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Acceptance and Willingness-to-Pay for Teledentistry: A Contingent Valuation Study



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ABSTRACT

Objectives: The study sought to assess patients' acceptance of teledentistry and their willingness-to-pay (WTP) for teledentistry.

Methods: Patients attending a dental appointment at a public hospital in Singapore were recruited to participate in a cross-sectional study between August 2021 and March 2023. Patients' acceptance of video consults and reviews were compared using McNemar tests. A bidding game contingent valuation method with random starting points was adopted to elicit participants' WTP for teledentistry. Logistic regression was carried out to assess participants' WTP equivalent in-person costs by sociodemographic factors.

Results: Out of 597 respondents, the proportion willing to have an initial consult via a video call was 54.4% and 70.9% for a video review. Teledentistry acceptance was lower among older age groups and higher among those with higher education levels (adjusted odds ratio [adj. OR] 3.63, 95% CI = 2.16–6.15 for video reviews for university graduates). The proportion of participants willing to pay at least the quantum of in-person care for video consults and reviews was 15.2% and 79.6%, respectively. Compared to those aged 21 to 30 years, the WTP for video reviews was lower among those aged 41 years and above (OR: 0.39, 95% CI = 0.20–0.72).

Conclusions: Majority of patients were willing to undergo and pay at least in-person costs for video reviews compared to video consults. Younger age and higher education levels were associated with a higher willingness to accept video consults and reviews, and a higher WTP at least the equivalent in-person costs for video reviews.

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Introduction

Teledentistry is the remote provision of clinical oral health care management through the use of information technology.¹ Its applications range from treatment, monitoring to education; though the primary modalities of teledentistry are tele-consultation and tele-diagnosis.² The technology has been applied across various dental disciplines, and studies have shown that teledentistry is effective for screening for dental caries, oral mucosal conditions and malocclusions, with sensitivity and specificity above 80%.^{2,3} The benefits of consults and reviews via video calls are improved access to care, shorter waiting times and reduced treatment

durations.^{4,5} Prior to the COVID-19 pandemic, teledentistry was largely used in rural areas and community-based settings such as schools and nursing homes to broaden access to care.⁶ The COVID-19 pandemic accelerated the adoption of teledentistry, particularly during lockdowns when routine and nonurgent dental care were suspended to mitigate transmission risks.⁷ Presently, teledentistry is frequently used as an alternative to conventional dental appointments in urban settings for triaging and assessing the urgency of care needed as well as replacing in-person consults and reviews for post-operative evaluations after minor surgical procedures and routine preventive care.⁸

Despite its benefits, barriers to teledentistry persist, specifically regarding its acceptability by patients.⁹ Although there are studies demonstrating that patients were accepting of tele-consults and found this mode of care delivery effective and easy to use during the COVID-19 pandemic,^{10,11} few studies have assessed the acceptability and cost-effectiveness of tele-consults postpandemic.^{12,13} Other considerations include the pricing and cost-effectiveness of teledentistry, as well as appropriate compensation to healthcare providers offering teledentistry services.¹⁴ Presently, there is no information on patients' willingness to pay (WTP) for teledentistry. WTP refers to the maximum monetary amount that an individual is willing to pay for a service, which guides pricing strategies and costing models.¹⁵ WTP assessments allow for the capture of the full economic value of teledentistry services, direct cost-benefit analyses, and enable pricing and demand forecasts for services. There is no study that has demonstrated the monetary value that patients place on teledentistry beyond the direct costs incurred by the healthcare system.¹⁶ Furthermore, even though studies have suggested that there are barriers to the adoption of telehealth services among older adults,^{9,17} none have assessed the effect of sociodemographic factors on the WTP for teledentistry. One key sociodemographic factor of concern is the highest education level. In Singapore, education levels can range from primary school to tertiary education in universities. In between, the Institute of Technical Education (ITE) offers vocational education and apprenticeships, while polytechnics offer diploma courses, and junior colleges (JC) offer education leading to the General Certificate of Education Advanced Level (GCE "A" level) examinations.¹⁸

The aim of this study was to elicit patients' acceptance and WTP for initial consultations and reviews through teledentistry. In addition, the study sought to evaluate the association between acceptance and WTP for teledentistry with sociodemographic characteristics.

Methods

Participant selection

Patients or parents of child patients attending a dental appointment at a public hospital in Singapore were recruited between August 2021 and March 2023 for this cross-sectional study. The following patient types were included, namely (1) patients who were returning to the hospital for postoperative reviews either after dental rehabilitation under general

anaesthesia and/or after third molar extraction/s, (2) patients who were visiting the hospital for restorative treatment (restorations, fixed and removable prosthodontics) and/or following up for these restorative treatments and (3) patients attending initial consults. Recruitment was purposefully stratified across different visit types to assess if perspectives towards teledentistry differed by patient groups. The inclusion criteria for respondents (patients or parents of child patients) were a minimum age of 21 years and an ability to read English. The study was approved by the National Healthcare Group Domain Specific Review Board (DSRB: 2021/00270).

