Journal of Medical Systems (2019) 43: 293
https://doi.org/10.1007/s10916-019-1422-2

MOBILE & WIRELESS HEALTH

The Use of eHealth Applications in Hong Kong: Results of a Random-Digit Dialing Survey

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Received: 27 August 2018 / Accepted: 10 July 2019 / Published online: 23 July 2019

Abstract

eHealth has become popular worldwide, and it is transforming health care. However, studies examining the use of eHealth applications in the Chinese population are scarce. The study reports on the characteristics of eHealth applications in Hong Kong information and communication technology (ICT) users, their attitudes towards eHealth, and their reasons for not using eHealth applications. A cross-sectional random-digit dialing survey targeting adults using ICT was conducted in Hong Kong to elicit information on respondents' use of and attitudes towards eHealth. A total of 495 ICT users completed the survey, of whom 353 (71.3%) were eHealth users. A smartphone was the most frequent way of performing eHealth activities (71.7%). The most prevalent eHealth activity was reading about health/illness (86.4%), with 93.5% indicating that eHealth applications improved their understanding of health care issues. People with less education were less likely to use eHealth applications. Non-eHealth users indicated that the main reasons for not using eHealth applications were lack of interest in health information (49.3%) and lack of confidence in the reliability of online information (45.1%). Quality monitoring of health information available on ICTs and tailoring the design and readability are recommended to meet the needs of those seeking health resources and to promote eHealth. Evidence from the study demonstrates the potential of eHealth to improve the dissemination of health information in Hong Kong, and it provides a basis for improving eHealth integration.

Keywords eHealth · Internet · Smartphone · Health information · Cell phone · Survey · Information science

Introduction

eHealth, the use of information and communication technology (ICT) (e.g., computers and cellphones) for health [1], has become increasingly popular in health services and processes. It allows timely access to more resources needed for care [2], and it enables consumers and caregivers engage more actively in their care and health maintenance [3]. Systematic reviews have demonstrated the potential of computer and mobile technology to change health behaviors and to improve clinical outcomes [4, 5]. However, the quantity and quality of eHealth programs are limited [4, 5], and only a few pilot programs have been scaled up or translated into sustainable public health policies. Knowledge about people's use of and attitudes towards eHealth may provide insights for understanding critical factors that affect e-health applications adoption.

Nationwide surveys have been conducted in developed countries such as the United States [6–9] and those in Europe [10] to measure people's use of, attitudes towards,

This article is part of the Topical Collection on *Mobile & Wireless Health*

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and activities related to eHealth. However, population-based data in Asian populations, and specifically the Chinese, are scarce. To our best knowledge, only one population-based survey has been conducted in Taiwan [11], in which the prevalence of eHealth applications in Taiwan (64%) was comparable to that in Western countries (44%–70%) [6–10]. However, the survey did not examine people's attitudes towards eHealth and the perceived effects of eHealth, which are fundamental for identifying the extent to which the benefits of eHealth are being realized. Also, cultural variations such as the Western emphasis on patient autonomy vs. the Chinese emphasis on respect for authority [12] may contribute to different attitudes towards eHealth applications. Therefore, the transferability of the Western findings to the Chinese population cannot be assumed. More research is needed to examine the use of, attitudes towards, and activities related to eHealth in Chinese people. Such knowledge will assist health care providers, administrators, and policy makers to make informed decisions about formulating evidence-based eHealth policies in the Chinese population, as well as maximizing the potential of sustainable implementation of the policies to achieve strategic benefits.

Hong Kong, with the vast majority of the population being Chinese, is one of the most technologically advanced regions in the world. Hong Kong government statistics have shown high Internet usage and smartphone penetration: the percentage of persons aged 10 and over who used the Internet increased from 79.9% in 2014 to 87.5% in 2016, while the rate of smartphone penetration rose from 77.2% in 2014 to 85.8% in 2016 [13]. Our study provides the first evidence on the use of and attitudes towards eHealth applications in Hong Kong people using a random-digit dialing survey. The current study examines: (1) the characteristics of eHealth applications in Hong Kong, (2) people's attitudes towards eHealth (i.e., the perceived effects of eHealth, eHealth literacy, and future use of eHealth applications), (3) factors associated with using eHealth applications, and (4) the reasons for non-use.

