The use of smartphones on General Internal Medicine wards

A mixed methods study

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Summary

Objective: To describe the uses of institutional and personal smartphones on General Internal Medicine wards and highlight potential consequences from their use.

Methods: A mixed methods study consisting of both quantitative and qualitative research methods was conducted in General Internal Medicine wards across four academic teaching hospitals in Toronto, Ontario. Participants included medical students, residents, attending physicians and allied health professionals. Data collection consisted of work shadowing observations, semi-structured interviews and surveys.

Results: Personal smartphones were used for both clinical communication and non-work-related activities. Clinicians used their personal devices to communicate with their medical teams and with other medical specialties and healthcare professionals. Participants understood the risks associated with communicating confidential health information via their personal smartphones, but appear to favor efficiency over privacy issues. From survey responses, 9 of 23 residents (39%) reported using their personal cell phones to email or text patient information that may have contained patient identifiers. Although some residents were observed using their personal smartphones for non-work-related activities, personal use was infrequent and most residents did not engage in this activity.

Conclusion: Clinicians are using personal smartphones for work-related purposes on the wards. With the increasing popularity of smartphone devices, it is anticipated that an increasing number of clinicians will use their personal smartphones for clinical work. This trend poses risks to the secure transfer of confidential personal health information and may lead to increased distractions for clinicians.

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Background

The use of smartphones by health care professionals is rising in popularity [1, 2]. Traditionally, clinical communication in hospitals often occurred through the use of numeric paging systems. However, with the rapidly changing landscape of communication technology, clinicians are adopting more advanced information and communication technology (ICT) systems to facilitate clinical communication [3].

The benefits and drawbacks of ICT systems such as numeric paging, alphanumeric paging and smartphones in healthcare have been described. Numeric paging is an attractive option due to its reliability, low cost and low-risk of committing privacy violations; however, numerous drawbacks have been reported such as pages sent to the wrong physician, inability to convey the urgency of the issues resulting in an inability to triage and time wasted waiting for return calls to landline phones [4, 5]. Alphanumeric pagers have similar benefits and drawbacks but with the added benefit of being able to convey the urgency of patient care issues [4]. Smartphones have not been found to have these drawbacks and numerous benefits of smartphone use have been described such as perceived improvements in efficiency and clinical communication [4, 6, 7] due to increased connectivity. However, this increased connectivity is associated with increased interruptions and negative impacts on interprofessional relationships due to reduced face-to-face interactions [4].

Over 80% of physicians own a smartphone and the majority use their personal smartphones for work-related activities [1]. Smartphones are being used by healthcare practitioners for education and training, clinical practice, and research purposes with many practitioners finding the devices useful for communication, documentation, accessing medical references and viewing patient data [7–11].

Although studies have been conducted to examine the uses of institutional smartphones in healthcare institutions, there are still gaps in understanding how clinicians are using their personal smartphones in the clinical environment. With the rising popularity of smartphones, further research is needed in this area as personal smartphones are inevitably being used for patient care purposes and solutions need to be implemented to protect patient privacy.

Objective

This article focuses on the uses of smartphone devices in healthcare institutions. The objective of this study is to describe the uses of institutional and personal smartphones on General Internal Medicine wards and highlight potential consequences of their use.

Methods

Setting

We conducted a multi-site study between June 2009 and June 2011 with medical students, residents, attending physicians and allied health professionals of General Internal Medicine (GIM) at 4 academic teaching hospitals – Toronto General Hospital and Toronto Western Hospital of the University Health Network (site 1), Sunnybrook Health Sciences Centre (site 2) and St. Michael's (site 3). All participants provided written informed consent.

General Internal Medicine teams consist of medical students, junior residents, a senior resident and an attending physician. At site 1, all team members with the exception of attending physicians were equipped with encrypted institutional BlackBerry devices to facilitate clinical communication. At site 2, each team was provided with an encrypted institutional BlackBerry device that was carried by the senior resident and all clinicians were provided with alphanumeric pagers. At site 3, clinicians received numeric pagers for clinical communication. The study was approved by the Research Ethics Board affiliated with the participating hospitals.

Institutional policies for smartphone use at the participating hospital sites, in compliance with the Personal Health Information Protection Act (PHIPA), specify that personal health information

(PHI) is prohibited on devices that are not encrypted to protect patient privacy. It is the responsibility of users to ensure their personal devices are encrypted if they intend on storing or transporting PHI.

Institutional Blackberry devices are encrypted by the organization. Email messaging from the devices was secure to other internal email addresses or certain external organizations in which a secure link has been established. Text (SMS and Blackberry Messenger [BBM]) messaging was neither encrypted nor secure. For the sites where institutional Blackberry devices were provided to residents, there was no restriction on the amount of personal use permitted.

