

Smartphone apps in microbiology—is better regulation required?

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Abstract

Increasing diversity of available medical applications (apps) has led to their widespread use in healthcare delivery. However, app involvement in diagnosis and patient management has raised concerns, specifically regarding accuracy and reliability of content. Here, we report on the contemporary range of microbiology-themed apps and prevalence of medical professional involvement in app development. Of 94 microbiology-themed apps identified, only 34% had stated medical professional involvement. The lack of such involvement in app design is concerning and undermines consumers' ability to be informed regarding quality of content. We propose that increased regulatory measures are introduced to safeguard patient welfare.

Keywords: Apps, microbiology, regulation, safety, smartphones

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By 2015, over 86% of the world population will own at least one cell phone [1]. In all, 46% of adult Americans [2] and over one-quarter of adults in the UK own a smartphone (a mobile phone with enhanced computing functions), with the majority (59%) having acquired them in 2011 [3]. Smartphone 'apps' (downloadable software applications) permit software developers to create tools to aid healthcare delivery. An estimated 1000 new health-related apps are released every month [4] with market forecasters projecting global downloads of 142 million by 2016 [5].

Surveys [5,6] report that over 85% of medical professionals use smartphones and 30–50% [5,7] use apps in their clinical practice. Apps providing information and advice on medications (79%) are most popular [7]. Their popularity in various specialties has been reported [6–11], including reviews on available apps in anaesthesia [8] and infectious diseases [11].

In comparison, there is a paucity of information published on microbiology apps. However, innovations such as a microscope attachment for a camera-enabled mobile phone are of use in the diagnosis of malaria, sickle-cell anaemia, water-borne parasites and tuberculosis [12,13]. The ability to provide remote access to digital record keeping, monitoring automated sample analysis and expert diagnosticians has led to potentially exciting developments in healthcare provision [12,14]. Given their popularity and uptake by medical professionals, we aimed to identify the currently available apps with relevance to clinical practice in microbiology and identify the level of medical involvement in such apps.

Between 8 and 12 January 2012, the six relevant apps stores (Apple, Blackberry Mobile Market, Google Android Market, Nokia Ovi, Samsung and Microsoft Windows Marketplace) were searched using major microbiological terms (microbiology, microbes, antibiotics, antimicrobials, MRSA, *Clostridium difficile*).

Apps were categorized as 'reference' (microbiology textbooks, laboratory/diagnostic test interpretations, guidelines), 'education' (microbiology questions/flashcards for examinations, educational talks), 'antibiotic guidance' (pharmacology advice, dose calculators) and 'others'. General medical textbooks, games, arcades, wallpaper apps, social networking apps and apps under construction were excluded. Details regarding app content were obtained from the associated app description and advertising online. Information collected included type and price of app and author background. All prices in US \$ were converted to £ using the exchange rate on 12 January 2012 (£1 = \$1.53559). Collection/analysis of data was performed by one individual to ensure consistency.

Our search revealed 94 microbiology-themed apps in total (see Table 1 for a selection of examples); 36 apps (38%) were from Google Android, 51 (54%) were from Apple, five (5%) were from Blackberry and two (2%) were from Microsoft Windows Marketplace. No microbiology apps were identified on Nokia Ovi or Samsung Application stores. Eleven apps were available on both Google Android and Apple, two on Apple and Microsoft Windows marketplace and two apps were available on three app stores—Apple, Google Android and Blackberry.

'Antibiotic guidance' was the most popular type of app ($n = 42$, 47%) followed by 'Education' ($n = 28$, 23%) then

