Mobile Phone Access and Preferences Among Medical Inpatients at an Urban Canadian Hospital: A Cross-Sectional Survey

Maryam AboMoslim (maryam.abomoslim@ubc.ca)
The University of British Columbia

Niloufar Ghaseminejad-Tafreshi
University of British Columbia

Abdulaa Babili
London School of Hygiene & Tropical Medicine

Samia El Joueidi
The University of British Columbia

John A Staples
University of British Columbia

Penny Tam
University of British Columbia

Richard Lester
University of British Columbia

Research Article

Keywords: mHealth, eHealth, Virtual Care, Mobile Health, Mobile Phone Penetration, Cellular Access, Patient Engagement

Posted Date: June 23rd, 2021

DOI: https://doi.org/10.21203/rs.3.rs-598318/v1

Abstract

Background: Digital health interventions are increasingly used for patient care, yet little data is available on the phone access type and usage preferences of medical ward patients to inform the most appropriate digital interventions.

Methods: To learn about mobile phone ownership, internet access, and cellular use preferences among medical patients, we conducted a researcher-administered survey of patients admitted to five internal medicine units at Vancouver General Hospital (VGH) in January 2020.

Results: A total of 81 ward patients completed the questionnaire from the two survey dates. Of those, 63.0% owned their own mobile phone, an additional 22.2% had access to a mobile phone via a proxy (or an authorized third-party) such as a family member, and 14.8% did not own or have access to a mobile phone. All participants with mobile phone access had cellular plans (i.e., phone and text) ; however, a quarter of respondents did not have data plans with internet. 71.1% of men owned a mobile phone compared to only 52.8% of women. All participants at a 'high' risk of readmission had access to a mobile phone, either as phone-owners or proxy-dependent users.

Conclusion: Access to mobile phones among medical ward patients was high, but incomplete. More patients had cellular than data plans (i.e., internet and applications). Understanding patient-specific access is key to informing potential uptake of digital health interventions aimed at using patients' mobile phones (mHealth) from an effectiveness and equity lens.

Background

The use of mobile phone technology is becoming known as the fourth industrial revolution as devices have become more advanced, affordable, and an integral part of life. There are an estimated 4.78 billion unique mobile phone users among the current global population of over seven billion people, giving a penetration rate of approximately 61.43% [1, 2]. Furthermore, the digital health market revenue is expected to reach over $536.6 billion by the end of the year 2025 [3]. A subsection of this market, Mobile Health (mHealth), is defined by the World Health Organization (WHO) as "mobile and wireless technologies to support the achievement of health objectives" [4]. In the course of mHealth adoption as a healthcare delivery tool, mobile phones are increasingly viewed as medical devices by the WHO, U.S. FDA, hospital administration, healthcare providers, and insurance companies [5, 6]. This remarkable expansion of the digital market suggests a move towards mHealth innovations as the new standard of care and highlights the importance of evaluating mobile phone access among patients as they transition in and out of hospitals, community care and other healthcare settings.

Timely access to health information and care is important at the patient, provider, and health system levels given its impact on clinical outcomes, patient satisfaction, and continuity of care [7]. As such, innovative healthcare interventions have used mHealth platforms to improve medication adherence, post-discharge transitional care, patient-provider communication, and medical biomarkers such as

suppression of viral load among HIV positive individuals and serum glucose in individuals with diabetes [8–12]. Despite major advancement in the field of digital health, the uptake of digital interventions has remained below expectations [13, 14]. Some worry that the interventions used may not be best tailored to the patients' access and usage, especially among those that are most vulnerable and use a disproportionate amount of health care resources [15]. Although many patients have access to mobile phones, little is known about their usage preferences or limitations such as internet access, which may be restricted, particularly for marginalized populations for whom data plans are unaffordable [16]. As more mHealth interventions are being deployed in clinical settings [9, 10], it is important to capture and assess patients' usage and preferences to ensure equitable access to health care resources. To this end, patients' mobile phone use patterns and their sentiments towards mHealth interventions remain inadequately researched [9, 10, 17, 18]. We sought to learn about mobile phone ownership, internet access, and cellular use preferences among medical ward patients in order to inform the development of an mHealth intervention aimed at improving continuity of care and reducing unplanned post-discharge readmission to the hospital.

Methods

Study Sample and Setting

This study took place on the Internal Medicine Clinical Teaching Units (IM CTU) at Vancouver General Hospital (VGH), a quaternary-care teaching hospital with approximately 700 acute care beds located in the Canadian province of British Columbia (BC). The IM CTU has approximately 114 beds and provides acute medical care to over 4,400 individuals each year. Each unit is assigned Care Management Leads (CMLs) who follow a discharge-planning protocol that consists of the assignment of a Readmission Risk Assessment Score (RRAS) to each patient. Prior to discharge, patients receive a 'Low', 'Moderate', or 'High' RRAS depending on medical risk (such as an exacerbation of a chronic disease) and/or social risk (such as an inability to carry-out self-management activities). Hospital readmissions are not only costly to the healthcare system, but they often place a significant burden on patients and their families [19]. As a result, many programs focus on reducing the rate of readmission by implementing targeted interventions for those likely to return to the hospital after discharge [20]. At VGH, patients are referred to a Transitional Services Team (TST) and the Vancouver Community Case Management (VCCM). Additionally, patients deemed at 'moderate' to 'high' risk of readmission receive a follow-up phone call within 48 hours of discharge. Unfortunately, these post-discharge resources exclude those who are considered 'low' risk but may in fact require support after being discharged from the hospital due to other issues not captured by the RRAS such as low socioeconomic status [11].