Study Types

Data were collected using a mixed-methods approach, which incorporates both qualitative and quantitative research to enhance the depth and breadth of understanding the phenomenon under study [12–14]. The qualitative findings reported in this study resulted from a secondary analysis of a primary data set, which has been previously described in a study evaluating the benefits and drawbacks of different communication interventions on inpatient care delivery [7]. The entire qualitative data set was reanalyzed with a focus on the uses of personal smartphones in the clinical environment, which was not addressed in the primary analysis.

Observations

Using a work shadowing approach, residents were followed by a member of the research team (VL) during their routine work on weekdays, weeknights, and weekends. Each observation lasted for approximately 4 to 5 hours and occurred between 10:00am and 11:30pm. All communication events and workflow interruptions were observed using a non-participatory approach where the researcher had little interaction with participants being observed. Data was collected in the form of field notes with time stamps for each communication event observed. In total, 37 work shadowing observations (9 junior and 9 senior residents from site 1, 3 junior and 4 senior residents from site 2 and 9 junior and 3 senior residents from site 3) were conducted. All site 1 residents and 2 senior residents from site 2 were carrying an institutional Blackberry device. Each resident was shadowed only once.

Interviews

Semi-structured interviews were conducted by a member of the research team (VL) with medical students, residents, attending physicians and allied health professionals. Face-to-face interviews consisting of open-ended questions relating to the use of communication devices and systems were posed. Interviews were audio recorded and transcribed verbatim. 9, 20, 9 and 25 interviews were conducted with medical students, residents, attending physicians and allied health professionals, respectively. In total, 63 interviews were conducted from sites 1 to 3.

Surveys

We surveyed residents at site 1 on their use of personal smartphones in the clinical environment. Survey items asked about the use of personal smartphones for calls, text messages and emails for work purposes. Three clinicians reviewed the survey for face validity, clarity and comprehensiveness.

Analysis

Qualitative and quantitative analyses were conducted. Thematic analysis, with a focus on smartphone uses, was conducted on the qualitative data [15]. Field notes obtained from observations and interview transcripts were coded by one author (KT) and the codes were organized into themes. An iterative review process occurred between authors (KT, RW) on a regular basis to ensure consensus on the coding framework and themes identified. Quantitative analysis involved generating descriptive statistics for the survey data.

Results

From observations, the majority (59%) of participants carried their personal smartphone while performing clinical work. Personal smartphones used by the participants were mainly BlackBerry or iPhone devices (▶Table 1).

On General Internal Medicine wards, smartphones were found to be primarily used for clinical communication and, to a more limited extent, personal use.

Use of smartphones on clinical wards a) for clinical communication.

Clinical communication includes two subthemes: (1) team communication, (2) interprofessional communication.

At sites 1 and 2, institutional smartphones were utilized most for team communication. All residents who were shadowed at site 1 and site 2 used institutional smartphones to communicate with team members. Of the residents who carried their personal devices, 27% (6/22) used it for team communication (▶Table 1). The majority, 6/7, of site 2 residents carried their personal devices with 5/6 using their personal devices for team communication. Only one site 1 resident used his personal smartphone to communicate with team members. Although 6/12 residents at site 3 carried a personal smartphone, none were observed using their devices for team communication; communication was observed to occur exclusively through the paging system.

Communication occurred through voice calling, text messaging (SMS or BBM) and email messaging. Email messaging through institutional devices is not encrypted; however, a secure link is created for internal communication within the organization as well as to certain external organizations. Text messaging is neither encrypted nor secure. A reason for the adoption of smartphones during clinical work can be attributed to a perceived increase in efficiency and mobility:

> "my [iPhone] which is my own personal thing that I just use and pay for …allows me to be much more efficient…because I can just talk to people on the move…it allows me to multitask a lot more, a lot more efficiently. And it also allows me to call people…directly so I don't have to wait for pages."

From the work shadowing observations, 23% (5/22) of residents used their personal devices for interprofessional communication (▶Table 1). All residents at site 1 used institutional smartphones for the purpose of communicating with clinicians from other professions and medical specialties with 3/10 of residents using their personal smartphones in addition to their institutional Blackberry devices. 2/6 residents at site 2 used personal smartphones for interprofessional communication. No residents at site 3 were observed using smartphones for interprofessional communication.

A resident described how he used his personal smartphone to communicate with clinicians from other specialities.

> "As a senior resident I often end up getting a lot of calls for consults for our team so I'll call other services like the hematology service and the endocrinology service. It's easier for me to just page them to my BlackBerry and in that way I can keep moving ward to ward".

