

# Brief Communication

## Technology-Based Suicide Prevention: Current Applications and Future Directions

David D. Luxton, Ph.D., Jennifer D. June, B.A.,  
and Julie T. Kinn, Ph.D.

*The National Center for Telehealth and Technology,  
Defense Centers of Excellence (DCoE) for Psychological Health  
and Traumatic Brain Injury, Tacoma, Washington.*

### Abstract

*This review reports on current and emerging technologies for suicide prevention. Technology-based programs discussed include interactive educational and social networking Web sites, e-mail outreach, and programs that use mobile devices and texting. We describe innovative applications such as virtual worlds, gaming, and text analysis that are currently being developed and applied to suicide prevention and outreach programs. We also discuss the benefits and limitations of technology-based applications and discuss future directions for their use.*

**Key words:** *technology, telehealth, e-health, suicide prevention*

### Introduction

Suicide is a serious public health problem worldwide. In the United States, there are more than 33,000 suicides per year, making suicide the nation's 11th leading cause of death.<sup>1</sup> Suicide and attempted suicide cost \$33 billion annually in the United States, including \$32 billion in lost productivity and \$1 billion in medical costs.<sup>2</sup> Further, suicide rates in the U.S. military have been trending upward, with record high numbers reported in recent years.<sup>3</sup> These facts call for the development and evaluation of effective and innovative methods for suicide prevention.

Traditional approaches to suicide prevention outreach include the use of mailings, brochures, billboards, radio, television, and telephones. The advancement of technologies, such as the Internet and smartphones, and their increased use by the general population provide new opportunities for effective suicide prevention and outreach.<sup>4</sup> In this article, we review existing technologies used in suicide prevention and outreach, with a focus on primary and secondary prevention programs that increase awareness, provide education and support, and connect individuals with services. Our goal is to raise awareness of extant programs, provide information useful for the development of new programs, and encourage the evaluation of technology-based suicide prevention programs.

### Web-Based Suicide Prevention

More than 220 million people in the United States have access to the Internet at home or work, with worldwide access over 1.7 billion.<sup>5</sup> The increasing availability and popularity of the Internet has expanded opportunities for suicide prevention. Existing online suicide prevention programs include Web sites that provide information about treatment resources, self-help and resources for helping others, and anonymous counseling services. The National Suicide Prevention Lifeline ([www.suicidepreventionlifeline.org](http://www.suicidepreventionlifeline.org)), for example, provides a free 24-h hotline as well as links to other suicide prevention resources. The site also links to the Veterans Suicide Prevention Hotline and a live chat feature for veterans and others in the military community.

One advantage of Web-based outreach and prevention programs is that persons in crisis can access information at all times of day and are not limited to seeking help during conventional business hours. Further, some users prefer the privacy and anonymity afforded by the Internet and may choose to initially visit a Web site instead of calling a telephone hotline or seeking help in-person. Community discussion forums, blogs posted by suicide prevention experts, and self-assessment tests that provide feedback and recommendations can be also integrated into these sites. The Web site *afterdeployment.org*, for example, provides a depression self-assessment, contact information during times when the user is experiencing significant distress, as well as content identifying when signs and symptoms should be evaluated by a clinician.

Engaging and interactive multimedia content can also be integrated into the design of suicide prevention Web sites. For example, the National Suicide Prevention Lifeline's *www.lifeline-gallery.org* Web site features suicide survivor stories presented by avatars (a user's graphical or animated representation of self). Users create and design the appearance of their avatars, write a description about their experiences with suicide, and then record their voices or choose a computer-generated voiceover to tell their stories. As of March 2010, users had shared more than 600 stories. The innovative use of these avatars provides a personalized, interactive experience while helping users maintain anonymity. In sum, Web-based suicide prevention programs not only connect individuals with services, but can also create interactive and engaging environments for support and education.

### SOCIAL NETWORKING AND ONLINE COMMUNITIES

On social networking sites such as Facebook and MySpace, users create Web-based personal profiles and link to friends' profiles. Online social networking allows users to communicate within personalized social networks by posting text, e-mail, instant messaging,

and links to other sites and resources. An advantage of social networking sites for suicide prevention and outreach is that they facilitate social connections among peers with similar experiences. These sites have the potential to foster supportive interactions with others and create a community among those who are coping with similar challenges.

