

# Mobile Telephones and Psychotherapy: I Capability and Applicability

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Mobile telephone technology has become commonplace around the world. As with many new technologies such as computers and the Internet, mobile telephones have been enlisted to assist with psychological and medical interventions. The current article briefly reviews mobile telephone technology applications in clinical psychology, focusing on the latest developments in this technology, and how they may be applied to psychotherapy. It extends on previous work (e.g., Boschen & Casey, 2008) by examining the ever-expanding list of features that are included in current and future mobile telephone handsets, and how these features may enable more effective psychological interventions.

Mobile telephones are now commonplace in most areas of the world. In 2007 there were over 250 million handsets in use in the United States (Central Intelligence Agency, 2008). By the end of 2008 there were over 4 billion mobile telephone subscriptions worldwide (International Telecommunication Union, 2009). In both the developed and developing world the number of mobile telephone subscriptions has gradually risen over the last 10 years, reaching 100.3 and 39.2 subscriptions per 100 people, respectively. The cost of basic handsets has continued to drop, and coverage of the mobile telephone networks has continued to expand. Mobile telephony is increasingly replacing fixed-line telephones for many applications. Mobile telephone technology has been the single most rapidly embraced technology in world history (International Telecommunication Union, 2009).

## Advantageous Mobile Telephone Attributes

Despite the ubiquity of mobile telephones, and the computing power they possess, they have not been extensively used in the implementation of psychological and psychiatric interventions (Boschen & Casey, 2008). This is surprising given the many at-

tributes they possess that may assist therapists working with clinical problems. Boschen and Casey summarized a total of 11 specific properties of mobile telephones that made them particularly suitable for use as adjuncts in cognitive behavioral therapy (CBT): Mobile telephones are small and easy to carry, with many people carrying them in their pocket or on their person for most of their waking day; they are a technology that is readily accepted by most people, as evidenced by their rapid market penetration; they are a comparatively low-cost device; they are a device with comparatively low ongoing maintenance costs; they are a device already owned by a large number of people; they are always on in that they continue to operate (and be contactable or able to execute instructions) without user activation or intervention; they are always connected, maintaining communication with their network even when not in use; they are programmable, meaning they are able to run novel applications software, developed for specific purposes by individuals or organizations; they are capable of recording media, including audio, photographs, and in many cases video, as well as being able to play or show these media to the user; they are capable of interacting with the user to allow input of data using a keypad, keyboard, or touchscreen; and they are generally designed to be easy to use for most of the population (Boschen & Casey). In addition to these previously identified attributes, mobile telephones have several other advantageous qualities: Their use attracts no attention, allowing users to interact with a handset without fear of stigma or judgment; they possess significant computing power, allowing development and execution of complex software; and they now exist as a common platform to which additional devices and capabilities can be added (e.g., bar code reader).

Several of these attributes set mobile telephone technology apart from other technologies such as laptop computers. Laptop and desktop computers have signifi-

cant advantages, such as greater processing power, larger screens, and easier-to-use input devices (full-size keyboards, etc.). They are also, however, limited in several areas in comparison with mobile telephones. While offering some portability, a laptop computer is not as small and lightweight as a mobile telephone. A laptop computer does not offer the same "always on" and "always connected" capability of a mobile telephone. The use of a laptop computer in a public environment (e.g., during an exposure task) is also more conspicuous than using a mobile telephone. Laptop computers do not have the same market penetration as mobile telephones, and are also generally more expensive than most mobile handsets.

## Addressing Challenges to Psychotherapy Effectiveness

The ability of mobile telephones to address some of the common challenges to successful implementation of CBT has been discussed by Boschen and Casey (2008). These authors grouped the challenges to successful CBT into three broad categories: difficulties in assessment and monitoring, difficulties in homework adherence, and difficulties in treatment generalization. The gathering of accurate assessment and monitoring data from psychotherapy patients can be difficult for many reasons. When recorded using more traditional pen-and-paper methods, data are often recorded retrospectively, which may compromise accuracy of the information. Also, sampling of data may not be representative if the timing of its collection is patient-initiated (Shiffman & Stone, 1998). Mobile telephones allow for immediate entry of data on patient symptoms and experiences. Device-initiated sampling (either at predetermined or random times) may also allow for gathering of more accurate and representative monitoring data for use in later therapy sessions (Bang, Timpka, Eriksson, Holm, & Nordin, 2007). An example of mobile telephone use to assist in random sampling of assessment data is provided by Axelson et al. (2003), in which the researchers used calls to mobiles to sample mood and activity of their participants.

