

## Scientific Research Report

## Willingness to Pay for Preventive Dental Care Amongst Older Adults

Rakhi Mittal<sup>a\*</sup>, Wong Mun Loke<sup>a</sup>, Desmond Ong Luan Seng<sup>b</sup>, Tan Mei Na<sup>a</sup>, Gabriel Lee Keng Yan<sup>a</sup>, Patrick Finbarr Allen<sup>a</sup><sup>a</sup> Faculty of Dentistry, National University of Singapore, Singapore<sup>b</sup> National University Polyclinic, Jurong, Singapore

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## ABSTRACT

**Objective:** The aims of this study were (1) to investigate willingness to pay (WTP) for preventive and curative dental care procedures and (2) to determine the factors that influence older adults' WTP for dental care.

**Methodology:** Older, independently living adults from Singapore aged 60 years and older and eligible for government-subsidised dental care were nonrandomly recruited for this study. Data were collected using questionnaires and a clinical examination which recorded details of caries experience, number and distribution of posterior occluding contacts, prosthodontic status, and periodontal status. Using a contingent valuation method, participants were asked to rate WTP in Singapore dollars [SGD\$] for 4 aspects of care: dental fillings, dental scaling, dental extraction, and disease prevention advice. Negative binomial regression was used to assess the relationship between the predictor variables associated with WTP for dental fillings, scaling, extraction, and preventive advice.

**Results:** The mean value of WTP for a dental filling was SGD\$30.23 (SGD\$31.05), for scaling was SGD\$30.28 (SGD\$29.46), for dental extraction was SGD\$35.08 (SGD\$58.54). In a multivariate model, factors associated with higher WTP fees were as follows: (1) dental filling: age (younger), level of education (higher), and frequency of dental visits (regular); (2) scaling: level of education (higher), agree that dental problems affect overall health, and frequency of dental visits (regular); (3) dental extractions: age (younger), level of education (higher), frequency of dental visits (regular), and prosthodontic status (not wearing); (4) preventive advice: age (younger), gender (male), ethnicity (Chinese), level of education (higher), marital status (married), self-perceived oral health (good), and dental visits (regular).

**Conclusions:** The findings of our study suggest that older adults are willing to pay most for extraction and least for preventive advice.

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## Introduction

Expenditure on dental care is substantial and is primarily financed through insurance schemes, government funding, out-of-pocket payments by individuals, or a combination of these.<sup>1-3</sup> As the burden of oral disease in ageing populations rises, consumption of oral health care amongst older adults is likely to increase substantially. It is therefore important to understand the value older adults place on dental care.

According to the World Health Organisation, oral health is an integral part of general health and an important determinant of quality of life.<sup>4</sup> Although older adults are retaining their natural dentition longer than in the past, the prevalence of untreated oral diseases in older age groups is high.<sup>5,6</sup> Despite a high risk of oral health disorders and tooth loss in old age, it has been observed that dental service utilisation decreases with age.<sup>7,8</sup> There are a number of influences on health services utilisation including knowledge level/health literacy, attitudinal factors, level of educational attainment, and ability to pay for care. In many countries, a surgical/restorative (curative) service delivery model of oral health care has been the norm, and many older adults have not been accustomed to the provision of prevention-focused oral

\* Corresponding author. NUS Faculty of Dentistry, 9 Lower Kent Ridge Rd, Level 10, National University Centre for Oral Health, Singapore 119085, Singapore.

E-mail address: [drakhimittal@yahoo.com](mailto:drakhimittal@yahoo.com) (R. Mittal).<https://doi.org/10.1016/j.identj.2021.11.002>0020-6539/© 2021 The Authors. Published by Elsevier Inc. on behalf of FDI World Dental Federation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

health care services. It is also reported that many older adults still hold the opinion that tooth loss is a normal part of the ageing process and is not preventable.<sup>9</sup> There is little evidence about how older adults value different types of dental care and, in particular, the value they place on preventive dentistry. Given the established service delivery norm, with widespread use of fee-per-service for surgical and restorative care, it seems plausible therefore that uptake of prevention-focussed dental services by older adults may be limited.

