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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 PSYCHIATR* 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.
Use of Mobile Telephones in Medicine and Health Behavior

Recently, mobile telephone technology has been rapidly embraced by the medical community. Research has investigated the application of mobile telephony in chronic disease management (Blake, 2008). Specifically, mobile telephone technology has been used for assessment, treatment, and information exchange in medical conditions such as hypertension (Logan et al., 2007), asthma (Hung et al., 2007; Pinnock, Slack, Pagliari, Price, & Sheikh, 2007), chronic obstructive pulmonary disease (Liu et al., 2008), and diabetes (Franklin, Greene, Waller, Greene, & Pagliari, 2008; Kim & Kim, 2008), as well as in sexual health settings (Lim, Hocking, Hellard, & Ariken, 2008). Mobile telephones have been used to assist in medication compliance (Skinner, Rivette, & Bloomberg, 2007) and management of medication side effects (Weaver et al., 2007). Additionally, Zanner and colleagues (Zanner, Wilhelm, Feusner, & Schneider, 2007) have reported on use of a mobile telephone–based first-aid package.

Mobile telephones have been used across several studies of health behaviors. Mobiles have been used to assist in assessment and treatment of obesity (Joo & Kim, 2007; Morak et al., 2008), exercise and physical activity programs (Hurling et al., 2007; Liu et al., 2008), and dietary assessment and management (Kikunaga et al., 2007). Although many of these studies were not strictly randomized controlled trials, together they constitute a body of converging evidence that mobile telephone technology may be useful in managing health conditions.

Use of Mobile Telephones in Psychological / Psychiatric Disorder Assessment

Despite their use in medicine and health behaviors, mobile telephone handsets have not been as extensively incorporated into psychotherapy assessment and research. Mobile telephones have been utilized as assessment tools in a small number of research studies. Many of these were used to assess use of addictive substances or addictive behaviors. Taylor and Katomeri (2007) used participants’ own mobile telephone to assess the duration between when participants completed an experimental manipulation (involving exercise or a period of rest) and their next subsequent cigarette. Participants were asked to send a single text message to the researchers when they smoked their first cigarette after leaving the experiment. Although the authors did not report on the effectiveness of this assessment method, the expected correlation between subjective craving and time until smoking was detected, suggesting that the text message assessment was suitable in this assessment role.

A rudimentary comparison of pen-and-paper monitoring against mobile telephone monitoring was conducted by Collins, Kashdan, and Gollnisch (2003). This study compared monitoring methods in their assessment of alcohol intake in 20 social drinkers. Those participants in the mobile telephone monitoring group contacted a central Interactive Voice Response (IVR) system using a mobile telephone each day to report their alcohol intake. Although there were no significant differences in monitoring compliance, the authors report several other advantages to cellular handset use, such as immediate entry of data into a central dataset, and time-stamping of the data for verification of the time at which it was recorded. A similar method using mobile telephones to contact an IVR system was used to gather information from problem gamblers, including the type of gambling, gambling outcomes, and subjective mood and arousal ratings (Gee, Coventry, & Birkenhead, 2005). The research group reported that monitoring using mobile handsets was successful, and that the method also showed promise for future interventions with this problem.

In a more challenging test of the utility of mobile telephone assessment, Freedman, Lester, McNamara, Milby, and Schumacher (2006) evaluated the ability of handsets to assess cocaine use and cravings in a cohort of 30 homeless cocaine-dependent individuals who had recently completed a treatment program. Data entry was initiated by a call to the mobile telephone handset once during every 3-hour period, at which time participants would enter monitoring data using the handset keypad. In this research, the authors reported good compliance, with 80% of participants completing the assessment period. Furthermore, the authors reported that the assessment of cues associated with craving increased participants’ awareness of the relationship between cues and cocaine use.

Assessment of mood and affective variables has also been conducted using mobile telephones in a small collection of studies. Mobile telephones have been used to assess mood, affect, and activity ratings in adolescents with and without mood disorders. In two studies, calls to mobile telephones have been used to prompt participants to provide data for use in comparing mood and activity (Axelson et al., 2003), or to examine the relationship between altered striatal functioning and positive affect in real-world settings (Forbes et al., 2009).

Although the studies that utilized mobile telephone technology suggest some promise for their use in research and clinical settings, several limitations are noteworthy. Firstly, all of the assessment studies reviewed here made use of only the most basic mobile telephone technology. All assessments used either voice calls or text messaging to capture data, making no use of more advanced mobile technologies such as GPS, multimedia recording, or accelerometers (Boschen, 2009). Secondly, there has been no detailed comparison between data gathered using mobile telephones and more traditional (e.g., pen-and-paper) methods. While Collins et al. (2003) made some comparison between these two methods, their analysis was limited to ensuring that the results between the two methods were similar in two small samples. More useful in future work would be a more thorough investigation of the use of the two assessment methods to detect theory-consistent differences, for example between a group of problem and nonproblem drinkers, or between successfully treated and untreated drinkers.