Homework is recognized as a core element of cognitive behavioral interventions, with significant effects of therapeutic outcome (Burns & Auerbach, 1992; Kazantzis, Deane, & Ronan, 2000; Neimeyer & Feixas, 1990). Despite this, nonadherence to negotiated homework tasks between sessions is a common problem faced by clinicians. Using

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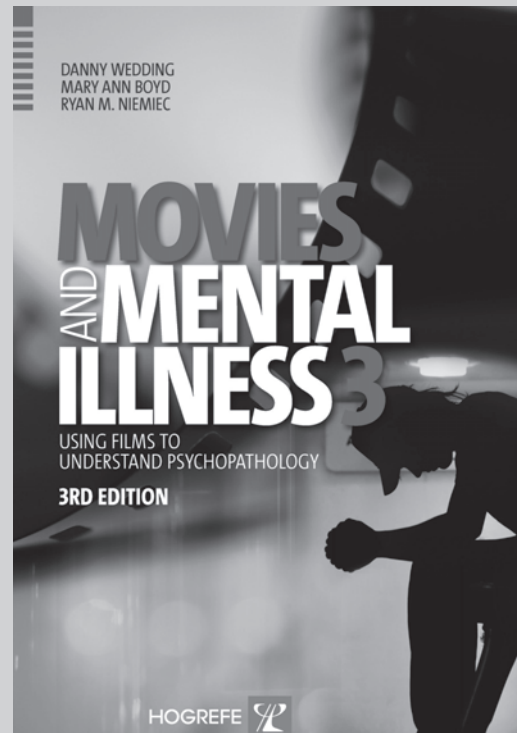
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a mobile telephone as a reminder to undertake homework tasks may increase adherence. A mobile telephone device may also carry information to remind the patient of the details of the homework tasks, including skills previously learned in face-to-face therapy sessions.

The generalization of treatment effects to outside the consulting room is a further challenge for CBT practitioners. Patients who are able to effectively implement strategies and skills while with the therapist may have more difficulty in doing so between sessions. In many conditions such as exposure therapy, failure to use skills outside the therapy session is associated with increased risk of relapse (Boschen, Neumann, & Waters, 2009). Mobile telephones may assist in this transition in many ways, including allowing telephone contact with a therapist, providing reminders of previously learned skills from therapy sessions, playing of media (e.g., for exposure therapy), or with software that teaches additional skills and strategies. For example, mobile telephones were used by Flynn, Taylor, and Pollard (1992) to assist two individuals with driving phobia to undertake car trips without a therapist present, where communication with the therapist could occur if required.

#### Capabilities of Current Mobile Telephones

Mobile telephone and electronics technology has developed to a point where a handset is now often capable of many more tasks than simple voice communication. In the short time since the publication of the initial review of mobile telephone capabilities and their potential applications in CBT (Boschen & Casey, 2008), devices have integrated new capabilities such as GPS, accelerometry, and fast, sophisticated Internet browsing, expanding the potential for use in clinical psychology applications. Creative use of mobile telephone technologies allows for novel extensions and modifications of traditional face-to-face cognitive and behavioral interventions (Bang et al., 2007). Each of these technologies, as well as their clinical applications within CBT, is discussed below with a view to demonstrating the many different ways in which these capabilities can be utilized. A summary of these abilities and their applications is provided in Table 1.

#### *Voice Communication*

The original application of mobile telephone technology was to allow for conve-

nient mobile voice communication. Mobile voice communication with a therapist allows for therapeutic input and assessment when the patient is away from the consulting room. The therapist may use the telephone to communicate with a patient during an exposure task, as was done by Flynn et al. (1992) with individuals with driving phobia. Mobile voice communication between a patient and therapist also allows for therapeutic input and assessment when the therapist is away from the consulting room. A therapist may communicate with a patient during a car journey between two appointments, for example. Some studies have reported on treatments in which all or part of the intervention is delivered by telephone conversation (e.g., Carlbring et al.; Lovell et al., 2006; Mohr et al., 2005; Taylor et al., 2003). The ability of many current handsets to also allow video calls provides a further channel of communication, allowing the therapist and patient to respond to non-verbal cues.