In Singapore, a form of co-payment for dental care was introduced by the government through its means-tested Community Health Assist Scheme (CHAS) in 2012. Under CHAS, the government subsidises costs of oral health care provided by private-sector dental practitioners. The level of financial subsidy provided is determined by the estimated household monthly income per person and housing status. Apart from CHAS, the Pioneer Generation (PG) scheme was launched in 2015 for all Singaporean citizens born in or before 1949 where eligible citizens receive additional subsidies for dental treatment. Given the relative novelty of these schemes, it is timely to assess whether they have influenced care-seeking attitudes in older adults.

Significant costs are incurred in oral health care, and there is a lot of interest in economic evaluation of health care through a variety of methods. Some of these methods, such as quality-adjusted life years, have limited application in dentistry. How much an individual is willing to pay can be a proxy for how much they value the item or service, including health care services. Willingness to pay (WTP) methodology has been applied to inform policy decisions in health care, and advocates of WTP suggest that it can be used in determining cost-benefit analyses.<sup>10-14</sup> Such techniques are based on either observed actual consumer behaviour (revealed WTP approach) or hypothetical consumer behaviour expressed in a survey (stated WTP approach). Contingent valuation is a stated-preference approach that uses survey methods to ascertain the maximum amount individuals would be willing to pay for products or services presented in the context of hypothetical scenarios. There have been some questions about the validity of WTP methods, and potential sources of bias have been highlighted.<sup>10</sup> These include starting point bias, range bias, and hypothetical bias, any of which can arise depending on the study methodology. Due to its practical advantages and demonstrated reliability, contingent valuation has been extensively used in studies of demand for a variety of health care goods and services. It is likely that a variety of factors will influence patients WTP for health care, including situational awareness, health literacy, socioeconomic status, and ability to pay.

The aims of the present study were to investigate the WTP for preventive compared to curative dental care procedures and to determine the factors that influence older adults' WTP for their oral health care.

## Methods

### Ethical approval

Ethical approval for this study was granted by the National University of Singapore–Institutional Review Board (NUS-IRB Reference code: H-17-047) and Domain Specific Review Board (DSRB Reference Number: 2017/00223). Written informed

consent was obtained from all participants, and participants were informed that they could withdraw from the research at any time.

### Participant recruitment

The participants for this study were recruited from two observational cohort studies in Singapore. Participants from both cohorts were included if they were (1) aged 60 to 90 years; (2) eligible for government financial subsidies for dental care, namely, the Community Health Assistance Scheme (CHAS Blue Card/Orange Card) and/or the Pioneer Generation Scheme; and (3) able to understand/communicate in Mandarin/Hokkien, English, or Malay. The first cohort was a study of mental health and ageing in Singapore whose study protocol has been reported in detail elsewhere.<sup>15</sup> The recruitment strategy was to enrol 30% of older community-dwelling adults aged between 60 and 90 years living in the Central Western district of Singapore. The second cohort was recruited consecutively from amongst patients older than 65 years of age attending a primary care medical outpatient clinic (Jurong National University Polyclinic) in Western Singapore.

### Data collection

Data were collected from in-person interviews using a survey questionnaire and a clinical examination. The survey questionnaire included details of age, gender, ethnicity, education, marital status, oral health knowledge, self-rating of oral health status, and oral health attitudes. The proxy for socioeconomic status was type of housing, and this was in keeping with standard practice for health surveys in Singapore.<sup>16</sup> In Singapore, there is a mixture of public rental housing together with owner-occupied public and private housing within most residential precincts. The public rental housing is generally heavily subsidised and tends to be occupied by groups of lower socioeconomic status.

### Oral health clinical examination

After participants completed the questionnaire, a clinical examination was conducted by calibrated examiners and recorded details of the following: (1) decayed, missing, and filled teeth (DMFT); (2) root decay (active decay or filled); (3) number and distribution of posterior occlusal contacts; (4) prosthodontic status (presence/absence of denture, denture fit, retention, stability, and hygiene); and (5) periodontal status (probing pocket depths, periodontal attachment loss, gingival bleeding).

### WTP measurement

The WTP process was piloted beforehand to ensure content and face validity and adjusted prior to administration in the study.

In a face-to-face interview with a research team member, a contingent valuation method was used and the respondent was asked to indicate the highest amount they were willing to pay for each of the following: (1) scaling and polishing of teeth, (2) dental extractions, (3) dental restorations/fillings,

and (4) preventive advice by a dentist, including dietary and smoking cessation advice. The interviewer checked each respondent's understanding of each of these procedures prior to asking them to indicate their WTP preferences. Payment cards with varying dollar values were shown to the respondent until they settled on a specific amount that they were willing to pay for a given procedure.

