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ABSTRACT

Purpose of the study. Smartphone use among healthcare professionals has become widespread and will continue to grow in the coming years. **Study design.** A survey was distributed to interns in October 2012 to two of the national intern training networks in the Republic of Ireland, asking how they used smartphones to carry out their clinical work. **Results**. It was found that out of 108 interns (47.0% response rate, 108/230), 94.4% (102/108) owned a smartphone. Of those respondents who owned a smartphone, on at least a daily basis for the purposes of work, 83.3% (85/102) made or received phone calls, 87.2% (89/102) sent or received texts, and 41.2% (42/102) sent or received emails on their smartphone. A total of 52.9% (54/102) had used their smartphone to take a work related picture. The most commonly used app was the British National Formulary. It was used daily by 29.4% (30/102) of respondents with a smartphone. The most commonly used website was Wikipedia. It was accessed at least weekly by 30.4% (31/102) of respondents with a smartphone. **Conclusions.** Smartphones are used by the majority of interns on a daily basis in order to perform their job. As such, there is a need for guidance on how patient information can be safely secured and transmitted using smartphones, their appropriate use and any restrictions on the use of these devices in particular clinical settings and, particularly for interns, advice is needed on the credibility of medical apps and websites.

INTRODUCTION

The smartphone has been described as a "mobile telecommunication device with advanced features such as medical applications, word processing, internet access, and other computing capabilities."(1) Among physicians, smartphones are becoming a key part of everyday clinical practice. The popularity of these devices can be attributed to their myriad of uses for both medical education and medical practice. Smartphones are routinely used for communication purposes and offer many advantages including quicker responses, the opportunity to text or email about non-urgent issues, increased communication or consultation between members of a multidisciplinary team, and increased communication about patients.(2-4)

The ability to access medical knowledge through a smartphone also extends its use beyond that of a simple communication device. It is not only possible to access medical websites with a smartphone (e.g. Medscape, Medline), but also to download specific medical software packages or 'apps' to the phone (e.g. British National Formulary, BNF; Monthly Index of Medical Specialities, MIMS). To illustrate, the Apple App Store currently lists more than 500,000 medical apps available for download.(5) Therefore, the need for interns to carry around paper copies of the BNF or MIMS are no longer necessary as all of the information, and more, can be rapidly accessed through their smartphones.

Several studies have examined how doctors are using smartphones and apps in their day-to-day lives and practice. In a survey of 3,306 interns, fellows, and attending physicians across 27 medical specialities, it was found that 56% reported using medical apps in their practice.(6) Payne and colleagues (5) conducted a similar survey among UK medical students and junior

doctors. They found that 79% of medical students and 74.8% of junior doctors owned smartphones. The majority of respondents owned between one and five medical apps and both cohorts reported using the apps several times daily. The types of apps each group used also differed, with students reporting app use primarily for educational purposes while doctors typically used apps relating to their clinical practice such as medical calculator apps, or drug reference apps.

Currently, there is only limited research examining the use of smartphones by interns, with none focused on how interns use all of the possible functions of a smartphone (phone, text, email, picture, apps, and web access) to carry out their clinical work. However, the pervasive usage and acceptance of smartphones in medical practice has raised a number of important concerns from both patient safety and confidentiality perspectives. Concerns have been raised over the trustworthiness of the information sourced through medical apps or the internet, the distraction caused by devices, the security of patient-related information stored and transmitted by the devices, and the potential of such devices to negatively impact on professionalism.(3, 6, 7)

The purpose of the research reported in this paper is to survey Irish interns (internship is the first year of clinical practice for doctors in Ireland) to obtain information on how they are using their smartphones during their work as a intern. The objectives of the study are to obtain information on:

- the proportion of interns that use smartphones to perform their duties.
- the frequency and purpose of communications (telephone, texts, and emails) made and received by interns on a smartphone in the performance of their duties;

- the frequency and purpose of the use of the camera on a smartphone in the performance of their duties; and
- which medical apps and websites were being used/accessed by interns via a smartphone and the frequency of use/access.

METHOD

Procedure

Interns from two of the six national intern training networks in the Republic of Ireland were asked to complete an online anonymous questionnaire about how they use their smartphones to carry out their job. The intern network coordinators for the two intern networks emailed the web link to the survey in late October 2012 to 230 interns. A reminder email was sent in mid-November 2012. Ethical approval was obtained prior to commencing the research.