Several Facebook pages are devoted to suicide prevention. One popular fan page is "Suicide Prevention" (retrieved from Facebook, 2010), which has more than 44,100 fans.<sup>6</sup> The page provides links to suicide prevention Web sites and hotlines as well as information about the warning signs of suicide. The site builds community by allowing users to upload images of loved ones who have died by suicide and allowing others to comment on pictures and personal stories.

### WEB-BASED VIDEO AND PODCASTING

Online video content is another useful tool for suicide prevention and outreach. Video can provide information about the warning signs of suicide or how to seek help. The popular video-sharing Web site *YouTube* allows anyone with Internet access to view videos and registered users can upload their own. We searched the *YouTube* site for videos that involved suicide prevention (key words: suicide prevention), and as of May 18, 2010, our search yielded 2,680 hits. The results consisted of a wide range of videos on the topic of suicide prevention, including many public service announcements. One public service announcement created by the Veteran's Administration features actor Gary Sinise encouraging distressed Veterans and Service Members to seek help. Nonprofit organizations and university-sponsored videos promoted suicide prevention awareness programs and both national and institutional resources. Other videos were created by individual users and feature contents such as personal accounts of getting help as well as memorials of loved ones who died by suicide.

Podcasting is another excellent way to provide information about behavioral health to the general public. Podcasting is the distribution of a series of digital audio and video media files (podcasts and vodcasts) that are released episodically via the Internet. They are available for automatic or manual download to a personal computer and can be transferred to a personal media device such as an iPod or other MP3 player. An advantage of podcasting for suicide prevention is that the content can be subscribed by and automatically delivered to users. Thus, users receive updated podcasts effortlessly and these podcasts are available whenever a crisis arises.

A number of suicide prevention podcasts currently exists (a March 28, 2010 search for podcasts on iTunes with the key words "suicide prevention" returned 63 hits). For example, the Center for Disease Control (CDC) currently has five podcasts on the topic of suicide available on their Web site, such as "understanding suicide" and "coping with traumatic events podcast."<sup>7</sup> These podcasts provide information about the warning signs of suicide and prevention resources.

### Outreach via e-Mail

Suicide prevention programs that use e-mail to contact at-risk populations are also a promising method for outreach. A primary advantage of e-mail outreach is that it reaches a large number of

people efficiently and affordably. Many international suicide prevention organizations currently provide support via e-mail. Samaritans ([www.samaritans.org](http://www.samaritans.org)) is a British organization that provides a volunteer-run e-mail support service. Users receive personalized responses from counselors within 12 h of initiating contact.

E-mail is also effective for large-scale community outreach programs. For example, Haas et al.<sup>8</sup> contacted college students at risk for depression and suicide via e-mail. Students first completed an online behavioral health survey, and then an automatic computer-generated scoring system categorized participants into high-, moderate-, and low-risk groups based on level of depression and suicidal ideation. Mental health providers received e-mail notifications of students' scores and subsequently contacted the participants who were ranked moderate and high risk to initiate e-mail correspondence. The students who participated in e-mail correspondence with a therapist had approximately three times greater likelihood of entering into face-to-face treatment compared with the students who did not take part in e-mail correspondence.

Another potentially effective use of e-mail outreach for suicide prevention is sending caring letters to patients at high risk for suicide following discharge from inpatient psychiatric treatment, when risk for repeated suicide attempt is heightened.<sup>9-11</sup> Motto<sup>12,13</sup> found that periodically sending personalized correspondence to inpatient psychiatric patients after discharge significantly reduced later suicides when compared with those who did not receive letters. The "caring letters" concept is the first psychological intervention that has reduced suicide in a randomized clinical trial.<sup>14,15</sup> The National Center for Telehealth and Technology is currently conducting a pilot Caring Letters study at Madigan Army Medical Center (MAMC) to evaluate the feasibility of the program for possible expansion to other military hospitals. The protocol includes both traditional regular mail as well as the option for e-mail correspondence. The primary advantage of the caring e-mail correspondence is that it reaches service members despite geographic location. An e-mail-based suicide prevention program is ideal for mobile populations such as military service members and university students.