Study design and data collection

Participants completed a self-administered questionnaire on their sociodemographic characteristics. Data on participants' age (21-30 years, 31-40 years, 41-50 years, 51-60 years, >60 years), respondent type (self, parent of child patient), reason for dental attendance (first consult, restorative visit, post-operative review), gender (male, female), ethnicity (Chinese, Malay, Indian/ others), nationality (Singapore citizen/ permanent resident, foreigner), highest education attainment (secondary school and below (including primary school), ITE/polytechnic/ JC, bachelor's degree and above), housing type (1-3 room public housing, 4-room public housing, 5-room public housing or larger flats, private residence), employment status (employed, unemployed/ others), personal monthly expenditure (<\$500, \$500-1000, \$1001-1500, \$1501-2000, >\$2000), company reimbursement and insurance (yes, no), travel time to dental clinic (<15 minutes, 15-30 minutes, 31-45 minutes, >45 minutes), and travel mode (personal car, private hire, public transport) were recorded. Thereafter, participants were provided with a description and graphic explaining teledentistry, including its strengths and weaknesses ([Appendix Figure S1](#)). Their perspectives towards teledentistry, including their acceptance for initial consults and reviews by video calls were recorded.

Contingent valuation

A bidding game contingent valuation method was adopted to elicit the maximum amount participants were willing to pay for video consults and reviews. Three trained interviewers assessed participants' WTP for teledentistry face-to-face using a bidding method with random starting points. A scripted explanation on the WTP method ("cheap talk") was provided to ensure that participants provided realistic and budget-constrained responses. Cards with monetary values were shuffled to provide random starting bids to overcome biases associated with a constant initial amount bid. There were two distinct payer patient groups; (1) private-paying patients who pay full cost out-of-pocket, and (2) subsidised-paying patients who pay around 50% of the cost out-of-pocket and receive governmental subsidies for the balance. Pre-testing was carried out with 10 patients to assess the comprehensibility and content validity of the questionnaire. The starting values for an initial consult via video call ("video consult") ranged from SGD\$50 to \$90 (SGD\$1.00 = USD\$0.74) for private-paying patients, and SGD\$10 to \$50 for subsidised-paying patients. The starting values for a postoperative review via a video call ("video review") ranged from SGD\$10 to \$50, and SGD\$0 to \$40 for

private and subsidised-paying patients, respectively. These values were centred around the median values of in-person consults and reviews, and the range of WTP values was assessed and established during the pretesting phase. Patients' WTP were elicited in intervals of SGD\$5. If the starting bid was accepted, the interviewer would offer participants the card with a value higher than the original bid by SGD\$5. This continued in progressive intervals of SGD\$5 until the participant rejected the bid; the last bid was set as the maximum WTP. If participants were willing to pay the highest monetary value in the range on the cards, they were then asked a follow-up question on the maximum amount they were willing to pay for the service. Conversely, if the starting bid was rejected, the interviewer would offer participants the card with a value lower by SGD\$5. This continued in progressive intervals of SGD\$5 until the participant accepted the bid.

Statistical analysis

Sample size calculation was carried out to estimate the proportion of participants willing to accept for teledentistry via video consults and video reviews. Based on an expected acceptance rate of 51%,¹⁹ to estimate the proportion at 95% CI with 5% precision level, a sample size of 384 was required. To further assess the proportion of participants who were willing to pay at least in person costs, including among the subset of individuals who were willing to accept teledentistry, a minimum sample size of at least 489 respondents was required based on estimates from the literature (19%)²⁰ and after accounting for a 5% attrition rate due to incomplete responses. All statistical analyses were performed using R version 4.2.1. Participants' ratings on their acceptance of teledentistry were tabulated and reported, and compared across groups, including participants' reason for attendance at the dental clinic, using chi-square tests. Mean WTP values were tabulated, and the proportion of participants' willing to pay more than or equal to in-person costs of consults and reviews according to their payer status (private/subsidised) was calculated. The proportion of participants willing to accept and WTP for consults and reviews were compared using McNemar tests. Logistic regression was carried out to assess participants' odds of being willing to pay at least the cost of in-person consults by age and other sociodemographic factors. As part of a supplementary analysis to assess the association between actual WTP and sociodemographic factors, Tobit regression with a lower bound of zero was carried out. A directed acyclic graph with hypothesised associations between variables was developed, taking into account participants' sociodemographic factors, reasons for dental visit, travel mode and time, and financial status, to guide adjustment variable selection for each exposure variable using the minimal sufficient adjustment sets²¹ (Supplementary Appendix Figure S2). The significance level was set at 5%. McFadden pseudo-R squared values²² were tabulated for all models.

