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Mobile apps: An effective, inclusive and equitable way of delivering patient and nurse education?

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1. Introduction

Mobile health care applications (mhealth) apps are small, specialized programs downloaded onto mobile devices such as smartphones and tablets intended for use in the diagnosis, treatment, management or prevention of disease (Canadian Medical Association, 2015). It is estimated that half of the more than 3.4 billion smartphone and tablet users have downloaded (mHealth) apps (Yang and Silverman, 2014). mhealth apps are a component of a relatively new field of eHealth known as mHealth (mobile health) and mHealth is itself a component of digital health (World Health Organization, 2018). Health care apps come in two types: the first are used by health care providers to store patient information and review laboratory results and may be integrated with other technologies such as an electrocardiography monitor (Yang and Silverman, 2014). The subject of this review are apps of the second type which include health and wellness programs and educational apps and are designed for private use outside of a health care facility: examples include fitness apps, such as Fitbit, and education apps.

The number of people using mobile phones and tablets has increased exponentially opening the way for the development of mobile health apps. They have become an increasingly popular way for health professionals to deliver health education, support, monitoring, reminders and a range of other supportive interventions (Canadian Medical Association, 2015). But frequently benefits are listed with little consideration of possible drawbacks (Ventola, 2014; Kenny et al., 2012). Apps have also been designed for health professional education: despite their popularity there has been surprisingly little research into the effectiveness of these interventions in the nurse education sphere. In this contemporary issues, paper we discuss the complexities of developing mobile health apps and their use in nurse and patient education.

1.1. Apps in health professionals' education

Apps and social media are being used in nurse education to deliver contextualised, experiential learning (Kenny et al., 2012) and develop student nurse competency in health informatics, information literacy and information management (Airth-Kindree and Vandenbark, 2014). A review of apps for health professionals back in 2012 (Mosa et al., 2012) found 57 apps including those focusing on diagnosis, drug reference and clinical communication and 11 applications for medical or nursing students focusing on medical education. Handheld versions of nursing and medical books, journals interactive anatomy tools, medical calculators, medical references, and drug references on smartphones provide mobile learning opportunities for medical and nursing students (Mosa et al., 2012) and purchasing electronic copies of textbooks or accessing them from a university library is cheaper than buying conventional textbooks. Over 325,000 health apps are now available worldwide with more than 200 added each day (Aitken et al., 2017; Bates et al., 2018).

Table 1 lists examples of apps designed for use in health professionals' education and support.

A systematic review of mobile apps for nursing students listed favorable attitudes towards learning and motivation as positives but barriers included infection control in the clinical area, protecting patient information, short battery life, cost of mobile devices and negative perceptions by patients and hospital personnel (Lee et al., 2018). The authors concluded that smartphone-based apps, when compared to controls who did not use the apps, could enhance nursing students' motivation and satisfaction but found no support for consistent positive effects of mobile device use on undergraduate nursing students' knowledge and clinical skills (Lee et al., 2018). Similar conclusions were made in an older systematic review of the use of mobile technology in clinical nurse education: mobile technology was used by students for drug references and calculations, translating information for patients and was seen by students as enhancing their learning, increasing confidence and productivity and allowing them to spend more time with patients (O'Connor and Andrews, 2015). However, the authors noted that mature students and international students needed more support to use the apps and some students had poor computer literacy.

Instant messaging has been used to increase student-lecturer participation in a resource poor area (Rambe and Bere, 2013) but there were concerns that text messaging limited the rigor of discussion and

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Table 1
Examples of apps designed for use in health professionals' education and support.

Name of app	Information	Accessible
Student health app[a]	The free-to-download Student Health App provides access to general and mental health information for high school and university students.	https://www.expertselfcare.com/health-apps/student-health-app/
Pzizz[a]	Designed to help calm the mind, fall asleep fast, stay asleep, and wake up refreshed.	https://www.nhs.uk/apps-library/pzizz/
First aid by British Red Cross[a]	Simple skills for a variety of situations	https://www.nhs.uk/apps-library/first-aid-british-red-cross/
Visual anatomy free[b]	An interactive reference, and education tool with audio pronunciation.	https://play.google.com/store/apps/details?id=com.hssn.anatomyfree&hl=en

[a] Endorsed by National Health Service, UK.
[b] Quality not assessed.

disrupted family life. Other concerns are that these technologies distract students' attention from the educational task and subvert higher-order thinking, concentration, and persistence necessary for critical thinking (Connolly, 2011). Overreliance on information that is only accessible with internet connectivity may cause serious risks if there is no offline accessibility, particularly for medication and emergency care issues. With dependence on external sources for routine information it is possible that students could be less likely to commit essential information to memory and be unable to recall it without access to the device/service.