Study Inclusion and Exclusion Criteria

We focused on patients who would potentially be discharged from hospital to independent living within the community. Inclusion criteria consisted of patients who were 1) admitted to one of five IM CTUs; 2) able and willing to provide informed consent; and 3) able to complete the survey in English or via the aid of a proxy (i.e., present spouse or child). The exclusion criteria consisted of patients who were 1) residents of Long-Term Care Facilities (LTCF) as they are not mHealth-dependent; or 2) unable to interact

with study staff as determined by the CMLs.

Data Sources

The survey was preloaded on a Wi-Fi-enabled tablet and administered orally by study staff. Members of the research team approached eligible participants in their room, obtained informed consent, and administered the survey, each of which took approximately 5 minutes to complete. Surveys were administered on January 7th, 2020 and January 23rd, 2020; a two-week period between survey dates was allotted to decrease chances of surveying the same pool of patients. Participants already surveyed on January 7th, and remaining in the hospital on January 23rd, were excluded the second time to avoid duplicate responses. Readmission Risk Assessment Score (RRAS) as well as patient demographic information, such as gender and year of birth, were accessed via the CMLs and de-identified using the assignment of a unique patient identifier. No incentive was provided for participating in this study. The survey form was built on and data was collected using Qualtrics software, Version January 2020.

Study Design and Protocol

This cross-sectional observational study consisted of a ten-question researcher-administered survey. The questions obtained information on patient mobile phone ownership, usage, preferences, and internet access. All survey questions were developed in English, designed by the mHealth Research Group, and audited by a physician, a CML nurse, a leading mHealth researcher and physician, and the Director of Strategic Initiatives at Vancouver Coastal Health (VCH). Research staff received training on the ethical administration of surveys, obtaining informed consent, infection control, etiquette of interacting with marginalized patients, and other study protocols to be upheld throughout the study. This study was approved by the University of British Columbia Behavioral Research Ethics Board.

Statistical Analysis

The initial target sample size was 342, however, this was reduced due to the onset of the COVID-19 pandemic restricting further access to medical wards and patient rooms. All data was double entered. Descriptive statistics are reported as median with interquartile range for continuous variables and as proportions for dichotomous variables.

Results

The total number of IM CTU patients present on day one and day two of the study were 107 and 113 respectively. Sixteen patients who were surveyed on day one remained on the ward on day two and were therefore excluded from the survey on day two. Other exclusions included patients from Long Term Care Facilities (LTCF) (n = 27), patients who were non-responsive and/or study staff were given instruction not to approach (n = 19), patients with a language barrier for whom no interpreter was present (n = 16), patients from a corrections facility (n = 2) given regulations regarding mobile phone ownership, and patients who were deceased (n = 2). Most common reasons for non-response of eligible patients were “patient asleep” at the time of surveying (n = 27) and reasons not captured (n = 12). Therefore, 81 of the 138 eligible patients were successfully surveyed. Figure 1 (Recruitment of participants at Vancouver General Hospital Internal Medicine Wards) outlines the patient flowchart from identification to the final cohort of participants.

Participant characteristics

Table 1 provides characteristics of study participants and eligible patients. The median age of respondents was 70 (30 to 98). The gender proportion amongst eligible participants was 51% female to 49% male, which was comparative to the final surveyed sample of 44% female and 56% male. 71% of participants were at a 'moderate' to 'high' risk of readmission to the hospital (44% moderate RRAS, 27% high RRAS).

Table 1
Characteristics of Survey Participants

Characteristics	Total (n = 81)	Male (n = 45, 55.6%)	Female (n = 36, 44.4%)
Age (Years)	70	69	73.5
Median	38–98	30–94	35–98
Range			
RRAS, n (%)	22 (27.2%)	10 (12.3%)	12 (14.8%)
High	36 (44.4%)	19 (23.5%)	17 (21.0%)
Moderate	17 (21.0%)	11 (13.6%)	6 (7.4%)
Low			
Note: RRAS, Readmission Risk Assessment Score; 6 (7.4%) with unspecified RRAS			

Mobile Phone Accessibility

Among study participants, 85.2% had access to a cellphone; 5% of whom shared it with a spouse or child, and 22% of whom had access through a proxy (an authorized third-party such as a spouse or child). Only 15% of participants had no phone access at all, whether shared, personal or via a proxy.

All participants with a mobile phone had a cellular plan; 92% (47/51) had a plan with texting and calling, and 8% had a plan with the ability to call only. Of those with a mobile phone, 25% did not have a smartphone required for app-based mHealth interventions. Tables 2a. and 2b. outline the usage and accessibility of patients.

Table 2a. Mobile phone access and use patterns among survey participants from general medical wards at the Vancouver General Hospital in January 2020: Phone access

Characteristics	Participants n (%)
Cellphone Access[a]	**69 (85.2%)**
Personal cellphone	46 (56.8%)
Shared* cellphone	4 (4.9%)
Access through Proxy	18 (22.2%)
No cellphone access	**12 (14.8%)**
Total	**81**

[a] Missing data: 1 didn't specify if shared or personal, *Shared with spouse, Proxy: Authorized individual.