Results

A total of 597 participants (patients themselves = 460; parents of child patients = 137) completed the survey and WTP exercise. Majority of the participants (42.4%, $n = 253$) were visiting

the hospital for new consults, 38.0% ($n = 227$) for restorative visits, and 19.6% ($n = 117$) for postoperative reviews (Table 1).

Acceptability of teledentistry for initial consultations and review visits

Overall, 47.2% ($n = 282$) of participants were willing to have both initial consults and reviews via a video call, while 21.9% ($n = 131$) of participants were not willing to accept teledentistry for both initial consults and reviews. Over half of the participants (54.4%, $n = 325$) indicated that they were willing to have an initial consult via a video call which was significantly lower ($p < .001$) than the acceptance for a video review (70.9%, $n = 423$) (Table 1). Participants' acceptance of video consults was positively associated with their acceptance of video reviews ($p < .001$) (Table 1).

The acceptance of video consults and reviews was higher for younger respondents and those with a highest education level of ITE/polytechnic/JC and above (Table 2). Compared to those aged 21 to 30 years of age, the OR of being willing to accept video consults was 0.51 (95% CI = 0.32-0.81, $p = .005$) for those aged 31 to 40 years, 0.38 (95% CI = 0.23-0.62, $p < .001$) for those aged 41 to 50 years, 0.30 (95% CI = 0.16-0.53, $p < .001$) for those aged 51 to 60 years, and 0.20 (95% CI = 0.11-0.36, $p < .001$) for those aged >60 years of age. The OR for the acceptance of video reviews were 0.76 (95% CI = 0.43-1.32, $p = .339$), 0.36 (95% CI = 0.21-0.62, $p < .001$), 0.30 (95% CI = 0.16-0.57, $p < .001$), and 0.17 (95% CI = 0.09-0.33, $p < .001$) respectively in ascending order of age groups (Table 2). Relative to those with up to secondary school education, the adj. OR for acceptance of video calls was 4.69 (95% CI = 2.71-8.34, $p < .001$) for those with a highest education level of ITE/polytechnic/JC and 3.85 (95% CI = 2.26-6.74, $p < .001$) for those with a university degree (Table 2). The adj. OR for the acceptance of video reviews were 3.48 (95% CI = 2.02-6.06, $p < .001$) and 3.63 (95% CI = 2.16-6.15, $p < .001$) respectively (Table 2). While the adj. OR for the acceptance of video reviews was higher among those living in 4-room public housing (adj. OR: 1.97, 95% CI = 1.06-3.67, $p = .031$) and in 5-room or larger public housing (adj. OR: 2.21, 95% CI = 1.15-4.26, $p = .017$), there was no statistically significant difference for those living in private properties compared to those living in smaller 1-3-room public housing (Table 2, Supplementary Appendix Figure S3). There were no statistically significant associations between other sociodemographic variables, travel patterns and acceptance of video calls and reviews (Supplementary Appendix Tables S1-S7), although participants who were at the hospital for a postoperative review were less likely to accept a video review (adj. OR: 0.54 (95% CI = 0.31-0.95, $p = .032$) (Supplementary Appendix Table S8).

WTP for teledentistry for initial consultations, restorative, and review visits

The proportion of participants willing to pay at least the quantum of in-person care was higher for video reviews (79.6% [$n = 475$]) than video consults (15.2% [$n = 91$]) ($p < .001$) (Table 3). There was no statistically significant association between age and WTP at least the equivalent in-person costs for video consults. Compared to those aged 21 to 30 years, the OR for being willing to pay at least the equivalent in-person

Table 1 – Acceptance of video call for initial consultations and reviews by sociodemographic factors.