Methods

Study Design

We conducted a cross-sectional telephone survey using random-digit dialing. Sampling was carried out by calling cellphone numbers randomly, assigning four random digits to the end of a start number range drawn from the numbering plan for telecommunications services published by the Hong Kong Office of the Communications Authority. A total of 1,500 cellphone numbers were sampled.

Participants

The target respondents of the survey were those aged 18 or over (excluding tourists and live-in domestic helpers), living in Hong Kong at the time of the survey, able to speak Cantonese or Mandarin, and ICT users (defined as having used ICTs in the past year).

Of the 1,500 cellphone numbers sampled, 314 were invalid. Among the 1,186 remaining, 438 were not reachable and 216 (with unknown eligibility) declined to participate in the study. In addition, 37 number holders were ineligible, because they did not speak Cantonese or Mandarin ($n = 16$), were under 18 ($n = 15$), or were not ICT users ($n = 6$). Thus, the final sample was 495 eligible ICT users.

Measurement

Respondents were classified as eHealth or non-eHealth users according to whether they used ICT for health purposes. A 20-item questionnaire that covered three domains (characteristics of eHealth applications, attitudes towards eHealth, and sociodemographic characteristics) was designed for eHealth users. In the case of non-eHealth users, their attitudes towards eHealth and demographics were assessed with the relevant domains (16 items in total) of the same questionnaire, with modified wordings for some statements. Moreover, their reasons for non-use were sought. Caution was observed during the design of the questionnaires to minimize refusals by keeping the length to a minimum while still collecting the necessary information. Appendix 1 lists the items included in the questionnaire. The details of each domain are summarized as follows:

Characteristics of eHealth applications (4 items)

The kinds of ICT from which health information was acquired were ranked in the order of frequency of use. The frequency of using eHealth applications was also examined. Furthermore, the means used to perform eHealth activity and the types of eHealth activities performed were assessed.

Attitudes towards eHealth (8 items)

Attitudes toward eHealth was measured in three aspects:perceived effects of eHealth, eHealth literacy, and future use of eHealth. The responses were measured on a four-point Likert-type scale ranging from 1 to 4 (1 = strongly agree, 2 = agree, 3 = disagree, 4 = strongly disagree). Participants' perceptions of the effects of eHealth were assessed by asking for their views on four statements modified from Baker et al. [6], focusing on understanding, self-management of healthcare needs, care-seeking, and lifestyle. To evaluate eHealth literacy, two items that were extracted from the eHealth Literacy Scale [14] were used. In addition, two items

were used to assess participants' future use of eHealth applications (i.e., intentions and plans to use eHealth) in the next two to three months.

Socio-demographic characteristics (8 items)

Information about age, gender, education, monthly income, self-rated health status, presence of disability/chronic illnesses, presence of chronic illnesses/disability in family, and caregiving status was collected.

Procedures

Ethical approval was obtained from the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster. The study was conducted between December 2015 and March 2016.

Content validity

To evaluate the content validity of the questionnaires, three researchers with extensive experience of using electronic innovations for health interventions reviewed the Chinese and English versions of the questionnaires. The reviewers rated the relevance of the items on a four-point Likert-type scale ranging from 1 (not relevant) to 4 (very relevant) [15]. The content-validity index (CVI), which includes the item-level (I-CVI) and the scale-level content-validity indices (S-CVI), was then computed to assess content validity. To calculate the I-CVI of an item, the number of raters rating the item as 3 (*relevant, but needs minor alteration*) or 4 (*very relevant*) was divided by the total number of raters. The S-CVI was calculated as the mean of I-CVIs of all the items in the scale. With the use of this averaging method, the S-CVI was calculated as 1.0, higher than the recommended standard [16]. In addition, suggestions on the Chinese translation of two items were considered to improve clarity.

Cognitive debriefing

Cognitive debriefing interviews were conducted with 10 Chinese ICT users [17]. The questions were read by the researchers to the participants, simulating a telephone survey. Minor item revisions were made to improve comprehensibility, and the modified items were reviewed by the three reviewers, who agreed with the revisions. The questionnaires were then finalized.

Data collection

Sample numbers were called one by one by trained interviewers. When phone contact was successfully established, the respondent was invited to undertake the interview process. The interviewer first explained the purpose of the survey, based on an information sheet, and reassured the respondents that data collected in the survey would be kept strictly confidential. Verbal consent was then sought to take part in the interview. If the first call was not successful, the interviewer was required to make at least five callbacks, at different times of the day (including the evening) and on different days of the week, to increase the chances of contact. Briefing and debriefing sessions were arranged during data-collection period to ensure that the interviewers understood the fieldwork procedures, and so that any problems encountered could be resolved and shared among interviewers. Survey administration averaged 15 min per respondent.