Table 2b. Mobile phone access and use patterns among survey participants from general medical wards at the Vancouver General Hospital in January 2020: Phone and plan type

Of 51 Respondents with Personal/Shared Cellphone	n (%)
Type of Phone[b]	
Basic Phone (text/call)	8 (15.7%)
Feature phone (text/call/internet)	3 (5.9%)
Smartphone	38 (74.5%)
IOS	*21 (41.1%)*
Android	*16 (31.4%)*
Other	*1 (2.0%)*
Mobile phone plan	
Text and Call	47 (92.2%)
Call	4 (7.8%)
No	0 (0.0%)
Internet Access[c]	
Data and Wi-Fi	26 (50.9%)
Wi-Fi only	11 (21.6%)
None	12 (23.5%

[b] Missing data: 2 no answer, [c] Missing data: 2 no answer.

We also captured cellphone access and preferences in relation to patients' risk of readmission assessment score (RRAS). In this population, patients with an RRAS of 'moderate' or 'high' receive regular follow-up phone calls from the hospital transition team for a period of 30 days after discharge. Participants who had a 'High' Risk of Readmission Assessment Score (RRAS) all had some form of phone access, with a majority being phone owners. The 'Low' RRAS group had a similar distribution. The 'Moderate' risk of readmission group had the highest percentage of non-phone owners (Table 3).

Table 3. Distribution of phone ownership/access by Readmission Risk Assessment Score

RRAS	High	Moderate	Low	Unspecified
Demographic	**n= 22**	**n= 36**	**n= 17**	**n= 8**
Phone owner	16 (72.7%)	21 (58.3%)	11 (64.7%)	3 (37.5%)
Access via Proxy	6 (27.3%)	7 (19.4%)	5 (29.4%)	1 (12.5%)
No phone access	0 (0.0%)	8 (22.2%)	1 (5.9%)	2 (25.0%)

Note: RRAS, Readmission Risk Assessment Score

Cellphone ownership patterns

Table 4 summarizes the mobile phone ownership patterns among participants. The median age of phone owners (66 years) is notably lower than the median age of non-phone owners or proxy-dependent phone owners (84 years). Of the 81 survey respondents, 71.1% of men (32/45) and 52.8% of women (19/36) owned a mobile phone. More women (19.4%) than men (11.1%) did not have access to a phone at all, either personally or by proxy. Around 73% of the participants use their phone to text, with the majority of texters being women. Approximately a quarter of participants had previous experience texting a healthcare provider, most of which refers to one-way communication – meaning patients are only receiving texts in the form of reminders or information. Past use of a mobile phone to communicate with their HCP was 22.2% in this population over all (18/81), specifically lower amongst male respondents (19.0%) in comparison to women (32.2%); however, given the opportunity, both genders expressed that they would use mHealth services in the future, irrespective of age or accessibility.

Table 4. Distribution of gender and age of survey participants by phone ownership/access

Responses	Overall Median – (range)	Male (N_t=45)	Female (N_t=36)
Phone owners	51 (63.0%)	32 (71.1%)	19 (52.8%)
Age (years)	66 – (30 to 89)		
Access via proxy	18 (22.2%)	8 (17.8%)	10 (27.8%)
Age (years)	84 – (48 to 98)		
No phone access	12 (14.8%)	5 (11.1%)	7 (19.4%)
Age (years)	84– (33 to 94)		
Communicate via text	37 (72.5%)	22 (68.8%)	15 (79.0%)
Communicate with HCP via text	18 (22.2%)	8 (19.0%)	10 (32.2%)

Note: N_t = total number; HCP = Healthcare providers; SD = Standard deviation. this table present the breakdown of phone ownership type, distribution of texters, and patient who texted their HCP by gender.

The level of interest of those seeking the opportunity to text their HCP was high, with 72% (53/74) of participants said they would and 28% (or 21/74) said they would not. As for the specific reasons for communicating through text with their HCP, the responses were divided into 'one-way' and 'two-way' communication (Figure 2). One-way indicating that patients are only receiving text, and two-way meaning that patients can both send SMS to and receive SMS from their healthcare providers. Except for receiving appointment reminders (one-way), participants preferred two-way communication, which includes capacity for medication monitoring (such as reporting side effects and requesting prescription refills) (67.9%), and to discuss healthcare concerns (71.1%). Participants indicated that they would like the opportunity to receive one-way texts in the form of medication (60.4%) and appointment reminders (75.5%) and receiving standard health information relating to their condition (66.0%).

Figure 3 outlines the most frequently used communication methods. Voice call was the most preferred communication method by participants, followed by SMS/texting; with video call being the least preferred. Patients appear bimodal on video preferences, either second choice (30%) or last choice (70%) but not first. Preferences for text messaging was most varied.

Discussion

This cross-sectional survey study found that mobile phone ownership and access is high among medical ward patients; with less access in older patients and among women, but often offset by sharing phone access with proxies. In general, mobile phone owners also had cellular plans with the ability to call and to

text. Although many participants reported using their mobile phones regularly, few indicated texting an HCP in the past. Furthermore, we found cellphone-owners and non-cellphone owners alike would like the opportunity to use their mobile phones to communicate with an HCP during their care process. mHealth initiatives have the potential to bridge this gap in care by providing transitional services to all patients discharged from the hospital regardless of their RRAS. Accordingly, most participants with a 'high' and 'low' risk of readmission assessment score (RRAS) had access to a mobile phone which has important clinical implications in planning for mHealth services aimed at reducing hospital readmissions. The 'moderate' group had some variability, with about a quarter not having phone access at all.