### Mobile Devices and Smartphones

Hand-held mobile devices, including cell phones and other "smart" hand-held communication devices (e.g., iPhone, Blackberry, Droid), are rapidly becoming a cultural standard for communication. Many smart mobile devices include Web browsers that transmit content specifically designed for the device's capabilities. These devices can deliver evidence-based assessment tools and are appropriate for suicide prevention because they are carried on-person and are accessible at all times of day. Smart devices also provide immediate two-way contact with support systems and providers during a crisis or to manage unexpected acute symptoms.

*Apps* (applications) are programs designed for mobile devices. Apps can be designed to help users self-assess and monitor psychiatric symptoms including suicidal ideation. Users can personalize content and access hotline links, psychological tools (e.g., relaxation exercises), and appointment reminders. The Automatic Thought Record, for

example, is a tool common in cognitive behavioral treatment of depression<sup>16</sup>; an app could provide a more discreet and readily available mode of completing the records, compared with the photocopied worksheets typical in cognitive behavioral treatment. Content can also be stored and delivered to mobile devices that help individuals cope with crisis. For example, virtual versions of the “Hope Box” or “Survivor Kit” could include multimedia pictures, letters, poetry, coping cards, and prayer cards that serve as reminders of pleasant events or positive relationships that communicate that life is worth living.<sup>17</sup>

*Text messaging* or “texting” is a fast, economical, and simple communication between users and can be used to send reminders of treatment appointments. Texting is especially popular among adolescents, with over 50% of adolescents with cell phones sending at least 50 text messages per day.<sup>18</sup> Text messaging for prevention services has been increasing both nationally and internationally. In Great Britain, the Samaritans added a text messaging component to their crisis intervention programs in 2006. They have since received over 200,000 text messages without large-scale marketing efforts.<sup>19</sup> In the United States, the Crisis Call Center, a suicide prevention organization, has collaborated with the University of Nevada, Reno, to implement a crisis text messaging service. Another example is the Mississippi Department of Health working with communications provider AnComm to pilot an anonymous text messaging helpline program for adolescents and schools.<sup>20</sup> Teens can anonymously send texts to report incidents and seek help during crises.

## **Other Innovative Uses of Technology for Suicide Prevention**

### **VIRTUAL WORLDS**

Virtual worlds are software-based programs that provide immersive and interactive environments. Second Life (SL), for example, is an online virtual world that enables users or “residents” to interact with each other via avatars. Residents can explore, meet others, participate in individual and group activities, create and trade virtual property and services, or travel throughout the virtual world. SL has grown rapidly since its launch in 2003 and has millions of users.<sup>21</sup>

Virtual worlds provide an innovative opportunity for suicide prevention and outreach. Behavioral health services on SL can be used as an adjunct to care or for aftercare.<sup>22</sup> The Survivors of Suicide Project (<http://secondlife.com/destination/survivors-of-suicide-project>) is a “sim” (simulation) in SL that provides suicide prevention information and support. Most of the objects in the sim are clickable and provide information regarding suicide prevention. Visitors coping with loss due to suicide can also light virtual remembrance candles to honor their loved ones. Another example is the Survivors of Suicide Group ([www.survivorsofsuicide.com/](http://www.survivorsofsuicide.com/)). The group consists of family or friends of those lost to suicide and suicide attempt survivors. The sim allows users to post writings and art to promote healing after the death of a loved one by suicide.

### **COMPUTER AND WEB-BASED GAMING**

Computer and Web-based gaming provides another opportunity for suicide prevention, especially because of its appeal among

younger persons. In 2008, the U.S. Army developed an interactive suicide prevention DVD called *Beyond the Front*. Used both individually and in groups, this video-based game provides personal stories of two fictional U.S. soldiers who face various difficulties. Interspersed by dramatic video, users are provided with options to choose the best course of action for the characters. Games are also integrated into social networking Web sites such as Facebook and MySpace. Linked users can receive notification of their friends’ choice of games and then elect to play the games themselves. Although our search did not find any social networking games geared toward suicide prevention on a social networking platform, social networking sites are a logical next step for creative interventionists.