Users of personal smartphones acknowledged the risk to the security of confidential personal health information (PHI). They used mechanisms to reduce that risk but appeared to favor efficiency and mobility over security:

> "I used the Blackberry messenger program to link up with all the team Blackberrys on my team and basically I use that to communicate with them. I obviously follow certain rules…I do not use any patient names. If anything I use initials. Mr. H. Mr. N."
> "I would rather use my personal device. I realize there's confidentiality issues, but I would much rather."

The response rate for the survey was 100% (23/23). Similar to the interview data, results from the survey suggest that residents use their personal cell phone for work-related purposes (▶Table 2). 57% (13/23) and 43% (10/23) of residents have used their personal cell phones to make phones calls

and/or text or email for work purposes, respectively. While 74% (17/23) of residents agreed that institutional smartphones reduce the likelihood of using personal cell phones to email or text personal health information, nonetheless, approximately one-third of the surveyed residents reported using their personal cell phones to email or text patient information that may have contained patient identifiers.

Use of smartphones on clinical wards b) for personal use

The personal use of smartphones varied depending on the resident observed. Of residents who carried their personal devices, 18% (4/22) were observed using their devices for personal reasons (▶Table 1). No residents at site 1 were observed using their own smartphones for personal use but 4/18 used institutional Blackberry devices for this purpose. 3/6 of site 2 residents and 1/6 of site 3 residents who carried their personal smartphones used it for personal reasons. Among residents who were observed using their own smartphones for personal reasons, they engaged in this activity an average of 4.25 times per observation.

An example of a resident who was a high user of his personal smartphone is shown in ▶Table 3. Over a 5 hour session, one resident used his personal smartphone 23 times during the observation period with 13 incidents being for personal issues such as making personal calls, checking personal emails, sending BBM messages and reviewing non-work-related apps. Although most events occurred while the resident was in the nursing station updating patients' medical charts, one patient encounter was interrupted as the resident viewed his personal smartphone while the patient was talking.

Discussion

Principal findings

Our study describes the uses of institutional and personal smartphones in General Internal Medicine wards. The majority of the smartphones observed were BlackBerry and iPhone devices, which were used for voice calling, text (SMS or BBM) messaging, and email messaging for the purposes of clinical communication and/or personal use.

When residents are provided with institutional smartphones, they appear less likely to use their personal smartphones for clinical communication. This is supported by the fact that residents from site 1, where all team members are provided with an institutional smartphone, were observed using their personal smartphones much less often for clinical communication compared to residents from site 2, where all team members are provided with an alphanumeric pager but only the senior resident is provided with an institutional smartphone. Interestingly, residents from site 3, where communication occurred exclusively through a numeric paging system, were not observed using their personal smartphones for clinical communication. This could be due to the fact that the hospital site had poor cellular reception as described by one of the participants. Although interviewees acknowledged benefits of using personal smartphones for clinical communication such as increased efficiency and mobility, residents at site 3 appear less likely to violate regulations on personal health information (PHI) due to their exclusive use of the numeric paging system [16].

Although some residents were observed using their personal smartphones for non-work-related activities, personal use was infrequent and most residents did not engage in this activity. One resident was a high user of his personal smartphone and frequently used the device for personal reasons; however, this behavior does not appear to be typical amongst residents. Two potential consequences from the use smartphones can be highlighted. The first consequence is that the use of personal smartphone devices brings with it risks to the security of personal health information [17, 18], as these devices are not secure and many institutions have yet to implement a framework for securing personal smartphones. Institutional policies regarding smartphone use specify it is the responsibility of the users to encrypt their personal devices if they intend on storing or transporting PHI; however, medical trainees were not provided with institutional support for encrypting their personal devices. Providing institutional smartphones may reduce the risk of PHI being transferred inse-

curely. However, with hospitals continuing to face constrained budgets, there is an increasing trend for institutions to have a "bring your own device" model where institutions secure the corporate and patient data stored on personal devices.

The second consequence is that increased personal use of smartphones allows for increased connectivity to personal lives. This may be acceptable, but the potential consequences are increased distractions and a blurring of the work-life boundary, a term coined 'distracted doctoring' [18-21].

Comparison with other work

The use of smartphones by clinicians for clinical communication has been previously described in the literature. Perceived improvements in efficiency and mobility from smartphone use have been reported and our study supports these findings [4, 6, 7, 13, 21]. However, the existing literature describes settings where institutional devices were provided to the residents [4, 6, 7, 11]. In this study, we provide further information about the uses of personal smartphones in healthcare institutions.

