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Using the technology acceptance model to examine acceptance of telemedicine by cancer patients in an ambulatory care setting

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Abstract

Background: Telemedicine has demonstrated benefits for cancer patients including the potential to improve care coordination and patient outcomes. Since June 2020, teleconsultations have been implemented in the National Cancer Centre Singapore.

Objectives: This study aims to assess cancer patients acceptance of telemedicine as a complement to traditional in-person care and identify factors affecting their acceptance.

Methods: An online self-administered questionnaire was designed using a modified technology acceptance model (TAM) previously validated to predict acceptance of telemedicine by patients and factors affecting acceptance. Descriptive statistics were used to summarise data on demographic factors and TAM construct scores. Univariate and multivariate logistic regression were used to determine how demographics factors and TAM constructs influenced acceptance.

Results: Respondents (n = 278; mean age 59 years) were mostly female (67.6%), Chinese (86.3%) and received parenteral chemotherapy (72.6%). Technology access and confidence were generally moderate to high, while past telemedicine use was low (18%). Overall, more than half (59.7%) expressed acceptance. The odds of acceptance were significantly higher if respondents agreed that their healthcare access would improve by using telemedicine (OR 4.17, 95% CI 1.71–10.16) or they would have the necessary resources for using telemedicine (OR 4.54, 95% CI 2.30–8.97).

Conclusion: Acceptance of telemedicine was high amongst respondents. Facilitating conditions such as having necessary resources and perceived improved access were identified as main predictors of high acceptance. Telemedicine services should work to improve these aspects, leverage on advantages and address disadvantages brought up by patients.

Keywords

Telemedicine, telehealth, Covid-19, oncology

Introduction

Telemedicine is defined as the "systematic provision of healthcare services over physically separate environments via Information and Communications Technology (ICT)".[1] In oncology, telemedicine services can help cancer patients cope with long-term impact of the disease.[2] Examples of tele-oncology interventions include cancer tele-genetics, cancer-related tele-applications, remote chemotherapy supervision, symptom management, survivorship care, palliative care, telepathology, and increased access to cancer clinical trials.[3] Teleconsultations were introduced in the National Cancer Centre Singapore (NCCS) in June 2020

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and monthly consults have increased from 115 in June 2020 to 231 in May 2021.

Using telemedicine can support patients in self-managing their disease,[4] save time and money,[5,6] and improve timeliness of care.[7] Telemedicine can also alleviate caregiver burden, with minimal impact on existing care resources.[8] More recently, the COVID-19 pandemic has driven telemedicine use to continue delivering care remotely,[9] protecting patients from unnecessary exposure to the virus.[10] The value of implementing telemedicine also lies in its potential to refine coordination of patient-centred care.[11]

However, studies also reveal a large proportion of patients still prefer traditional in-person care to remote care whenever possible.[12,13,14] Numerous barriers such as lack of social support, lack of technological infrastructure and patients' preferences hampering adoption have been ascertained.[15] Notably, patient acceptance of telemedicine has been perceived as a major determinant of its widespread and sustained uptake,[16,17] and assessing it is important during initial development and evaluation of digital health interventions.[18] However, current acceptance among cancer patients is unclear. Acceptability studies so far have heterogeneous study methods and tended to focus on a sole intervention or cancer type, making it difficult to generalise findings to a wider range of services or patient population.[19] Most studies depict telemedicine as a standalone service, and it is unclear if patient acceptance would change if it is unambiguously positioned as an adjunct to traditional care instead.

Rapid technological advancement, coupled with lowered barriers to technology, may lead to a higher acceptance of telemedicine.[20] Encouragingly, other studies have previously found that the Internet is commonly used by cancer patients to search for disease-related information and support.[21,22,23] Finally, patients may be more receptive towards telemedicine if reassured that the traditional mode of in-person care would not be replaced completely.

Therefore, our study objectives were to: (1) assess cancer patients' acceptance of telemedicine as a complement to traditional in-person care in the ambulatory care setting, (2) identify factors which affect this acceptance, and (3) make recommendations based on evidence from study findings.

Methods

Study cohort and design

This was a cross-sectional study conducted at NCCS, a multidisciplinary cancer centre managing approximately 70% of all public-sector institution cancer patients in Singapore. Ethics review approval with exemption was obtained from the SingHealth Centralised Institutional Review Board (2020/2691).

Participants were recruited via convenience sampling. Patients included were aged 21 years old and above, proficient in English or Mandarin, and had attended at least one in-person consultation at NCCS. Participation was anonymous and voluntary.