#### *Text and Multimedia Messaging*

Text messaging (also known as Short Message Service or SMS) and the more sophisticated multimedia messaging (MMS) are a standard component of current handsets. SMS and MMS allow the user to send and receive small amounts of text or images from handset to handset almost instantaneously, and at low cost. Therapist-initiated messages can be used to remind the patient to complete a certain task, or to give instructions or information. A degree of interaction is also possible, with SMS messages leading to an appropriate therapist or automated response (e.g., Lukasiewicz et al., 2007). Patient-initiated messages can be used to convey information and assessment data to the therapist, or to request information from the therapist or an automated system. At a more basic level, SMS messages can be used to remind patients of appointments, thus increasing attendance rates (e.g., Foley & O'Neill, 2009; Geraghty, Glynn, Amin, & Kinsella, 2008; Koshy, Car, & Majeed, 2008; Leong et al., 2006). An extensive review of the use of text messaging in behavior change is provided by Fjeldsoe, Marshall, and Miller (2009).

#### *Media Recording and Playback*

Using microphones and increasingly high-resolution cameras, today's mobile telephones are capable of recording audio as well as still images and full motion video. Ever-increasing memory capacity allows for storage of large libraries of audio, images,



and video. The ability to record media may be used by a patient to record information about performance of homework tasks (e.g., to record a speech given by the patient as part of an exposure task). Cameras can also be used to capture assessment data, for example, the capture of an image of a meal as a quick, convenient way of monitoring dietary intake (e.g., Kikunaga, Tin, Ishibashi, Wang, & Kira, 2007).

Built-in speakers, headphone output, and dramatic improvements in screen technology also allow for playback of previously recorded media. Photographs, video, and audio recordings can be utilized as exposure stimuli by patients in between consultations. For example, the "loop tape," which has been used to treat intrusive thoughts in obsessive-compulsive disorder (e.g., Salkovskis & Westbrook, 1989), can be replaced with a recording held in the memory of a mobile telephone. This example also highlights how mobile telephones may improve on existing technologies—a mobile phone can be programmed to automatically or randomly commence playback of the intrusive thought, rather than relying on the patient to initiate the playback. Such spontaneous playback is much more similar to the typical experience of individuals with obsessive thoughts, allowing them to practice managing more realistic simulations of their intrusions.

#### **Bluetooth and 802.11 Wireless**

Many mobile telephone handsets are now equipped with wireless communication technologies in addition to their cellular radio. Bluetooth is a short-range wireless communications protocol often used for communication between personal computers and peripherals, or between mobile telephones and wireless headsets. Bluetooth also allows for communication between a mobile telephone and nearby personal computer, allowing a patient who has gathered data on their handset to easily and quickly transfer this to the therapist for future examination and analysis. Bluetooth technology can also be used within the consulting office to transmit assessment data between a central server and handheld device (e.g., Kim, Yoo, Park, & Kim, 2007; Murrarapu, 2007).

Many advanced mobile telephones also come equipped with a version of the 802.11 wireless protocol, also known as "wi-fi." Wi-fi technology offers superior range and data transfer speeds, compared to Bluetooth, and also commonly allows for connection to local area networks (LANs) or

to the Internet through a nearby wireless router/gateway. This connection capability allows the patient to transfer data from a more remote location, or to transfer larger amounts of data (e.g., audio, pictures, video) in shorter times. Connection via a wi-fi gateway also allows Internet access, the benefits of which are reviewed below.

#### **Email**

Many network subscriptions now offer email access, either through access to the cellular network, or through a direct connection to the Internet (see below). Email access allows for messages that are considerably longer than SMS or MMS, and also allows for the potential to attach files with additional data. Email can be used to communicate more detailed, lengthy questions and responses between therapist and patient. The advent of near-instantaneous email methods such as "push email" allows emails to be sent with the same level of instantaneity as SMS, with messages arriving automatically at the recipient's handset without need for them to initiate retrieval from a central email server.

#### **Advanced Input Technology**

Modern mobile telephone handsets offer the user a range of methods by which they can input data directly into the device. Simpler handsets may use a traditional keypad, on which the user can input numeric data, alphanumeric data by using combinations or repetitions of certain keys. Many more sophisticated handsets now offer full (albeit small) qwerty keyboards to facilitate easier entry of text. Some popular handsets make use of large touchscreens that are sensitive to either pressure or changes in electrical conductivity that occur when in contact with skin. These touchscreens allow a virtual keyboard to be presented to the user. Touchscreens also allow the data entry method that is presented on screen to be changed as required to facilitate rapid data entry. For example, when a patient is simply required to choose from three options, a single screen with three large virtual buttons can be displayed.