Limitations

This study has several limitations. The qualitative portion of the study was a secondary analysis of a much larger data set. We reanalyzed the entire data set focusing on uses of personal smartphones, which was not addressed in the primary analysis. As such, these issues were not directly addressed in all interviews resulting in missing data. However, the research question of the secondary analysis and primary study are about the same phenomenon, information and communication technologies in the clinical work environment, so we believe the dataset is appropriate for the secondary analysis. With respect to the survey, the sample size was small with only 23 participants and occurred at one site. This limits the generalizability of the study. Also, the smartphone landscape has rapidly evolved and the percentage of those carrying smartphones has increased, with a higher percentage of iPhone users. In addition, due to the nature of work shadowing, the use of smartphones for clinical communication and personal use may be greater than described as it was difficult to capture the context of all communication events. In workshadowing residents, the act of observing them may have biased the results as the participants may have modified or improved their typical behaviour in response to being observed. This may have occurred as residents at site 1 were not observed using their personal smartphones for clinical communication; however, results from the survey show that many residents are using their personal cell phones to call, text message or email colleagues for work purposes. As such, the use of personal smartphones in the clinical environment may be greater than described. Finally, there may be differences between sites such as poor cell phone reception that may affect smartphone use.

Conclusion

Clinicians are using personal smartphones for work-related and, to a limited extent, non-work-related purposes. With the increasing popularity of smartphone devices, it is anticipated that an increasing number of clinicians will use their personal smartphones for clinical work. This trend poses risks to the secure transfer of confidential personal health information and may lead to increased distractions for clinicians.

Clinical Relevance Statement
The use of smartphones by clinicians has become ubiquitous in healthcare. With the rising trend in smartphone use for clinical work purposes, more attention needs to be focused on ensuring these devices are secure for patient-related communication.

Conflicts of Interest
The authors declare that they have no conflicts of interest in the research.

Protection of Human and Animal Subjects
The study was performed in compliance with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans, and was approved by the research ethics boards at the University Health Network, Sunnybrook Health Sciences Centre and St. Michael's.

Table 1   Personal smartphone use on internal medicine wards

	Site 1	Site 2	Site 3
Number of BlackBerry devices	7	4	3
Number of iPhone devices	2	1	2
Number of other devices	1	1	1
Total of personal smartphone users	10	6	6
Number of residents who used their personal smartphone for team communication / total of personal smartphone users (%)	1/10 (10)	5/6 (83)	0/6 (0)
Number of residents who used their personal smartphone for interprofessional communication / total of personal smartphone users (%)	3/10 (30)	2/6 (33)	0/6 (0)
Number of residents who used their personal smartphone for personal reasons / total of personal smartphone users (%)	0/10 (0)	3/6 (50)	1/6 (17)
Total of personal smartphone users / residents work shadowed (%)	10/18 (56)	6/7 (86)	6/12 (50)

Table 2   Residents' perceived use of personal cell phones for clinical work, n=23

Statement	Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree	
	n	%	n	%	n	%	n	%	n	%
1. I have used my personal cell phone to make phone calls for work purposes.	4	17	4	17	2	9	8	8	5	22
2. I have used my personal cell phone to text or email for work purposes.	4	17	8	35	1	4	5	22	5	22
3. I have used my personal cell phone to text or email information about patients to other clinicians. (note this may or may not include patient identifiers)	9	39	6	26	1	4	5	22	2	9
4. I was less likely to email or text personal health information on my personal cell phone while using institutional smartphones.	2	9	0	0	4	17	6	26	11	48

Table 3   Events of personal use of smartphone device by MD#5

Time	Event
10:26	He looks at his personal BB. He is chatting on his BB regarding his god sister's pregnancy.
10:43	MD#5 leaves patient's room. He puts the chart back. He then reads his personal BB. He got an email from Burberry about their summer collection.
10:50	He reads a personal email on his BB. It is about his friend's son birthday party.
10:55	MD#5 checks the stock market on his BB.
11:33	MD#5 looks at his BB and types a BBM to his girlfriend. He informs me that that they just started dating/secretly seeing each other and is trying to keep the relationship under wraps for now.
12:20	He makes a call on his BB to his dad.
12:39	He takes a look at his BB. He tells me he got an email mail from Biotherm.
13:17	● MD#5 leaves patient's room. ● His BB rings. ● MD#5 picks up near the nursing station ● It is a call from his contractor returning MD#5's message earlier about fixing up his condo. ● At 1:20, MD#5 hangs up. He goes to the back room but is unable to log into the EPR
13:53	MD#5's BB rings. He picks up. It is a call from his contractor.
14:13	MD#5 changes his picture profile on his BB as he replies to a BBM.

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