Questionnaire design

In order to construct the questionnaire the following steps were carried out. Firstly, a review of the literature was conducted and other questionnaires examining smartphone use by healthcare professionals were reviewed. Based upon this review, a draft questionnaire was developed. The questionnaire was designed to assess the use of the core functions of a smart phone: telephone; send or receive text messages; send or receive emails; camera; and to access apps and websites. For the communication (telephone, texts, and emails) and camera functions of the smartphone, the purpose was to obtain information on the frequency of the use and the reason of use.

In order to obtain information on the names, and frequency of usage, of apps and websites accessed by the interns, advice was also obtained from four interns who regularly use apps and websites during their clinical work. Based upon this information, the questionnaire required respondents to specifically rate the frequency with which six apps (BNF, MIMS, Oxford Handbook of Clinical Medicine (OHCM), Medscape, MD on call and the University College Hospital Galway intern guide), and four websites (Wikipedia, Medscape, Mayo clinic, and patient.co.uk) were accessed. However, the questionnaire was also designed to allow the respondents to include information on their use of other medical apps and websites other than those mentioned above. The draft online version of the questionnaire was reviewed by interns (n=6), senior physicians responsible for intern training (n=4), and medical educators (n=2). Based upon these comments, changes were made to the instructions and some of the questionnaire items to improve clarity and understanding

Data analysis

The data was collected using Surveymonkey (an online questionnaire hosting site), and analysed using IBM SPSS Statistics 20.0 and Microsoft Excel. Descriptive analysis was carried out in order to obtain information on: the frequency and purpose of the use of smartphones for communication (telephone, texts, and emails); the frequency and reasons why pictures were taken with a smartphone; and which medical apps and websites were being accessed and the frequency of their use/access.

RESULTS

Of the 108 respondents (47.0% response rate, 108/230), a total of 102 (94.4%, 102/108) reported owning a smartphone. Of those interns who owned a smartphone, 66.7% (68/102)

owned an iPhone, 26.5% (27/102) owned an android phone, and the remaining 6.9% (7/102) owned another type of smartphone (e.g. Windows phone, Blackberry). To simplify the text for the rest of the article, 'respondent' will refer to all questionnaire respondents who own a smartphone, with the percentages calculated based upon the 102 respondents who owned a device.

Phone calls and texts

A total of 85/102 (83.3%) of the smartphone users who responded to the survey made or received a work related phone call and 89102 (87.3%) wrote or received a text at least once a day, and 42/102 (41.2%) sent or received an email at least once a day. By far the most common reasons provided were to answer bleeps (phone calls only), obtain medical advice on a patient from a senior, and summarise the day's events with seniors (see Table 1). Examples of work-related activities mentioned by no more than two respondents that are not included in Table 1 were: to receive results, receive job requests, phone GPs, and human resources related activities.

Table 1. Frequency and purpose of work-related phone calls, texts, and emails made or received using a smartphone. For the columns of 'phone calls or texts' or 'phone call texts, or emails', the most frequent category of use only is provided. Numbers represent percentages and numbers of respondents.

Frequency	**Phone calls**	**Texts**	**Emails**	**Phone calls or texts**	**Phone calls, texts, or emails**
Many times a day	48.0% (49/102)	50% (51/102)	11.8% (12/102)	62.7% (64/102)	66.7% (68/102)
Few times a day	33.3% (34/102)	34.3% (35/102)	12.7% (13/102)	28.4% (29/102)	25.5% (26/102)
Once a day	2.0% (2/102)	2.9% (3/102)	16.7% (17/102)	1.0% (1/102)	2.0% (2/102)
Few times a week	6.9% (7/102)	5.9% (6/102)	26.5% (27/102)	4.9% (5/102)	4.9% (5/102)
Once a week	2.9% (3/102)	5.9% (6/102)	6.9% (7/102)	1.0% (1/102)	0
Few times a month	0	1.0% (1/102)	7.8% (8/102)	0	0
Once a month	1.0% (1/102)	0	2.0% (2/102)	1.0% (1/102)	0
Never	1.0% (1/102)	3.9% (4/102)	15.7% (16/102)	1.0% (1/102)	1.0% (1/102)
No response	4.9% (5/102)	0	0	0	0
Purpose					
Answer bleeps	52.0% (53/102)	-	-	52.0% (53/102)	52.0% (53/102)
Obtain medical advice on a specific patient	58.8% (60/102)	60.8% (62/102)	7.8% (8/102)	73.5% (75/102)	75.5% (77/102)
Summarise the day's events with seniors	53.9% (55/102)	66.7% (68/102)	6.9% (7/102)	74.5% (76/102)	74.5% (76/102)
Request tests/consults	10.8% (11/102)	7.8% (8/102)	2.9% (3/102)	13.7% (14/102)	16.7% (17/102)
Education and training	8.9% (9/102)	11.8% (12/102)	51.0% (52/102)	17.6% (18/102)	55.9% (57/102)
Communicate theatre/scope list	9.9% (10/102)	10.8% (11/102)	8.8% (9/102)	15.7% (16/102)	18.6% (19/102)
Other work related reasons	6.9% (7/102)	10.2% (10/102)	5.9% (6/102)	13.7% (14/102)	17.7% (19/102)