		Total	Video consult			Video review		
			No	Yes	P-value*	No	Yes	P-value*
Overall		597 (100%)	272 (45.6%)	325 (54.4%)		174 (29.1%)	423 (70.9%)	<.001 [†]
Age	21-30 y old	155 (26.0%)	44 (28.4%)	111 (71.6%)	<.001	26 (16.8%)	129 (83.2%)	<.001
	31-40 y old	172 (28.8%)	75 (43.6%)	97 (56.4%)		36 (20.9%)	136 (79.1%)	
	41-50 y old	131 (21.9%)	67 (51.1%)	64 (48.9%)		47 (35.9%)	84 (64.1%)	
	51-60 y old	70 (11.7%)	40 (57.1%)	30 (42.9%)		28 (40.0%)	42 (60.0%)	
	>60 y old	69 (11.6%)	46 (66.7%)	23 (33.3%)		37 (53.6%)	32 (46.4%)	
Participant	Self	460 (77.1%)	203 (44.1%)	257 (55.9%)	.198	135 (29.3%)	325 (70.7%)	.842
	Parent of child	137 (22.9%)	69 (50.4%)	68 (49.6%)		39 (28.5%)	98 (71.5%)	
Reason for dental attendance	First consult	253 (42.4%)	119 (47.0%)	134 (53.0%)	.153	68 (26.9%)	185 (73.1%)	.507
	Restorative visit	227 (38.0%)	109 (48.0%)	118 (52.0%)		72 (31.7%)	155 (68.3%)	
	Postoperative review	117 (19.6%)	44 (37.6%)	73 (62.4%)		34 (29.1%)	83 (70.9%)	
Gender	Female	303 (50.8%)	142 (46.9%)	161 (53.1%)	.516	82 (27.1%)	221 (72.9%)	.256
	Male	294 (49.2%)	130 (44.2%)	164 (55.8%)		92 (31.3%)	202 (68.7%)	
Ethnicity	Chinese	395 (66.2%)	178 (45.1%)	217 (54.9%)	.624	109 (27.6%)	286 (72.4%)	.195
	Indian/Others	82 (13.7%)	35 (42.7%)	47 (57.3%)		22 (26.8%)	60 (73.2%)	
	Malay	120 (20.1%)	59 (49.2%)	61 (50.8%)		43 (35.8%)	77 (64.2%)	
Resident	Singaporean citizen /Permanent resident	569 (95.3%)	256 (45.0%)	313 (55.0%)	.208	164 (28.8%)	405 (71.2%)	.4334
	Foreigner	28 (4.7%)	16 (57.1%)	12 (42.9%)		10 (35.7%)	18 (64.3%)	
Highest education	Secondary school and below	111 (18.6%)	85 (76.6%)	26 (23.4%)	<.001	65 (58.6%)	46 (41.4%)	<.001
	ITE/Polytechnic/JC	223 (37.4%)	74 (33.2%)	149 (66.8%)		47 (21.1%)	176 (78.9%)	
	Bachelor's degree and above	263 (44.1%)	113 (43.0%)	150 (57.0%)		62 (23.6%)	201 (76.4%)	
Housing type	Public housing (1 to 3-room)	71 (11.9%)	42 (59.2%)	29 (40.8%)	.048	33 (46.5%)	38 (53.5%)	.004
	Public housing (4- room)	211 (35.3%)	100 (47.4%)	111 (52.6%)		61 (28.9%)	150 (71.1%)	
	Public housing (≥5 room)	178 (29.8%)	73 (41.0%)	105 (59.0%)		42 (23.6%)	136 (76.4%)	
	Private condominium/Landed property	137 (22.9%)	57 (41.6%)	80 (58.4%)		38 (27.7%)	99 (72.3%)	
Employment status	Employed	432 (72.4%)	190 (44.0%)	242 (56.0%)	.210	109 (25.2%)	323 (74.8%)	<.001
	Unemployed/ Others	165 (27.6%)	82 (49.7%)	83 (50.3%)		65 (39.4%)	100 (60.6%)	
Monthly spend	<\$500	163 (27.3%)	76 (46.6%)	87 (53.4%)	.793	57 (35.0%)	106 (65.0%)	.052
	\$500 - \$1000	134 (22.4%)	62 (46.3%)	72 (53.7%)		44 (32.8%)	90 (67.2%)	
	\$1001 - \$1500	100 (16.8%)	44 (44.0%)	56 (56.0%)		21 (21.0%)	79 (79.0%)	
	\$1501 - \$2000	69 (11.6%)	27 (39.1%)	42 (60.9%)		14 (20.3%)	55 (79.7%)	
	>\$2000	131 (21.9%)	63 (48.1%)	68 (51.9%)		38 (29.0%)	93 (71.0%)	
Company reimbursement	No	390 (65.3%)	183 (46.9%)	207 (53.1%)	.359	124 (31.8%)	266 (68.2%)	.051
	Yes	207 (34.7%)	89 (43.0%)	118 (57.0%)		50 (24.2%)	157 (75.8%)	
Travel time	<15 min	56 (9.4%)	27 (48.2%)	29 (51.8%)	.067	20 (35.7%)	36 (64.3%)	<.001
	15-30 min	219 (36.7%)	87 (39.7%)	132 (60.3%)		57 (26.0%)	162 (74.0%)	
	31-45 min	173 (29.0%)	78 (45.1%)	95 (54.9%)		35 (20.2%)	138 (79.8%)	
	>45 min	149 (25.0%)	80 (53.7%)	69 (46.3%)		62 (41.6%)	87 (58.4%)	
Travel mode	Personal car	182 (30.5%)	74 (40.7%)	108 (59.3%)	.112	49 (26.9%)	133 (73.1%)	.545
	Private hire	65 (10.9%)	26 (40.0%)	39 (60.0%)		17 (26.2%)	48 (73.8%)	
	Public	350 (58.6%)	172 (49.1%)	178 (50.9%)		108 (30.9%)	242 (69.1%)	

* Chi-square test.