Variables and outcome measures

A self-administered patient questionnaire was devised in three overarching parts. The first part collected information on demographics, technology-related factors and past telemedicine experience. Social support items were derived from the Duke Social Support and Stress Scale.[24] The second part was adapted from an extended technology acceptance model (TAM)[25,26] to measure telemedicine acceptance and factors affecting acceptance. The final part was on potential advantages and disadvantages of telemedicine[27] to further understand patient attitudes and hence propose better-tailored recommendations. Agreement with statements in the latter two parts were rated on a 5-point Likert scale from "strongly disagree" to "strongly agree". Respondents were also invited to provide an open-ended remark about their opinion on telemedicine.

The questionnaire was available in either English (Annex 1) or Mandarin (Annex 2). Both versions were hosted on the commercial e-survey platform Qualtrics (Qualtrics, Provo, UT, USA) and distributed via Short Message Service (SMS) to patients who had attended the Ambulatory Treatment Unit at least once in 2020. Data collection ran from 5 to 18 September 2020.

Technology acceptance model. Technology acceptance model is a validated model which predicts and explains user acceptance of new technologies (Figure 1).[26] "Perceived usefulness" is the degree to which the technology is believed to enhance job performance, while "perceived ease of use" is the degree to which use of the technology is seen as effortless.[26] These two variables demonstrated positive correlations with usage intention, the equivalent of user acceptance.[28] Therefore, measuring perceived usefulness and perceived ease of use by end-users enables one to predict their acceptance of a new technology.

Kamal et al.'s extended TAM model which had additional constructs: trust, social influence, facilitating conditions, technology anxiety, resistance to use, and perceived risk (Table 1) added to the original TAM. By accounting for more factors potentially affecting acceptance in the digital health context, the model attempted to measure patient acceptance more accurately. Each TAM construct was measured by 2 or 3 items (Annex 3 in Data Supplement). The extended TAM model which was chosen for the study was specifically validated to investigate telemedicine acceptance in patients.[25] (Figure 2)

Statistical analysis

Descriptive statistics were used to summarise demographic factors and TAM construct scores. A single value for each TAM construct was obtained by averaging scores of items measuring the same construct. Respondents were then categorised into different groups based on their mean usage intention score: those scoring above 3 would have minimally agreed with at least one of the statements measuring usage intention, and therefore were considered part of the "high acceptance" group. Conversely, scores equal to or less than 3 were considered "low acceptance".

To study factors affecting acceptance, univariate and multivariate logistic regressions were performed. The independent variables were TAM constructs and demographic factors, while the dependent variable was acceptance. TAM constructs were studied as continuous predictors while demographic factors were studied as categorical variables. The independent variables used for multivariate regression contained all TAM constructs and demographic factors significant in the univariate analysis. Odds ratios and their 95% confidence intervals were computed. All statistical analyses

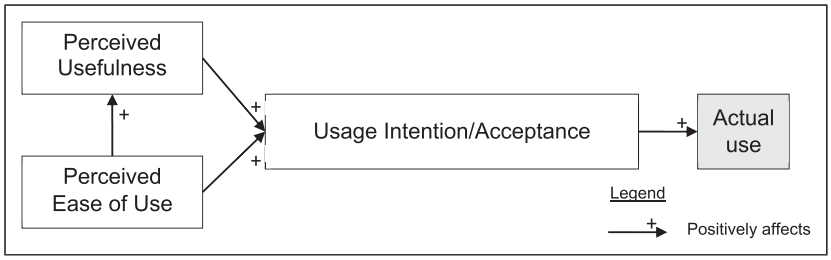

Figure 1. Diagram of original TAM.

Table 1. Definitions of additional TAM constructs.[25]

Construct	Definition
Trust	The extent to which a patient believes in the services offered by telemedicine
Social influence	The degree to which a patient thinks the people around him/her would want him/her to use telemedicine
Facilitating conditions	The presence of sufficient institutional and technical support for a patient to adopt telemedicine
Technology anxiety	The unease felt by a patient when using telemedicine for the first time
Resistance to use	Psychological barrier towards changes in the status quo brought about by telemedicine
Perceived risk	The extent to which a patient is uncertain about whether the outcomes of participating in a telemedicine-related activity are desirable