### Statistical analysis

In addition to reporting descriptive data, we used an exploratory approach and undertook bivariate and multivariate analyses with WTP for each dental procedure as the dependent variable. As data were not normally distributed, non-parametric tests (Kruskal–Wallis test) were used for bivariate analysis. Negative binomial regression was used to assess the relationship between the predictor variables, namely (1) sociodemographic factors (age, gender, ethnicity, education, marital status, and housing type) and (2) oral health-related factors (self-perceived oral health, oral health attitude, dental visits, eligibility for oral health benefits, denture status, DMFT, root decay, number of occlusal contacts, periodontal status) associated with WTP for dental fillings, dental scaling, dental extractions, and disease prevention advice. Based on an assumption of equivalence between regular and irregular dental service users, using DMFT as the primary outcome, a total of 290 participants was required to give the study 80% power at a 5% level of significance. Data were analysed using Statistical Package for the Social Sciences version 24 (IBM), and statistical significance was set at  $P < .05$ .

## Results

### Response

Three hundred eighty-six independently living older Singaporean adults who met the inclusion criteria agreed to participate in the study. Details of the study participants are given in detail in [Table 1](#).

### Profile of participants

The majority of our study population was aged between 60 and 75 years (mean [SD], 73.58 [5.83]), female, married, and of Chinese ethnicity. Sixty-five percent of the participants completed primary school education or beyond, and 75% of the participants lived in Housing and Development Board with more than 3 rooms/condominium (higher socioeconomic status). Further, 26.7% were eligible for CHAS benefits, 33.9% were eligible for only PG benefits, and 39.4% were eligible for both CHAS and PG benefits.

### Self-perception of oral health and oral health attitudes

Fifty-seven percent of participants perceived their oral health to be "good," 82.9% of them agreed that they were afraid of losing their teeth, 83.7% agreed that dental problems affected their overall health, and 67.6% agreed that dental treatment is more costly than medical treatment.

### Oral health behaviours and oral health status

Almost half of the participants (49.5%) made routine dental visits, 57.3% of them wore acrylic/Co/Cr removable partial dentures. The mean caries experience was high, with mean (SD) decayed and filled root surfaces of 20 (9.09) and coronal surfaces of 14 (9.68). Regarding occlusal contacts, 62.4% of the participants had 5 or fewer pairs of occluding teeth.

### WTP for dental fillings

The mean (SD) value of WTP for a dental filling was SGD\$30.23 (31.05). [Table 1](#) shows the bivariate analyses, with WTP for dental fillings associated with age, educational attainment, oral health attitude, dental visits, denture status, root decayed filled, coronal DMFT, occlusal contacts, and entitlement to PG benefits as well as entitlement to both CHAS and PG benefits. In the multivariate model, participants were willing to pay higher fees if they were aged 60 to 75 years (IRR [95% confidence interval (CI)], 1.47 [1.15-1.88]), had at least primary school education (incidence rate ratio [IRR] [95% CI], 1.29 [1.01-1.65]), and reported visiting the dentist regularly (IRR [95% CI], 1.41 [1.11-1.79]) ([Table 2](#)).

### WTP for scaling

The mean (SD) value of WTP for scaling was SGD\$30.28 (29.46). [Table 1](#) shows the bivariate analyses, with WTP for scaling associated with age, ethnicity, educational attainment, self-perceived oral health, oral health attitude, dental visits, denture status, root DMFT, coronal DMFT, occlusal contacts, and entitlement to PG benefits as well as entitlement to both CHAS and PG benefits. In the multivariate model, participants who had at least primary school education (IRR [95% CI], 1.44 [1.13-1.84]), were afraid of losing their teeth (IRR [95% CI], 1.28 [0.96-1.72]), agreed that dental problem affects overall health (IRR [95% CI], 1.34 [0.99-1.81]), and reported regular dental visits (IRR [95% CI], 1.41 [1.11-1.79]) were more willing to pay higher fees for dental scaling ([Table 2](#)).

