Instagram and WhatsApp in Health and Healthcare: An Overview

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Abstract: Instagram and WhatsApp are two social media and networking services introduced in 2010. They are currently subsidiaries of Facebook, Inc., California, USA. Using evidence from the published literature and case reports indexed in PubMed and other sources, we present an overview of the various applications of Instagram and WhatsApp in health and healthcare. We also briefly describe the main issues surrounding the uses of these two apps in health and medicine.

1. Introduction

The rise of smartphones, tablets and mobile apps is an important development in health and healthcare, particularly social apps that provide learning and collaboration opportunities to busy health professionals and peer-to-peer support and health education for the general public [1,2]. Effective use of smartphones is part of how doctors and patients communicate in the 21st century. The latest social media trends point to social networking services and mobile tools, such as Instagram [3] and WhatsApp [4], as a viable medium for sharing and discussing clinical cases and medical and health knowledge.

In 2006 and 2007, the first and third authors published two highly accessed and cited reviews of social media applications in health and healthcare [5,6]. Since then, a growing number of social media and networking services have been introduced and have grown popular in the health and healthcare arena, joining the more established and older services in the social media toolbox, such as Facebook, Twitter and LinkedIn. This paper focuses on two social media and networking services that were launched in 2010, namely Instagram, a photo- and video-sharing service, and WhatsApp, an instant messaging client. Both services are currently (as of April 2016) subsidiaries of Facebook, Inc., California, USA. The article examines the available research evidence and reports into their uses in health and healthcare and the main issues that are involved in such applications.

Photo-sharing and messaging apps are part of the mobile revolution. They change how text, audio and visual information are shared and communicated within social networks. In medicine, Instagram and WhatsApp are finding a niche among health professionals that use hospital-specific and dedicated accounts and groups on these platforms to communicate and encourage social and mobile forms of learning.

Instagram and WhatsApp are free and easy-to-use apps that facilitate all sorts of clinical and non-clinical exchanges, and can also support mobile learning. WhatsApp user base reached one billion

in February 2016 [7], while Instagram's monthly active user base is expected to reach 520 million by the end of 2016 [8]. Facebook (the parent company) is currently exploring business models to monetize the two services [8], learning from the successful and innovative revenue generation models implemented by WeChat [9], WhatsApp's direct Chinese competitor (e.g., ordering a taxi or paying for goods and services directly from the platform).

Instagram is available as an app for the Android and iOS platforms [3], but can also be accessed from any Web browser on desktop PCs and notebooks, thanks to its Web-based user timelines functionality, e.g., the Instagram timeline of the US CDC (Centers for Disease Control and Prevention [10] and Figure 1).
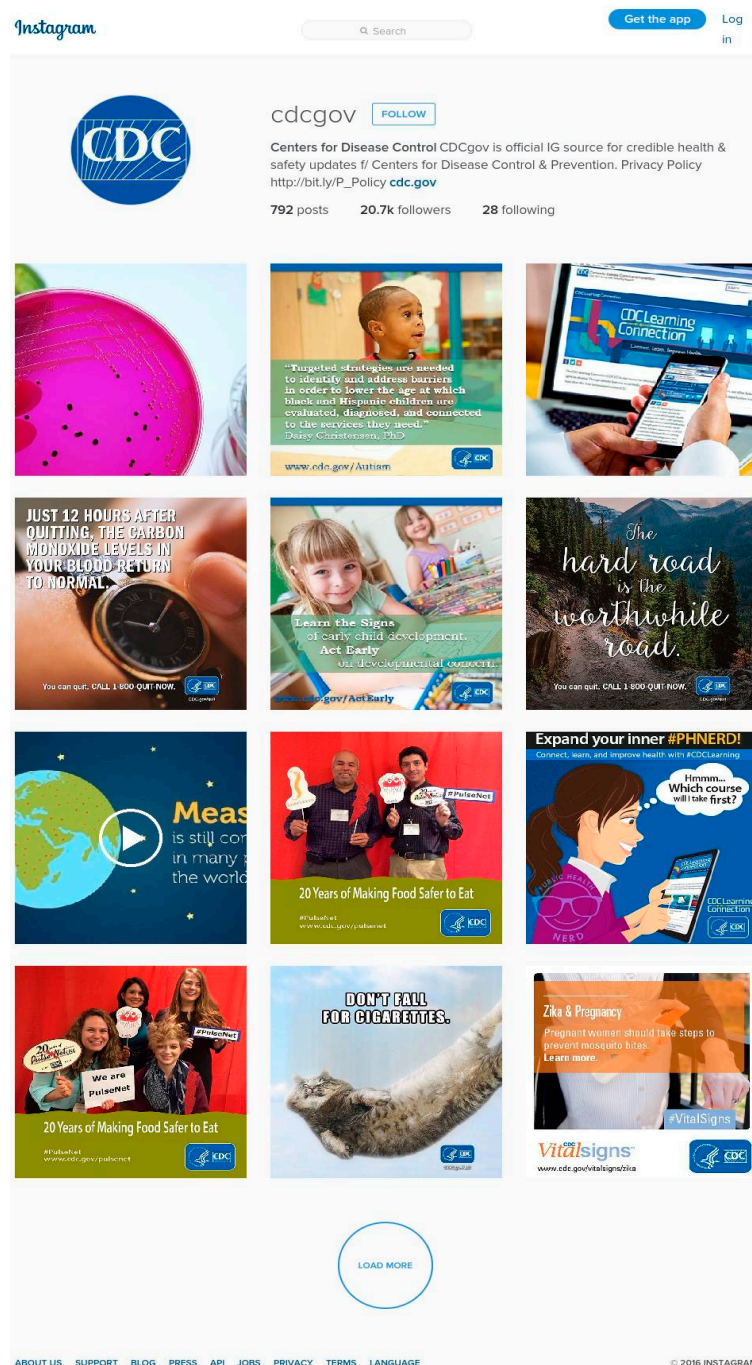