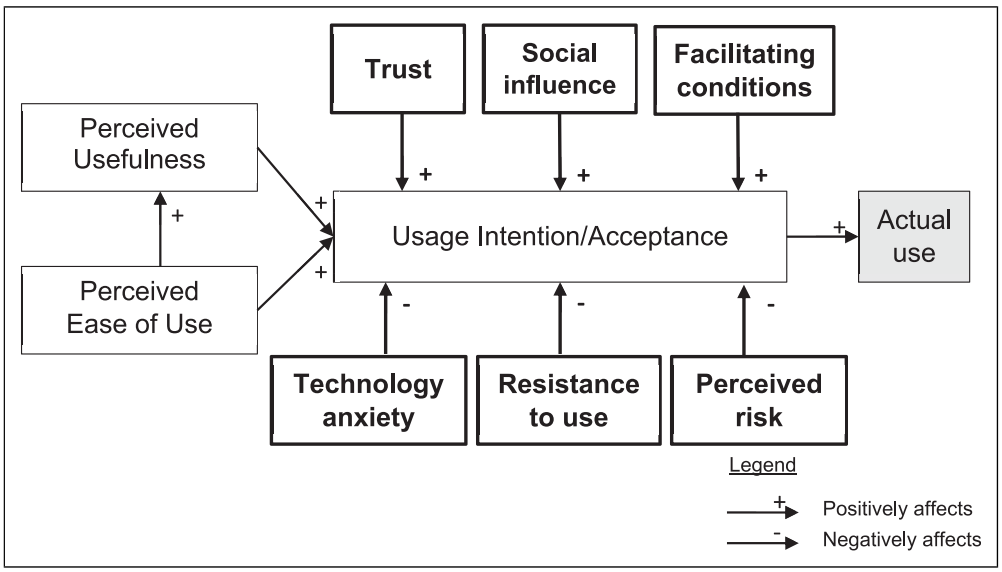

Figure 2. Diagram of extended TAM.

were conducted at a significance level of 0.05. Results were analysed in IBM SPSS Statistics for Windows, Version 23.0 (IBM Corp., Armonk, NY, USA).

Perceived advantages and disadvantages were reported descriptively as percentage agreement with each statement. Agreement was defined as a rating of "agree" or "strongly agree". For open-ended responses, thematic analysis was done to identify recurring themes which could supplement the discussion on perceived advantages and disadvantages. Quotes were labelled and presented in the results if they sufficiently reflected the main sentiment of similar responses.

Results

Demographics

Out of 3088 SMS recipients, 278 (9.0%) respondents completed the survey and were included in this study. The mean age of the respondents was 59 years old. Majority of respondents were female (188/278, 67.6%) and Chinese (240/278, 86.3%). Majority of respondents were receiving parenteral chemotherapy (159/219, 72.6%) and oral anti-cancer medications (56/219,25.6%) (Table 2). Majority of respondents had never used telemedicine before (228/278, 82.0%) (Table 3). These patients were largely satisfied with their experience (mean 3.98, SD 1.22).

All demographic factors were analysed for their influence on acceptance of telemedicine (Table 4). Significant predictors of high acceptance were monthly income >$3,500 (odds ratio [OR] 3.28, 95% CI 1.34–8.02; $p = 0.01$), private transport (OR 1.97, 95% CI 1.15–3.38; $p = 0.01$), Internet access (OR 1.90, 95% CI 1.16–3.12; $p = 0.01$), confidence in technology (OR 2.36, 95% CI 1.44–3.85; $p = 0.001$) and past telemedicine use (OR 2.28, 95% CI 1.38–5.78; $p = 0.005$).

Table 2. Demographics of respondents.