† McNemar test, comparing video consult and review.

costs for video reviews was 0.39 (95% CI = 0.20-0.72, $p = .003$) for those aged 41 to 50 years, 0.27 (95% CI = 0.13-0.54, $p < .001$) for those aged 51 to 60 years, and 0.20 (95% CI = 0.10-0.40, $p < .001$) for those aged >60 years (Table 4). The proportion of participants willing to pay at least the equivalent in-person costs for video reviews differed additionally by education and housing type (Table 4). Relative to participants with up to secondary school education, the adj. OR for the WTP for video reviews was 3.54 (95% CI = 1.96-6.47, $p < .001$) for those with a highest education level of ITE/polytechnic/JC, and 3.80 (95% CI = 2.18-6.68, $p < .001$) for those with a university degree (Table 4). Compared to those living in smaller 1-3 room public

housing, the adj. OR of the WTP for video reviews was higher among those living in 5-room or larger public housing (adj. OR: 2.44, 95% CI = 1.16-5.14, $p = .018$) (Table 4). No statistically significant associations between the other sociodemographic variables, travel patterns, reason for dental visit and WTP was observed (Supplementary Appendix Tables S4-S8).

The overall mean WTP for a video consult and review were SGD\$26.0 (95% CI = 24.6-27.4) and SGD\$13.8 (95% CI = 13.1-14.5), respectively. Older adults aged >60 years had a lower WTP for video consults (β -8.76, 95% CI = -13.91 to -3.60, $p < .001$) and video reviews (β -3.88, 95% CI = -6.37 to -1.39, $p = .002$) compared to those aged 21 to 30 years. Similarly,

Table 2 – Logistic regression of association between sociodemographic factors and acceptance of teledentistry (N = 597).

	Acceptance of video consult				Acceptance of video review			
	Unadjusted OR (95% CI)	P-value	Adjusted OR* (95% CI)	P-value	Unadjusted OR (95% CI)	P-value	Adjusted OR* (95% CI)	P-value
Age								
21-30 y old	Ref.				Ref.			
31-40 y old	0.51 (0.32-0.81)	.005			0.76 (0.43-1.32)	.339		
41-50 y old	0.38 (0.23-0.62)	<.001			0.36 (0.21-0.62)	<.001		
51-60 y old	0.30 (0.16-0.53)	<.001			0.30 (0.16-0.57)	<.001		
>60 y old	0.20 (0.11-0.36)	<.001			0.17 (0.09-0.33)	<.001		
Highest education*								
Secondary school and below	Ref.		Ref.		Ref.		Ref.	
ITE/Polytechnic/JC	6.58 (3.96-11.24)	<.001	4.69 (2.71-8.34)	<.001	5.29 (3.24-8.75)	<.001	3.48 (2.02-6.06)	<.001
Bachelor's degree and above	4.34 (2.66-7.28)	<.001	3.85 (2.26-6.74)	<.001	4.58 (2.87-7.39)	<.001	3.63 (2.16-6.15)	<.001
Housing type[†]								
Public housing (1 to 3- room)	Ref.		Ref.		Ref.		Ref.	
Public housing (4-room)	1.61 (0.94-2.79)	.088	1.34 (0.74-2.46)	.337	2.14 (1.23-3.72)	.007	1.97 (1.06-3.67)	.031
Public housing (≥5- room flat)	2.08 (1.20-3.67)	.010	1.63 (0.88-3.06)	.122	2.81 (1.57-5.04)	<.001	2.21 (1.15-4.26)	.017
Private condominium/ Landed property	2.03 (1.14-3.67)	.017	1.60 (0.81-3.15)	.175	2.26 (1.25-4.13)	.007	1.49 (0.73-3.03)	.275

* Adjusted for participant's age, participant, gender, ethnicity, nationality.

[†] Adjusted for participant's age, participant gender, ethnicity, nationality, highest education.

individuals aged 41 to 50 years and 51 to 60 years had a lower WTP for video consults and reviews compared to those aged 21 to 30 years ([Supplementary Appendix Table S9](#)).

A subgroup analysis was carried out among the participants who indicated that they were willing to accept video consults and video reviews. In this group, WTP at least the equivalent in-person costs were not significantly different between the various age groups, although the adj. OR of WTP at least the equivalent in-person costs for video reviews was higher for those with bachelor's degrees and above compared to those with up to secondary school education (adj. OR: 3.00, 95% CI = 1.19-7.31, $p = .017$) ([Supplementary Appendix Tables S10 and S11](#)).

Discussion

This is the first postpandemic study globally assessing patients' WTP for teledentistry relative to in-person costs for dental consults and reviews. This study showed that approximately half of the participants were willing to accept video consults and over two-thirds of participants were willing to accept video reviews postpandemic, which corroborates the findings of other studies conducted during the pandemic.^{19,23} Zain et al.¹⁹ reported that 44% of patients in a university in Malaysia would consider using a video call for dental consultations; while Saraswati et al. reported that 48% of participants in India were keen to try a teledentistry service.²³ A higher proportion of patients (79.3%) in England stated they would recommend video consultations to other individuals.²⁴ Of note, the proportion of participants who found the consultation helpful increased from 32.6% (before consult) to 55.0% after experiencing video consults themselves.²⁴ Given that the participants in this study did not have prior experience with teledentistry, a positive teledentistry experience may likely increase their acceptance of video consults.