There are other considerations. Educators also need to control the disruption to educator's lives created by these technologies: in one study the lecturer made himself available online daily between 8 am and 10 pm (Rambe and Bere, 2013) which would negatively impact both his work and leisure time. There are other drawbacks to the use of apps and mobile devices including battery and storage capacity, broadcasting constraints, signal interferences, disconnections, limited bandwidths, and network delays (Silva et al., 2013) and these may disproportionately affect people in rural or remote areas or who are using older devices. Apps may not be available for all smartphone devices. It is clearly not practical for students to own multiple smartphone devices and single applications may not provide all required information, resulting in the need to use a combinations of applications (Mosa et al., 2012): nurse educators need to be aware of these drawbacks before including apps in the curriculum.

1.2. Health care apps

It is estimated that 3.7 billion mHealth apps were downloaded by users in 2017 and the supply of new apps has outpaced demand (Research2Guidance, 2017). The most popular health apps provide services for “connection to doctors”, followed by diabetes, “heart, circulation, blood” and “medication”; in the mental health field depression is the most popular (Research2Guidance, 2017). Table 2 gives examples of apps designed for use with health consumers.

1.3. Confidentiality, privacy and accuracy of information

There are concerns about the use of social media and apps relating to confidentiality and the accuracy of information. Significant work is needed in order to overcome the legal and cultural differences that exist globally over privacy (the user's right to keep their own information private), confidentiality (the obligation of third parties to respect this privacy), data security (the physical, technological, or administrative safeguards used to protect identifiable health data from unwarranted access or disclosure and legislation) (Kotz et al., 2009; Martínez-Pérez et al., 2015). In addition, private devices should not be used to store patient-related information or photographs.

Nurse educators need to ensure that user data is protected and this can make app development complex. Apps should comply with national legislation on privacy and security especially in relation to storing or communicating patient data and encryption and the ability to remotely destroy all data on a device in the case of loss or theft, considered (Mosa et al., 2012). Similarly, antiviral software to protect against spyware should be installed and devices protected with passwords and fingerprint. It is also important to ascertain whether data entered into the app is shared with the developer or other third parties (Canadian Medical Association, 2015): this is especially the case with freeware.

Apps may not contain complete or accurate evidence-based information (Airth-Kindree and Vandenbark, 2014) and many apps do not cite the evidence behind the information they provide (Aungst et al., 2014). Flaws may be detrimental to patients for example, many apps are developed without the input of health professionals with profit as the primary motivation (Buijink et al., 2013). In one example, three of four smartphone apps incorrectly diagnosed more than 30% of melanoma cases as benign (Bates et al., 2018). Conflicts of interest may exist, most notably with pharmaceutical companies.

The evidence base for the content of material on apps is not the only concern; it is also important to assess whether there is sound theory underpinning the design of the app. A 2015 study to analyse the linkage of health behaviour change interventions in cancer survivorship mHealth apps to theories and models used to predict health behaviour

Table 2
Examples of apps designed for use with health consumers.

Name of app	Information	Accessible
Untire: Beating cancer fatigue[a]	Designed for cancer patients and survivors	https://www.nhs.uk/apps-library/untire-beating-cancer-fatigue/
The check-in app	Designed by Beyond Blue and Two Bulls in consultation with young people to help take the fear out of having a conversation with a friend who might be struggling	https://www.beyondblue.org.au/about-us/about-our-work/youthbeyondblue/the-check-in-app
myDiabetes[a]	Designed to assist self-management of diabetes. Guidelines in line with latest clinical guidelines (download fee applies)	https://www.nhs.uk/apps-library/my-mhealth-mydiabetes/
My health guide[a]	Designed as a communication tool for people with learning difficulties (download fee applies)	https://play.google.com/store/apps/details?id=com.hssn.anatomyfree&hl=en

[a] Endorsed by National Health Service, UK.

change found that the mHealth apps varied greatly in the use of theoretical elements of health behaviour change (Dahlke et al., 2015). The authors suggested that mHealth intervention design needs a stronger theoretical and evidence-based underpinning (Dahlke et al., 2015). Similarly, Australian researchers reported that only a small portion of the 93 accepted behavioural change techniques were present in popular health and lifestyle mobile apps (Antezana et al., 2018). Research on the inclusion of health behaviour theory in gamification apps to change behaviours such as exercise, found that levels varied but were higher on average than non-game health apps (Payne et al., 2015). Researchers have concluded that collaboration between app designers, clinicians and behavioural specialists is crucial to help promote lasting behaviour change (Edwards et al., 2015; Payne et al., 2015).