Demographic	Total (*n* = 278)		High acceptance[a] (*n* = 166)	
	n	%	*n*	%
Age (years)				
Mean (SD)	59.36 (10.77)		58.93 (11.05)	
≤54	96	34.5	64	38.6
55-64	87	31.3	44	26.5
≥65	95	34.2	58	34.9
Gender				
Female	188	67.6	116	69.9
Male	90	32.4	50	30.1
Ethnicity				
Chinese	240	86.3	142	85.5
Malay	21	7.6	15	9.0
Indian	10	3.6	3	1.8
Others	7	2.5	6	3.6
Highest education level				
Secondary/Pre-University	141	50.7	78	47.0
Tertiary/Postgraduate	100	36.0	66	39.8
Primary	37	13.3	22	13.3
Employment status				
Unemployed	153	55.0	86	51.8
Full time	97	34.9	62	37.3
Part time	28	10.1	18	10.8
Monthly income (SGD)				
<$1500	24	8.6	14	8.4
$1500–$2500	13	4.7	8	4.8
$2501–$3500	22	7.9	10	6.0
>$3500	44	15.8	35	21.1
Prefer not to say	22	7.9	13	7.8
Not applicable	153	55.0	86	51.8
Primary mode of transport to NCCS				
Public bus/train	111	39.9	57	34.3
Private vehicle	89	32.0	63	38.0
Taxi/private hire	76	27.3	45	27.1
Others	2	0.7	1	0.6
Payment category				
Singaporean/PR Subsidised	217	78.1	124	74.7
Singaporean/PR private	54	19.4	38	22.9
Non-resident	5	1.8	4	2.4
Foreign resident	2	0.7	0	0.0
Social support[b]				
Spouse/partner	155	55.8	96	57.8
Children/grandchildren	87	31.3	50	30.1
Brothers/sisters	34	12.2	20	12.0
Parents/grandparents	16	5.8	11	6.6
Other relatives	11	4.0	8	4.8
Neighbours/co-workers	3	1.1	2	1.2
Others	9	3.2	6	3.6
None	59	21.2	31	18.7
No. of supportive persons				
0	59	21.2	30	18.1
1	145	52.2	94	56.6
2	60	21.6	34	20.5
≥3	14	5.0	8	4.8
Treatment type[b]				
Parenteral chemotherapy	159	72.6	92	69.7
Oral anticancer medication	56	25.6	39	29.5
Others[c]	12	5.5	8	6.1
None	32	14.6	22	16.7

[a]Respondents who agree or strongly agree with at least one statement measuring usage intention.
[b]More than one option may have been selected.
[c]These include clinical trials, radiotherapy, medication for side effects and non-cancer hormone therapy.

Table 3. Satisfaction with telemedicine.

Variable	Total (*n* = 278)		High acceptance[a] (*n* = 166)	
	n	%	*n*	%
Past telemedicine use				
Yes	50	18.0	39	23.5
Satisfaction with telemedicine				
Very satisfied	22	44.0	20	51.3
Somewhat satisfied	16	32.0	10	25.6
Neither satisfied nor dissatisfied	4	8.0	3	7.7
Somewhat dissatisfied	5	10.0	4	10.3
Very dissatisfied	3	6.0	2	5.1
Mean (SD)[b]	3.98 (1.22)		4.08 (1.22)	

[a]Respondents who agree or strongly agree with at least one statement measuring usage intention.
[b]On a scale of 1 to 5, where higher values indicate greater satisfaction.

As technology confidence was a significant factor, univariate analyses were also conducted on each confidence item to pinpoint the more important technologies affecting acceptance (Table 5). Being confident in using video calls (OR 2.75, 95% CI 1.65–4.58; $p < 0.001$) was most associated with high acceptance, followed by finding the information on the Internet (OR 2.26. 95% CI 1.25–4.07; $p = 0.006$), wearable devices (OR 2.19, 95% CI 1.29–3.71; $p = 0.003$) and social network sites (OR 1.65, 95% CI 1.02–2.68; $p = 0.04$) (Table 6).

Table 4. Influence of demographics on acceptance of telemedicine.

Variable	Total (n = 278)		High acceptance[a] (n = 166)		Unadjusted odds ratio (95% CI)[b]	p value
	n	%	n	%		
Age (years)						
<65	183	65.8	108	65.1	Reference	
≥65	95	34.2	58	34.9	1.09 (0.66–1.81)	0.74
Gender						
Female	188	67.6	116	69.9	1.29 (0.78–2.15)	0.33
Male	90	32.4	50	30.1	Reference	
Ethnicity						
Chinese	240	86.3	142	85.5	Reference	
Non-Chinese	38	13.7	24	14.5	1.18 (0.58–2.40)	0.64
Highest education level						
Up to pre-university	178	64.0	100	60.2	Reference	
Tertiary and above	100	36.0	66	39.8	1.51 (0.91–2.52)	0.11
Employment status						
Unemployed	153	55.0	86	51.8	Reference	
Employed	125	45.0	80	48.2	1.39 (0.85–2.25)	0.19
Monthly income (SGD)						
Up to $3500	59	57.3	32	47.8	Reference	
>$3500	44	42.7	35	52.2	**3.28 (1.34–8.02)***	0.01
Primary mode of transport						
Public	190	68.3	103	62.0	Reference	
Private	88	31.7	63	38.0	**2.02 (1.18–3.47)***	0.01
Payment category						
Subsidised	217	78.1	124	74.7	Reference	
Non-subsidised	61	21.9	42	25.3	1.66 (0.91–3.04)	0.10
Social support						
Yes	219	78.8	136	81.9	1.58 (0.89–2.83)	0.12
No	59	21.2	30	18.1	Reference	
Treatment type						
Parenteral	159	57.2	92	55.4	Reference	
Not on parenteral	60	21.6	40	24.1	1.46 (0.78–2.71)	0.24
Missing data	59	21.2	34	20.5	N.A.	
Internet access						
Yes	174	62.6	114	68.7	**1.90 (1.16–3.12)***	0.01
No	104	37.4	52	31.3	Reference	
Technology confidence[c]						
Confident	154	55.4	106	63.9	**2.36 (1.44–3.85)***	0.001
Not confident	124	44.6	60	36.1	Reference	
Past telemedicine use						
Yes	50	18.0	39	23.5	**2.28 (1.38–5.78)***	0.005
No	228	82.0	127	76.5	Reference	