Figure 1. The US CDC (Centers for Disease Control and Prevention) timeline on Instagram, as captured on 15 April 2016 [10].

Instagram users can easily share photos and videos with text captions and hashtags on their timelines. Timeline visitors and followers can 'like' or comment on timeline posts. Instagram Direct lets users send private messages to single contacts or groups.

With WhatsApp, users can send text messages, and share video and voice messages and images over the Internet to their personal and professional learning networks. WhatsApp's Group Chat feature lets users chat and share content with up to 256 people at once. WhatsApp's Broadcast Lists are saved lists of message recipients that a user can repeatedly send broadcast messages to without having to select them each time. Available for the Android, iOS and Windows Phone platforms [4], the app is tied to the user's cellular mobile number, but can also be accessed from any Web browser on desktop PCs and notebooks (Figure 2), once an account has been created via the app on the user's smartphone. The service has recently implemented end-to-end encryption to protect user privacy [11], making it even better suited to clinical applications.
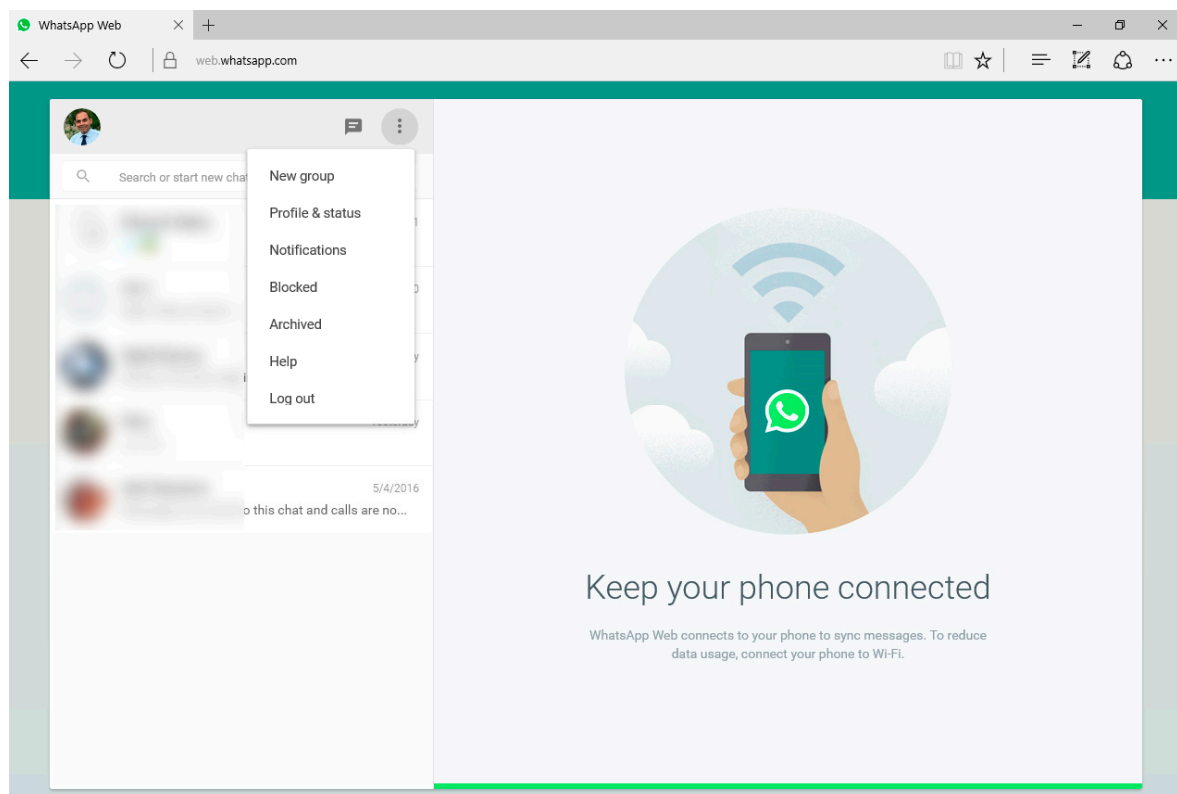