The acceptance of teledentistry was lower for video consults compared to reviews. While studies suggest that there is good accuracy in the telediagnosis of oral health conditions and appropriateness of referrals among experienced dental professionals; the quality of video consults may be lower among mid-level clinicians and in the absence of high-quality diagnostic images,³ which may affect patients' confidence in teledentistry. Bahanan et al.²⁵ found that the perceived risks of teledentistry had a negative impact on participants' intention to adopt the technology. Furthermore, participants may not trust or value teleconsults for dentistry as dental care is conventionally perceived to require "hands-on" surgical interventions,²⁶ which ultimately will require face-to-face appointments after the video consultations.²⁷ On the contrary, patients were likely more receptive to video reviews as the purpose of such sessions are often the assessment of postoperative recovery, and thus may be perceived to be a viable substitute for in-person visits²⁸ with lower chances of misdiagnosis.²⁹ Participants may also value the convenience of a video review which eliminates the need for travelling and waiting at the dental clinic.³⁰ This may be corroborated in part by the study's finding of a higher acceptance of video reviews observed among participants who reported a longer travelling time to the dental clinic as compared to those who reported a short travelling time of less than 15 minutes, although there was insufficient evidence to reject the null hypothesis of no difference by travelling time (adj. OR: 1.58, 95% CI = 0.77-3.17, $p = .203$ for 15-30 minutes, and adj. OR: 2.15, 95% CI = 0.98-4.68, $p = .055$ for 31-45 minutes) ([Supplementary Appendix Table S7](#)). While a difference in the acceptance of video reviews by employment status was noted in the bivariate analysis ([Table 1](#)), no statistically significant difference was observed after adjusting for confounders ([Supplementary Appendix Table S4](#)).

The proportion of participants willing to pay at least the equivalent in-person costs was higher for reviews (79.6%) compared to consults (15.2%), although the mean WTP for

Table 3 – Proportion of participants (N = 597) willing to pay at least (\geq) in-person costs.