[a]Respondents who agree or strongly agree with at least one statement measuring usage intention.
[b]Values bolded and marked with an asterisk (*) are significant at the .05 level.
[c]Confidence is defined as a mean total confidence of ≥3, the equivalent of "quite confident" and above.

Table 5. Influence of individual technology confidence items on acceptance of telemedicine.

Technology confidence item[c]	Total (n = 278)		High acceptance[a] (n = 166)		Unadjusted odds ratio (95% CI)[b]	p value
	n	%	n	%		
Making phone calls						
Confident	257	92.4	157	94.6	2.09 (0.85–5.15)	0.10
Not confident	21	7.6	9	5.4	Reference	
Sending and receiving text messages						
Confident	251	90.3	150	90.4	1.02 (0.46–2.29)	0.96
Not confident	27	9.7	16	9.6	Reference	
Sending and receiving e-mails						
Confident	222	79.9	136	81.9	1.37 (0.759–2.47)	0.29
Not confident	56	20.1	30	18.1	Reference	
Finding information on the Internet						
Confident	221	79.5	141	84.9	**2.26 (1.25–4.07)***	**0.006**
Not confident	57	20.5	25	15.1	Reference	
Using social networking sites						
Confident	157	56.5	102	61.4	**1.65 (1.02–2.68)***	**0.04**
Not confident	121	43.5	64	38.6	Reference	
Using video calls						
Confident	182	65.5	124	74.7	**2.75 (1.65–4.58)***	**<0.001**
Not confident	96	34.5	42	25.3	Reference	
Using wearable devices						
Not confident	180	64.7	96	57.8	Reference	
Confident	98	35.3	70	42.2	**2.19 (1.29–3.71)***	**0.003**

[a]Respondents who agree or strongly agree with at least one statement measuring usage intention.
[b]Values bolded and marked with an asterisk (*) are significant at the .05 level.
[c]Confidence is defined as a rating of 1 = quite confident or 2 = extremely confident for the respective item.

Table 6. Mean TAM scores and their influence on acceptance of telemedicine.

TAM construct	Mean (SD)		Unadjusted odds ratio (95% CI)[b]	p value
	overall	high acceptance[a]		
Facilitators				
Perceived usefulness	3.47 (0.78)	3.80 (0.65)	**8.46 (4.77–14.97)***	**<0.001**
Perceived ease of use	3.45 (0.78)	3.75 (0.69)	**5.82 (3.56–9.51)***	**<0.001**
Facilitating conditions	3.45 (0.69)	3.74 (0.59)	**9.73 (5.34–17.76)***	**<0.001**
Social influence	3.10 (0.85)	3.39 (0.80)	**3.57 (2.35–5.41)***	**<0.001**
Trust	2.96 (0.56)	3.14 (0.48)	**5.83 (3.25–10.47)***	**<0.001**
Barriers				
Resistance to use	3.63 (0.79)	3.55 (0.78)	0.74 (0.54–1.01)	0.06
Technology anxiety	2.97 (0.91)	2.64 (0.87)	**0.30 (0.21–0.43)***	**<0.001**
Perceived risk	2.64 (0.74)	2.41 (0.73)	**0.28 (0.18–0.43)***	**<0.001**
Usage intention	3.41 (0.79)	3.92 (0.44)	N.A.	N.A.

[a]Respondents who agree or strongly agree with at least one statement measuring usage intention.
[b]Values bolded and marked with an asterisk (*) are significant at the .05 level.

Table 7. Multivariate regression on factors associated with telemedicine acceptance.