Statistical Analysis

All analyses were performed by means of SPSS version 20.0 with two-sided p values, and with values <0.05 considered statistically significant. The overall response rate was computed as the number of completed interviews divided by the number of reachable people. Sample characteristics were reported by descriptive analysis. Independent group t tests were computed for continuous variables, and chi-square tests were computed for categorical data to assess differences between the demographic characteristics of eHealth users and non-users. Next, descriptive statistics were calculated for details of the characteristics of eHealth applications and attitudes towards eHealth. Multiple logistic regressions were performed to explore whether demographic characteristics were associated with use of eHealth. The response variable (i.e., use of eHealth) was fitted simultaneously on several independent variables (age, gender, education, monthly income, self-rated health status, own chronic illness/disability, family chronic illness/disability, and being a caregiver). The results were supported by conditional odds ratios (CORs), and 95% confidence intervals were calculated.

Results

The response rate was 66.2% (i.e., 495 of 748 contacted individuals). Of the 495 completers, 353 (71.3%) were eHealth users (i.e., they had used ICT for health purposes) and 142 (28.7%) were non-eHealth users (i.e., they had never used ICT for health purposes). The sociodemographic characteristics of the 495 ICT users that made up the sample are shown in Table 1.

Table 1 Sociodemographics of eHealth and non-eHealth users

	Total ($n = 495$, 100%)		eHealth users ($n = 353$, 71.3%)		Non-eHealth users ($n = 142$, 28.7%)		*p value*[a]
	n	%	n	%	n	%	
Age (years)							<0.001**
18–29	163	32.9%	127	36.0%	36	25.4%	
30–49	190	38.4%	143	40.5%	47	33.1%	
≥50	142	28.7%	83	23.5%	59	41.5%	
Gender							0.010*
Male	213	43.0%	139	39.4%	74	52.1%	
Female	282	57.0%	214	60.6%	68	47.9%	
Education							<0.001**
None/primary	31	6.3%	12	3.4%	19	13.4%	
F1-F7	262	52.9%	171	48.4%	91	64.1%	
Associate degree	67	13.5%	53	15.0%	14	9.9%	
University or above	94	19.0%	80	22.7%	14	9.9%	
Monthly income							0.420
$9999 or less	25	5.1%	14	4.0%	11	7.7%	
$10000–29999	184	37.2%	125	35.4%	59	41.5%	
$30000 or more	159	32.1%	101	28.6%	58	40.8%	
Self-rated health Status							0.004*
Very good/good	249	50.3%	185	52.4%	64	45.1%	
Fair	217	43.8%	155	43.9%	62	43.7%	
Bad	29	5.9%	13	3.7%	16	11.3%	
Own chronic illness/ disability							<0.001**
Either/ both	101	20.4%	54	15.3%	47	33.1%	
No	394	79.6%	299	84.7%	95	66.9%	
Family chronic illness/ disability							<0.001**
Either/ both	109	22.0%	62	17.6%	47	33.1%	
No	386	78.0%	291	82.4%	95	66.9%	
Being a caregiver							0.001*
Yes	52	10.5%	27	7.6%	25	17.6%	
No	443	89.5%	326	92.4%	117	82.4%	

Note. The total number of responses for some variables is less than the total number of participants because of missing values on those variables

p-value[a] obtained by chi-square test; * = $p < 0.05$, ** = $p < 0.001$

Study Variables

Characteristics of eHealth applications

The ICT used most frequently was a smartphone, followed by a computer and then a tablet, as shown in Table 2. Most respondents (32%) reported using eHealth about once a month, while around 19.5% did so about once a week. Among the four methods to access health-related information, the web was used the most (84.7%), followed by instant messengers (42.2%), online videos (38.8%), and mobile applications (20.1%). The most prevalent of the five activities related to eHealth was reading about health/illness, with 86.4% of respondents reporting that they had done so. The other activities occurred with lower frequency, with ordering medicines/ health products being the least prevalent (17.6%; Table 2).