		Total	Video consult			Video review		
			WTP < in-person costs	WTP ≥ in-person costs	P-value*	WTP < in-person costs	WTP ≥ in-person costs	p-value*
Overall			506 (84.8%)	91 (15.2%)	N.A.	122 (20.4%)	475 (79.6%)	<.001 [†]
Age	21-30 y old	155 (26.0%)	126 (81.3%)	29 (18.7%)	.557	18 (11.6%)	137 (88.4%)	<.001
	31-40 y old	172 (28.8%)	145 (84.3%)	27 (15.7%)		21 (12.2%)	151 (87.8%)	
	41-50 y old	131 (21.9%)	116 (88.5%)	15 (11.5%)		33 (25.2%)	98 (74.8%)	
	51-60 y old	70 (11.7%)	60 (85.7%)	10 (14.3%)		23 (32.9%)	47 (67.1%)	
	>60 y old	69 (11.6%)	59 (85.5%)	10 (14.5%)		27 (39.1%)	42 (60.9%)	
Participant	Self	460 (77.1%)	393 (85.4%)	67 (14.6%)	.399	102 (22.2%)	358 (77.8%)	.054
	Parent of child	137 (22.9%)	113 (82.5%)	24 (17.5%)		20 (14.6%)	117 (85.4%)	
Reason for dental attendance	First consult	253 (42.4%)	212 (83.8%)	41 (16.2%)		49 (19.4%)	204 (80.6%)	.134
	Restorative visit	227 (38.0%)	200 (88.1%)	27 (11.9%)	.141	55 (24.2%)	172 (75.8%)	
	Postop review	117 (19.6%)	94 (80.3%)	23 (19.7%)		18 (15.4%)	99 (84.6%)	
Gender	Female	303 (50.8%)	264 (87.1%)	39 (12.9%)	.102	62 (20.5%)	241 (79.5%)	.987
	Male	294 (49.2%)	242 (82.3%)	52 (17.7%)		60 (20.4%)	234 (79.6%)	
Ethnicity	Chinese	395 (66.2%)	340 (86.1%)	55 (13.9%)	.162	79 (20.0%)	316 (80.0%)	
	Indian/Others	82 (13.7%)	71 (86.6%)	11 (13.4%)		16 (19.5%)	66 (80.5%)	.817
	Malay	120 (20.1%)	95 (79.2%)	25 (20.8%)		27 (22.5%)	93 (77.5%)	
Resident	Singaporean citizen /Permanent resident	569 (95.3%)	481 (84.5%)	88 (15.5%)	.787	114 (20.0%)	455 (80.0%)	.274
	Foreigner	28 (4.7%)	25 (89.3%)	3 (10.7%)		8 (28.6%)	20 (71.4%)	
Highest education	Secondary school and below	111 (18.6%)	100 (90.1%)	11 (9.9%)	.063	51 (45.9%)	60 (54.1%)	<.001
	ITE/Polytechnic/JC	223 (37.4%)	180 (80.7%)	43 (19.3%)		31 (13.9%)	192 (86.1%)	
	Bachelor's degree and above	263 (44.1%)	226 (85.9%)	37 (14.1%)		40 (15.2%)	223 (84.8%)	
Housing type	Public housing (1 to 3- room)	71 (11.9%)	59 (83.1%)	12 (16.9%)	.821	22 (31.0%)	49 (69.0%)	.001
	Public housing (4- room)	211 (35.3%)	182 (86.3%)	29 (13.7%)		55 (26.1%)	156 (73.9%)	
	Public housing (≥5- room)	178 (29.8%)	148 (83.1%)	30 (16.9%)		24 (13.5%)	154 (86.5%)	
	Private condominium/ Landed property	137 (22.9%)	117 (85.4%)	20 (14.6%)		21 (15.3%)	116 (84.7%)	
Employment status	Employed	432 (72.4%)	368 (85.2%)	64 (14.8%)	.638	72 (16.7%)	360 (83.3%)	<.001
	Unemployed/ Others	165 (27.6%)	138 (83.6%)	27 (16.4%)		50 (30.3%)	115 (69.7%)	
Monthly spend	<\$500	163 (27.3%)	133 (81.6%)	30 (18.4%)	.750	47 (28.8%)	116 (71.2%)	.003
	\$500-\$1000	134 (22.4%)	114 (85.1%)	20 (14.9%)		29 (21.6%)	105 (78.4%)	
	\$1001-\$1500	100 (16.8%)	87 (87.0%)	13 (13.0%)		12 (12.0%)	88 (88.0%)	
	\$1501-\$2000	69 (11.6%)	59 (85.5%)	10 (14.5%)		7 (10.1%)	62 (89.9%)	
	>\$2000	131 (21.9%)	113 (86.3%)	18 (13.7%)		27 (20.6%)	104 (79.4%)	
Company reimbursement	No	390 (65.3%)	329 (84.4%)	61 (15.6%)	.710	95 (24.4%)	295 (75.6%)	<.001
	Yes	207 (34.7%)	177 (85.5%)	30 (14.5%)		27 (13.0%)	180 (87.0%)	
Travel time	<15 min	56 (9.4%)	47 (83.9%)	9 (16.1%)	.950	10 (17.9%)	46 (82.1%)	.077
	15-30 min	219 (36.7%)	188 (85.8%)	31 (14.2%)		43 (19.6%)	176 (80.4%)	
	31-45 min	173 (29.0%)	145 (83.8%)	28 (16.2%)		28 (16.2%)	145 (83.8%)	
	>45 min	149 (25.0%)	126 (84.6%)	23 (15.4%)		41 (27.5%)	108 (72.5%)	
Travel mode	Personal car	182 (30.5%)	154 (84.6%)	28 (15.4%)		29 (15.9%)	153 (84.1%)	
	Private hire	65 (10.9%)	51 (78.5%)	14 (21.5%)	.299	11 (16.9%)	54 (83.1%)	.096
	Public	350 (58.6%)	301 (86.0%)	49 (14.0%)		82 (23.4%)	268 (76.6%)	

Reference:

Subsidised SGD\$30 (consult), SGD\$15 (review).

Private SGD\$70 (consult), SGD\$30 (review).

* Chi-square test.

[†] McNemar test, comparing video consults and video reviews.

Table 4 – Logistic regression of association between sociodemographic factors and WTP at least in person costs for teledentistry (N = 597).

	WTP at least in person costs for video consult				WTP at least in person costs for video review			
	Unadjusted OR (95% CI)	P-value	Adjusted OR ¹ (95% CI)	P-value	Unadjusted OR (95% CI)	P-value	Adjusted OR ¹ (95% CI)	P-value
Age								
21-30 y old	Ref.				Ref.			
31-40 y old	0.81 (0.45-1.44)	.471			0.95 (0.48-r1.85)	.868		
41-50 y old	0.56 (0.28-1.09)	.093			0.39 (0.20-r0.72)	.003		
51-60 y old	0.72 (0.32-1.54)	.418			0.27 (0.13-r0.54)	<.001		
>60 y old	0.74 (0.32-1.57)	.443			0.20 (0.10-r0.40)	<.001		
Highest education*								
Secondary school and below	Ref.		Ref.		Ref.		Ref.	
ITE/Polytechnic/JC	2.17 (1.11-4.60)	.031	2.26 (1.06-5.14)	.042	5.26 (3.11-9.05)	<.001	3.54 (1.96-6.47)	<.001
Bachelor's degree and above	1.49 (0.75-3.17)	.274	1.74 (0.82-3.95)	.166	4.74 (2.88-7.88)	<.001	3.80 (2.18-6.68)	<.001
Housing type [†]								
Public housing (1 - 3- room)	Ref.		Ref.		Ref.		Ref.	
Public housing (4-room)	0.78 (0.38-1.68)	.515	0.78 (0.37-1.73)	.521	1.27 (0.70-2.28)	.422	1.08 (0.55-2.08)	.813
Public housing (≥5- room flat)	1.00 (0.49-2.14)	.993	1.01 (0.47-2.28)	.977	2.88 (1.48-5.60)	.002	2.44 (1.16-5.14)	.018
Private condominium/ Landed property	0.84 (0.39-1.88)	.663	0.91 (0.38-2.23)	.830	2.48 (1.25-4.95)	.009	1.80 (0.79-4.10)	.159