In recent years, many medical technology developers focus on smart phone apps as a mode of service delivery. However, our data show that not all medical participants have access to internet on their mobile devices, nor may know how to use 'apps'. In fact, 25% (12/51) of participants could not access the internet through their phone, either through Wi-Fi or Data, limiting access to app/internet-dependent mHealth services. However, almost all participants can access a basic mobile device that can send and receive phone calls and text messages. Moreover, when asked about their preference of one-way versus two-way communication links with their HCP, there was a higher inclination for two-way communication with a participant stating that "one-way doesn't make sense. It must be two-way." In our short discussions with respondents, they indicated that the personalized responses of two-way communication provided more value. To elucidate, more patients indicated that they would prefer to text their HCP with medication-related concerns (which includes discussing side-effects, need for a refill, etc.), in comparison to receiving a medication reminder. One of the survey respondents expressed that the ability to schedule appointments virtually ('two-way; via text) in addition to appointment reminders ('one-way') is ideal. Although two-way communication was preferred, participants still would like the opportunity to receive one-way texts. This suggests that mHealth initiatives that aim to provide care through smart mobile apps, often requiring internet connection and depending on automatic-response or generic medical information, may be less effective in reaching certain patient populations. Indeed, in a meta-analysis, 2-way texting interventions were more effective than 1-way interventions at improvement medication treatment adherence [21]. Lastly, given the predominant participant preference for voice calls, it is plausible to presume that the uptake of complicated phone apps would be significantly low, particularly in the elderly population.

Another implication of this study is minimizing access barriers to innovative health care technology as our findings highlight possible inequities in access to care [22] considering that a higher percentage of male participants had access to mobile phones as compared to women and a younger median age attributed to phone owners in the study. These findings are in line with other studies that found women to be disadvantaged in terms of mobile internet use and less likely to own a mobile phone [23, 24]. Gordon and Hornbrook [25] point to a digital divide between older populations regarding device ownership and health information preferences. However, in a study we conducted in Kenya among HIV participants, women actually had equal or more mHealth participation than their male counterparts [26]. This may point to a potential preference for mHealth that involves text messages among certain demographics, and perhaps other modalities for others. Furthermore, cellphone penetration rates were lower in our

participant group in comparison to the rest of Canada [2]. Reasons contributing to this discrepancy may be that our participants were older, or may be from marginalized communities.

The preference for female participants to text is consistent with other literature, which reports that more female than male participants are “mediated communicators” who more habitually communicate using their mobile phones, and have a higher preference for direct two-way communication with their health care team [27]. When asked about the opportunity to text their HCPs, only 17% of women declined, compared to 33% of men who did. Notably, a male respondent enthusiastically reported that mobile phone use in healthcare “is the future” and that although he is unable to text, his family/female spouse would utilize an mHealth intervention on his behalf. This sentiment was shared by other participants. These data provide initial indication that gender may affect the inclination to using mHealth interventions, where a subgroup (e.g., males or low RRAs) are less inclined to using an mHealth intervention. This is useful information for researchers and clinical teams to know in terms of uptake strategies and engaging different subgroups as needed.

Our study has an above average survey response rate, of 59%, which is a strength of this study [28]. The high response rate was likely due to the distribution method, where surveys were researcher administered direct to patients on a ward. We aimed to ensure the highest inclusion of patients-in-ward as possible, including patients who may have had limitations in reading or answering the survey, understanding the survey questions, using the tablet/phone, and other potential hindrances to completing the survey on their own. Another strength of our study is that the survey was audited by a consortium of health professionals, including an mHealth professional, an HCP working on the ward, and a member from the hospitals initiatives team to ensure relevancy to study objectives and the hospital’s priorities for patient care.

This study has several limitations that may introduce bias and reduce generalizability. First, our sample size was limited due to research activity cessation in response to the COVID-19 pandemic. That said, given the boom in digital health and virtual care, the results of these at-risk hospitalized medical patients may be even more relevant. Second, we did not screen patients with language barriers as it prevented them from understanding survey questions or providing informed consent. In future iterations of this study, we aim to utilize interpretation services to better understand the access and phone preferences of this population. Third, although initial demographic comparisons show no significant differences between participant responders and non-responders in terms of gender and age, with a 59% response rate, we expect some nonresponse bias (See Table 1). Finally, we surveyed patients in the IM CTUs where the results may not be generalizable to other urban hospital inpatients, such as surgical patients. This study population was conveniently sampled which may have introduced biases through patient selection. This specific population was selected as they are part of an active and already funded project by the UBC mHealth Research Group. Future iterations of this survey should include a variety of inpatient hospital wards in an urban clinical setting.