Attitudes towards eHealth

Table 3 reports the percentages of respondents (both eHealth users and non-eHealth users) who strongly agreed or agreed that eHealth had the indicated effects. Among users, 93.5% said that eHealth improved their understanding of healthcare issues. Fewer respondents said that it improved their ability to manage healthcare needs, affected their choice of healthcare providers, or had an influence over their lifestyle (79% to 80.1%). Similar results were obtained among non-users. More than 60% of respondents believed that using eHealth would improve their understanding of healthcare issues, while the percentage indicating effects on their ability to manage health needs and decisions about healthcare or lifestyle management ranged from 41.5% to 52.8%.

Table 2 Descriptive statistics related to the performance of eHealth activities among eHealth users

The most often used ICT for conducting eHealth activities	n (%)
Computer	86 (24.4)
Smartphone	253 (71.7)
Tablet computer	14 (4.0)
Frequency of conducting eHealth activities	**n (%)**
More than once per week	41 (11.6)
About once per week	69 (19.5)
About once per month	113 (32.0)
Every 2–3 months	60 (17.0)
Less than every 2–3 months	50 (14.2)
Less than every year	20 (5.7)
Means to conduct eHealth activities	**n (%)**
Instant messengers (e.g. WhatsApp, WeChat, email)	149 (42.2)
Online videos (e.g. YouTube)	137 (38.8)
World Wide Web	299 (84.7)
Mobile applications	71 (20.1)
eHealth activities conducted	**n (%)**
Approaching health professionals	93 (26.3)
Ordering medicines/ health products	62 (17.6)
Reading about health/ illness	305 (86.4)
Deciding whether to see a doctor	71 (20.1)
Preparing for an appointment	132 (37.4)

Two questions specifically asked about eHealth literacy (Table 3). Among users, more than 75% strongly agreed or agreed that they had the necessary skills to evaluate the health resources they found by using ICT, and they felt confident in using it to make health decisions. Of non-users, only 52.8% and 39.4% of respondents strongly agreed or agreed with the two statements, respectively.

Regarding future use of eHealth applications, more than 65% of users indicated that they intended and planned to conduct eHealth activities in the next two to three months, while only about 20% of non-users indicated that they intended and planned to do so (Table 3).

Factors associated with use of eHealth applications

Multiple logistic regression analyses were conducted to uncover the factors associated with eHealth use by comparing users with non-users. As shown in Table 4, education was significantly associated with the use of eHealth applications. People with primary education or less (COR = 0.057, 95% CI = 0.016, 0.206) and those with some secondary education (COR = 0.267, 95% CI = 0.118, 0.602) were less likely to use eHealth applications than those with a university education or higher.

Reasons for ICT users not to use eHealth applications

When the non-eHealth users were asked why they did not use eHealth applications, the majority reported that they had no interest in health information (49.3%), and they lacked confidence in the reliability of online information (45.1%). We found 18.3% of respondents expressing difficulty in finding relevant information, and 16.9% indicating other reasons, with eye fatigue associated with visual displays being the most prevalent. Relatively few respondents reported not using eHealth applications because of unawareness about such information sources (7%) or lack of technical support (7.7%).

Discussion

Principal Findings and Comparison with Prior Work

This is the first random-digit dialing survey to investigate the use of eHealth applications in Hong Kong and to examine whether sociodemographic factors predict the use of eHealth. In the present study, eHealth users comprised 71.3% of the sample, which is consistent with the proportion in population-based surveys conducted in European countries and Taiwan [10, 11]. Considering other studies conducted among Chinese people, a survey based on a convenience