Independent variable	Adjusted odds ratio (95% CI)[a]	*p* value
Perceived usefulness	**4.84 (1.25–18.80)***	**0.02**
Perceived ease of use	1.83 (0.39–8.60)	0.45
Resistance to use	1.08 (0.34–3.46)	0.90
Trust	0.86 (0.17–4.39)	0.86
Technology anxiety	0.50 (0.17–1.44)	0.20
Facilitating conditions	**6.30 (1.16–34.28)***	**0.03**
Social influence	0.60 (0.14–2.50)	0.48
Perceived risk	0.33 (0.09–1.18)	0.09
Monthly income (>$3500)	1.08 (0.25–4.61)	0.92
Primary mode of transport (private)	2.12 (0.44–10.32)	0.35
Internet access (yes)	0.42 (0.09–1.85)	0.25
Technology confidence (confident)	1.18 (0.26–5.43)	0.83
Past telemedicine use (yes)	2.71 (0.20–37.02)	0.46

[a]Values bolded and marked with an asterisk (*) are significant at the .05 level.

Table 8. Multivariate regression on individual items of significant TAM constructs.

TAM statement	Agree[a]				Adjusted odds ratio (95% CI)[c]	p value
	Total (*n* = 278)		High acceptance[b] (*n* = 166)			
	n	%	*n*	%		
Perceived usefulness						
Using telemedicine would be useful **in my** daily routine.	156	56.1	129	77.7	2.13 (0.90–5.04)	0.08
Using telemedicine would improve **my** access **to** healthcare services.	148	53.2	127	76.5	**4.17 (1.71–10.16)***	**0.002**
Using telemedicine would improve **the** quality **of my** health care.	112	40.3	95	57.2	1.20 (0.50–2.89)	0.69
Facilitating conditions						
I would be able to have all the necessary resources **for using the telemedicine services**	160	57.6	130	78.3	**4.54 (2.30–8.97)***	**<0.001**
I would acquire sufficient knowledge **for using telemedicine service.**	160	57.6	123	74.1	1.52 (0.75–3.06)	0.24
Telemedicine will suit well **with my health care routine**	99	35.6	86	51.8	1.59 (0.68–3.73)	0.29

[a]Respondents who agree or strongly agree with the TAM statement in the first column.
[b]Respondents who agree or strongly agree with at least one statement measuring usage intention.
[c]Values bolded and marked with an asterisk (*) are significant at the .05 level.

Descriptive statistics of TAM constructs

Amongst the mean TAM scores and its influence on acceptance of telemedicine, the highest-scoring facilitator of acceptance was perceived usefulness (mean 3.47, SD 0.78), while the highest-scoring barrier was resistance to use (mean 3.63, SD 0.79). Compare to scores for overall cohort, mean scores of the high acceptance group were generally higher for facilitators and lower for barriers. All TAM constructs, except for resistance to use, were found to significantly affect acceptance in the univariate analysis.

Upon fitting all TAM constructs and significant demographic factors into a multivariate logistic regression model, significant factors affecting acceptance were facilitating conditions (OR 6.30, 95% CI 1.16–34.28; $p = 0.03$), followed by perceived usefulness(OR 4.84, 95% CI 1.25–18.80; $p = 0.02$) (Table 7). Two critical items identified were: "I would be able to have all the necessary resources for using the telemedicine services" (OR 4.54, 95% CI 2.30–8.97; $p < 0.001$) and "Using telemedicine would improve my access to healthcare services" (OR 4.17, 95% CI 1.71–10.16; $p = 0.002$).] (Table 8)

Perceived advantages and disadvantages of telemedicine

Almost all respondents (261/278, 93.9%) completed this optional section of the survey, while a small proportion gave open-ended responses (64/278, 23.0%). Respondents generally appreciated that there were both advantages and disadvantages to telemedicine, as a fair amount of agreement was observed across most statements.

For perceived advantages, respondents agreed extensively that telemedicine could enable them to receive more