### WTP for dental extraction

The mean (SD) value of WTP for a dental extraction was SGD \$35.08 (58.54). [Table 1](#) shows the bivariate analyses with WTP for a dental extraction associated with age, educational attainment, marital status, reported frequency of dental visits, denture status, occlusal contacts, and entitlement for both CHAS and PG subsidies. In the multivariate model, participants who were 60 to 75 years old (IRR [95% CI], 1.32 [1.02-1.70]), had at least primary school education (IRR [95% CI], 1.28 [1.00-1.65]), agreed that dental treatment was more costly than medical treatment (IRR [95% CI], 1.21 [0.96-1.52]), and reported routine dental visits (IRR [95% CI], 1.24 [0.98-1.58]) were more willing to pay higher fees for extraction. Those who were wearing dentures were willing to pay a lower amount (IRR [95% CI], 0.76 [0.59-0.98]) for dental extraction than those who were not wearing any type of denture ([Table 2](#)).

**Table 1 – Correlation between participant characteristics and WTP for dental filling, scaling, extraction, and preventive advice (N = 386).**

Participant factors	n	WTP dental filling		WTP scaling		WTP extraction		WTP preventive advice	
		Mean \$ (SD)	P value	Mean \$ (SD)	P value	Mean \$ (SD)	P value	Mean \$ (SD)	P value
<i>Sociodemographic factors</i>									
<i>Age</i>									
60-75 years	262	33.28 (31.59)	<.01*	32.14 (28.97)	<.01*	39.76 (68.06)	<.00*	8.57 (16.28)	.12
Older than 75 years	124	23.88 (29.00)		26.42 (30.21)		25.29 (28.02)		5.48 (12.99)	
<i>Gender</i>									
Male	132	32.29 (34.42)	.58	31.36 (27.49)	.32	40.55 (90.69)	.74	9.13 (18.23)	.32
Female	254	29.17 (29.16)		29.73 (30.47)		32.23 (30.55)		6.76 (13.57)	
<i>Ethnicity</i>									
Chinese	269	32.30 (33.23)	.17	32.72 (30.75)	.01*	33.87 (33.53)	.51	7.14 (16.00)	.01*
Non-Chinese	117	25.47 (24.81)		24.68 (25.48)		37.85 (93.63)		8.56 (13.73)	
<i>Education</i>									
Passed primary and above	252	34.58 (33.07)	<.001*	35.72 (31.25)	<.01*	40.25 (69.56)	<.01*	9.08 (17.49)	.07
No formal education	134	22.07 (24.97)		20.07 (22.53)		25.35 (25.34)		4.74 (9.59)	
<i>Marital status</i>									
Married	246	31.04 (30.74)	.16	30.90 (29.31)	.38	37.65 (69.07)	.09*	7.22 (13.45)	.87
Single/divorced/widowed	140	28.82 (31.65)		29.20 (29.79)		30.56 (32.43)		8.18 (18.23)	
<i>Housing type</i>									
HDB more than 3 rooms/ condo/landed	288	32.42 (33.38)	.12	31.23 (29.27)	.26	34.18 (33.28)	.18	7.44 (15.96)	.30
HDB 1-3 room set	98	23.80 (21.76)		27.52 (29.98)		37.71 (101.57)		7.96 (13.42)	
<i>Oral health factors</i>									
<i>Self-perceived oral health</i>									
Good	220	31.84 (31.91)	.30	33.00 (31.53)	.06	34.25 (34.29)	.43	6.54 (14.20)	.02*
Fair/poor	166	28.11 (29.83)		26.68 (26.11)		36.16 (80.21)		8.93 (16.69)	
<i>Afraid of losing teeth</i>									
Agree	320	31.48 (31.43)	.03*	31.71 (30.18)	.03*	36.52 (63.32)	.52	7.83 (15.38)	.56
Disagree/unsure	66	24.17 (28.60)		23.38 (24.69)		28.08 (23.65)		6.29 (15.22)	
<i>Dental problem affects overall health</i>									
Agree	323	31.53 (31.76)	.05*	32.13 (30.45)	<.01*	35.61 (61.73)	.55	7.65 (16.03)	.34
Disagree/unsure	63	23.57 (26.35)		20.84 (21.54)		32.33 (38.50)		7.14 (11.31)	
<i>Dental treatment is costly than medical treatment</i>									
Agree	261	28.97 (31.06)	.13	29.79 (30.33)	.32	36.76 (67.58)	.37	6.95 (13.64)	.77
Disagree/unsure	125	32.87 (30.99)		31.31 (27.64)		31.56 (32.35)		8.87 (18.40)	
<i>Dental visits</i>									
Routine visits	191	37.41 (33.60)	<.001*	38.12 (30.48)	<.001*	38.15 (34.77)	<.01*	9.23 (18.17)	.21
Non-routine visits	195	23.21 (26.60)		22.62 (26.32)		32.06 (74.82)		5.95 (11.76)	
<i>Wear dentures</i>									
Wear acrylic/Co/Cr RPD	221	26.87 (28.20)	.02*	26.81 (29.20)	<.01*	29.20 (28.14)	.02*	7.38 (14.70)	.60
No dentures	165	34.74 (34.08)		34.94 (29.25)		42.94 (82.91)		7.83 (16.20)	
<i>Root decay</i>									
0-20	149	34.05 (33.42)	<.01*	35.18 (30.15)	<.01*	40.00 (75.66)	.12	7.79 (16.93)	.24
>20	237	25.87 (29.60)		24.68 (27.68)		29.44 (27.49)		7.32 (13.34)	
<i>Coronal DMFT</i>									
0-14	179	33.70 (33.18)	.11	34.25 (25.30)	<.01*	40.03 (28.85)	.04*	8.31 (16.97)	.87
>14	207	27.13 (27.93)		26.39 (28.11)		34.94 (28.15)		6.64 (13.00)	
<i>Occlusal contact</i>									
≤5 teeth in occlusion	241	25.93 (26.37)	<.01*	24.72 (26.86)	<.001*	33.16 (68.34)	.02*	7.42 (14.45)	.20
>5 teeth in occlusion	145	37.38 (36.56)		39.53 (31.30)		38.26 (36.92)		7.82 (16.77)	
<i>Oral health benefits</i>									
Only CHAS	103	27.67 (26.84)	.68	31.26 (29.18)	.36	43.19 (99.37)	.21	7.23 (13.89)	.94
Only PG scheme	131	36.26 (35.50)	.01*	35.36 (31.68)	.03*	34.31 (30.02)	.27	8.36 (17.79)	.49
Both CHAS and PG scheme	152	26.80 (28.78)	.06	24.63 (26.79)	<.01*	30.24 (34.95)	.02*	7.07 (13.99)	.52

