

# Mobile phone technology for improved mental health care in South Africa: possibilities and challenges

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## Abstract

We consider the potential and current uses of mobile phones in the mental health field in South Africa. From the limited research conducted, mobile phones seem most suited to enhancing cognitive behavioural therapy. In addition, mobile phones seem to have many other benefits, such as increasing adherence to medication, allowing therapists to monitor clients' progress, improving the therapeutic relationship, and providing information to both clients and therapists. We also examine the ethical concerns and challenges related to mental health care in South Africa and emphasise the need for psychologists to exercise caution in incorporating such technologies into their practice. At this stage, there is insufficient evidence to support the notion that these technologies can replace face-to-face interventions; however, they have many properties which, if used correctly and with ethical considerations, may enhance therapy, prevention, and public mental health.

## Keywords

Mental health care, mHealth, mobile health, South Africa

The number of activated Subscriber Identity Module (SIM) cards for mobile phone usage globally probably exceeded 6 billion in 2012 (Buhi et al., 2012). The rapid growth in mobile phone users, especially in low- and middle-income countries (LMICs), creates opportunities for mobile phones to contribute significantly to health interventions. Mobile phones have been used by a range of health-care providers, including psychologists, to improve access to care, monitoring health outcomes, supervision, and health surveillance. Mobile phones may improve health conditions and alleviate financial burdens on understaffed hospitals and provide substantial potential to support

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people in managing their own health (Hawe, Shiell, & Riley, 2004, 2009). Several review articles have identified randomised trials examining the efficacy of text-message or voice call interventions for education, reminders, monitoring, or management of medications and symptoms of asthma, stress, smoking, and diabetes, and in improving adherence to health advice and health promoting regimens such as increasing physical activity (Buhi et al., 2012; Cole-Lewis & Kershaw, 2010; Fjeldsoe, Marshall, & Miller, 2009; Krishna, Boren, & Balas, 2009). Mobile phones may generate improved feedback for chronic illness care and monitoring (Anhoj & Moldrup, 2004; Cho, Lee, Lim, Kwon, & Yoon, 2009; Shapiro et al., 2008), transmit images for documentation (Razdan, Johannes, Kuo, & Bagley, 2006), or may be used for diagnostic purposes (Frean, 2007; Piek et al., 2006; Zimic et al., 2009). A review of the literature on mobile technology for health using the Web of Science database reveals a rapid increase in literature on the topic. A recent special issue of the journal *Professional Psychology: Research and Practice* provided an overview of the possibilities and challenges for the use of smartphone technology for mental health, and surveyed the available literature, which comes mainly from the United States (Luxton, McCann, Bush, Mishkind, & Reger, 2011).

While mobile coverage is limited in many African countries, in 2000, South Africa accounted for 81% of the sub-Saharan mobile network subscribers. By 2006, 86% of the country had coverage by at least one network. This, together with the reduction in prices of mobile phones ranging from about 200 Rand (approximately US\$22), has made mobile phone technology more accessible to the South African public (Buys et al., 2009). There has been a rapid uptake of mobile phone technology in a variety of health-related fields in this country, for example, in diabetes care (Flisher et al., 2007; Rotheram-Borus et al., 2012) and in improving HIV medication adherence (Pop-Eleches et al., 2011). It has also been used in large-scale health research projects to collect data and to monitor adherence by community workers to manualised treatment regimens (Tomlinson et al., 2009; Tomlinson et al., 2013). As far as we are aware, though, there are no data in the public domain exploring the use of mobile technology specifically in the mental health field in South Africa. It is well established that mental health resources in South Africa are limited. It is also true that mental health practitioners are not equally distributed across the country, and that people in rural and remote areas (in South Africa most of which are now covered by mobile technology) face particular challenges in accessing mental health care. Almost four out of five people with a severe mental illness in LMICs will not have received treatment in the past year (Demyttenaere et al., 2004). Mobile technology is therefore an important option to explore in addressing South Africa's treatment gap. In this article, we explore some of the potential benefits of this technology, and also consider some of the challenges associated with it in South Africa.