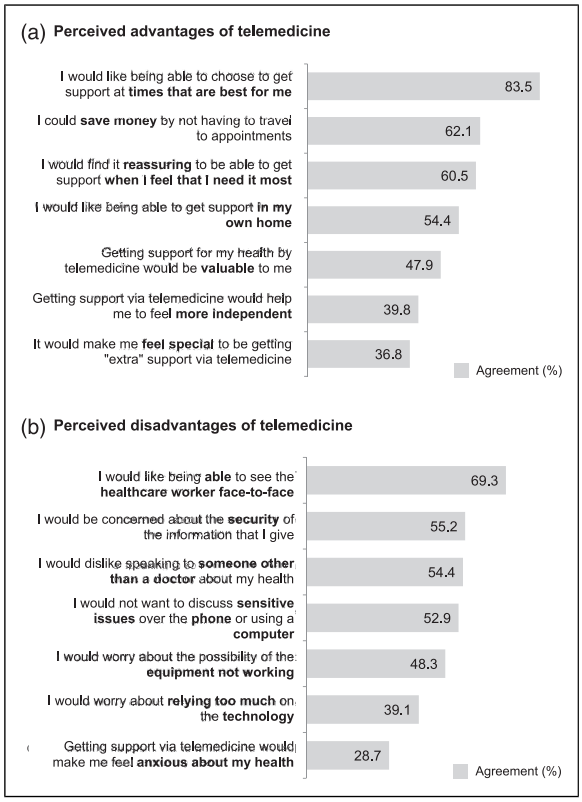

Figure 3. Percentage agreement with each perceived advantage and disadvantage of telemedicine (n = 261).

convenient support (218/261, 83.5%), enjoy cost savings from travel (162/261, 62.1%), and get more timely care to meet their needs (158/261, 60.5%) (Figure 3(a)). These advantages were frequently reiterated in the free responses.

Other advantages of telemedicine mentioned were regarding continued and safe care during the COVID-19 pandemic, access to overseas expertise, better flexibility in arranging consultations to accommodate other parties, and more cost-effective healthcare delivery.

The greatest disadvantage was the preference for "being able to see the healthcare worker face-to-face" (181/261, 69.3%) (Figure 3(b)). Respondents expressed strong opinions that telemedicine should remain as a complement to traditional care as it would not suit all situations. A major concern behind this was the apparent infeasibility of physical examinations if done remotely. Other disadvantages re-emphasised from those in Figure 3(b) include security issues such as verification of patient identity (144/261, 55.2%) and lack of adequate technical equipment (126/261, 48.3%). Additional worries raised were related to the patient's ability to use technology, extent of patient privacy in a teleconsultation, and language barriers. Lastly, numerous respondents stated that they were unaware of telemedicine or had not tried it before, making it challenging to form concrete opinions on the system.

Discussion

Demographics

This study found that more than half (59.7%) of cancer patients expressed "high acceptance" of telemedicine. Respondents who were more inclined to accept telemedicine had a higher monthly income and mainly took private transport to NCCS. Consistent with prior research, this may suggest that higher socioeconomic status positively predicts telemedicine acceptance.[29] Such patients may be more confident in having the resources to use telemedicine, which also affected acceptance in our study. Demographic factors which concur with past findings included technology-related, relating to Internet access, technology confidence (specifically video calls, Internet, and wearables), and past telemedicine use.[30]

Respondents who believed that telemedicine would offer them better healthcare access were significantly more likely to accept it. These findings add to current evidence that cancer patients deeply value healthcare which is convenient and readily accessible.[19] The complexity and seriousness of cancer can often be distressing, and thus receiving timely attention can help patients ease their worries and facilitate the recovery progress.[21]

Respondents who felt they did not have the necessary resources for telemedicine were significantly less likely to accept it. This is possibly connected with the finding that 37.4% of respondents lacked access to the Internet, which is an unexpectedly substantial proportion compared to other reports.[31] For instance, another recent study found that 26.5% of cancer patients in their sample did not have daily Internet access, while national statistics in 2019 suggested that 11% of the country's population did not use the Internet.[32] Another likelihood was that most respondents were unfamiliar with telemedicine, which could have caused uncertainty about what the "necessary resources" might have referred to specifically.

A major aim of a tele-oncology system should be to improve the convenience of accessing healthcare. Patients should find it easier and faster to choose a suitable consultation timing using telemedicine compared to physical clinic visits: this outcome could be a measure of the effectiveness of future tele-oncology services. One consideration for design is user friendliness, especially as confidence was subpar in using video calls. As illustrated by the mean sample age (59 years old), cancer patients are usually older. A straightforward navigation system and layout, as well as provision of instructions for use, may boost use confidence in older patients.[33]'

Within the minority of patients who used telemedicine before, mean satisfaction with the service was high. Past telemedicine use was also a significant driver of telemedicine acceptance on univariate analysis. In their free responses, several respondents mentioned not knowing enough about telemedicine to form a definite opinion on it. Patients might have initially set lower expectations for telemedicine if they were not familiar with it. Therefore, conducting a brief telemedicine trial for patients to explore the system informally is a plausible method of increasing familiarity and hence acceptance.[34] Technical assistance could be provided throughout the trial, especially for first-time or less confident users, to help raise confidence in using the service and its perceived usefulness.