Table 3 eHealth users' and non-eHealth users' attitudes towards eHealth

	eHealth users, n = 353	non-eHealth users, n = 142
Perception about effects of eHealth	**Agree or strongly agree, n (%)**	**Agree or strongly agree, n (%)**
1. eHealth improved my understanding of symptoms, conditions or treatments in which I was interested. (eHealth users) I believe using ICT for health information can improve my understanding of symptoms, conditions or treatment in which I am interested. (non-eHealth users)	330 (93.5)	92 (64.8)
2. eHealth improved my ability to manage my healthcare needs, reducing the frequency of visits to a doctor or other healthcare providers. (eHealth users) I believe using ICT for health information can improve my ability to manage my healthcare needs, reducing the frequency of visits to a doctor or other healthcare provider. (non-eHealth users)	281 (79.6)	62 (43.7)
3. eHealth led me to seek care from different doctors or health providers than I would otherwise have visited. (eHealth users) I believe using ICT for health information would lead me to seek care from different doctors or health providers than I would otherwise have visited. (non-eHealth users)	283 (80.1)	59 (41.5)
4. eHealth affected the way I manage my lifestyle. (eHealth users) I believe using ICT for health information can affect the way I manage my lifestyle. (non-eHealth users)	279 (79.0)	75 (52.8)
eHealth literacy		
1. I have the necessary skills to evaluate the health resources I find using eHealth applications.	273 (77.3)	75 (52.8)
2. I feel confident in using eHealth applications to make health decisions.	274 (77.6)	56 (39.4)
Future use of eHealth applications		
1. I intend to use eHealth applications in the next two to three months.	244 (69.1)	29 (20.4)
2. I plan to use eHealth applications in the next two to three months.	236 (66.9)	30 (21.1)

sample in Hong Kong in 2006 reported that 44% of the respondents had sought online health information [18], which is substantially lower than the figure revealed by our study. This is likely to be related to the remarkable increase use of ICTs by the general public over the last 10 years [13]. Interestingly, the prevalence in this study is much higher than that reported in a recent survey conducted using convenience sampling in Mainland China (26.4%) [19]. Although methodological differences should be taken into account, the marked difference in the prevalence of eHealth use between Mainland China and Hong Kong is worth exploration. First, the variation may be contributed to by the higher smartphone and Internet penetration in Hong Kong than in Mainland China [20]. In addition, the varied cultural values of the people in the two regions is a plausible explanation. Traditional Chinese culture emphasizes conformity to authority over individual autonomy, which is distinct from Western culture, which values patient autonomy and individual responsibility for one's health [12]. Hong Kong, having been a British colony for decades, is a highly Westernized city in China. Therefore, people in Hong Kong, who are more affected by Western culture, may be more eager to take the initiative to acquire health information themselves using ICT than those in Mainland China. The latter may be more inclined to visit the authorities (i.e., healthcare professionals) than actively to search for eHealth resources for health purposes. However, this explanation is conjectural, and it warrants further investigation.

Our findings revealed that smartphones are used more than computers for performing eHealth activities. Compared to computers, cellphones are more portable, more accessible, and easier to use [21]. These key features give cellphones the advantage over other ICT devices, resulting in a component of eHealth now commonly referred to as mHealth, i.e., the use of mobile technologies in medical and public health practices [22]. Smartphones, cellphones with more advanced technological capabilities [23], hold strong potential for enhancing health services support. Growing use of smartphones within the context of eHealth is anticipated.

The present study further confirms that reading health-related information is the main eHealth-related activity in Chinese people, as in previous studies conducted in Western countries [7, 8, 10]. The major perceived effect of eHealth is improvement in the understanding of health. The effects of eHealth on improving the use of healthcare, such as affecting care seeking or improving patients' ability to manage conditions on their own, are relatively less common, but they occur at higher prevalence rates than previously reported [6], revealing that ICTs not only have great potential for improving the

Table 4 Factors associated with use of eHealth applications

Variables	Total count	Count of eHealth users	Conditional odds ratio [95% confidence interval]	p-value
Age				
18–29	163	127	0.707 [0.324,1.540]	0.383
30–49	190	143	1.202 [0.640,2.259]	0.567
≥50	142	83	1	
Gender				
Male	213	139	0.632 [0.394,1.014]	0.057
Female	282	214	1	
Education				
None/primary	31	12	0.057 [0.016,0.206]	<0.001
F1-F7	262	171	0.267 [0.118,0.602]	0.001
Associate degree	67	53	0.572 [0.221,1.481]	0.250
University or above	94	80	1	
Monthly income				
$9999 or less	25	14	1.053 [0.401, 2.764]	0.917
$10000–29999	184	125	1.361 [0.821, 2.257]	0.232
$30000 or more	159	101	1	
Self-rated health status				
Very good /Good	249	185	2.065 [0.675,6.318]	0.204
Fair	217	155	2.771 [0.979,7.846]	0.055
Bad	29	13	1	
Own chronic illness/ disability				
Either/ both	101	54	1.181 [0.535,2.604]	0.681
No	394	299	1	
Family chronic illness/ disability				
Either/ both	109	62	1.410 [0.682,2.912]	0.354
No	386	291	1	
Being a caregiver				
Yes	52	27	0.734 [0.331,1.627]	0.447
No	443	326	1	

provision of health-related information, but they also have considerable influence on the public's use of healthcare. However, concern has been expressed about whether such effects will be beneficial or harmful, because quality control of online health resources is a challenge [24]. Furthermore, individuals vary widely in their health information literacy [25]. It is essential to regulate the quality of health information available in ICTs and to improve the public's critical appraisal of it to ensure that eHealth enhances care, rather than hindering it.