## The potential for mobile phone use in mental health care

Even in countries with better resources than South Africa, the needs for mental health care (traditionally delivered on a face-to-face, one-to-one basis) cannot be met (Kazdin & Blase, 2011), and the concentration of mental health services in urban, affluent areas which have major business and universities nearby is a global phenomenon (Kazdin & Blase, 2011).

It is in the field of cognitive behavioural therapy (CBT) that most research has been undertaken using mobile phone technology. CBT is a problem-solving orientated type of therapy which teaches patients skills that entail modifying distorted thinking and beliefs, and the treatment commonly focuses on modifying behaviours in relation to a single presenting or overriding problem (Watts et al., 2013).

Mobile phones are particularly suited to CBT given its highly structured framework and the way it employs homework as a learning tool (Watts et al., 2013). They can also assist in the accuracy of the information that the therapist receives by collecting information during homework tasks, since retrospective feedback is sometimes unreliable (Boschen & Casey, 2008). In some cases, using a mobile phone may prompt the client to provide more detailed feedback, because pen and paper feedback is not always convenient (Luxton et al., 2011). Mobile phones may also help CBT therapy progress more quickly, and due to the fact that some tasks can be done using the mobile phone and without the therapist, they may assist in fostering independence while providing support at the same time (Preziosa, Grassi, Gaggioli, & Riva, 2009). This will also allow the therapist to make the best use of the time available with the client. Mobile phones can assist in transferring knowledge from the therapeutic setting into real-life settings (Preziosa et al., 2009). In light of the evidence that many people, even many socio-economically disadvantaged people, already have mobile phones, it is a relatively inexpensive way to disseminate information (Aguilera & Muñoz, 2011). In exploring the potential of the mobile phone in CBT, we will look at some of its applications separately and examine the use that they might have in psychotherapy.

## Mobile messaging

Mobile phone text-messaging (i.e., short messaging service [SMS]) and multimedia messaging service (MMS) are relatively inexpensive tools that have become widely used communication media. This communication medium has become equally, if not more, popular than telephone voice calls. Bocking et al. (2011) described a process known as mobile cognitive therapy (M-CT) consisting of eight modules in which the patient has therapist contact via Internet, phone calls, and SMS. The modules comprise homework assignments and feedback tasks. The participants can also view videos which can explain a topic in more detail. All of this can be done using one device, the mobile phone. This study utilises the SMS feature in several ways. First, if participants do not log on after a certain period of time, they will receive an SMS reminder to continue with the therapy. Second, SMS is used to monitor the patient's mood throughout the therapy. Patients will be sent an SMS asking them to provide feedback on their mood using numerals. If a depressive episode is detected, participants will receive help from the online modules, which can provide the opportunity of learning to cope with this episode.

Aguilera and Muñoz (2011) have argued that one of the reasons for individuals dropping out of CBT is because they feel a lack of connection between themselves and the therapist. They showed that daily text messages strengthened the therapeutic alliance. Patients felt that the therapist was concerned about their welfare, and reported that they would be less likely to withdraw from the therapy (Aguilera & Muñoz, 2011). Even when the messages were automated, patients felt the messages were sent directly from their therapist. Thus, text messages have the potential of improving adherence to therapy. At the end of 2 months, many of the patients reported that they felt closer to their therapist and that the messages had made them more likely to attend sessions (Aguilera & Muñoz, 2011). However, this study was limited by a small sample size and no control group. Further studies would need to be conducted to confirm these findings.

Text messaging is also an important motivational tool and has been particularly successful in helping CBT patients quit smoking. Regular motivational smoking cessation messages sent by SMS have been shown to lead to more patients quitting smoking (Obermayer, Riley, Asif, & Jean-Mary, 2004; Rodgers et al., 2005). These studies did not replace client–therapist CBT but were able to show that mobile technology can be effective in extending the services CBT has to offer, and in maintaining good outcomes.

SMS is an older mobile technology which may be one of the services low-income populations have easy access to. Despite this access, in a country such as South Africa, there may be cheaper and more accessible ways of engaging with those who do not have the funds for SMS. In recent times, instant messaging service use has overtaken that of SMS, especially among the younger population in South Africa. The most popular of these is Mxit. It is particularly favourable in a LMIC due to its versatility, in being able to be used across networks, and its cost effectiveness (around 2 cents in comparison to SMS, which costs around 70 cents). In 2007, this media boasted a subscription of over 4 million users. It was thought to be acquiring approximately 9000 users per day (Chigona & Chigona, 2008). The use of this media in psychotherapy is one which has not yet been researched; however, its use in facilitating distance learning in South Africa has been explored, and it has been found to be a cost-effective way of fostering a sense of community and togetherness (Makoe, 2010).