Use of Mobile Telephones in Psychological / Psychiatric Interventions

Similarly to their role in assessment, mobile telephone technologies have enjoyed limited application in clinical psychology and psychiatry interventions. The largest body of intervention research has used mobile telephones in smoking cessation programs. A range of interventions for smoking cessation have been investigated, from simpler methods involving text messages, up to more complex interventions using video and other multimedia played by mobile handsets. In the earliest example of text messaging to assist in quitting smoking (Obermayer, Riley, Asif, & Jean-Mary, 2004), a series of text messages were tailored to 46 regular smokers, based on information about each individual’s own high-risk situations and times, as well as their target quitting date. Participants were sent text messages as their quit date approached, and then were sent three text messages at high-risk times on their quit date. Each day after the quit date, two further text messages were sent, aimed at relapse prevention. Throughout the intervention, participants were also able to contact the automated system to obtain assistance and suggestions in high-risk situa-
In this uncontrolled 6-week study, 22% of participants had achieved a 1-week period of continued abstinence. The ability of SMS messages to assist in smoking cessation was confirmed in a larger cohort of 1,705 smokers who participated in a randomized controlled trial (RCT) comparing a tailored text message intervention with a control group given only text messages thanking them for their participation. In this study by Rodgers et al. (2005), 28% of the treatment group had quit smoking, as compared to 13% of the control group. The use of text messaging as an aid to smoking cessation has also been found to be equally effective when compared across different cultural groups (Bramley et al., 2005).

Recently, more sophisticated smoking cessation programs have attempted to integrate not only text messaging, but also multimedia playback. The Happy Ending automated smoking cessation program (Brendryen, Drozd, & Kraft, 2008; Brendryen & Kraft, 2008) incorporates text messaging, audio messages, and automated phone calls to check successful abstinence, along with email and Internet materials. To date, two RCTs have been conducted using Happy Ending, both of which have supported the efficacy of the Happy Ending program in improving abstinence and relapse prevention. Building on the earlier work of the Auckland group (Rodgers et al., 2005), Whittaker et al. (2008) conducted an innovative pilot smoking cessation study adding the use of video playback of material designed to assist smokers in maintaining abstinence. In addition to text messages, video materials were available on demand that depicted role models using strategies to manage cravings. Although only a small pilot trial, the authors reported that 9 of the 15 participants who completed the program were abstinent after 1 month—sufficient encouragement for the research team to embark on a larger scale RCT.

Another study (Riva, Grassi, Villani, Gagglioli, & Preziosa, 2007) examined the use of mobile handsets to assist in management of exam stress in 30 female university students who were preparing for an exam in 1 week. Some participants were provided with either audio (CD) or audio-video (DVD) at home, while others were provided with portable audio (MP3 player), or an audio-video narrative played from a mobile handset. The authors report the superiority of the mobile telephone intervention, which was more effective in assisting participants to relax before an exam than the other methods, or a nonintervention control.

In the earliest article detailing the use of mobile telephones in CBT, two individual patients utilized mobile telephone voice communication to assist in treatment of driving phobias (Flynn, Taylor, & Pollard, 1992). The two individuals were allowed to use mobile telephones while driving a predetermined route as part of an in vivo exposure program. Each person was permitted to contact the therapist, or anyone else, during the driving trip. After 4 weeks of treatment in which telephone use was unrestricted, the use of the mobile telephone was gradually faded over a period 4 weeks. While both patients were able to increase their driving range while the telephones were available, one reported significant relapse of symptoms upon removal of the telephone, and appeared to have become dependent on its presence at a 3-year follow-up.

Anxiety associated with school refusal was treated by Aviv (2006) using mobile telephone handsets. In this study, the author used "tele-hypnosis" with 12 adolescents, allowing contact with the therapist for hypnotic interventions via mobile phone. Of the 12 students treated, 8 were able to return to full-time schooling, while a further 3 showed improved attendance.

In addition to active treatment augmentation, mobile telephones also have a potential role in relapse prevention strategies. The high rates of relapse in schizophrenia were targeted by Španiel and colleagues in 2008, using mobile telephones to assist in relapse prevention in a cohort of 45 individuals with psychotic illnesses. The focus of the relapse prevention strategy was early identification of warning signs of relapse, including changes in sleep, appetite, and ability to concentrate. Participants sent weekly SMS messages to a central server that would then evaluate whether the individual was at increasing risk of relapse. When risk levels reached a critical threshold, an email was automatically sent to the treating psychiatrist, who would contact the patient to arrange a review. Compared to before the relapse prevention program was started, there was a drop of 60% in hospital admission rates during the mobile telephone-based relapse prevention program. It is notable that dropout rates were also very low at only 10% during the trial.