Figure 2. WhatsApp's Web-based interface running in Microsoft Edge Web browser on a Windows 10 desktop PC.

Sources of Evidence

This review is based on articles collected via PubMed by searching for entries using the keywords 'WhatsApp OR Instagram'. More than 70 PubMed-indexed records were found as of mid-April 2016, in addition to some other hand-picked papers about the two apps that the authors located through sources such as CINAHL, Embase and Med-e-Tel 2016 conference proceedings. Of these, a total of about 50 papers that had WhatsApp or Instagram as a major or the main focus were considered in this review. We excluded papers that only mentioned WhatsApp or Instagram in passing, and were not sufficiently focused on either of these services.

2. Instagram

Instagram's uses are mainly educational/informational and motivational/supportive. The app has great potential to serve as a social networking platform in visually rich disciplines, such as clinical dermatology [12], clinical infectious diseases [13] and radiology [14], owing to its strong, albeit not unique, photo- and video-sharing affordances. However, negative uses capitalizing on these same visual affordances have also been documented in the literature, such as the promotion of tobacco and alcohol use [15–17], of pro-anorexia messages [18] and of unhealthy foods that are high in calories but low in nutrients [19]. According to Moreno et al. [20], non-suicidal self-injury or self-harm content is also popular on Instagram and may influence adolescents, with 'Content Advisory' warnings failing to protect unwitting users.

Yi-Frazier et al. [21] experimented with the use of Instagram in disease-related discussions and photo-sharing for peer-to-peer support among adolescents with type 1 diabetes. Another study by Al-Eisa et al. [22] concluded that the use of Instagram with a home exercise programme as a motivational modality could be attractive and effective to reinforce adherence and maintain an appropriate level of physical activity. However, Tiggemann and Zaccardo [23] reported that Instagram fitspiration images (promoting exercise and healthy food to inspire viewers towards a healthier lifestyle) might have negative unintended consequences for body image among certain users, who are more prone to develop increased negative mood and body dissatisfaction and decreased state appearance self-esteem upon exposure to such images.

Photo-sharing platforms are also being used for information exchange about public health crises, but the useful-signal-to-noise ratio can be low. Seventy-eight percent (78%) of images in an Instagram sample about Ebola were primarily coded as 'jokes' or 'unrelated' in a study by Seltzer et al. [24]. Nevertheless, Instagram remains one of the tools used by the World Health organization (WHO), the US Centers for Disease Control and Prevention (Figure 1, [10]) and other public health bodies to disseminate visually-rich public health messages that both educate and interest the general public, and for risk communication during public health crises and man-made or natural disasters. Cool et al. [25] report one such use by the WHO following Typhoon Haiyan in the Philippines.

Correia et al. [26] describe a quite novel use of Instagram to monitor Drug-Drug Interactions (DDI) and Adverse Drug Reactions (ADR) among the general public through complex network analysis of Instagram user timelines.