Attention should be paid to the relatively limited Internet access of respondents, which will impede the success of telemedicine.[35] Close to half of respondents were also worried about the equipment for telemedicine not functioning. Nevertheless, general technology access is

anticipated to rise with time due to rapid advancements in expanding connectivity, which may promote reception to telemedicine.[8] Alternatively, future research could seek to confirm and investigate the reasons underlying this phenomenon: previously identified barriers include cost, lack of interest, or not perceiving Internet access as useful.[36,37] This would enable more targeted decision-making for addressing Internet access rates among patients.

Technology acceptance model constructs

Our findings re-emphasise that telemedicine should only complement and not replace traditional care. Out of all TAM constructs, resistance to use was the highest and did not significantly affect acceptance; this suggests that patients might still choose to receive care via standard practices if it suits them, regardless of acceptance status.[36] Respondents expressed a marked preference to see healthcare workers in-person, and felt that telemedicine would only suit seasoned, stable patients not requiring physical examinations or tests. Providers should reassure patients that telemedicine will be primarily used as an adjunct, and the option of physical clinic visits would always remain available.

Based on the multivariate logistic regression model, significant factors affecting acceptance to telemedicine were facilitating conditions and perceived usefulness. Though our sample had mean age of 59 years old, close to 65% of our patients were older than 65 years old. Based on published studies, elderly patients were reported to require facilitating conditions as a main factor to accepting telemedicine.[38,39] For telemedicine to occur, there is a need for sufficient knowledge and competency on operating the technological resource which result in an elderly patient's barrier to acceptance.[38]

The potential for technology to facilitate timely access to healthcare should be perceived as a useful advantage of telemedicine. Telemedicine would enable remote connections among patients and healthcare providers. As a result, this increases the accessibility for patients to healthcare providers. The notion of perceived usefulness in the acceptance to telemedicine from a healthcare providers' perspective has been published in various studies supporting its use in healthcare systems.[40,41]

Perceived advantages and disadvantages of telemedicine

Our findings also identify points for patient education, as most respondents seemed unfamiliar with telemedicine. Awareness of telemedicine could be spread via healthcare providers or print material, which were the top few preferred information sources for cancer patients.[22] Resources for telemedicine should be clearly specified, such as the platform's compatibility with various operating systems or devices. Concerns about online security were observed in more than half of respondents and should be addressed: patients could be reassured that recent guidelines reinforce telemedicine IT policies to adhere to professional standards and state laws such as the Personal Data Protection Act.[1]

Limitations

Limitations of our study include selection bias was likely, as respondents were recruited via convenience sampling. As data collection was web-based, this excluded patients who do not use a mobile phone or the Internet. Therefore, actual technology access and confidence may be lower than reported. The small response rate also suggests that non-response bias may exist, and the opinions of non-respondents remain unknown. Non-response rate was consistent with other web-based surveys on telemedicine[42,43,44]

Conclusion

Our study showed that acceptance of telemedicine was high amongst respondents.

Respondents were largely satisfied with their telemedicine experience. Facilitating conditions such as having necessary resources and perceived improved access were identified as main predictors of high acceptance. Amongst the mean TAM scores and its influence on acceptance of telemedicine, the highest-scoring facilitator of acceptance was perceived usefulness, while the highest-scoring barrier was resistance to use. For perceived advantages, respondents agreed extensively that telemedicine could enable them to receive more convenient support, enjoy cost savings from travel and get timelier care to meet their needs. Telemedicine services should work to improve these aspects, leverage on advantages and address disadvantages brought up by patients.

Author contributions

Chan Zhi Yao – data analysis, drafting and submission of manuscript
Lim Chen Fang – planning of study design, data collection, data analysis, drafting of manuscript
Leow Jo Lene - planning of study design, data analysis, drafting of manuscript
Chium Feng Yong – planning of study design, data collection, data analysis, drafting of manuscript
Lim Su Wen - planning of study design, data collection, data analysis, drafting of manuscript
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Tsi Min Yuan Moses - provision of data to be part of data collection, drafting of manuscript
Tan Ying Cong Ryan - data analysis, drafting of manuscript
Chew Sui Tjien Lita - planning of study design, data collection, data analysis, drafting of manuscript, final review of manuscript

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Availability of data

The datasets generated and/or analysed during the current study are available upon request with valid reason from corresponding author.

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Supplemental Material

Supplemental material for this article is available online.

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