Conclusions and Limitations of the Literature

Despite the growing number of favorable research studies, the reader should be aware of a range of limitations in both the available research literature and the mobile devices themselves. The major limitation of the current research into mobile use in psychotherapy is the number and quality of previous studies. This review located only 10 studies published using mobile telephones in a treatment role, with less than half of these being randomized controlled trials. Others included single case studies, and uncontrolled treatment trials with small samples. Furthermore, mobile telephones have been employed in a very limited range of psychological conditions, with 6 of these 10 studies focusing on smoking cessation, 3 on anxiety/school refusal, and one on relapse prevention in psychotic illness. With such a limited range of literature, it is difficult to confidently assert the therapeutic utility of mobile handsets in a wider therapeutic role.

The condition for which there is most empirical evidence for the effectiveness of mobile telephone use is smoking cessation. The studies reviewed here provide several reports of randomized controlled trials, as well as investigations of whether equivalent treatment effects are observed in different cultural groups (Maori). The studies on smoking cessation also utilize the largest samples of any treatment studies using mobile telephones. Although further research is required, even in this area, it is in smoking cessation that the greatest evidence for the potential of mobile handset use is available.

To date, it is also impossible to draw firm conclusions about the specific effectiveness of the mobile handset itself, within therapy. No studies have examined whether adjunctive mobile telephone use improves outcome in psychotherapy. Nor have there been any studies in which the cost-effectiveness of mobile telephone use is specifically examined, comparative to face-to-face therapy. There is also very little data available on differences among different demographic groups in effectiveness of mobile telephone use. Only the study of smoking cessation by Bramley et al. (2005) made direct comparisons between different demographic groups (Maori and non-Maori New Zealanders). No studies have compared effectiveness based on age, gender, socio-economic status, education levels, or other demographic variables. This lack of evidence may currently mask problems with generalization of the available studies to different groups. Where studies are conducted with university students, for example, a similar program may prove less effective in nonuniversity students. This cannot be judged on the basis of the currently available data.
### Table 1. Previous Psychological Research Using Mobile Telephones

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<th>Study</th>
<th>Sample</th>
<th>Method</th>
<th>Results</th>
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<tr>
<td><strong>ASSESSMENT STUDIES</strong></td>
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<td>Axelson et al. (2003)</td>
<td>(N = 21) adolescents (16 with affective disorder, 5 controls)</td>
<td>Calls to mobile phones used to gather ecological momentary assessment of mood, activity, environment and events.</td>
<td>Low dropout rate. Comprehensive data cited as evidence of strength of mobile phone use in ecological momentary assessment.</td>
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<tr>
<td>Collins et al. (2003)</td>
<td>(N = 20) social drinkers</td>
<td>Compared pen-and-paper assessment of alcohol intake with data gathered from mobile telephones, over 14 day period.</td>
<td>Mobile telephone associated with advantages such as immediate entry of data into a central database, time-stamping of data.</td>
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<td>Forbes et al. (2009)</td>
<td>(N = 33) adolescents (15 with depression, 28 controls)</td>
<td>Calls to mobile handsets used to prompt adolescents to enter data regarding level of positive affect.</td>
<td>No specific information provided on validity of use of phones in assessment, although the hypothesized results were observed.</td>
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<td>Freedman et al. (2006)</td>
<td>(N = 30) homeless cocaine users</td>
<td>Automated calls to mobile handsets used to gather drug use and craving data over 2-week period.</td>
<td>Acceptable assessment method, with 80% of individuals completing. Also reported to increase awareness of relationship between cues and drug use.</td>
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<tr>
<td>Gee et al. (2005)</td>
<td>(N = 17) problem gamblers</td>
<td>Mobile handsets used for data collection on problem gambling and related variables.</td>
<td>Gambling associated with increased physical arousal. Assessment method described as effective.</td>
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<tr>
<td>Taylor &amp; Katomeri (2007)</td>
<td>(N = 60) smokers</td>
<td>Text message use to inform experimenters of duration until first cigarette after leaving experiment.</td>
<td>No specific information reported on validity of assessment, but hypothesized correlations between craving and latency to first cigarette observed.</td>
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<tr>
<td><strong>TREATMENT STUDIES</strong></td>
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<tr>
<td>Aviv (2006)</td>
<td>(N = 12) adolescents with school refusal</td>
<td>Adolescents treated with hypnosis for school refusal, and permitted to contact therapist to assist via mobile telephone when attending school.</td>
<td>Eight participants were able to return to full-time schooling, with three others showing significant improvement in attendance.</td>
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<tr>
<td>Bramley et al. (2005)</td>
<td>(N = 355) Maori and (N = 1,350) non-Maori smokers</td>
<td>Compared text messaging for smoking cessation in Maori versus non-Maori participants.</td>
<td>Text messaging intervention equally effective in both groups.</td>
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<tr>
<td>Brendryden et al. (2008)</td>
<td>(N = 290) smokers</td>
<td>RCT comparing multimedia program for smoking cessation incorporating text messages and audio recordings, with information booklet control condition.</td>
<td>Increased abstinence rates for the treatment condition up to 12 months after cessation.</td>
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### Study Sample Method Results