Another instant messaging service that is increasingly being used in South Africa is WhatsApp. This is a messaging service available to all mobile phones using the Android, Blackberry, iOS, and Symbian operating systems with costs similar to that of Mxit. Based on available information from the android operating system, we can estimate that this service has over a million South African users (Schrittwieser et al., 2012). Research is, however, lacking, and further studies would need to be conducted. Given its low cost, WhatsApp may be a solution worth exploring for use in poor countries. BlackBerry Messenger (BBM) is also a popular instant messaging platform, but is limited to BlackBerry users and reliant on smartphone technology, which is not affordable to the average South African (Luxton et al., 2011) While these technologies may be cheaper and more accessible, they may pose logistical problems for the therapist and may be more complicated to manage than the more simple SMS technology (Schrittwieser et al., 2012).

## Mobile cameras

One of the criticisms of technologically delivered mental health care is that the therapeutic relationship is compromised without face-to-face contact. Much of mental health work and therapy relies on interpreting facial expressions and body language, both of which are lost without face-to-face contact (Castelnuovo, Gaggioli, Mantovani, & Riva, 2003). There are those who argue that face-to-face contact is not as important for therapeutic success as was once thought (Marks & Cavanagh, 2009), but the mobile application of video conferencing (VTC) restores this contact and allows for a distal therapeutic relationship which more closely mimics face-to-face treatment (Castelnuovo et al., 2003).

VTC may be particularly helpful for people with social anxiety and agoraphobia as it enables them to receive treatment at home until such a time as they are able to leave their home (Castelnuovo et al., 2003). It may also provide a more immediate form of communication in the completion and monitoring of CBT homework tasks. The therapist may gain a visual picture of situations, which cannot be accessed in the consulting room, and immediate 'in situ' feedback becomes possible. Much of CBT relies on this in situ approach, but for therapists to travel from their place of work is costly and time-consuming. A therapist may, through the use of VTC, virtually accompany a client with social phobia as they approach strangers in a busy marketplace (Castelnuovo et al., 2003). Despite criticism that VTC therapy lacks the visceral immediacy of face-to-face therapy and is therefore less effective, evidence suggests that there is no difference in outcomes. Ghosh, McLaren, and Watson (1997) compared 10 face-to-face with 10 VTC therapies, and no difference was found in the client's experience of the therapeutic alliance in comparison to face-to-face therapy. Research on these issues is still, however, in its

infancy – although VTC has shown considerable promise as it is still not utilised frequently and is even less often evaluated (Luxton et al., 2011).

While the use of such technology is not currently feasible in countries such as South Africa, it is predicted that future data costs will be driven down by the increasing number of undersea cables connecting sub-Saharan Africa to the rest of the world (SAinfo Reporter, 2012). This would improve the possibility of their use in the future. At present, however, in comparison to international standards, South Africa's mobile telecommunication costs are high. According to the Africa Prepaid Mobile Price Index 2012 (Calandro, Gillwald, & Stork, 2012), which compares the prices for mobile communication, in terms of cost, South Africa is far behind many other African countries ranking 30 out of 46 African states. Lack of competition and monopolies has been blamed for these high costs (Sherer, 2012).

## Mobile applications

The smartphone is distinct from other mobile devices, not only due to its advanced capabilities but also due to its use of applications, commonly known as apps. Apps can be downloaded to be used for a specific function. Luxton et al. (2011) conducted a search of the BlackBerry apps website in April 2011 and found over 200 mental health-related apps. We repeated this search using the same strategy in March 2012, and found that number to have increased to approximately 300. This shows the increasing marketing of such applications. When searching for applications from BlackBerry, Apple, and Android, regarding 'Therapy', we found 'apps', such as 'blue sleep therapy', 'laughter therapy', 'music therapy', 'heartbreak therapy', 'brainwave tuner', 'confidence now', 'rejection therapy', 'blue light therapy', 'behaviour tracker pro', 'voice for you', and 'many more' (Google Incorporated, 2013; Apple Incorporated, 2013; Blackberry.com, 2012).