### **TEXT ANALYSIS**

Computerized text analysis uses software to categorize words or syntax using specified criteria. For example, Linguistic Inquiry and Word Count Version 2007 software (LIWC2007)<sup>23</sup> evaluates various emotional, cognitive, and structural components present in individuals’ verbal and written speech. This technology can search text within e-mails or Web site postings to identify persons who might be at risk for suicide. Such technology could allow for large-scale automated surveillance of Web sites and blogs to identify users at high risk.

Text analysis can also be integrated into Web sites and e-mail services. For example, the popular online search engine Google has integrated a feature into its search engine that displays a link and message about the National Suicide Prevention Lifeline at the top of the search page when key word searches indicate suicidal ideation or intent (e.g., “I want to die”). Users can then access suicide prevention resources immediately to receive help.

### **Discussion and Future Directions**

This review demonstrates the increase in efforts to leverage technology for suicide prevention and outreach programs. One of the most significant benefits common to many of these technological applications is their ability to overcome barriers to care. Technology can increase the geographical reach of suicide prevention programs by bringing care to remote and underserved communities. Further, these programs provide efficient and near instantaneous access to information that is not limited to conventional business hours. This is important because crises frequently emerge in the absence of healthcare providers and technology-based applications can provide solutions when conventional resources are not available. Other major obstacles that individuals face when considering behavioral health treatment include social stigma, concerns about privacy, and not knowing where to begin to seek care. The use of innovative and creative technology for suicide prevention programs can help to address these issues and promote widespread prevention and intervention. Further, technology that leverages innovative entertainment and communication capabilities may enhance the appeal and effectiveness of prevention programs for targeted populations who are at risk.

Technology-based programs also have limitations. Limited access to Internet and other technologies is one obstacle to care. Moreover, technology-based programs must accommodate the communication habits and technology preferences of current and future users. Available technologies and popular preferences for using those technologies are constantly changing. These systems and applications also need to be culturally relevant to be accepted by end-users. Further, it is important for those developing technology-based programs to consider best methods for reaching groups at particular risk of suicide.

Other issues to consider are confidentiality and privacy concerns as well as clinical safety. Although use of the Internet can provide a sense of anonymity, fear of a possible breach of confidentiality can prevent individuals from participating in suicide prevention programs. Further, providers must consider risks to confidentiality when responding to suicide risks that are communicated via texting, e-mail, or other electronic method. This can create both ethical and legal issues if not addressed before initiation of prevention and outreach programs. Also, although texting and e-mail provide almost immediate delivery of messages, users may falsely expect immediate responses. It is therefore important to clearly indicate expected response time. Protections around anonymity provided by technology may also limit safety if an individual is expressing indications of self-harm intent. Safety plans to address these issues must be considered and clearly stated.

Although social networking sites and chat rooms can foster supportive interactions among those who are coping with similar challenges, these services could also increase risk for suicide behavior among vulnerable persons. For example, shared instructions for suicide methods, bullying, and potential suicide pacts are a relevant concern. The establishment of usage guidelines as well as the monitoring of content on Web sites, chat rooms, and other media can help limit these problems.

The unregulated quality of resources available on the Internet is also a concern. Many established organizations, such as the National Suicide Prevention Lifeline and the Crisis Call Center, follow ethical guidelines and use evidence-based practice. There are many Web sites geared toward suicide prevention that might not follow available standard of care guidelines. This can be a problem because users might not be able to discern between such reputable sites and other resources made by well-meaning laypeople. Another concern is the potential for media to exacerbate suicide risk by glamorizing suicide.<sup>24</sup> The establishment of media guidelines, such as those published by The Centers for Disease Control and Prevention,<sup>25</sup> can help, although more research is needed to evaluate the effectiveness of such controls.

There are several future directions for the evaluation of technology-based suicide prevention that we recommend for consideration. There is currently a dearth of published outcome-based research of technology-based suicide prevention programs that limits conclusions about their effectiveness. We therefore recommend systematic evaluations of technology-based programs that include measurable outcomes such as suicide, nonfatal self-harm behaviors,

and treatment utilization. An evaluation of the “caring letters” concept that uses e-mail for outreach, for example, is one possibility.<sup>26</sup> A large, randomized, controlled trial could compare a caring e-mails intervention to usual care as a way to reduce suicide deaths and rehospitalizations after patients are discharged from inpatient psychiatric treatment.