\* P &lt; .05.

CHAS, Community Health Assist Scheme; DMFT, decayed, missing, and filled teeth; HDB, Housing and Development Board; PG, Pioneer Generation; RPD, removable partial dentures; WTP, willingness to pay.

**WTP for preventive advice**

The mean (SD) value of WTP for preventive advice was SGD\$7.57 (15.34). Table 1 shows the bivariate analyses with WTP for preventive advice associated with ethnicity, educational attainment, and self-perceived oral health. In the multivariate model, factors associated with WTP preventive advice were age (60-75 years), (IRR

[95% CI], 1.73 [1.30-2.31]), gender (male), (IRR [95% CI], 1.49 [1.16-1.91]), ethnicity (Chinese), (IRR [95% CI], 0.66 [0.50-0.85]), educational attainment (primary school or higher), (IRR [95% CI], 1.69 [1.30-2.21]), marital status (married), (IRR [95% CI], 0.77 [0.60-0.98]), self-perceived oral health (good), (IRR [95% CI], 0.70 [0.54-0.89]), and dental visits (regular), (IRR [95% CI], 1.61 [1.23-2.10]) (Table 2).

**Table 2 – Multivariate analysis of factors affecting WTP for dental fillings, scaling, extractions, and preventive advice (N = 386).**