Apps are designed in a number of ways. As far as apps for clients are concerned, there are apps aimed at assisting clients to assess themselves and become more self-aware. Others monitor the severity of symptoms and indicate when treatment may be beneficial, according to algorithms in the apps. Some of the applications offer support with a hotline for indications of severe symptoms. Apps can also provide virtual coaches who provide audio or video real-time instruction to a patient practising a skill (Luxton et al., 2011). Apps for therapist use include the 'e-moods, bipolar mood tracker', which tracks mood daily, as well as tracking sleep and anxiety, thus providing feedback to the therapist (Blackberry.com, 2012). This feedback could either be direct, or could be stored to be reviewed at therapy sessions. These developments are intriguing, but we could find no research which assessed the effectiveness of these apps.

Apps are convenient – there is, for example, a quick reference guide to the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM IV*; American Psychiatric Association, 2000) available as a smartphone app (Luxton et al., 2011). Apps may be particularly useful in storing homework feedback and general functioning. This may assist in better usage of time in therapy sessions. Many CBT therapists report a problem with the accuracy of retrospective feedback. They also find pencil and paper feedback to be less convenient to the client. Smartphones provide the possibility of overcoming this obstacle (Luxton et al., 2011).

## Other mobile functions

In addition to the use of apps, smartphones and mobile phones have other uses in therapy. Therapists can audio record training sessions which patients can listen to at home. This could include relaxation techniques and motivational messages. The Global Positioning System (GPS) function could

aid in tracking the location of a client during exposure therapy. Streaming and podcasts can provide psycho educational material. Social networking sites can provide social support. These are just some examples of the possible uses for the smartphone (Luxton et al., 2011).

## **The challenge of using mobile phones for mental health care in South Africa**

With the increase in use of technology for mental health comes an increase in potential challenges. As promising as recent studies have been, there is still a lack of empirical research on the impact of mobile technology in this field (Preziosa et al., 2009). Mobile technologies may be useful as a method for individuals with relatively high levels of functioning, but may be difficult to access for some people with more severe forms of psychopathology, or people needing very high levels of interpersonal support. However, certain very disabling conditions such as agoraphobia or social phobia may be well suited to treatments at a distance, using mobile technology, especially in the early stages of treatment (Rummell & Joyce, 2010).

There are many ethical considerations to take into account when technology is used to administer therapy. Rummell and Joyce (2010) discovered that fewer than 10% of e-therapy providers were licensed psychologists. It is true that even in face-to-face treatment, people may masquerade as professionals. Mobile technologies may make this deception easier and may also encourage qualified therapists to outsource some of their work to other (possibly unqualified) colleagues. As technology develops, ethical principles and practices must be developed in order to keep pace with technological developments. Currently, laws and guidelines regulating the use of technology in therapy lag behind the growth of technology itself (Moser, 2012; Rummell & Joyce, 2010). As yet, the American Psychological Association has not taken a formal decision on where it stands with regard to mobile counselling and is yet to provide specific guidelines regarding this kind of therapy (Rummell & Joyce, 2010). Regardless of the lack of guidelines from professional bodies in South Africa, even if such therapy were to be implemented, medical aid insurance schemes in South Africa may not cover the costs. Currently, if medical insurance schemes do cover therapy, cover is provided for face-to-face services only (Alaba & McIntyre, 2012; Kazdin & Blase, 2011). For many South Africans, however, this is not a concern as private health insurance is unaffordable (Alaba & McIntyre, 2012).