#### **GPS**

A significant innovation since the publication of the initial review of mobile telephone use in CBT (Boschen & Casey, 2008) is the incorporation of Global Positioning System (GPS) technology into many handsets. This technology allows the handset to communicate with a collection of satellites

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to accurately determine its location anywhere on the globe. The handset can then use this positioning data in a variety of applications. In mobile handsets, GPS data are typically coupled with navigation software to provide a turn-by-turn navigation aid, or to show the user their position on a local map. Although mobile telephone-based GPS has not yet been utilized in CBT research, there are a number of applications that may be considered by future clinicians and researchers. For example, a client with a driving phobia may undertake a homework task in which they attempt to leave home and journey to a certain point outside their normal safety circle. In this example, the handset would not only provide guidance to the destination, but could also record the route taken, and the speed at which the client moved during the journey. Following the exercise, the patient and therapist could review this data, examining points where the patient slowed down, or paused along their journey. The exact duration spent in the exposure location could also be recorded.

Some GPS-equipped handsets also run software that allows for remote retrieval of the handset location using a password transmitted by SMS. With a client's authorization, the therapist could use such remote monitoring to track a client's location during a task. For example, a client with alcohol dependence may identify that immediately after work is a high-risk situation for drinking, in which they are often tempted to go to a certain public bar. The therapist

could retrieve their current location using the remote GPS monitoring software, and send a previously agreed SMS if the handset is found to be within a certain range of the bar. A similar approach has already been used to track the location of adolescents, with a view to assessing their movement to specific locales where risky behaviors such as cigarette smoking may take place (Wiehe et al., 2008).

### *Accelerometers*

Some newer mobile telephone handsets incorporate accelerometers to allow the telephone to "know" its orientation and movement in space. This technology is typically used in handsets to allow the screen to automatically switch from portrait to landscape orientation as the user rotates the device. In clinical psychology, accelerometer technology (also known as "actigraphy") has been previously used in various applications such as monitoring overall activity levels (e.g., Yoshiuchi et al., 2006), as well as monitoring sleep patterns (e.g., Sazonov, Sazonova, Schuckers, Neuman, & CHIME Study Group, 2004). In future, the accelerometers in mobile telephones may be employed in similar ways, to measure movement and activity in the user.

### *Internet Browsing*

High-speed Internet communication protocols such as HSDPA, along with the large high-resolution displays on some handsets, allow a mobile handset to operate

as an effective mobile Internet browser. The Internet is already established as an effective medium for delivery of automated or therapist-guided cognitive behavioral interventions for many conditions (e.g., Anderssen, 2009; Reger & Gahm, 2009). Giving a patient the ability to access similar websites from their handset, regardless of their current location, opens up many possibilities to expand the use of these established treatments. Patients may, for example, access a website that may assist in managing problem gambling (e.g., Carlbring & Smit, 2008) directly from the gambling venue. Mobile telephones may also be utilized as a high-speed modem for a laptop computer, allowing full access to a website on a PC with a more comfortable sized screen and keyboard.

### *Web 2.0 and Social Networking*

Recent years have seen an explosion in the popularity of social networking Internet sites such as MySpace, Facebook, and Twitter, as well as other sites driven by user-uploaded content such as YouTube. These websites are sometimes collectively known as Web 2.0, referring to a second generation of Internet content that is user-contributed rather than centrally generated. The growth in popularity and influence of Web 2.0 was recognized in the 2006 Time Magazine Person of the Year being awarded to "you" (i.e., the population of Internet users who use and contribute to Web 2.0 webpages; Grossman, 2006). Some newer

**TABLE 1. Mobile Telephone Capabilities With Example Clinical Psychology Applications**

Technology	Clinical Application
Voice communication	A patient with agoraphobia "reports in" to the therapist while sitting in a shopping centre.
Text messaging	Reminder messages sent by an automated system to a patient to remind them to use cognitive strategies prior to an anticipated stressful event.
Audio recording	Recording of a speech given by a patient as part of an exposure homework task.
Photograph/video capture	Photographing meals as a simple means of recording dietary intake for later analysis.
Media playback	Playback of exposure stimuli such as an audio recording for exposure to obsessions.
Bluetooth	Communication of assessment results from a patient's mobile telephone to a central computer in the therapist's consulting offices.
Internet connectivity	Patient access to existing websites with demonstrated efficacy in dealing with gambling problems.
High-resolution screens	Clear display of video and photographic exposure stimuli.
GPS	Tracking of patient movements, with phone-initiated relapse-prevention software when an individual with an alcohol problem approaches a bar.
Accelerometers	Assessment of activity levels in a patient with depression.
Miscellaneous applications	Use of PDF reader applications to allow patients to read handouts.

