate for patients who cannot use a bridge for various reasons, such as a lack of the number of teeth required to serve as support for a bridge or owing to financial limitations. [19, 20]

Taoyuan and other seven regions of Taiwan provide non-low-income removable denture subsidies for older people. The aim of this study was to describe the demographic characteristics of older people who applied for the removable denture subsidy program from 2015 to 2018, and to investigate the distribution of denture types and related factors. The results of this study can be helpful to decision makers in improving dental subsidy plans in the future.

## Methods

We conducted a cross-sectional study in 2019. Older individuals were selected who participated in removable prosthesis subsidy programs from 2015 to 2018 in the Geriatric Dental Clinic of Taoyuan Hospital. A survey was administered, which included an oral examination and removable denture designs

for those who met the requirements of the subsidy program. These requirements were as follows: at least 65 years old, more than 4 remaining teeth in a single jaw or more than 2 teeth with free ends, and the third molar is not included.

In this study, the following inclusion criteria were used: 1) Geriatric Dentistry patient at Taoyuan Hospital from 2015 to 2018, 2) completed the application procedure for participating in the removable denture subsidy program for older people, which includes oral examination, an application form, and application fee. 3) fabrication and delivery of a removable denture completed.

Each subsidy applicant must complete the following steps: oral examination, complete the application form and submit it to the Municipal Health Bureau; removable denture fabrication begins after passing the oral examination, with intraoperative and postoperative photos. The applicant's name, age, denture type, application fee, and removable denture design are the most important items on the application form. In the present study, the author completed the oral examinations and collected application form information regarding the denture type, amount of application, and design of the removable denture. Dental assistants (SM and WJ) were responsible for taking photographs and administrative duties. Ethics approval was applied for from the Ethics Committee of Taipei City Hospital, Taiwan, and all participants gave informed consent.

The single-jaw RPD subsidy is TWD 15,000 for an RPD with fewer than 3 RT per jaw; the single-jaw complete denture subsidy is TWD 20,000. The sex, age, and position of the RT for each subsidized individual are recorded. After the application process, fabrication and delivery of removable dentures are completed and a satisfaction survey performed.

Recording of the tooth position is based on the World Dental Federation notation system. [21] The patient's age was based on age on the day of the oral examination. The predictor variables were sex and age. As an outcome variable, edentulous in both jaws, according to information on the subsidy application, was used.

For the statistical analysis, IBM SPSS version 21 was used (IBM Corp., Armonk, NY, USA). First, descriptive statistics were computed. Next, to investigate the relationships among age groups, the Pearson coefficient of contingency was calculated. Finally, binary logistic regression analysis was performed to determine whether age and sex were independent predictors of edentulous status and the need for complete dentures.

## Results

In this study, included participants had previously received oral examination before subsidy application and delivery of removable dentures during 2015–2018 at the Taoyuan Hospital Geriatric Dentistry clinic. After excluding participants with incomplete information and those whose removable denture was not yet delivered, a total of 423 patients met the inclusion criteria for the present study.

During 2015–2018, there were 432 applications received during the study period, excluding two patients under age 65 years, three with low incomes, and four who could not complete the entire process by the end of 2018. Individuals who obtained removable dentures at their own expense were not included. Thus, a total of 423 eligible individuals were included. Among them, 54.4% were men and 45.6% women.

Table 1 shows the distribution of sex and age of participants who applied for the removable denture subsidy. Among 423 applicants, 273 applied for removable dentures for both jaws; 150 applied for single-jaw removable dentures because they already had, did not need, or did not meet the requirements for removable dentures on opposite sides.

Table 1  
Characteristics who participated elderly removable dentures subsidy program in Geriatrics Dentistry of Taoyuan Hospital, 2015-2018, n=423

	Age	Gender		Total	p- value*
		Female	Male		
Applied	65-74	39	30	69	0.003
Single	75-84	30	31	61	
Arch	85-94	4	15	19	
	95	0	1	1	
	Total	73	77	150	
Applied Both	65-74	50	62	112	<0.001
Arches	75-84	56	46	102	
	85-94	14	45	59	
	Total	120	153	273	
Total	65-74	80	92	181	
	75-84	86	77	163	
	85-94	18	60	78	
	95	0	1	1	
	Total	193	230	423	
* Pearson's Chi-square Test for Independence					

Tables 2 and 3 show the denture types among participants who applied for a single- and double-arch subsidy, respectively. Among the 273 applicants for a double-arch subsidy, 64 were edentulous, accounting for 23.4%.