Many therapists are not trained in administering mobile therapy and therefore are uncomfortable with its use. It is essential that, in order for this technology to be used successfully, therapists be adequately trained in its use. Therapists should try to keep up to date with the latest tools of the trade and not shy away from technological aids (Rummell & Joyce, 2010). Their reluctance may stem from their concern that by including mobile technologies to the existing range of mediums of communication between the therapist and client, it may make professional therapeutic boundaries more difficult to define and maintain. The boundaries of any new communication medium would need to be carefully negotiated beforehand (Rummell & Joyce, 2010). There is also the possibility that being able to instantly message their therapist would foster dependence in some patients and boundaries would have to be negotiated in new ways in order to protect both the therapist and the client (Rummell & Joyce, 2010). The amount of contact between the therapist and the client would have to be carefully monitored and the times during which the therapist could be contacted would need to be put firmly in place. In addition to the reluctance of therapists to adopt this medium of therapy, we must also consider the willingness and ability of the average South African to utilise mobile technology. In a study by Gitau, Marsden, and Donner (2010), it was found that despite providing users with mobile telephones, there was reluctance when it came to using them. This

study was based on women in Cape Town, South Africa – all of whom had never used computer or mobile phone technology before. The researchers found that one of the barriers to mobile technology usage was due to factors such as digital illiteracy. Training required the use of a translator as the participants were first language isiXhosa speaking. The users found applications such as general packet radio service (GPRS) were in different locations of each phone and difficult to access. The researchers also found that many of the applications on the mobile relied on the use of a computer for set up, something which none of the participants had access to (Gitau et al., 2010). This study is limited by its small sample size. Despite these barriers, however, mobile phone technology has been seen as more ‘user friendly’ than other technologies, such as computers or the Internet (Gitau et al., 2010).

South Africa is a country with 11 official languages, and yet, mobile phone providers only cater to those proficient in popular international languages, such as English, German, French, and Spanish. This means that those proficient in only an African language may not be able to utilise mobile technology, not due to illiteracy or a lack of intelligence but simply because they cannot understand the language (Posel, 2011). In addition to this pertinent issue, we must also consider how many South African therapists are proficient in African languages, and further research may need to be conducted regarding the provision of translation so that more South Africans can be reached (James & Versteeg, 2007). Other challenges concern quality control, which is difficult with the total number of mental health apps available. It is possible that many of these apps contain inaccurate information, which is not based on empirical evidence. This may do more harm than good if inaccurate information is disseminated to vulnerable people. Data security is another concern in the mental health field. There is a threat to patient security which comes from sending information via a technological medium. The mobile device itself also poses a threat to security if it is lost or stolen (Luxton et al., 2011). South African mobile users report a high threat of theft (Crankshaw et al., 2010). Mental health practitioners should be encouraged to ensure that they use password protection and disseminate information only over secure networks with data encryption (Luxton et al., 2011). We also know that among South Africans in rural areas, the sharing of mobile phones is common, and as a result, privacy may be complicated and therapists may also not be certain that they are communicating with the intended person (James & Versteeg, 2007).

## Conclusion

Changes in technology may be difficult for therapists to incorporate into more established practices, but it may well be the case that the use of mobile technologies may enhance mental health interventions. At this stage, there is no evidence to support the notion that these technologies can replace such interventions. Ethical issues in this field are complex and need to be carefully considered, and there is also the danger that the allure of technology may lead clinicians to over-value the impact of these new innovations. There is certainly potential for mobile technology to provide assistance to those who have previously not had access to therapy; however, rules and guidelines would have to be put in place to manage the use of this technology. As technology becomes cheaper in South Africa and data costs decrease, mobile phones may become a more accessible means of receiving psychological intervention. As in every area of innovation in the mental health field, openness to new developments is important, but the careful assessment of potential benefits and harm is an ethical responsibility. Further research in this field is needed in order to truly weigh up the benefits and challenges of using mobile technology to ease the burden of access to therapy in the context of the complex South African environment.