Conclusion

mHealth solutions are useful medical innovations in the delivery of care, but concerns hindering adaption involve mobile phone ownership and disparities in cellular and internet access among patient populations. This study outlines an assessment of patient's mobile phone access and usage preferences where cellular service access among Canadian acute medical ward patients was high yet diverse. Insight gained through understanding of mobile phone use patterns of patient populations may support health service planners to develop interventions that are sustainable, current, and patient-centered. Such considerations are even more critical during the current global pandemic as vulnerable and marginalized communities face disparities in access to care and unique challenges in accessing community resources. We hope findings from this study can be employed to inform interventions aimed at supporting vulnerable populations around the world. The contribution of this paper is in uncovering positive values on mobile phone penetration and cellular service access. Furthermore, it offers a detailed breakdown of gender and age disparities in access and mobile phone usage patterns. This has implications for the use of mobile phones for the provision of healthcare and development.

Abbreviations

BC: British Columbia
CML: Care Management Lead
IM CTU: Internal Medicine Clinical Teaching Units
LTCF: Long-Term Care Facilities
mHealth: Mobile Health
RRAS: Readmission Risk Assessment Score
SD: Standard Deviation
TST: Transitional Services Team
VCCM: Vancouver Community Case Management
VGH: Vancouver General Hospital
VCH: Vancouver Coastal Health

U.S. FDA: United States of America Food and Drug Administration (FDA)

WHO: World Health Organization

Declarations

Ethics approval and consent to participate

Ethics approval was obtained from the University of British Columbia Behavioral Research Ethics Board (H19-03366). Participants were given the option to read the consent cover letter or be read it by one of the researchers, per UBC's guidelines on survey research. Consent was officially obtained by the following line: "By completing the survey, you are consenting to participate in this research."

Consent for publication

Not applicable.

Availability of data and materials

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

Competing interests

Dr. Richard Lester has founded WelTel International mHealth Society (a nonprofit organization) and WelTel Inc (a company) to help develop and scale the technologies to deliver the research-based services and has an interest in both organizations.

Funding

This study was funded by Canadian Institute of Health Research (CIHR) with in-kind support from Vancouver Coastal Health Research Institute (VCHRI). CIHR funding was used to protect the research time of authors MAM, SJ and NGT. In-kind support from VCHRI was from authors RL, PT, JS.

Author contributions

MAM and RL contributed to the conception and design of the study, with support from PT and JS. Authors MAM, AB, and SJ conducted the interviews and collected the qualitative data. MAM led the data analysis, interpretation of findings and drafting of the manuscript with significant contributions from NGT, AB, and RL. All authors have read and approved the final version of this manuscript.

Acknowledgments

We thank Jennifer Peterson for her guidance and support throughout this study, the CML team for their cooperation and Susan Seaman for her input on the survey.

References

1. Fourth Industrial Revolution | World Economic Forum [Internet]. [cited 2021 Apr 2]. Available from: https://www.weforum.org/focus/fourth-industrial-revolution
2. Smartphone Ownership Is Growing Rapidly Around the World, but Not Always Equally | Pew Research Center [Internet]. [cited 2021 Apr 2]. Available from: https://www.pewresearch.org/global/2019/02/05/smartphone-ownership-is-growing-rapidly-around-the-world-but-not-always-equally/
3. Market Research Reports. Digital Health Market Revenue of US$536.6 bn by the end of 2025: Technology Advancement and Innovation - Press Release - Digital Journal [Internet]. Market Research Reports. 2017 [cited 2021 Apr 2]. Available from: http://www.digitaljournal.com/pr/3518555
4. Ryu S. mHealth: New Horizons for Health through Mobile Technologies: Based on the Findings of the Second Global Survey on eHealth (Global Observatory for eHealth Series, Volume 3). Healthc Inform

Res [Internet]. 2012 [cited 2021 Apr 2];18(3):231. Available from: http://www.who.int/about/

5. Salud OM de la. WHO | Medical device – full definition [Internet]. World Health Organization. 2013 [cited 2021 Apr 2]. p. 1. Available from: https://www.who.int/medical_devices/full_deffinition/en/
6. About the Digital Health Center of Excellence | FDA [Internet]. [cited 2021 May 10]. Available from: https://www.fda.gov/medical-devices/digital-health-center-excellence/about-digital-health-center-excellence
7. Starfield B, Shi L, Macinko J. Contribution of primary care to health systems and health [Internet]. Vol. 83, Milbank Quarterly. Milbank Memorial Fund; 2005 [cited 2021 Apr 2]. p. 457–502. Available from: /pmc/articles/PMC2690145/
8. Lester RT, Ritvo P, Mills EJ, Kariri A, Karanja S, Chung MH, et al. Effects of a mobile phone short message service on antiretroviral treatment adherence in Kenya (WelTel Kenya1): A randomised trial. Lancet. 2010 Nov 27;376(9755):1838–45.
9. Larbi D, Randine P, Årsand E, Antypas K, Bradway M, Gabarron E. Methods and evaluation criteria for apps and digital interventions for diabetes self-management: Systematic review. J Med Internet Res. 2020;22(7):1–13.
10. Wang Y, Xue H, Huang Y, Huang L, Zhang D. A Systematic Review of Application and Effectiveness of mHealth Interventions for Obesity. Adv Nutr. 2017;8(3):449–62.
11. Hu J, Gonsahn MD, Nerenz DR. Socioeconomic status and readmissions: Evidence from an urban teaching hospital. Health Aff. 2014 Aug 2;34(5):778–85.
12. Arora S, Peters AL, Burner E, Lam CN, Menchine M. Trial to examine text message-based mhealth in emergency department patients with diabetes (TExT-MED): A randomized controlled trial. Ann Emerg Med [Internet]. 2014;63(6):745–754.e6. Available from: http://dx.doi.org/10.1016/j.annemergmed.2013.10.012
13. Nurgalieva L, O'Callaghan D, Doherty G. Security and Privacy of mHealth Applications: A Scoping Review. IEEE Access. 2020;8:104247–68.
14. Gurupur VP, Wan TTH. Challenges in implementing mHealth interventions: a technical perspective. mHealth. 2017;3:32–32.
15. Huygens MWJ, Vermeulen J, Swinkels ICS, Friele RD, Van Schayck OCP, De Witte LP. Expectations and needs of patients with a chronic disease toward self-management and eHealth for self-management purposes. BMC Health Serv Res [Internet]. 2016 Jul 8 [cited 2021 May 2];16(1):232. Available from: http://bmchealthservres.biomedcentral.com/articles/10.1186/s12913-016-1484-5
16. Jennings L, Lee N, Shore D, Strohminger N, Allison B, Conserve DF, et al. U.S. Minority Homeless Youth's Access to and Use of Mobile Phones: Implications for mHealth Intervention Design. J Health Commun [Internet]. 2016 Jul 2 [cited 2021 Apr 2];21(7):725–33. Available from: https://www.tandfonline.com/doi/full/10.1080/10810730.2015.1103331
17. Stevenson JK, Campbell ZC, Webster AC, Chow CK, Tong A, Craig JC, et al. Ehealth interventions for people with chronic kidney disease. Cochrane Database Syst Rev. 2019;2019(8).