<table>
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<th>Study</th>
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<th>Results</th>
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<tbody>
<tr>
<td>Flynn et al. (1992)</td>
<td>2 x N = 1 case studies</td>
<td>Mobile handsets used as contact for people with driving phobia during solo (exposure) trips.</td>
<td>Improvement reported in both cases, with one relapsing. Cautions by authors that mobile phones may operate as safety signals.</td>
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<tr>
<td>Obermayer et al. (2004)</td>
<td>N = 46 university student regular smokers</td>
<td>Tailored text messages used in preparation and relapse prevention in smoking cessation program.</td>
<td>Almost half of participants had attempted to quit at least once during the 6-week trial. A total of 22% had achieved 1 week of continued abstinence.</td>
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<td>Riva et al. (2007)</td>
<td>N = 30 female university students</td>
<td>Compared audio-visual narratives delivered via mobile phone with MP3 players and home DVD players, as a means of managing exam anxiety.</td>
<td>Delivery via mobile telephone superior to MP3 player or home DVD player, allowing audio and video stimuli to be used.</td>
</tr>
<tr>
<td>Rodgers et al. (2005)</td>
<td>N = 1,705 smokers</td>
<td>RCT comparing SMS for smoking cessation against a control group receiving messages thanking them for participating.</td>
<td>SMS intervention found to be superior, with 28% quitting smoking, compared with only 13% of the control group.</td>
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<tr>
<td>Španiel et al. (2008)</td>
<td>N = 45 patients with psychotic illness</td>
<td>Remote assessment of Sz patients using SMS to detect early warning signs of relapse and initiate early intervention.</td>
<td>Drop of 60% in relapse rates during the program, compared with prior to the program.</td>
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<tr>
<td>Whittaker et al. (2008)</td>
<td>N = 15 smokers</td>
<td>Multimedia mobile phones used to play video to assist smoking cessation. Videos of role models using craving coping strategies available on demand.</td>
<td>Successful development and pilot of multimedia smoking cessation program. After 4 weeks, 9 of 15 participants reported abstinence.</td>
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</table>
From the studies reviewed here, it is apparent that psychological treatments using mobile telephone technology have also been restrictive in their use of available technology. Research to date has utilized only voice and SMS communication, and limited multimedia playback. These capabilities represent only a small fraction of the technologies available on modern mobile telephone handsets (Boschen, 2009). While the current use of the range of features on handsets has been limited, the future may lead to innovative and inventive uses of the full capabilities of mobile telephones. Even so, there is no available empirical data on the utility of the wider range of telephone capabilities in psychotherapy.

In some cases, it is also possible that the use of a mobile telephone handset may have a negative impact on treatment. As demonstrated by Flynn et al. (1992), there exists the possibility, particularly in anxiety conditions, that mobile telephone handsets may act countertherapeutically. The relapsing participant in these case studies demonstrates a similar problem to that observed in technology-assisted treatments of other conditions such as OCD (Baer, Minichiello, Jenicke, & Holland, 1988). Clinicians must remain alert to the potential for device-dependence, as well as the risk of relapse when mobile telephone handsets are withdrawn.

There are a range of other technological limitations to mobile handset use in psychotherapy interventions. A range of these, including cost of handsets and programming difficulty, are discussed in Boschen (2009) and Boschen and Casey (2008). Despite these limitations in research, use of the available technology, and practicalities of use, the small number of treatment studies suggests that mobile telephony may hold promise in augmenting cognitive and behavioral psychotherapy. Further research is needed, however, to more confidently ascertain the potentials and pitfalls of incorporating handsets into psychological interventions.

Conclusion

Mobile telephone technology has been increasingly used in medical and health interventions, but has not been similarly embraced by cognitive behavioral therapists and researchers. Even where mobile telephones have been in use in assessment and treatment, studies have typically utilized only the basic features provided, rather than the more advanced features available in modern handsets. Despite this slow uptake of cellular telephone technology, these early studies provide hope that mobile telephones and allied technologies may provide useful tools in assessment and intervention.

References


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