Table 2  
Denture types who applied Single Arch subsidy in Geriatrics  
Dentistry of Taoyuan Hospital, 2015-2018, n=150

Type	Times	Percent (%)
LC	15	10.0
LR	46	30.7
LH	6	4.0
UC	17	11.3
UR	50	33.3
UH	16	10.7
Total	150	100
U= Upper arch; L= Lower arch; C= Complete denture; R=RPD; H= RPD with remaining teeth $\leq$ 3		

Table 3  
Denture types who applied Both Arches subsidy in Geriatrics Dentistry of  
Taoyuan Hospital, 2015-2018, n=273

Type	Times	Percent (%)
BC	64	23.4
BR	65	23.8
BH	16	5.9
UCLR	26	9.5
UCLH	20	7.3
URLC	20	7.3
URLH	19	7.0
UHLC	20	7.3
UHLR	23	8.4
Total	273	100
B = Both arches; U= Upper arch; L= Lower arch; C= Complete denture; R=RPD; H= RPD with remaining teeth $\leq$ 3		

Tables 4 and 5 show the tooth position and quadrant of the RT, and removable dentures applied to both arches, respectively. Logistic regression showed an effect of age on edentulous status for those who applied for the removable denture subsidy both for arches (n=273, odds ratio: 1.041 per year of age, 95% confidence interval: 1.004–1.080, P= 0.032)

Table 4  
Remaining teeth of tooth position, applied both arches  
removable denture subsidy in Geriatrics Dentistry of  
Taoyuan Hospital, 2015-2018, n=273

Position	Mean	SD	Position	Mean	SD
17	0.13	0.34	37	0.09	0.28
16	0.16	0.37	36	0.10	0.30
15	0.19	0.40	35	0.19	0.40
14	0.23	0.42	34	0.35	0.50
13	0.27	0.45	33	0.46	0.52
12	0.22	0.42	32	0.33	0.47
11	0.22	0.42	31	0.26	0.44
21	0.19	0.40	41	0.28	0.45
22	0.21	0.41	42	0.32	0.47
23	0.28	0.45	43	0.41	0.49
24	0.20	0.40	44	0.27	0.45
25	0.19	0.40	45	0.17	0.38
26	0.17	0.38	46	0.10	0.29
27	0.13	0.34	47	0.09	0.28
SD= Standard Division					

Table 5  
 Table 5 Remaining teeth of  
 quarters, applied both  
 arches removable denture  
 subsidy in Geriatrics  
 Dentistry of Taoyuan  
 Hospital, 2015-2018, n=273

Quarter	Mean	SD
I	1.42	1.83
II	1.37	1.79
III	1.79	2.01
IV	1.63	1.80
Total	6.22	5.56
SD= Standard Division		

## Discussion

In this study, a survey was conducted among a sample of older patients in the Taoyuan Hospital General Dentistry clinic who had applied for removable denture subsidies during 2015–2018. The results of this study will help policy makers to improve the program of removable denture subsidies for the elderly.

The survey results showed that there were slightly more male applicants than female ones, which was different from the general population in Taiwan where more old women have missing teeth. [11] The reason for our finding may be that men with missing teeth are relatively younger and can more easily go to the hospital to apply for a removable denture subsidy. These results may also be owing to insufficient information about the subsidy provided to the public or insufficient medical institutions available to participate in subsidy programs.

In terms of denture type, RPD was the most common for single jaws, and RPD and full dentures were most common for both arches. As for remaining teeth, the highest number of canines were on the left side of the lower jaw, which is the same as findings reported in related research. The quadrant of the remaining number of teeth was not much different compared with a 2015–2016 National Oral Survey in Taiwan. Logistic regression analysis showed that edentulous status among applicants for both jaws was only related to age and not gender.

Compared with non-denture wearers, denture wearers have a better quality of life in terms of chewing and consuming food. [22, 23] Some patients have dry mouth or severe atrophy in the alveolar bone of the lower jaw, complaining that the complete denture retention is insufficient, but they lack the financial



resources to obtain implant-supported removable dentures. [24–27] Some patients choose acrylic resin dentures, with good satisfaction levels, as reported in several studies. [28, 29]

In our subsidy program, the government pays about one-fifth of the market price for complete dentures for older patients, and about 37.5% of the market price for an RPD. Denture satisfaction is beneficial to the quality of life among older individuals wearing removable dentures. [30] The Taiwanese government provides several options for older people with missing teeth, to help solve the problem of accessibility. However, there should be provisions to limit subsidy applicants to those who are financially disadvantaged. [31] Perhaps owing to a lack of cost analysis or budgetary limitations, subsidy programs often have very inconsistent prices. [32]

Requirements differ for applicants to denture assistance programs for older adults in each county and city, thereby limiting the generalizability of our survey results to a single area. Future comprehensive research is needed across the country to provide further evidence for policy improvement.

## **Conclusions**

The Taiwanese government provides subsidies for older residents to help them overcome financial barriers to obtaining removable dentures, which help to improve the health and quality of life of subsidy beneficiaries. However, the amount of the available subsidies is low; therefore, willingness to participate in subsidy programs is also low among dental professionals, which may affect the quality of dentures produced. The government should exclude wealthy individuals and only provide subsidies to low-income residents as well as increase the subsidy amount, to benefit older residents who most need financial support to improve their dental health.

## **Abbreviations**

RT: Remaining teeth

MT: Missing teeth

RPD: Removable partial denture

## **Declarations**

## **Ethics approval and consent to participate**

Ethics approval was applied for from the Ethics Committee of Taipei City Hospital, Taiwan, and all participants gave informed consent.

## **Consent for publication**

Yes

## Availability of data and material

Yes

## Competing interests

The author declares that he has no competing interests.

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## Authors' contributions

N/A

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