18. Choi WS, Choi JH, Oh J, Shin IS, Yang JS. Effects of Remote Monitoring of Blood Pressure in Management of Urban Hypertensive Patients: A Systematic Review and Meta-Analysis. Telemed e-Health. 2020;26(6):744–59.
19. All Patients Readmitted to Hospital · CIHI [Internet]. [cited 2021 Apr 4]. Available from: https://yourhealthsystem.cihi.ca/hsp/inbrief.#!/indicators/006/all-patients-readmitted-to-hospital/;mapC1;mapLevel2;provinceC5001;trend(C1,C5001);/
20. Brooten D, Brown LP, Munro BH, York R, Cohen SM, Roncoli M, et al. Early Discharge and Specialist Transitional Care. Image J Nurs Scholarsh [Internet]. 1988 [cited 2021 Apr 4];20(2):64–8. Available from: https://pubmed.ncbi.nlm.nih.gov/3378819/
21. Wald DS, Butt S, Bestwick JP. One-way versus two-way text messaging on improving medication adherence: Meta-analysis of randomized trials. Am J Med [Internet]. 2015 Oct 1 [cited 2021 May 10];128(10):1139.e1-1139.e5. Available from: https://pubmed.ncbi.nlm.nih.gov/26087045/
22. Women & Mobile: A Global Opportunity A study on the mobile phone gender gap in low and middle-income countries [Internet]. [cited 2021 Apr 3]. Available from:
23. Khatun F, Heywood AE, Hanifi SMA, Rahman MS, Ray PK, Liaw ST, et al. Gender differentials in readiness and use of mHealth services in a rural area of Bangladesh. BMC Health Serv Res [Internet]. 2017 Aug 18 [cited 2021 May 2];17(1):573. Available from: http://bmchealthservres.biomedcentral.com/articles/10.1186/s12913-017-2523-6
24. Striving and Surviving: Exploring the Lives of Women at the Base of the Pyramid [Internet]. [cited 2021 May 2]. Available from: www.mwomen.org
25. Gordon NP, Hornbrook MC. Older adults' readiness to engage with eHealth patient education and self-care resources: A cross-sectional survey. BMC Health Serv Res [Internet]. 2018 Mar 27 [cited 2021 May 2];18(1):220. Available from: https://bmchealthservres.biomedcentral.com/articles/10.1186/s12913-018-2986-0
26. van der Kop ML, Karanja S, Thabane L, Marra C, Chung MH, Gelmon L, et al. In-Depth Analysis of Patient-Clinician Cell Phone Communication during the WelTel Kenya1 Antiretroviral Adherence Trial. PLoS One [Internet]. 2012 Sep 25 [cited 2021 May 10];7(9). Available from: https://pubmed.ncbi.nlm.nih.gov/23049928/
27. Kimbrough AM, Guadagno RE, Muscanell NL, Dill J. Gender differences in mediated communication: Women connect more than do men. Comput Human Behav. 2013 May 1;29(3):896–900.
28. Baruch Y, Holtom BC. Survey response rate levels and trends in organizational research. Hum Relations [Internet]. 2008 Aug 1 [cited 2021 May 1];61(8):1139–60. Available from: http://journals.sagepub.com/doi/10.1177/0018726708094863