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## References

- Aguilera, A., & Muñoz, R. F. (2011). Text messaging as an adjunct to CBT in low-income populations: A usability and feasibility pilot study. *Professional Psychology: Research and Practice, 42*, 472–478. doi:10.1037/a0025499
- Alaba, O. A., & McIntyre, D. (2012). What do we know about health service utilisation in South Africa? *Development Southern Africa, 29*, 704–724. doi:10.1080/0376835X.2012.730973
- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: Author.
- Anhoj, J., & Moldrup, C. (2004). Feasibility of collecting diary data from asthma patients through mobile phones and SMS (short message service): Response rate analysis and focus group evaluation from a pilot study. *Journal of Medical Internet Research, 6*(4), e42. doi:10.2196/jmir.6.4.e42
- Apple Incorporated. (2013, March 12). *Apple online store*. Retrieved from <http://www.apple.com/za/search/?q=apps&section=global&geo=za>
- Blackberry.com. (2012, March 26). *Apps and software*. Retrieved from <http://za.blackberry.com/>
- Bockting, C. L. H., Kok, G. D., Van der Kamp, L., Smit, F., Van Valen, E., Schoevers, R., . . . Beck, A. T. (2011). Disrupting the rhythm of depression using mobile cognitive therapy for recurrent depression: Randomized controlled trial design and protocol. *BMC Psychiatry, 11*(12), 1–9. doi:10.1186/1471-244X-11-12
- Boschen, M. J., & Casey, L. M. (2008). The use of mobile telephones as adjuncts to cognitive behavioural psychotherapy. *Professional Psychology: Research and Practice, 39*, 546–552.
- Buhi, E. R., Trudnak, T. E., Martinasek, M. P., Oberne, A. B., Fuhrmann, H. J., & McDermott, R. J. (2012). Mobile phone-based behavioural interventions for health: A systematic review. *Health Education Journal*. Advance online publication. doi:10.1177/00178969 12452071
- Buyts, P., Dasgupta, S., Thomas, T. S., & Wheeler, D. (2009). Determinants of a digital divide in Sub-Saharan Africa: A spatial econometric analysis of cell phone coverage. *World Development, 37*, 1494–1505. doi:10.1016/j.worlddev.2009.01.011
- Calandro, E., Gillwald, A., & Stork, C. (2012, March). *Issue Brief: African prepaid mobile index 2012: South Africa* (Research ICT Africa Policy Brief No. 1). Retrieved from [http://www.researchictafrica.net/docs/SA\\_Mobile\\_Prepaid\\_policy\\_brief.pdf](http://www.researchictafrica.net/docs/SA_Mobile_Prepaid_policy_brief.pdf)
- Castelnuovo, G., Gaggioli, A., Mantovani, F., & Riva, G. (2003). New and old tools in psychotherapy: The use of technology for the integration of the traditional clinical treatments. *Psychotherapy: Theory, Research, Practice, Training, 40*, 33–44. doi:10.1037/0033-3204.40.1/2.33
- Chigona, A., & Chigona, W. (2008). Mxit it up in the media: Media discourse analysis on a mobile internet messaging system. *The Southern African Journal of Information and Communication, 9*, 42–57. Retrieved from [http://idl-bnc.idrc.ca/dspace/bitstream/10625/43632/1/129625\\_2008\\_no3.pdf](http://idl-bnc.idrc.ca/dspace/bitstream/10625/43632/1/129625_2008_no3.pdf)
- Cho, J. H., Lee, H. C., Lim, D. J., Kwon, H. S., & Yoon, K. H. (2009). Mobile communication using a mobile phone with a glucometer for glucose control in Type 2 patients with diabetes: As effective as an Internet-based glucose monitoring system. *Journal of Telemedicine and Telecare, 15*, 77–82. doi:10.1258/jtt.2008.080412
- Cole-Lewis, H., & Kershaw, T. (2010). Text messaging as a tool for behaviour change in disease prevention and management. *Epidemiologic Reviews, 32*(1), 56–69. doi:10.1093/epirev/mxq004
- Crankshaw, T., Corless, I. B., Giddy, J., Nicholas, P. K., Eichbaum, Q., & Butler, L. M. (2010). Exploring the patterns of use and the feasibility of using cellular technology for clinic appointment reminders and