TABLE 1. A selection of microbiology-themed apps

Type of app	Example	Brief description
Reference	Meningitis Microbe world	Offers information to clinicians on meningitis; pathophysiology, symptoms and treatment Provides latest audio, video and news content in microbiology from the American Society for Microbiology
	John Hopkins' vaccines Sherris pathogenic parasites	Reference on administration and contraindications for various vaccines for registered users This text provides information on aetiological agents, pathogenic processes, epidemiology and basis of therapy
Educational	USMLE Microbiology Microbiology 101 Bacteriology	400+ questions in microbiology Revision course in microbiology Knowledge-based app about bacteria in relation to disease
	Antibiotic	Sanford's guide 2011 antimicrobial therapy Antibiotics a-pocketcards
Others	Thomson Reuters Clinical Xpert	Continuously aggregates data from disparate hospital information systems, providing real-time patient data
	Microbiology pronunciations Healthapps-MRSA and C diff	Audio of the pronunciations of microbes Provides public with infection numbers for methicillin-resistant <i>Staphylococcus aureus</i> and <i>Clostridium difficile</i> in NHS hospitals across England
	Understanding Lyme disease	Provides information on Lyme disease for patients

TABLE 2. Number of apps as per categories in the different online app stores (n = 94)

Online App store	Reference material	Educational material	Antibiotic advice	Others
Apple	9	17	23	2
Google Android	6	11	15	4
Blackberry	2	0	3	0
Microsoft Windows Marketplace	1	0	1	0
Nokia Ovi	0	0	0	0
Samsung application store	0	0	0	0

'reference' (n = 18, 19%) (Table 2). Other apps included audio help with microbiology pronunciations, information on infection rates in hospital, vaccinations and one offering clinicians real-time patient data from hospital information systems to allow monitoring.

Medical professional involvement (microbiologists, doctors, pharmacists, specialist nurses) was reported in the publicity material of 32/94 (34%) apps. Nineteen of 94 (20%) used general terms such as 'subject matter experts', 'team of doctors' or 'hospital team' which was regarded as medical involvement. Two of 94 (2.1%) were developed by software engineers. Four of 94 (4.3%) reported involvement by a named individual, but did not disclose professional background and 37/94 (39.4%) did not reveal authorship.

In all, 78% of reference apps charged for access (prices ranged from £0.64 to £99.50; mean £12.50); 79% of educational materials apps charged for access (range £0.69–24.49; mean £4.96) and 66% of apps providing antibiotic information or advice charged for access (range = £0.69–39.99; mean = 10.68). It was found that 63.2% of free apps and 58.5% of paid apps had medical involvement in their development. Specifically, six antibiotic dosage calculators were identified with only two revealing named medical professional

involvement. A number of authors of apps providing critical information (e.g. medicine dosing) explicitly stated that the accuracy of information provided could not be guaranteed.

The lack of peer-review or evidence base for content within apps has raised concerns [15]. Lack of medical involvement [9] in app development and use of privately funded/commercial educational material within clinical apps have been questioned [7]. Here, we report that over a third of currently available microbiology apps do not reveal the source of authorship with only 34% of apps revealing obvious medical involvement in their development. This prevents purchasers from being able to evaluate the degree of expertise involved in app creation before purchasing.

The small internal storage capacity, processing power and screen size of the mobile phone requires apps to be in a reduced format, [16] which reduces clarity. The challenge of capturing good images via mobile phone microscopy apps, [14] the question of confidentiality and data storage [17] and reliance on electronic transfer of information to mobiles presents opportunities for patient risk. A recent report highlighted the potentially lethal consequence of electronic interference when a medication was not stopped as an electronic text message interrupted a command being entered into a smartphone [18]. Furthermore, doctors using medical apps during patient care may be less likely to perform hand hygiene, thereby increasing the risk of bacterial transmission [15,19].

The Food and Drug Association has recently published guidelines stating their intention to regulate a subset of smartphone medical apps that might present a potential risk to patients [20]. In the UK, the Medications and Healthcare Products Regulatory Agency approved the first smartphone app in January 2012. However, they are yet to clearly state their role in regulating this area [4].

In conclusion, smartphones and apps are popular and possess many potential uses within microbiology. However, a more robust regulatory process may be required to prevent future harm to patients. Healthcare professionals should consider risks when using apps to aid in patient diagnosis and management. We recommend that a regulatory framework be established to ensure that the information provided on app store websites is complete, accurate and reliable; so enabling purchasers to make an informed decision before using medical smartphone apps.

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Transparency Declaration

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