Figures

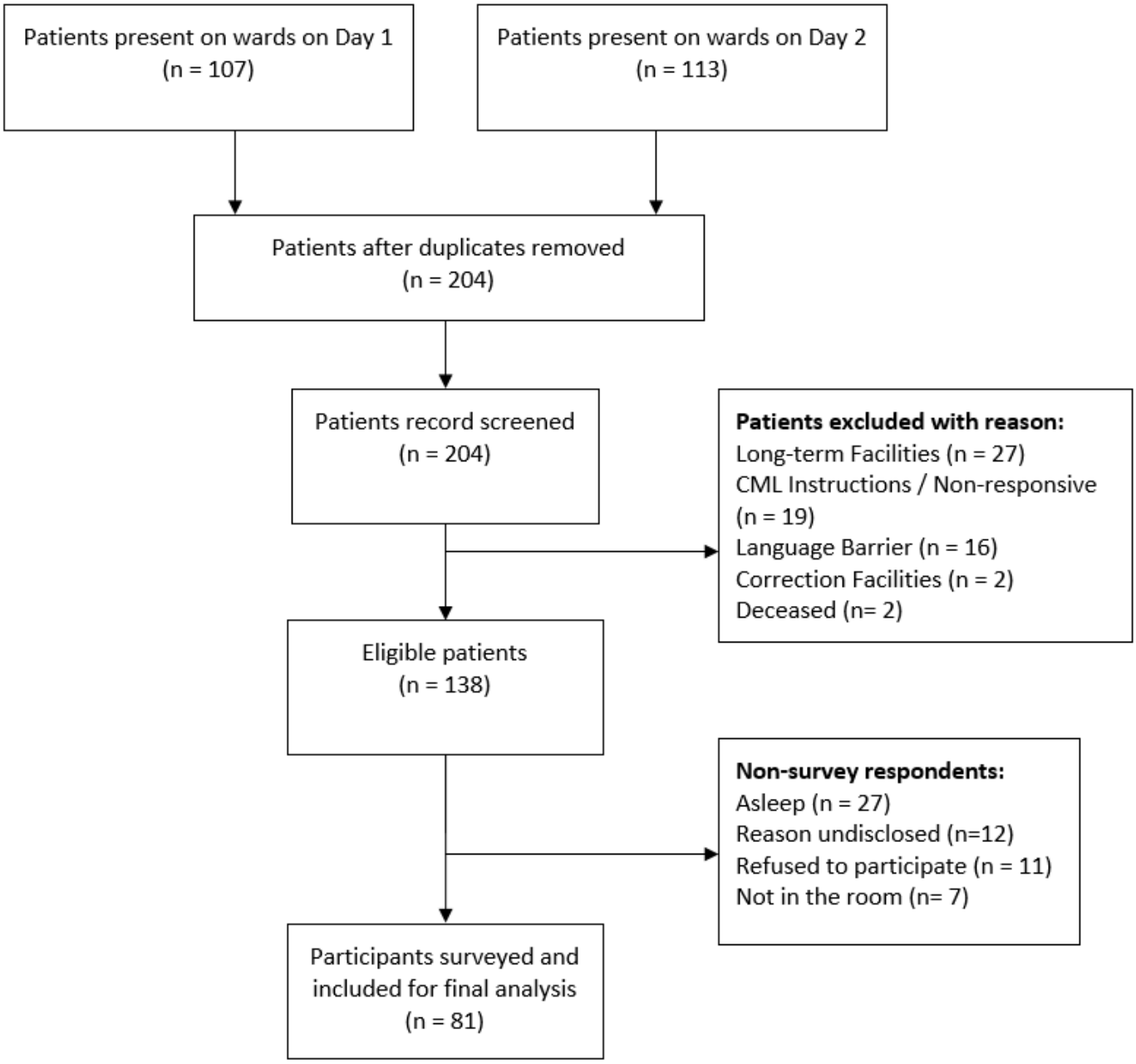

Figure 1

Recruitment of participants at Vancouver General Hospital Internal Medicine Wards