- adherence messages in an antiretroviral treatment clinic, Durban, South Africa. *AIDS Patient Care and STD'S*, 24, 729–734. doi:10.1089/apc.2010.0146
- Demyttenaere, K., Bruffaerts, R., Posada-Villa, J., Gasquet, I., Kovess, V., Lepine, J. P., & . . .Mneimneh, Z. N. (2004). Prevalence, severity, and unmet need for treatment of mental disorders in the World Health Organization World Mental Health Surveys. *Journal of the American Medical Association*, 291, 2581–2590. doi:10.1001/jama.291.21.2581
- Fjeldsoe, B. S., Marshall, A. L., & Miller, Y. D. (2009). Behaviour change interventions delivered by mobile telephone short-message service. *American Journal of Preventive Medicine*, 36, 165–173. doi:10.1016/j.amepre.2008.09.040
- Flisher, A. J., Lund, C., Funk, M., Banda, M., Bhana, A., Doku, V., & . . .Green, A. (2007). Mental health policy development and implementation in four African countries. *Journal of Health Psychology*, 12, 505–516. doi:10.1177/1359105307076237
- Frean, J. (2007). Microscopic images transmitted by mobile cameraphone. *Transactions of the Royal Society of Tropical Medicine & Hygiene*, 101, 1053. doi:10.1016/j.trstmh.2007.06.008
- Ghosh, G. J., McLaren, P. M., & Watson, J. P. (1997). Evaluating the alliance in video-link teletherapy. *Journal of Telemedicine and Telecare*, 3(Suppl. 1), 33–35. doi:0.037/0003-066X.55.4.407
- Gitau, S., Marsden, G., & Donner, J. (2010, April). After access: Challenges facing mobile-only internet users in the developing world. Paper presented at the twenty eighth international conference on human factors in computing systems (pp. 2603–2606). New York, NY: ACM.
- Google Incorporated. (2013, March 12). *Android apps*. Retrieved from <http://www.android.com/apps/#>
- Hawe, P., Shiell, A., & Riley, T. (2004). Complex interventions: How 'out of control' can a randomised controlled trial be? *British Medical Journal*, 328, 1561–1563. doi:10.1136/bmj.328.7455.1561
- Hawe, P., Shiell, A., & Riley, T. (2009). Theorising interventions as events in systems. *American Journal of Community Psychology*, 43, 267–276. doi:10.1007/s10464-009-9229-9
- James, J., & Versteeg, M. (2007). Mobile phones in Africa: How much do we really know? *Social Indicators Research*, 84, 117–126. doi:10.1007/s11205-006-9079-x
- Kazdin, A. E., & Blase, S. L. (2011). Rebooting psychotherapy research and practice to reduce the burden of mental illness. *Perspectives on Psychological Science*, 6, 21–37. doi:10.1177/1745691610393527
- Krishna, S., Boren, S. A., & Balas, E. A. (2009). Healthcare via cell phones: A systematic review. *Telemedicine and e-Health*, 15, 231–240. doi:10.1089/tmj.2008.0099
- Luxton, D. D., McCann, R. A., Bush, N. E., Mishkind, M. C., & Reger, G. M. (2011). mHealth for mental health: Integrating smartphone technology in behavioural healthcare. *Professional Psychology: Research and Practice*, 42, 505–512. doi:10.1037/a0024485
- Makoe, M. (2010). Exploring the use of MXit: A cellphone social network to facilitate learning in distance education. *Open Learning*, 25, 251–257. Retrieved from [http://umkn-dsp01.unisa.ac.za/xmlui/bitstream/handle/10500/5003/Makoe\\_MXit.pdf?sequence=1](http://umkn-dsp01.unisa.ac.za/xmlui/bitstream/handle/10500/5003/Makoe_MXit.pdf?sequence=1)
- Marks, I., & Cavanagh, K. (2009). Computer-aided psychological treatments: Evolving issues. *Annual Review of Clinical Psychology*, 5, 121–141.
- Moser, I. (2012, September 12–13). Telecare: New values, ideals and modes of caring. Keynote address at the Critical Care: Advancing an ethic of care in theory and practice conference, Brighton, UK.
- Obermayer, J. L., Riley, W. T., Asif, O., & Jean-Mary, J. (2004). College smoking-cessation using cell phone text messaging. *Journal of American College Health*, 53, 71–78. Retrieved from [http://www.clas.ufl.edu/users/msscha/PremedCSS/smoking\\_cessation\\_college\\_textmsg.pdf](http://www.clas.ufl.edu/users/msscha/PremedCSS/smoking_cessation_college_textmsg.pdf)
- Piek, J., Hebecker, R., Schütze, M., Sola, S., Mann, S., & Buchholz, K. (2006). Image transfer by mobile phones in neurosurgery. *Zentralblatt für Neurochirurgie*, 67(4), 193–196. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/17139604>
- Pop-Eleches, C., Thirumurthy, H., Habyarimana, J. P., Zivin, J. G., Goldstein, M. P., de Walque, D., & . . .Bangsberg, D. R. (2011). Mobile phone technologies improve adherence to antiretroviral treatment in a resource-limited setting: A randomized controlled trial of text message reminders. *AIDS*, 25, 825–834. doi:10.1097/QAD.0b013e32834670d7
- Posel, D. (2011). Adult literacy rates in South Africa: A comparison of different measures. *Language Matters*, 42(1), 39–49. doi:10.1080/10228195.2011.571703