Taking work related pictures

A total of 52.9% (54/102 respondents) of respondents had used their smartphone to take a picture at work, with 22.5% (23/102 respondents) taking a picture at least once a week. For those interns who use their smartphones to take pictures, the most common reasons provided were: for research (28/102 respondents), to obtain help interpreting a result (ECG or Chest X-ray) (19/102 respondents), and for advice on a wound or lesion from a senior team member (16/102 respondents).

Access apps and websites

A total of 73/102 (71.6%) of the smartphone-using respondents reported using at least one work-related app a month, and 69/102 (67.6%) respondents reported accessing at least one work-related website a month (see Table 2 for more details).

Table 2. Number of different work-related apps and websites accessed at least once a month. Numbers represent percentages and numbers of respondents.

Number accessed	Apps	Websites
0	28.4 % (29/102)	32.4% (33/102)
1	23.5 % (24/102)	18.6% (19/102)
2 or 3	29.4% (30/102)	40.2% (41/102)
≥4	18.6% (19/102)	8.8% (9/102)

Half of the interns accessed an app on at least on a daily basis (51/102; 50.0%). The frequency with which the respondents reported using their smartphones to access apps to carry out a task is provided in Table 3.

Table 3. Frequency of access to apps to perform a task, using a smartphone.

Apps	Any	BNF	MIMS	OHCM	Medscape	Hospital app*
Many times a day	28.4% (29/102)	19.6% (20/102)	4.9% (5/102)	0	3.9% (4/102)	6.9% (7/102)
Few times a day	19.6% (20/102)	9.8% (10/102)	3.9% (4/102)	1.0% (1/102)	5.9% (6/102)	6.9% (7/102)
Once a day	2.0% (2/102)	0	0	2.0% (2/102)	2.0% (2/102)	2.0% (2/102)
Few times a week	13.7% (14/102)	0	0	0	11.8% (12/102)	9.8% (10/102)
Once a week	1.0% (1/102)	0	0	2.0% (2/102)	2.9% (3/102)	2.0% (2/102)
Few times a month	6.9% (7/102)	1.0% (1/102)	1.0% (1/102)	8.8% (9/102)	9.8% (10/102)	2.9% (3/102)
Once a month	0	0	1.0% (1/102)	1.0% (1/102)	4.9% (5/102)	1.0% (1/102)

* Only available to interns from one network.

The BNF app was the most commonly used app by the interns (31/102; 30.4%). Other apps mentioned, but not included in Table 3 included ‘MD on call’ (used at least once a month by 15.7%, 16/102, respondents), and a drug dosage calculator (used at least once a month by 8.8%, 9/102, of respondents). A total of 25 other apps were reported to be used by one or two respondents at least once a month (e.g. MicroMedex, Epocrates).

The frequency with which the respondents reported using their smartphones to access websites to perform their work (or to carry out a task) is provided in Table 4. Although websites were not used as commonly as apps, almost half of the smartphone owning interns reported accessing a website on their smartphone for a work-related purpose at least once a month. The most commonly accessed website was Wikipedia, with 39/102 (38.2%) of the respondents accessing it in order to perform their job at least once a week. The next most commonly accessed website was Medscape (accessed by 26/102, 25.5%, the respondents at least once a week).

Table 4. Frequency of access to websites to perform a task, using a smartphone.