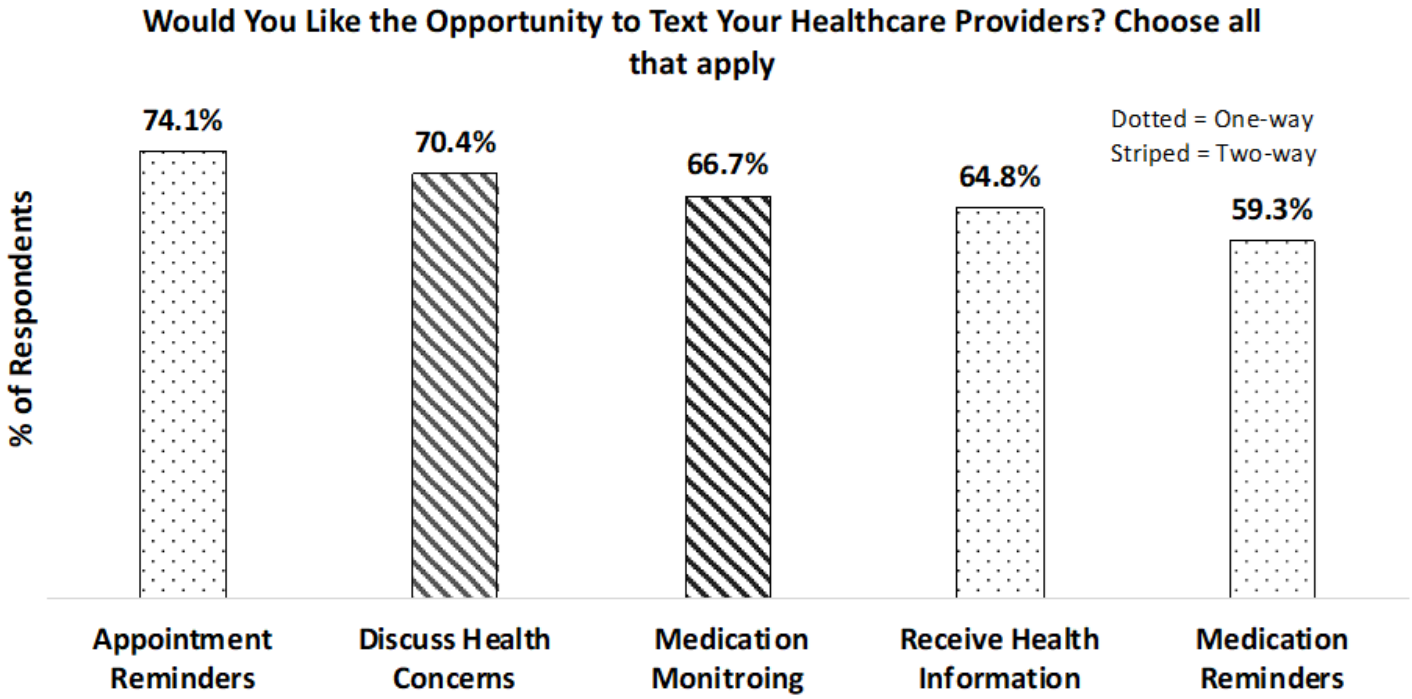

Figure 2

Participants preference for one-way versus two-way communication with HC

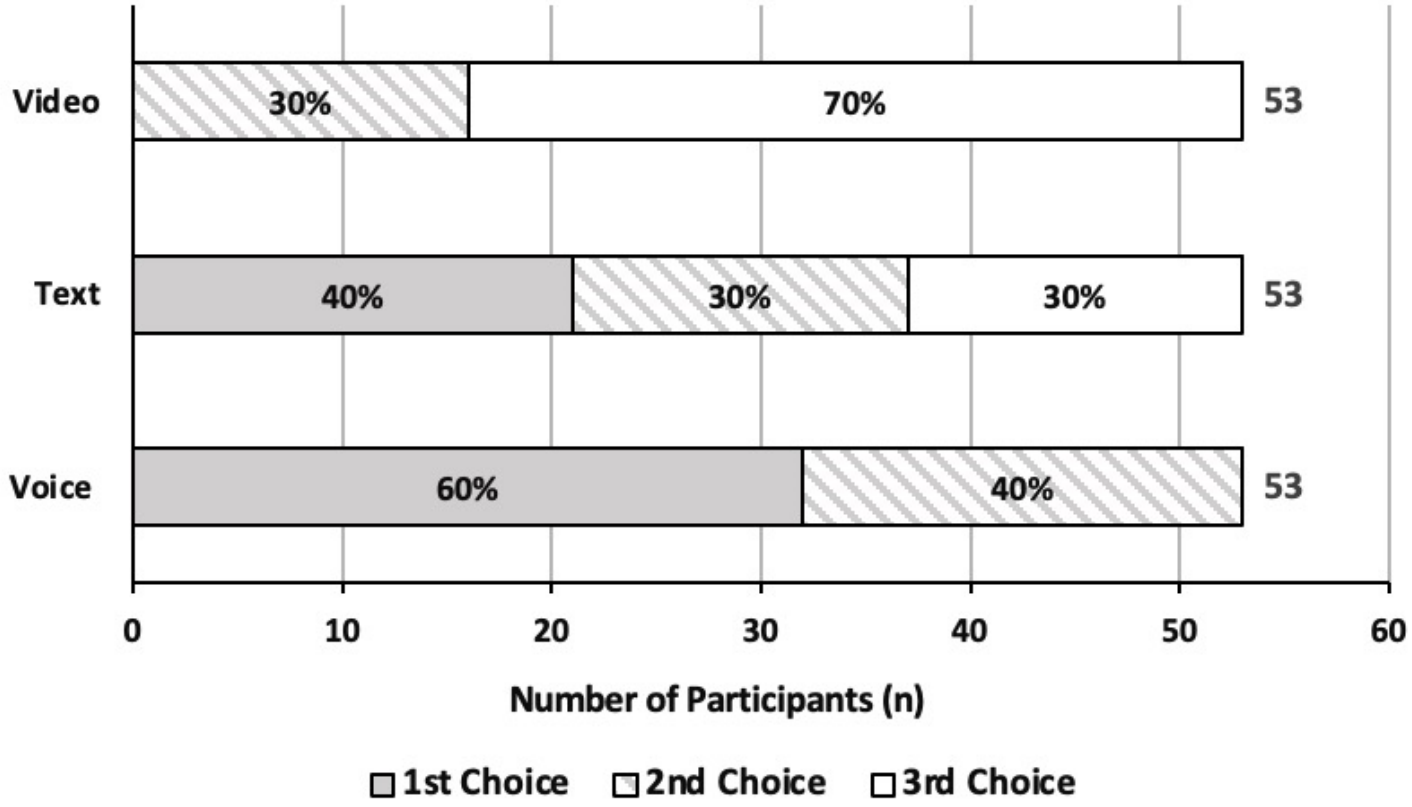

Figure 3

Participants’ relative preferred modalities of communication using their mobile phone