- Preziosa, A., Grassi, A., Gaggioli, A., & Riva, G. (2009). Therapeutic applications of the mobile phone. *British Journal of Guidance & Counselling, 37*, 313–325. doi:10.1080/03069880902957031
- Razdan, S., Johannes, J., Kuo, R. L., & Bagley, D. H. (2006). The camera phone: A novel aid in urologic practice. *Urology, 67*(4), 665–669. doi:10.1016/j.urology.2005.10.005
- Rodgers, A., Corbett, T., Bramley, D., Riddell, T., Wills, M., Lin, R. B., & Jones, M. (2005). Do u smoke after txt? Results of a randomised trial of smoking cessation using mobile phone text messaging. *Tobacco Control, 14*, 255–261. doi:10.1136/tc.2005.011577
- Rotheram-Borus, M. J., Tomlinson, M., Gwegwe, M., Comulada, W. S., Kaufman, N., & Keim, M. (2012). Diabetes buddies peer support through a mobile phone buddy system. *The Diabetes Educator, 38*, 357–365. doi:10.1177/0145721712444617
- Rummell, C. M., & Joyce, N. R. (2010). 'So wat do u want to wrk on 2day?' The ethical implications of online counselling. *Ethics & Behaviour, 20*, 482–496. doi:10.1080/03069880902957031
- Sainfo Reporter. (2012, November 23). *South Africa's telecommunications*. Retrieved from <http://www.southafrica.info/business/economy/infrastructure/telecoms.htm>
- Schrittwieser, S., Frühwirt, P., Kieseberg, P., Leithner, M., Mulazzani, M., Huber, M., & Weippl, E. (2012, February). Guess who's texting you? Evaluating the security of smartphone messaging applications. In *Proceedings of the 19th annual symposium on network and distributed system security*. Retrieved from [http://www.internetsociety.org/sites/default/files/07\\_1.pdf](http://www.internetsociety.org/sites/default/files/07_1.pdf)
- Shapiro, J. R., Bauer, S., Hamer, R. M., Kordy, H., Ward, D., & Bulik, C. M. (2008). Use of text messaging for monitoring sugar-sweetened beverages, physical activity, and screen time in children: A pilot study. *Journal of Nutrition Education and Behaviour, 40*, 385–391. doi:10.1016/j.jneb.2007.09.014
- Sherer, F. (2012, December 10). Why are South African Mobile communication costs so high? *Are major cell phone companies colluding to keep prices high?* Retrieved from <http://www.politicalanalysis.co.za/2012/12/10>
- Tomlinson, M., Rotheram-Borus, M. J., Doherty, T., Swendeman, D., Tsai, A., Ijumba, P., & Chopra, M. (2013). Value of a mobile information system to improve quality of care by community health workers. *South African Journal of Information Management, 15*(1).
- Tomlinson, M., Solomon, W., Singh, Y., Doherty, T., Chopra, M., Ijumba, P., & . . . Jackson, D. (2009). The use of mobile phones as a data collection tool: A report from a household survey in South Africa. *BMC Medical Informatics & Decision Making, 9*(1), 51. doi:10.1186/1472-6947-9-51
- Watts, S., Mackenzie, A., Thomas, C., Griskaitis, A., Mewton, L., Williams, A., & Andrews, G. (2013). CBT for depression: A pilot RCT comparing mobile phone vs. computer. *BMC Psychiatry, 13*(1), 49.
- Zimic, M., Coronel, J., Gilman, R. H., Luna, C. G., Curioso, W. H., & Moore, D. A. (2009). Can the power of mobile phones be used to improve tuberculosis diagnosis in developing countries? *Transactions of the Royal Society of Tropical Medicine and Hygiene, 103*, 638–640. doi:10.1016/j.trstmh.2008.10.015