* Adjusted for participant's age, participant, gender, ethnicity, nationality.

† Adjusted for participant's age, participant, gender, ethnicity, nationality, highest education.

reviews (SGD\$13.8) was lower than that for consults (SGD \$26.0). The findings on the proportion of patients willing to pay for teledentistry is aligned with that of other studies evaluating WTP for telemedicine for chronic conditions. A systematic review found that 19% to 70% of participants with chronic diseases were willing to pay for telemedicine services.²⁰ While no studies have assessed the WTP the cost of in-person dental services for teledentistry, Scherrenberg et al. reported that 70% of participants were willing to pay a similar quantum for cardiac telerehabilitation services as that for centre-based rehabilitation sessions.³¹ As with the level of acceptance of teledentistry, the WTP for video consults and reviews is likely affected by patients' perceptions, past experience with teledentistry, and exposure to educational programmes on the quality, risks and reliability of teledentistry.²⁰

This study clearly demonstrated that age affects the acceptance and WTP for both video consults and video reviews. There was a decreasing trend, with lower acceptance and WTP for video consults and reviews for older age groups. This may be due to differences in digital literacy and familiarity with technology.³² Barriers to teledentistry adoption such as technological anxiety, language barriers, and cognitive impairments have been shown to be more evident among older adults,⁹ although positive social influence can facilitate the increased uptake of teledentistry.²⁵ However, age had no impact on WTP among those who were willing to accept video consults and reviews, suggesting that the differences in WTP for video consults and reviews between younger and older individuals may be primarily affected by their acceptance of teledentistry. Participants who were visiting the hospital for postoperative dental reviews were also less likely to accept video reviews compared to those that were visiting for a first consult, possibly due to a preference for the status quo or due to concerns about their prior treatments.

Education and housing type were used as proxies for socioeconomic status (SES) and a higher acceptance and WTP

was observed with larger housing types (5-room or larger vs smaller public housing flats) and those with above secondary school level education. This is aligned with studies that suggest that WTP is associated with ability to pay,³³ and that individuals of lower SES are more price sensitive.³⁴ However, individuals in the highest SES group living in private residences had a lower acceptance and WTP for video reviews than those living in 5-room or larger public housing flats. Possible reasons could include greater data privacy concerns⁹ among those living in private residences. Further evaluations of the drivers of the uptake of teledentistry, participants' price sensitivity and the price elasticity of video consults and reviews can be conducted in future.

The main limitation of this study was that participants who indicated a zero WTP were not asked to provide a reason for their unwillingness to pay for teledentistry. Future studies should include follow-up questions to distinguish true zeros from protest zeros (eg, if the participant preferred full government subsidies) to ensure the validity of the elicited WTP for economic analyses.^{35,36} Nonetheless, the study mitigated the floor effects in the WTP by focusing on the proportion of participants who were willing to pay at least in-person costs. Additionally, this study elicited WTP via a bidding method, which may be subjected to range bias.³⁷ Nevertheless, the study sought to account for starting point and implied value bias by varying the value of the starting card through shuffling.³⁷

In conclusion, a higher proportion of participants were willing to undergo reviews via a video call compared to consults. The proportion of participants who were willing to pay at least the equivalent in-person costs for video reviews was also higher than that for video consults. Younger patients and those with a higher level of education had a higher willingness to accept teledentistry and had a higher WTP at least the equivalent in-person costs for video reviews.

Conflict of interest

None disclosed.

Author contributions

Sharon Hui Xuan Tan: Software, Data Curation, Investigation, Formal analysis, Writing—Original Draft, Visualisation. Ishreen Kaur Dhillon: Resources, Investigation, Writing—Review and Editing, Project administration. Mei Na Tan: Conceptualisation, Resources, Writing—Review and Editing. Rahul Nair: Conceptualisation, Methodology. Raymond Wong: Conceptualisation, Writing—Review and Editing. Yu Fan Sim: Conceptualisation, Resources, Data curation, Formal analysis, Writing—Review and Editing. Shijia Hu: Conceptualisation, Resources, Writing—Review and Editing. Catherine Hsu Ling Hong: Conceptualisation, Methodology, Investigation, Writing—Review and Editing, Supervision, Project administration.

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Consent for publication

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Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.identj.2025.02.004.

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