Participant factors	WTP dental filling		WTP scaling		WTP extraction		WTP preventive advice	
	IRR (95% CI)	P value	IRR (95% CI)	P value	IRR (95% CI)	P value	IRR (95% CI)	P value
<i>Sociodemographic factors</i>								
Age								
60-75 years	1.47 (1.15-1.88)	<.01*	1.17 (0.92-1.50)	.19	1.32 (1.02-1.70)	.03*	1.73 (1.30-2.31)	<.001*
Older than 75 years	–		–		–		–	
Gender								
Male	1.08 (0.85-1.36)	.50	1.16 (0.92-1.47)	.19	1.18 (0.93-1.50)	.15	1.49 (1.16-1.91)	<.01*
Female	–		–		–		–	
Ethnicity								
Chinese	1.00 (0.78-1.28)	.96	1.06 (0.83-1.35)	.61	0.86 (0.67-1.10)	.25	0.66 (0.50-0.86)	<.01*
Non-Chinese	–		–		–		–	
Education								
Passed primary and above	1.29 (1.01-1.65)	.03*	1.44 (1.13-1.84)	<.01*	1.28 (1.00-1.65)	.05*	1.69 (1.30-2.21)	<.001*
No formal education	–		–		–		–	
Marital status								
Married	1.00 (0.80-1.26)	.94	0.99 (0.79-1.25)	.98	1.06 (0.84-1.34)	.62	0.77 (0.60-0.98)	.03*
Single/divorced/widowed	–		–		–		–	
Housing type								
HDB more than 3 rooms/ condo/landed	1.06 (0.81-1.38)	.65	0.86 (0.66-1.13)	.28	0.98 (0.75-1.28)	.92	0.96 (0.71-1.28)	.78
HDB 1-3 room set	–		–		–		–	
<i>Oral health factors</i>								
Self-perceived oral health								
Good	1.08 (0.87-1.33)	.47	1.13 (0.91-1.401)	.23	0.99 (0.80-1.23)	.95	0.70 (0.54-0.89)	.01*
Fair/poor	–		–		–		–	
Afraid of losing teeth								
Agree	1.22 (0.92-1.63)	.15	1.28 (0.96-1.72)	.08	1.15 (0.85-1.54)	.35	1.20 (0.86-1.66)	.26
Disagree/unsure	–		–		–		–	
Dental problem affects overall health								
Agree	1.24 (0.91-1.67)	.16	1.34 (0.99-1.81)	.05*	1.05 (0.78-1.43)	.70	1.13 (0.81-1.57)	.46
Disagree/unsure	–		–		–		–	
Dental treatment is more costly than medical treatment								
Agree	0.89 (0.71-1.12)	.34	0.95 (0.76-1.19)	.70	1.21 (0.96-1.52)	.09	0.98 (0.77-1.26)	.91
Disagree/unsure	–		–		–		–	
Dental visits								
Routine visits	1.41 (1.11-1.79)	<.01*	1.41 (1.11-1.79)	<.01*	1.24 (0.98-1.58)	.07	1.61 (1.23-2.10)	<.001*
Non-routine visits	–		–		–		–	
Wear dentures								
Wear acrylic/Co/Cr RPD	0.82 (0.63-1.08)	.16	0.91 (0.70-1.18)	.49	0.76 (0.59-0.98)	.04*	0.88 (0.67-1.15)	.36
No dentures	–		–		–		–	
Root DMFT								
0-20	0.99 (0.75-1.31)	.99	0.98 (0.74-1.29)	.90	0.97 (0.73-1.49)	.44	0.75 (0.53-1.06)	.10
>20	–		–		–		–	
Coronal DMFT								
0-14	0.84 (0.64-1.09)	.19	0.92 (0.71-1.20)	.57	1.11 (0.86-1.43)	.42	1.24 (0.92-1.68)	.14
>14	–		–		–		–	
Occlusal contact								
≤5 teeth in occlusion	0.91 (0.67-1.23)	.55	0.81 (0.59-1.10)	.17	1.10 (0.81-1.50)	.52	1.13 (0.82-1.56)	.42
>5 teeth in occlusion	–		–		–		–	
Oral health benefits								
Only CHAS	0.83 (0.61-1.11)	.22	1.05 (0.78-1.42)	.71	1.07 (0.79-1.46)	.59	0.73 (0.53-1.01)	.06
Only PG scheme	1.07 (0.82-1.38)	.60	1.12 (0.86-1.45)	.37	0.98 (0.76-1.26)	.91	0.93 (0.70-1.24)	.65

\* P &lt; .05.

CHAS, Community Health Assist Scheme; CI, confidence interval; DMFT, decayed, missing, and filled teeth; HDB, Housing and Development Board; IRR, incidence rate ratio; PG, Pioneer Generation; RPD, removable partial dentures; WTP, willingness to pay.