1.4. Equity and access

Articles extoling the use of apps frequently begin with a comment about most people owning a mobile phone, or statistics on the growing ownership of phones, but there are groups excluded from the mobile revolution. Kenny et al. (2012) in a Canadian study of 121 nursing students and faculty found that 23% either did not have a mobile phone or had a device that was phone only and less than half (46%) owned smartphones. Participants viewed the advantage of mobile devices as most useful for accessing professional information at point of care and as an aid to communication via text between students and between students and faculty: the main barriers cited were cost and connectivity. Omitted from consideration were the nearly quarter of participants without access. Similarly omitted were the numbers of students enrolled in an information technology course excluded from a messaging app-based educational study because of lack of a mobile phone or inability to download the app, only 95 students out of a possible 163 participated in the study (Rambe and Bere, 2013). The authors acknowledged that excluded students required an alternative way to access and interact with the teaching materials.

Information communication technologies, which include apps, have been seen as a way to address health inequities within and between countries (Qureshi, 2016) but so far, while there are positive examples, there is little quality evidence of these having a positive impact (Kahn et al., 2010). In addition, there are few apps for people with the highest needs - patients with costly care, low levels of health, or low levels of English literacy (Bates et al., 2018).

On a positive note, mobile apps have also been developed to assist people with disabilities, for example to translate what a person says on a phone into text or voice operated interfaces that will text messages, make calls without the user touching the phone. There are also apps to assist non-verbal children and adults communicate.

Globally access to the internet is uneven with poorer nations disadvantaged; for example several African nations have less than 10% of their population with access whereas Europe has nearly 90% (Internet World Stats, 2019). Within nations there are also inequities: in Australia age, geography, education and income define access to and uses of online resources with people over the age of 65, the unemployed and migrants less likely to have access as well as those living in more rural areas (Thomas et al., 2018).

1.5. Quality assurance and evaluation

Mobile apps are frequently designed without a real understanding of the needs of the end-users, the usability of an app, or how to effectively design an app (Kumar et al., 2013). Schnall et al. (2016) describe a rigorous user-centred app design process which includes a needs assessment, functional requirement identification, and user interface design. The skills required are specialist, and nurse educators should include experts in this field in their team if designing an app.

As O'Connor and Andrews's (2015) note, evaluation of the apps used in nurse education centers on student's perception of their use and lacking is a validated tool to measure their effectiveness or a theoretical basis to their use. Required are quality standards and a quality review process for nursing-related mobile applications so that recommendations can be made about which software programs are reliable, easy to use, and have quality educational content (O'Connor and Andrews, 2015). This would greatly assist nurse educators and students in determining choice of mHealth apps.

In terms of apps for general or health use, legal and policy level initiatives to regulate quality and safety are gradually catching up with the technology. The European Union and US have regulatory requirements for medical device software, for example for calculating insulin doses or managing asthma. However, the U.S. Food and Drug Administration (FDA, 2019) intends to apply its regulatory oversight to "only those software functions that are medical devices and whose functionality could pose a risk to a patient's safety if the device were to not function as intended"(FDA, 2019, pp., p.2). This means that apps considered to be low risk such as mHealth apps and education apps are not yet subject to oversight for quality and accuracy of information. Suggested strategies to improve quality and safety include providing more rigorous and standardized evaluations of apps that are made accessible to patients (Bates et al., 2018) and research to assess which apps affect health and educational outcomes.

Checklist and quality criteria to objectively assess the merits of apps should be used before recommending apps to clients or students and thought be given to how the architecture of the app will protect confidentiality, ensure accountability and protect data (Boudreaux et al., 2014; Stoyanov et al., 2015) (Kotz et al., 2009). The Mobile App Rating Scale (MARS) is a reliable mHealth app quality rating tool and provides a measure of the app quality indicators of engagement, functionality, aesthetics, and information quality, as well as app subjective quality. (Stoyanov et al., 2015).

An excellent resource is published by the National Health Service; it lists only apps which have met quality criteria for clinical safety, data protection, security and usability: https://www.nhs.uk/apps-library/.

2. Conclusion

There is no doubt that apps can enhance health outcomes by increasing patients' access to health information, involvement in care, and reduction of cost. Doubtless the rise in popularity of apps in clinical care and education will continue and nurse educators and clinicians need to ensure they have a good understanding of the principles of design, ethics of use, accessibility, and potential drawbacks to the use of this technology. However, currently, there are no statutory requirements to demonstrate effectiveness in modifying either behavioural or clinical outcomes and we do not yet know the effects of reliance on apps on human connectivity and relationships. Educators need to ensure that the use of these technologies is both informed and evaluated and to take into account that students may have varying degrees of comfort with or access to the technology.

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