Websites	Any	Mayo clinic	Patient.co .uk	Wikipedia	Medscape
Many times a day	5.9% (6/102)	1.0% (1/102)	1.0% (1/102)	0	2.0% (2/102)
Few times a day	5.9% (6/102)	0	0	4.9% (5/102)	2.0% (2/102)
Once a day	5.9% (6/102)	0	0	3.9% (4/102)	3.9% (4/102)
Few times a week	32.4% (33/102)	5.9% (6/102)	6.9% (7/102)	24.5% (25/102)	12.7% (13/102)
Once a week	2.9% (3/102)	1.0% (1/102)	2.0% (2/102)	4.9% (5/102)	4.9% (5/102)
Few times a month	11.8% (12/102)	5.9% (6/102)	5.9% (6/102)	10.8% (11/102)	10.8% (11/102)
Once a month	2.9% (3/102)	1.0% (1/102)	4.9% (5/102)	5.9% (6/102)	1.0% (1/102)

A website mentioned by respondents, but not included in Table 4, Medicines.ie (used at least once a month by 3.9%, 4/102, of respondents). A total of 12 other websites were reported to be used by one or two respondents at least once a month (e.g. drugs.com, Melbourne consent).

DISCUSSION

The majority of interns who responded to the survey used their smartphones many times a day for their clinical work. This use was mostly for communication, but smartphones were also frequently used to access medical knowledge via apps and websites. The findings from this research have implications for education and training, the confidentiality of patient information, patient safety and quality of care.

Communication and information exchange

Smartphone are a very powerful tool for facilitating teamworking and communication between healthcare providers.(8) However, there are also potential negative implications in terms of distractions and the inappropriate exchange of confidential patient information.

As compared with pagers, smartphones can potentially minimise disruptions by allowing prioritisation of non-urgent communication.(9) However, this is not to say they cannot be a source of distraction. This may be exacerbated by the fact that not only are the interns in the current survey receiving work related communication, but as it is a personal phone, they are likely receiving additional personal communications. It has been suggested that smartphone use can also negatively impact the relationship between doctors and nurses,(10) lead to unprofessional behaviour,(11) interfere with medical equipment,(12) and be a possible source of infection.(13)

The potential loss of confidential patient data is also a major concern with smartphones.(14, 15) If a healthcare professional was to lose his or her smartphone, all of the information on texts, email, etc. could potentially be accessed by unauthorised personnel. It is possible to safely store sensitive data on a smartphone through encryption, password protection, or the download of software which can remotely erase all data.

To access medical knowledge

There is no organisation, or governing body, that regulates medical apps or websites to ensure that the content is current, valid, and reliable. Therefore, each healthcare professional is left to make that determination themselves. Visser and Bouman(15) provide a list of questions to

guide healthcare professionals as to whether they should download and use an app. These questions relate to clinical decision making, patient's privacy, and conflict of interest.

Although the BNF and MIMS apps are electronic version of the published paper versions of the guides, the same may not be the case for other apps and websites such as Wikipedia. Although not rigorously peer-reviewed, the quality of the information on Wikipedia may not be as poor as expected when compared to other more regulated sources of information.(16-19) Wikipedia was found to answer significantly fewer drug related answers than Medscape (40% and 83% respectively). However, there were no factual errors in Wikipedia identified in the study.(18) Similarly, another study of drug information in Wikipedia identified the absence of information on dosage, drug interactions, and adverse drug events.(19) Therefore, although the information on Wikipedia was not complete, it was not found to be incorrect.

Limitations

The main limitation of the study is that the survey was only carried out with a small number of interns in Ireland. However, the findings are broadly similar to other studies that have examined the use of smartphones by interns and medical students (4,5), and therefore the authors believe the findings are generalizable to interns in Ireland and other developed countries. Although the response rate may not be as high as would have been desired, it is good considering this was an unsolicited online survey, and higher than other published surveys of smartphone use by interns and medical students.(4, 5)

Implications of the findings and suggestions for further research

We are certainly not suggesting a complete restriction on the use of smartphones, and recognise that they can have a positive impact on clinical care and teamworking.

Nevertheless, there is a need for education and robust hospital policies on how patient information can be safely secured and transmitted using smartphones, the appropriate use and any restrictions on the use of these devices in particular clinical settings and, particularly for interns, advice is needed on the credibility of medical apps and websites. This guidance is necessary to ensure that interns are not inadvertently using smartphones in such a way that they compromise patient safety or privacy.

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