3. WhatsApp

A number of studies have examined the usefulness of WhatsApp in clinical decision-making and patient care. Nardo et al. [27] tested WhatsApp to verify if it facilitates communication, enhances learning, and improves patient care (and maintains privacy). They conducted focus groups of surgeons over the periods from March 2013 to July 2015 and September 2014 to July 2015 through a 'WhatsApp Surgery Group'. Patients signed consent and information-release forms to let team members communicate clinical data using WhatsApp. A total of 1053 images were used with an average of 78 images for each patient (range 41–143). One hundred twenty-five hours of communication were recorded, generating 354 communication events. An expert surgeon received the highest number of questions (p, 0.001), while residents asked clinical questions (p, 0.001) and were fastest to respond (p, 0.001). In their conclusion, they described WhatsApp as a low-cost and fast technology with the potential of facilitating clinical communications, enhancing learning, and improving patient care whilst preserving their privacy.

Another study by Cheung et al. [28] looked at whether group discussion and reminders via WhatsApp or Facebook were effective in preventing smoking relapse for those who had stopped smoking. They conducted a randomized controlled trial allocating recent quitters who had completed eight-week treatment reporting abstinence for at least seven days to WhatsApp (n = 42) or Facebook (n = 40) and a control (n = 54). Groups participated in two-month online group discussions on WhatsApp or Facebook, which were moderated by trained smoking cessation experts and received

a self-help booklet on smoking cessation. The control group only received the booklet. The primary outcome was two- and six-month relapse rates. WhatsApp was found to be effective in reducing relapse, thanks to enhanced discussion and social support. Inactive discussion in Facebook might have attributed to lower effectiveness.

Dorwal et al. [29] tested the use of WhatsApp in laboratory management by forming multiple laboratory groups. Thirty-five members used the service for three months and responses were taken on a scale of 1 to 10. Significant improvements in communication were seen in sharing photographic evidence, information about accidents, critical alerts, academic activities and directives. An increase in the load of adding information to the application and some disturbance in routine workflows were documented, but the benefits outweighed the minor hassles associated with the use of WhatsApp.

Research by Johnston et al. [30] analyzed WhatsApp as a communication method among emergency surgery teams in a London hospital. All emergency surgery team members ($n = 40$) who participated in their study used WhatsApp for 19 weeks. Initiator and receiver of communications were compared for response times and communication types. Safety events were reported. More than 1100 communication hours covering the details of 636 patients were logged, resulting in 1495 communication events. The attending started the most instruction-giving communication, while interns asked the largest number of questions ($p < 0.001$). The resident was faster to respond compared to intern or attending ($p < 0.001$). Participants felt the app helped to "*flatten hierarchy*" amongst students, residents and experienced consultants, enabling them all to actively contribute to discussions without inhibition.

Kaliyadan et al. [31] evaluated the frequency of use, advantages and disadvantages of WhatsApp in clinical discussion groups. An online survey was created and sent to a convenience sample made up of members of three WhatsApp dermatology groups. The survey looked at individual activities, satisfaction with app, and perceptions regarding platform. Sixty-one (61) dermatologists completed a survey; 38 males and 23 females. Ages of participants ranged from 26 to 57 years. Years of experience varied from 1st year residents to senior consultants with up to 34 years of clinical experience. Fifty (out of 61) respondents were active in other Web-based forums, such as Facebook or other e-groups. The majority of participants agreed that WhatsApp was better for case discourse.

Khanna et al. [32] assessed the impact of WhatsApp as an intradepartmental communication tool regarding (i) awareness of patient-related information; (ii) efficiency of the handover process; and (iii) duration of traditional morning handovers among orthopedic residents in a 300-bed tertiary care teaching center. Wide usage, low costs, availability and double password protection (phone lock and WhatsApp lock) made the group conversation feature an ideal tool for intradepartmental patient-related communication. Residents reported swifter and more efficient handovers with WhatsApp. The results indicated that WhatsApp can bring about an improvement in patient-related awareness, communication and handovers among orthopedic residents.

Mars et al. [33,34] undertook a descriptive scoping review of the literature of WhatsApp in clinical medicine. They searched PubMed, Science Direct and Google Scholar, among others. Their inclusion criteria were papers that described the use of WhatsApp in a telemedicine context. Papers describing the use of WhatsApp for teaching or social support in weight loss, exercise or similar programmes were excluded. Abstracts were reviewed for relevance, duplicates removed, and the remaining full text papers read. After initial abstract review 58 papers were retrieved and 32 met inclusion criteria. They found that WhatsApp is used for group chats and doctor-to-doctor telemedicine. The literature they reviewed showed a lack of understanding of how information is transmitted and stored when using WhatsApp and of the problems this might create for patient confidentiality and data security. They concluded that WhatsApp has a role to play, particularly in the developing world, as it is freely available and widely-used outside of medicine, and that guidelines are needed to assist users in adequately tackling the associated medicolegal and ethical concerns.