We also recommend research that evaluates the preferences for and use of evolving technologies such as social networking Web sites, smartphones, and virtual worlds among both clinical populations and the general public. Several published studies have reported the power of sharing information through peers on social networking sites.<sup>27-29</sup> A gap exists, however, in outcome-based research regarding the effectiveness of social networking sites to connect persons to behavioral health resources or on how these sites might influence behavior or attitudes toward suicide prevention. Studies that evaluate the number of visits to suicide prevention Web sites as well as usage of Web links to additional referral information or services will also help to evaluate the effectiveness of Web-based suicide prevention programs. Further, we recommend assessing cost-effectiveness as part of future program evaluations of technology-based suicide prevention programs. This information will be especially useful for comparing new technology-based to traditional suicide prevention programs and for determining when to expand programs.

In conclusion, technology has an important role in suicide prevention and its use will continue to grow. Although technology can provide opportunities for effective outreach and suicide prevention, technology is a tool that cannot replace careful clinical case management and use of empirically supported interventions and assessment. Further evaluation of technology-based programs to identify best practices, determine cost-benefit, and provide empirical support for their use is needed. Researchers might also consider the use of emerging technologies such as virtual worlds and texting and engage actively in assessing the effectiveness of these technologies. Further, more research on the integration of suicide prevention content into popular Web sites and social networking sites is recommended. With innovation and thorough evaluation, these new modes of communication and entertainment can help to save lives.

### Acknowledgments

The authors thank Robert P. Ciulla, Ph.D., Kevin M. Holloway, Ph.D., Mark A. Reger, Ph.D., and Gregory A. Gahm, Ph.D., for their assistance with this manuscript.

### Disclaimer

The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or reflecting the views of the Department of the Army or the Department of Defense.

### Disclosure Statement

No competing financial interests exist.