mobile telephone handsets come with software applications designed to allow for access to Web 2.0 sites directly from the device. Access to such websites may be used for a variety of therapeutic interventions. For example, social networking websites may be used for members of a therapy group to communicate with each other and their therapist in between group sessions. Clients may obtain exposure stimuli from websites with archives of video content such as YouTube: A client with emetophobia may be able to obtain a range of video footage of vomiting that would otherwise be difficult or time-consuming to obtain.

### *Software Applications*

Today's mobile handsets are powerful computing devices in their own right. Many advanced handsets run scaled-down versions of desktop operating systems such as Microsoft Windows or Apple OSX, making programming a comparatively easy endeavour. Mobile handsets have increasingly replaced separate personal digital assistants (PDAs) as they have incorporated PDA technology and operating systems. Previous interventions developed for PDAs can easily be run using current mobile telephones. With their high level of programmability, the potential for a wide array of software applications is almost limitless. Existing handsets, for example, are capable of displaying PDF documents for reading by clients, or running games designed to teach important therapy concepts to children.

Java is a programming language designed to allow software to be developed that can be easily converted to run on numerous different hardware platforms. Java is an integral part of most web-browsers, and is a standard component of most mobile handsets. Such cross-compatibility allows therapists/programmers to develop software that can be readily run on whatever handset their patient already owns. Java applications have, for example, been used previously to transfer medical data between patients and medical practitioners (Zhang et al., 2007).

### **Limitations and Cautions Regarding Mobile Telephones in Psychotherapy**

Despite the advantages and capabilities of mobile telephone technologies, there are also limitations that researchers and clinicians must remain aware of. Mobile handsets, while increasingly affordable, may prove too expensive to purchase and connect for some patients. The cost of the technology, however, must be considered in

light of the potential savings that may be gained in reduced therapist contact. Where a handset is used to augment traditional psychological interventions, there may be corresponding savings in cost of overall therapist contact.

Mobile handsets, like any other computer technology, require expertise to effectively program software applications. Where therapists can use off-the-shelf existing software or Internet applications, this is less of a concern. Where new software development is required, however, this may be an expensive and time-consuming undertaking. Designers of applications and Internet sites for use should also be mindful of ensuring that their applications are user-friendly enough to be used by individuals with all levels of technological experience.

The therapeutic alliance that is developed in psychotherapy is important in optimizing therapeutic outcome (e.g., Krupnik et al., 1996; Wampold, 2001). There is a danger that patients who have fewer hours of direct contact with a therapist may experience a weaker therapeutic alliance. There is, however, a large body of literature demonstrating that interventions administered, in part or in full, via a personal computer are effective (e.g., Kaltenthaler, Parry, & Beverly, 2004; Reger & Gahm, 2009). Further research is needed to establish whether incorporating mobile handsets into psychotherapy significantly alters effectiveness and efficacy.

For some conditions there is the potential for mobile telephones to work in a countertherapeutic manner. In anxiety disorders, a particular problem concerns the ability of a handset to operate countertherapeutically as a safety signal (Rachman, 1984). Treatments involving the use of mobile telephones should aim to have the patient relinquish therapeutic use of the device as treatment progresses. Previous research has demonstrated that patients can relapse after successful use of a device designed to augment treatment (Baer, Minichiello, & Jenicke, 1987, 1988; Flynn et al., 1992). Therapists should attempt to guard against such relapses by encouraging the patient to relinquish use of the device as part of treatment. For example, while patients may utilize a handset-based relaxation procedure during an agoraphobia exposure exercise, the exposure tasks should be revisited without the ability to use the mobile telephone. Another example of potential for countertherapeutic use of mobile handsets may be in individuals with significant paranoid ideation, who may be concerned about technology such as GPS monitoring.



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Therapists and clients should also be cautious that the additional use of the mobile telephone does not contribute to a pattern of multitasking behaviors that may increase stress or anxiety. As with any psychotherapeutic intervention, the clinical decision on whether to use mobile telephone technology must be made on the basis of each individual client's presentation. Client and therapist should also have a clear understanding of what will happen to the handset at the end of treatment.