## Discussion

There has been discussion of the impact of service remuneration systems on quality and accessibility of care, and there are issues with all currently available models.<sup>17</sup>

The financial cost of oral health care is a perceived barrier, but it is not the only barrier to seeking care in older

adults.<sup>18,19</sup> Beyond affordability, relatively little is known about how older patients value oral health care and what influences their WTP for care or their expectation of the oral health care services for which they pay. We acknowledge that convenience sample strategy is one of the limitations of the study. However, to the best of our knowledge, this is the first study of associations between WTP in a health care

system that uses public funds to subsidise private provider costs of dental care for older adults. We recognise that some concerns have been raised about use of WTP methods, especially the varying biases that have been described. However, we took steps to minimise these, including pre-piloting of the questions, face-to-face interviews to gather data, use of payment cards, and recruiting participants from outside dental care settings. These measures have been recommended as means to reduce bias associated with WTP studies. To measure WTP, we used a payment card option to get participants' valuation instead of starting with the amount based on the cost of the procedures commonly charged by general dental practitioners. Many of the studies reporting WTP used bidding game methods for the estimation of WTP. While the bidding game is simple to conduct, it has some inherent disadvantages. The initial anchor (or "price" offered) in a bidding game may influence the WTP estimate to be higher than that identified using the other contingent valuation methods.<sup>20</sup>

Singapore is a multi-ethnic society, with approximately 70% of its resident population being of Chinese ethnicity. This is reflected in the ethnic distribution of the participants in this study. The participants in this study are also quite typical of the elderly population of Singapore whose health care costs are subsidised at a level commensurate with their socioeconomic status. Housing status and monthly household income are used as a proxy for socioeconomic status when determining the level of subsidy for health care in Singapore. Hence, we used housing status as a proxy for socioeconomic status in our study. Use of public funding to subsidise costs of oral health care in the private sector in Singapore is recent. Surveys of dental status in Singapore indicate a high prevalence of tooth loss in older adults, which suggests that disease has been treated predominantly by dental extractions.<sup>21</sup> Costs of care in the private sector which, prior to provision of government subsidy, were mostly met by the patients themselves may have influenced a sporadic pattern of dental visits for dental extractions to manage pain. In our study, participants aged 60 to 75 years reported high WTP values for dental fillings, dental scaling, dental extractions, and preventive advice compared to participants older than 75 years. This is similar to a previous study which has shown that older respondents were found to have a lower WTP for health care intervention.<sup>22</sup> Future studies should be done to provide further insights into the relationship between advancing age and lower WTP for oral health care amongst older adults. Overall, the participants who were willing to pay higher fees for dental care were younger, were better educated, and reported visiting dentists regularly.

Also noteworthy was the increased WTP for dental scaling when the participants reported concern about losing teeth and they agreed that dental problems could affect their overall health. This may reflect the concern with high prevalence of type 2 diabetes mellitus in Singapore and the government's high-profile strategy to combat this problem. Interestingly, WTP for curative procedures was not strongly influenced by level or type of payment subsidy in multivariate analyses, whereas there was an association with WTP for preventive advice. Differences in WTP by eligibility of oral health benefits suggests potential disparities between needs and preferences amongst older adults. This suggests that attitudes formed

before the availability of dental care subsidies are well established and not substantially moderated by financial subsidies. A consistent finding was the impact of educational attainment level, and this may reflect underlying level of health literacy.<sup>23</sup> Socioeconomic status was not a predictor of WTP, which suggest that affordability is not as strong an influence as other factors which influence the value older adults place on different forms of oral health care.

It is acknowledged that the dollar amount of their WTP for various treatment may be influenced by the level of government subsidy for that particular treatment. However, we believe that the relatively low rate that our participants are willing to pay for preventive care reflects broader challenges in persuading the elderly to accept prevention-focussed oral health care. Ideally, as clinical costs are rising sharply, the focus of oral health care should shift from a paradigm of curative care to one of prevention. There are many obstacles to this, not least of which is having a remuneration system which primarily incentivises curative treatment. The fact that older adults are willing to pay less for preventive advice may indicate lack of knowledge about potential benefits of disease prevention.<sup>24</sup>

## Conclusions

The findings of our study suggest that different factors affect the value placed on dental care by older adults: (1) younger age means WTP more for restorations, extractions, and preventive advice; (2) educated participants and those who visited the dentist routinely had WTP higher fees for all dental care procedures; and (3) participants who had knowledge about the relationship of between oral health and systemic disease were willing to pay higher fees for scaling. It appears that WTP for preventive advice is limited when compared with curative care.

## Conflict of interest

None disclosed.

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