Petruzzi et al. [35] describe their use of WhatsApp to share clinical oral medicine information. This involved WhatsApp being used by dentists, physicians, hygienists, and patients to submit images

and questions. For each submission, a clinical impression was registered and classified as traumatic, infective, neoplastic, autoimmune or uncategorized. Three hundred and thirty-nine images were received for 96 patients; 92 (95.8%) patients underwent clinicopathologic examination, and 45 (49%) received a biopsy. Dentists (62%) and dental hygienists (26%) were the most frequent senders. The most common type of question was related to diagnosis (56%). The telemedicine impression agreed with the clinicopathologic assessment for 82% of cases. They concluded that multimedia messaging apps, such as WhatsApp, can support communication about oral conditions among clinicians and patients. Their experience showed that telemedicine consultation using WhatsApp can reduce geographic barriers to initial clinical consultation and encourage the significant majority of patients to pursue expert clinical examination.

Robinson et al. [36] report their findings of using WhatsApp to develop social presence among first-year undergraduate radiography students. An analysis was done using a validated tool specifically designed to identify categories of social presence, developed using the Community of Enquiry model. Students undertook the analysis. Six hundred posts (10% of total year's messages) were analyzed in the first-year student journey. WhatsApp was able to provide students with a platform to demonstrate characteristics relevant for the development of social presence. Furthermore, its immediacy seemed to offer advantages over embedded social media platforms, such as conventional discussion boards.

Another study by Wani et al. [37] assessed WhatsApp as a communication method among staff of plastic and reconstructive surgery at a tertiary care health facility. In 2012, Wani and colleagues used smartphones and WhatsApp as a communication method in patient management and as a tool for academic endorsements. There were 116 episodes regarding patient management, handled in a timelier fashion by using WhatsApp. The opinion of residents was sought regarding this method of communication. A majority of residents were satisfied with this mode of communication. Wani et al. concluded that WhatsApp is an effective, low-cost, quick and easy-to-implement method for clinical and academic endorsements. Along the same line, Martyn-Hemphill et al. [38] evaluated the use of WhatsApp instant group messaging amongst urology team members to promote patient safety within a busy acute and elective urology service, and found it to be "a cost and time efficient, user-friendly adjunct to traditional modes of communication".

Similarly, Astarcioglu et al. [39] concluded that WhatsApp "is cheap, quick, and easy to operate" following their assessment of its efficacy as a communication method between the emergency physician in a rural hospital without percutaneous coronary intervention (PCI) capability and the interventional cardiologist at a tertiary PCI centre.

Thota and Divatia [40] report a life-saving use of WhatsApp in resource-limited situations that involved sending clinical images. They were able to save the life of a critically ill patient by sending clinical monitor images of transvenous pacing with ECG (electrocardiogram) changes to, and receiving feedback from, an expert consultant who was 40 km away from the center where the patient was located. Giordano et al. [41] evaluated the inter- and intra-observer agreement in the initial diagnosis and classification by way of CT (computerized tomography) scans and plain radiographs of tibial plateau fractures photographed and sent using WhatsApp. They found an excellent inter- and intra-observer agreement in the imaging assessment of tibial plateau fractures on WhatsApp, and concluded that the app is suited for obtaining the opinion of an experienced consultant when not on call. In the same vein, Kelahmetoglu et al. [42] found that "sending and receiving images and videos on WhatsApp is an easy, rapid way of evaluating maxillofacial CT scans in night-time teleconsultation".

There are also studies that investigated the effectiveness of WhatsApp as a communication tool in supporting patients. In a study presented at the Third World Congress on Integrated Care, Mexico City, Mexico, 19–21 November, 2015, Saavedra Ramirez [43] reported on the use of WhatsApp as a means of communication within a self-help group that involved hypertensive patients with type 2 diabetes and expert medical staff. Social support received in this way promoted greater adherence of patients to treatment and self-care guidelines. However, in another study by Muntaner-Mas et al. [44], in which they evaluated the feasibility and preliminary effectiveness of a WhatsApp-based intervention

aimed at enhancing health-related physical fitness components and cardiovascular disease risk factors, WhatsApp was found to be less effective than the face-to-face mode with which it was compared.