The reasons for not using eHealth among ICT users also serve as an important addition to the literature, as studies have emphasized the need to explore such reasons to attune clinical care and public health communication strategies [6, 8]. Despite this increasing importance, to date, there has been only limited investigation of this aspect. In the present study, problems with ease of use accounted for less than 20%, as reported by the non-eHealth user respondents. The major reason for not using eHealth was lack of interest in health information, likely due to an absence of healthcare needs. The second commonly reported reason was uncertainty about the reliability of the information acquired from ICT, consistent with the literature that trustworthy health information on the Internet is much valued by the public [26]. This finding again highlights the need to monitor the accuracy of health information available on ICTs. Also, it may be important to improve people's eHealth literacy, which is essential for effective use of online resources. In this way, more ICT users can benefit from eHealth resources in future.

Regarding factors associated with eHealth use, the current results found that individuals with secondary education or below are less likely to use eHealth than those with a university education. This provides empirical data to support a

qualitative study conducted in Hong Kong, which suggested that less educated respondents were less likely to surf the Internet for health purposes [27]. This finding is also consistent with several prior quantitative studies in Western countries [6–10]. Of note, people with low levels of education have identified health information as one of the primary types of information for which they would be eager to search [7]. This underlines the need for eHealth resources to be available, tailored, and distributed to these people. Information should be made easier or simpler to read and understand for the less educated, without extensive text or complex navigation.

Overall, our study findings have demonstrated the widespread usage of eHealth applications for reading health-related information among Hong Kong people, with the perceived effects most pronounced on improving the understanding of health. However, the potential of eHealth for facilitating healthcare service delivery seems to be limited. Furthermore, the use of eHealth applications is predicted by education level, and the reliability of health information available on ICTs is a common concern among the public. This study covers a current gap in the literature regarding eHealth usage in Asian populations, particularly the Chinese. In terms of practice, the findings can assist stakeholders to understand the areas of priorities and weaknesses when planning for e-health initiatives adoption and implementation in the community and in healthcare institutions. Further research is needed to examine strategies to enable eHealth to reach less receptive audiences, such as those with lower education levels. Interventions aiming at improving eHealth literacy in ICT users are important. Also, it would be useful to validate rating instruments for evaluation of the quality of health information on ICTs. In addition, the effects of eHealth applications on healthcare cost reduction in diverse populations are yet to be uncovered.

However, the study also has several limitations, one of which was the possibility of sampling bias as a result of participant self-selection. Also, the sampling frame was based on cellphone-number holders. While there may be people who are eHealth users but do not have a cellphone, the number is likely to be small. Another limitation is that the questionnaire items may not have been sufficient to cover the broad range of existing e-Health applications, because of their rapidly evolving nature and extensive scope. Finally, data on the frequency of ICT usage was not collected. Thus, its confounding effects on study findings could not be adjusted in the analysis.

The use of eHealth applications is widespread in Hong Kong. The findings highlights the potential of eHealth to improve health information dissemination. Continuing efforts to ensure an appropriate use of eHealth and to maximize its potential are recommended.

Acknowledgments The authors would like to thank Policy 21 for data collection assistance and all participants who took part in the study.

Authors' contributions Conceptualisation and design of the study: DSTC, CKLO, MKPS, KH, AT. Data collection and analysis: DSTC, CKLO, MKPS. Preparation of the manuscript: DSTC, CKLO, MKPS, KH, AT. Reviewing of the manuscript: DSTC, CKLO, MKPS, KH, AT. All authors read and approved the final manuscript.

Funding This work was funded by the Small Project Funding, The University of Hong Kong.

Compliance with Ethical Standards

The study was conducted in accordance with the ethical standards of the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster and with the 1964 Helsinki declaration and its later amendments. Informed consent was obtained from all individual participants included in the study.

Conflict of interest The authors declare that there is no conflict of interest.

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