A further concern regarding mobile telephone technology is the extra commitment and burden this may place on therapists. While having the ability to contact a health professional has been demonstrated to increase perceived support in patients (Chin, Adams, Khoury, & Zurakowski, 2005), this should not be allowed at the expense of the therapist's own work-life balance. Where contact is permitted between sessions, clear boundaries and limits to this contact must be discussed and agreed upon. This is the case regardless of whether such contact occurs via voice, SMS, email, or social networking sites. There would also need to be clear agreement between patient and therapist regarding billing practices for such out-of-session contact and messages.

Using a portable device in an assessment role raises issues of data security, particularly if the device is used to store information for later analysis. Designers of software and Internet sites for use in psychotherapy augmentation should ensure that adequate data security measures, such as strong encryption of data, are in place to protect sensitive information. Therapists should also ensure that they are familiar with the mechanisms used to protect patient data, as well as the potential limitations of such measures. Before using a mobile handset for assessment or treatment, a client should also be made aware of these risks, and the methods used by the therapist to guard against unauthorised access to personal data.

Boschen and Casey (2008) also reported on other additional barriers to mobile telephone use. This earlier report discussed limitations of network coverage, and reluctance of some individuals (e.g., older adults and others less familiar with mobile telephone use) to use mobile telephone technology. The rapid increase in network coverage, as well as the zeal with which the technology has been embraced by consumers, make such barriers now seem almost insignificant.

Finally, clients, therapists, and researchers should recognize that the evidence for the effects of mobile telephone use on psychotherapy remains limited. All should be careful not to approach the use of these devices with a zeal that exceeds the available research evidence. There are limited data regarding which populations (e.g., certain age groups) may benefit from mobile telephones. There is a clear need for further research into the effects of mobile phones in psychotherapy, including their specific impact on therapeutic alliance, treatment cost, treatment accessibility, and effectiveness, as well as the groups for which mobile phone use is most effective.

## Conclusion

Mobile telephone technology continues to present several advantages that may be useful in helping to address common problems in the delivery of treatments such as CBT. Although the technology is being rapidly embraced by the medical profession, its application in clinical psychology has remained limited. The capabilities of current handsets, including new technologies such as accelerometers and GPS, provide an ever-increasing range of potential applications in clinical psychology that may be considered by clinicians and researchers.

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## Research Forum

# Mobile Telephones and Psychotherapy: II A Review of Empirical Research

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Mobile telephones have become a common, widely used communication tool across the globe, embraced more rapidly than any previous technology (International Telecommunication Union, 2009). In addition to their basic application as a voice communication technology, mobile telephone handsets have many attributes and features that make them an ideal device with which to augment cognitive and behavioral interventions (Boschen, 2009; Boschen & Casey, 2008). This paper reports on a collection of research studies in which mobile telephones have been used to augment cognitive behavioral therapy (CBT) for psychological disorders. It updates the recent review paper by Boschen and Casey, more than doubling the number of studies examined. It also compliments the review of mobile phone attributes and suitability for CBT

augmentation by Boschen (2009; this issue). A brief synopsis of the use of handsets in medical and health research and treatment is provided, along with a more detailed survey of the use of the technology in psychological assessment and intervention.

## Previous Use of Mobile Telephones

A search of the PubMed database was conducted on May 7, 2009, using the search terms "(CELL or CELLULAR or MOBILE) and (PHONE or TELEPHONE) and (PSYCHOL\* or PSYCHIAT\* or PSYCHOTHER\*)". This search returned 367 individual publications. Additional articles were found through examination of the references of those articles found in the initial search. Each abstract was examined for relevance. Only English language articles pertaining to mobile telephone use in psychological/

psychiatric disorders were included, while articles focused on medical and chronic health problems such as diabetes and obesity were excluded. Studies that focused on the use of mobile telephones as data-capture devices in epidemiological research were excluded, as were articles using mobile telephones to manage neurological/neuropsychological problems. Articles that reported on the use of mobile handsets to promote changes in dietary or exercise behaviors were excluded. Several articles reporting on the use of mobile telephones to manage stress associated with pregnancy, surgery, work rehabilitation, or commuting were also excluded. Review articles and two articles reporting on proposed methodologies (without empirical data) for using mobile phones were removed from the database, to maintain a focus on studies reporting new empirical data. A single article reporting on proposed use of mobile telephone handsets to manage battlefield stress was excluded. Finally, articles reporting on using personal digital assistants (PDAs), or using mobile telephones to access Internet websites, were not included. A total of 16 articles were identified using this search strategy, the list of which is provided in Table 1.