In the context of learning, social media have been used progressively in recent years to support all areas of learning. WhatsApp exhibits some useful benefits in this respect and its increasing popularity has spawned several research studies. Willemse [45] reviewed the experiences of undergraduate nurses in using WhatsApp to improve primary healthcare education at a university in the Western Cape, South Africa. Rambe and Bere [46] showed how WhatsApp can improve peer engagement and increase learner participation. The use of WhatsApp in mobile social learning was found to have a significant positive impact on learners' attitudes and achievement levels [47]. The discourse of spontaneous interaction [48] is assuming increasing importance as we begin to apprehend the power and potential of mobile learning and information exchange.

4. Discussion

Instagram's uses fall into two main categories, namely educational/informational and motivational/supportive applications. Instagram's public timelines feature enables health organizations, such as the US CDC [10], to reach out and disseminate visually rich public health messages to hundreds of millions of potential readers who are using the service. There are also some documented negative uses of Instagram, e.g., by the tobacco industry [15]. According to Lee et al. [49], Instagram users have five primary social and psychological motives: social interaction, archiving, self-expression, escapism, and peeking, but these motives are not always without negative consequences (see, for example, [23]). Lup et al. [50] found that more frequent Instagram use had negative associations for people who follow more strangers, but positive associations for people who follow fewer strangers, with social comparison and depressive symptoms among 18–29 year olds.

Sharing text, documents and images on WhatsApp may have a role in improving clinical decision-making and patient care for clinicians, from consultation to bedside. The tool facilitates and improves communication for healthcare teams, providing good ways for physicians to monitor work performed by clinical staff. For example, Gulacti et al. [51] found WhatsApp to be a useful communication tool between physicians, especially for emergency department consultants when they are outside the hospital.

One can also think of a good use of WhatsApp involving members of the general public subscribing to receive WhatsApp alerts that are relevant to their health needs, e.g., health information and health-related motivational messages covering weight loss coaching and support, healthy lifestyle tips, or smoking cessation, among other topics. WhatsBroadcast [52] can be used to deliver such alerts to subscribers. Lay users can also benefit from hosting relevant virtual peer-to-peer support groups in WhatsApp, e.g., for patients with chronic conditions, HIV-positive youth, etc.

Moreover, WhatsApp has been successfully used in health and medical education and learning. All respondents (*n* = 61 dermatologists) in a survey by Kaliyadan et al. [31] agreed that WhatsApp discussions enriched their clinical knowledge, not only with regard to particular clinical case discussions, but generally by sharing learning resources about relevant references/journal articles and upcoming conferences/meetings. WhatsApp group-chat dynamic also enables junior doctors to contact, and learn from, senior doctors more easily where they may not previously have felt able to phone them directly [53].

Both Instagram and WhatsApp enjoy ease of use, particularly of image uploading and downloading, with generally fast loading times (see, for example, the results reported in [31]). A number of studies we covered in this review concluded that Instagram and WhatsApp, being free to use, are suitable for low-resource settings (e.g., [27,37–40]). Different studies also concurred that the high photo quality (transmission and display) offered by these services is more than adequate for clinical diagnostic purposes in teleconsultations (e.g., [40–42]), although diagnostic picture quality is also dependent on other factors such as the user's camera specifications (including

camera lens specifications), lighting, and camera angle/position and distance from photographed lesions, particularly in disciplines such as clinical dermatology.

Table 1 presents some of the above discussed themes in relation to Instagram and WhatsApp uses in health and healthcare.

Table 1. Instagram and WhatsApp in health and healthcare: select themes from this review.

Theme	References
Instagram	
Alcohol and tobacco (negative uses of Instagram in marketing and promoting them)	[15–17]
Diet, exercise and fitness, including negative uses	[18,19,22,23]
Public health concerns and alerts, including uses by organizations such as the US CDC	[10,24–26]
Nonsuicidal self-injury and mental health related	[20,50]
Visual-social information-sharing	[12–14,21]
WhatsApp	
Tobacco treatment and control	[28]
eLearning	[46,47]
Enhanced communication and social interaction	[29,30,32,36–38,53]
Exercise and fitness	[44]
Medicolegal aspects	[33,34]
Nurses	[45]
Teleconsultation and Surgical	[27,30,35,37,39,41–43]
Visual-social information-sharing	[31,35,40]