## REFERENCES

- Center for Disease Control. Suicide: Facts at a Glance. Atlanta, Georgia: Center for Disease Control, **2009**. Available at [www.cdc.gov/ViolencePrevention/pdf/Suicide-DataSheet-a.pdf](http://www.cdc.gov/ViolencePrevention/pdf/Suicide-DataSheet-a.pdf) (last accessed April 20, 2010).
- Corso PS, Mercy JA, Simon TR, Finkelstein EA, Miller TR. Medical costs and productivity losses due to interpersonal and self-directed violence in the United States. *Am J Prev Med* **2007**;32:474–482.
- Kuehn BM. Soldier suicide rates continue to rise: Military, scientists work to stem the tide. *JAMA* **2009**;301:1111, 1113.
- Wilson JAB, Onorati K, Mishkind M, Reger MA, Gahm GA. Soldier attitudes about technology-based approaches to mental healthcare. *Cyberpsychol Behav* **2008**;11:767–769.
- Internet World Stats. Internet Usage Statistics: The Internet Big Picture. Miniwatts Marketing Group. **2010**. Available at [www.internetworldstats.com/stats.htm](http://www.internetworldstats.com/stats.htm) (last accessed March 30, 2010).
- Facebook. Suicide Prevention [fan page]. **2010**. Available at [www.facebook.com/pages/SuicidePrevention/6043207366?ref=mf#!pages/Suicide-Prevention/6043207366?v=info&ref=mf](http://www.facebook.com/pages/SuicidePrevention/6043207366?ref=mf#!pages/Suicide-Prevention/6043207366?v=info&ref=mf) (last accessed March 21, 2010).
- Center for Disease Control. Two Podcasts—Suicide and Coping. Atlanta, Georgia: Center for Disease Control, **2010**. Available at [www.cdc.gov/ncipc/dvp/suicide/UnderstandingSuicide%20Podcast.htm](http://www.cdc.gov/ncipc/dvp/suicide/UnderstandingSuicide%20Podcast.htm) (last accessed March 29, 2010).
- Haas AP, Koestner B, Rosenberg J, Moore D, Garlow SJ, et al. An interactive Web-based method of outreach to college students at risk for suicide. *J Am Coll Health* **2008**;57:15–22.
- Goldacre M, Seagroatt V, Hawton K. Suicide after discharge from psychiatric inpatient care. *Lancet* **1993**;342:283–286.
- Kan CK, Ho TP, Dong JY, Dunn EL. Risk factors for suicide in the immediate post-discharge period. *Soc Psychiatry Psychiatr Epidemiol* **2007**;42:208–214.
- Qin P, Nordentoft M. Suicide risk in relation to psychiatric hospitalization: Evidence based on longitudinal registers. *Arch Gen Psychiatry* **2005**;62:427–423.
- Motto JA. Suicide prevention for high-risk persons who refuse treatment. *Suicide Life Threat Behav* **1976**;6:223–230.
- Motto JA, Bostrom AG. A randomized controlled trial of postcrisis suicide prevention. *Psychiatr Serv* **2001**;52:828–833.
- Comtois KA, Linehan MM. Psychosocial treatments of suicidal behaviors: A practice-friendly review. *J Clin Psychol* **2006**;62:161–170.
- Joiner TE, Van Orden KA. The interpersonal-psychological theory of suicidal behavior indicates specific and crucial psychotherapeutic targets. *Int J Cogn Psychol* **2008**;1:80–89.
- Beck J. *Cognitive therapy: Basics and beyond*. New York: Guilford Press, **1995**.
- Berk MS, Henriques GR, Warman, DM, Brown, GK, Beck AT. A cognitive therapy intervention for suicide attempters: An overview of the treatment and case examples. *Cogn Behav Pract* **2004**;11:265–277.
- Lenhart A, Ling R, Campbell S, Purcell K. Teens and Mobile Phones. Washington, DC: Pew Research Center. **2010**. Available at <http://pewinternet.org/Reports/2010/Teens-and-Mobile-Phones.aspx> (last accessed May 31, 2010).
- Public Technology. Case study: Samaritans SMS Text Messaging Project Sift Media. **2008**. Available at [www.publictechnology.net/content/14736](http://www.publictechnology.net/content/14736) (last accessed May 27, 2010).
- Mississippi Department of Mental Health's Helpline. Talk About It. **2010**. Available at <https://login.ancomm.com/mshelpline> (last accessed June 7, 2010).
- Second Life. Economic Statistics. Linden Lab. **2010**. Available at [http://secondlife.com/whatis/economy\\_stats.php](http://secondlife.com/whatis/economy_stats.php) (last accessed April 20, 2010).
- Gorini A, Gaggioli A, Vigna C, Riva G. A second life for eHealth: Prospects for the use of 3-D virtual worlds in clinical psychology. *J Med Internet Res* **2008**;10:e21.
- Chung CK, Pennebaker JW. *The psychological functions of function words*. New York: Psychology Press, **2007**.
- Mann JJ, Apter A, Bertolote J, Beautrais A, Currier D, Haas A. Suicide prevention strategies: A systematic review. *J Am Med Assoc* **2005**;294:2064–2074.
- Center for Disease Control. CDC Social Media Tools Guidelines & Best Practices. Atlanta, GA. **2010**. Available at [www.cdc.gov/SocialMedia/Tools/guidelines/](http://www.cdc.gov/SocialMedia/Tools/guidelines/) (last accessed May 30, 2010).
- Luxton DD, Kinn JT, June JD, Pierre LW, Reger MA, Gahm GA. The Caring Letter Project: A Military Suicide Prevention Pilot Program (submitted).
- Moreno MA, Briner LR, Williams A, Walker L, Christakis DA. Real use or "real cool": Adolescents speak out about displayed alcohol references on social networking websites. *J Adolesc Health* **2009**;45:420–422.
- Okazaki S. The tactical use of mobile marketing: How adolescents' social networking can best shape brand extensions. *J Advert Res* **2009**;49:12–26.
- Park N, Kee K, Valenzuela S. Being immersed in social networking environment: Facebook groups, uses and gratifications, and social outcomes. *Cyberpsychol Behav* **2009**;12:729–733.

Address correspondence to:

David D. Luxton, Ph.D.

The National Center for Telehealth and Technology (T2)  
 Defense Centers of Excellence (DCoE) for Psychological Health  
 and Traumatic Brain Injury  
 Old Madigan Army Medical Center Bldg. 9933C  
 Tacoma, WA 98431

E-mail: david.luxton@us.army.mil

Received: June 9, 2010

Revised: July 22, 2010

Accepted: July 26, 2010