4.1. Instagram, WhatsApp and Learning

Learning is essentially a social activity, where people scaffold and extend each other's knowledge gain [54], but in recent years, new theories have emerged to explain distributed forms of learning that have been made possible through mobile technology and social media. Digital forms of scaffolding emerge where learners access new knowledge using personal devices [55]. The power differentials between experts and novices is also thought to be diminishing due to new and emerging forms of peer learning and knowledge production. This 'paragogical' theory is based on the premise that online networks are sufficiently developed to support user-generated content that can be shared freely and widely [55,56] to inform communities of practice and interest [57] ('paragogy' in this context refers to the conscious practice of peer learning, according to [56]). Another emerging theory relates to the increasing mutability of knowledge in the digital age. Proposed by Siemens [58], 'connectivism' suggests that knowledge now resides in the network as well as in the minds of those who use it. Learning is amplified and knowledge becomes more widely available as the network of people, tools and connections strengthens. WhatsApp fulfils many of the requirements of this kind of learning, and its rising popularity—particularly among younger generations—assures it continues to be widely used, and scrutinized, in many forms of peer production and information dissemination. The same could be said about Instagram and its uses in medical education, e.g., [59].

4.2. A Plethora of Options

Despite similar functionalities being offered on the main Facebook platform, e.g., photo- and video-sharing with hashtags on timelines, and private multimedia chat and messaging with single contacts or groups, there are still very many millions of users worldwide who prefer Instagram and/or WhatsApp over Facebook (or use Instagram and/or WhatsApp in addition to Facebook), particularly on smartphones. In a large sample of 2418 users, Montag et al. [60] recorded WhatsApp behaviour over a four-week period. Their data showed that the use of WhatsApp accounted for almost 20% of all smartphone behaviour compared with Facebook, which accounted for less than 10% of all recorded behaviour in the same study. In another survey conducted in 2015 [61], only 2% of UK doctors and 4% of US doctors reported using WhatsApp to communicate with patients in the month preceding

the survey, compared to 87% in Brazil, 61% in Italy and 50% in China (in China, WeChat is used as WhatsApp's equivalent).

Going beyond Facebook, Inc.'s offerings, several other tools and services exist, such as Skype (does not enforce account tying to user's cellular mobile number, [62]), WeChat (tied to user's cellular number—[9]), Viber (tied to user's cellular number, [63]), etc., but some of these alternative options are seen as more complex to use, offering less immediacy and spontaneity. Immediacy has been identified as one of the key affordances for successful learning and information dissemination in digital environments [36,64]. On the other hand, some of the available alternative options feature unique functionalities that might be useful in certain scenarios, e.g., Skype Translator applied to patient care [65]. Furthermore, encryption levels vary across these different options, which might be a decisive factor in preferring one service over the other, e.g., encrypting private messages only when they are in transit between a user's device and company servers, where they are stored and can be handed over if required by law (as in the main Facebook platform, for example) vs. end-to-end encryption, with the company not storing messages on its servers (as in WhatsApp, for example).

As with many other things in life in which there are many options and models to choose from (e.g., cars, smartphones, computers, etc.), it is an advantage to see Facebook embracing alternatives within its own portfolio of services and to have other options from different providers as well. Competition produces better services, and the availability of a number of options to select from enables end users to choose the service that best matches their individual and local needs, though this can, at times, be a confusing task to some people. However, with trial and error and by learning from the experiences of others (e.g., reports in the published literature as covered in this article), most users and teams will be able to find the tool(s) and protocols that best work for them.

Indeed, the different social media platforms on offer today are not mutually exclusive, and can in fact be synergistic. For example, the US CDC has established a presence on a good number of these platforms (Instagram being just one of them, [10]) to ensure the widest possible dissemination of its public health messages and to reach out to more people wherever they might be online. Different platforms will often have different but also overlapping demographics, and this should be carefully considered and leveraged by health and healthcare organizations when devising their social media outreach strategies.

4.3. Patient Privacy, Confidentiality and Other Issues Surrounding the Health and Healthcare Uses of Instagram and WhatsApp

Mars et al. [33,34] list the following downsides of WhatsApp, some of which might have medicolegal ramifications: frequent interruptions; disparity on urgency; decreased verbal communication; being online 24 h (could also be seen as an upside depending on context); cannot easily print communication record; communications are not readily included in patient's medical record; and identifying patients can be difficult. Other limitations of WhatsApp are to do with Internet connectivity issues, the lack of adequate follow-up in some case discussions, and the variable quality of images [31].

There have also been concerns related to the risks of breaching patient confidentiality and data protection requirements on Instagram and WhatsApp, e.g., [31]. These risks are common to all social media services and not only Instagram and WhatsApp [66]. For clinical photos posted on public Instagram timelines, it remains the poster's (doctor's) full responsibility to protect their patients' privacy and confidentiality (and also observe any applicable content copyrights). The same rules and ethical requirements (including patient consent) for publishing clinical photos in medical journals still apply here. Most reputable health and healthcare organizations have well-established and clear policies governing such clinician ethics and discipline issues as they apply to online environments, including social media.

For images privately stored on smartphones, and exchanged among closed groups using WhatsApp and similar apps, there are also risks of breaching patient confidentiality [67–69]; for

example, in cases of unauthorized access (e.g., if the smartphone is left unattended and unlocked); smartphone theft; if the photos are forwarded to the wrong recipients; or if the photos are advertently or inadvertently used beyond their original purpose to which the patient had consented. Measures to address confidentiality of patient data stored on, and exchanged via, smartphones include bolstering smartphone security (e.g., data encryption and remote data wiping in case the device is stolen). Again, organizations often have, and should have, very clear policies, rules and provisions in place regarding these very important information governance issues [69].

Drake et al. [70] point to the fact that when a message is sent from a device via an instant messaging service, the data are relayed to commercial servers that often reside outside of the user's home country via the Internet, where from recipient devices can retrieve messages. This can be problematic in countries such as the UK, where any transmission of sensitive, patient-level data to third-party providers outside the European Economic Area (EEA) would constitute a breach of the Data Protection Act of 1998. In 2014, the National Health Service (NHS) in England enumerated its concerns about instant messaging and advised against using it in clinical exchanges due to problems with data and third-party server security and territory, but this position is gradually changing with the introduction of NHS-oriented apps, such as Babylon Pocket Doctor [71] and Push Doctor [72]. In the US, the Health Insurance Portability and Accountability Act (HIPAA) protects confidential healthcare information, with similar laws in Canada and Australia protecting patients. WhatsApp may partially meet these standards given its newer end-to-end encryption policies and that it does not store chat content/history on WhatsApp's servers (unlike Facebook messaging, [11,73]), but these protections remain not formally and explicitly tested in a clinical environment, and should not be accepted without more robust evidence.

No discussion of social media in health and healthcare is complete without at least a mention of user (patient) privacy issues on these networks. Bertsima et al. [74] offer a good treatment of this important subject, including a comprehensive range of options for strengthening online privacy in healthcare social networks.

4.4. Successive Updates and Versions

Pooling together older and newer studies about a given social media service (as in this article) might carry some limitations. Older studies would have their results based on older versions of the service, and might not fully apply to newer (better or worse) versions of the same service. For example, WhatsApp used to have an annual subscription fee of US $0.99, but is now completely free. It also does not support live video calls (it only supports voice calls) as of April 2016, but this is about to change with the introduction of video calling in the next update of WhatsApp [75]. Additionally, in the past, Instagram could only be accessed by logging to one's account on a dedicated Instagram smartphone app; Windows PC users could not access content on Instagram. However, this is has changed today, with the introduction of Web-based Instagram public timelines (e.g., [10]) that can be fully displayed on any PC or mobile browser, without using the dedicated app or having an Instagram account. Furthermore, Instagram is now no longer limited to square (1:1) photos as it used to be in the past.

The first author expects future versions of WhatsApp to introduce even more social and health-related functionalities similar to those already in place in WeChat, WhatsApp's immediate rival [76,77].

5. Conclusions

Social media have changed, and will continue changing, health and medicine [5,6,78]. Smartphones are effective across a range of social learning and communicative contexts in health and healthcare: in patient care, monitoring, rehabilitation, communication, diagnosis, teaching and research [1,2]. Adding Instagram and WhatsApp to the clinical communication and teaching toolbox facilitates timely responses among health teams, faster handovers for residents at hospitals, and a

wider dissemination of public health messages to more people. Apps, when deployed as user-friendly adjuncts to traditional communication, can help to create virtual communities of enquiry and practice, and bridge distances both temporal and psychological that may be characteristic of busy distributed healthcare settings. However, more research into the safety and security of Instagram, WhatsApp and similar apps should be conducted, particularly to address concerns about patient confidentiality and safe, secure communications. New research techniques, such as Imagga [79], an automated image recognition and tagging software tool, are also needed and are being introduced to help in investigating the various and ever-growing health and healthcare uses of Instagram and related apps [80].

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