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Technology Use, Preferences, and Capacity in Injured Patients at Risk for Posttraumatic Stress Disorder

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Abstract

OBJECTIVE—This investigation comprehensively assessed the technology use, preferences, and capacity of diverse injured trauma survivors with Posttraumatic Stress Disorder (PTSD).

METHOD—121 patients participating in a randomized clinical trial of stepped collaborative care targeting PTSD were administered baseline 1-, 3-, and 6-month interviews that assessed technology use. Longitudinal data about the instability of patient cell phone ownership and phone numbers were collected from follow-up interviews. PTSD symptoms were also assessed over the course of the six months after injury. Regression analyses explored the associations between cell phone instability and PTSD symptoms.

RESULTS—At baseline 71.9% (n=87) patients reported current cell phone ownership and over half (58.2%, n=46) of these patients possessed basic cell phones. Only 19.0% (n=23) of patients had no change in cell phone number or physical phone over the course of the six months post-injury. In regression models that adjusted for relevant clinical and demographic characteristics, cell

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phone instability was associated with higher 6-month post-injury PTSD symptom levels (P<0.001).

CONCLUSIONS—Diverse injured patients at risk for the development of PTSD have unique technological use patterns including high rates of cell phone instability. These observations should be strongly considered when developing technology-supported interventions for injured patients with PTSD.

BACKGROUND

Technology-based interventions are becoming a mainstay of healthcare delivery in US health care systems in general as well as in trauma care systems in particular (Choo, Ranney, Aggarwal, & Boudreaux, 2012; Van Eaton et al., 2014). Some commentaries suggest that the technological innovation in US health care and trauma care systems has marked potential for a positive impact on patient care and outcomes (Breslau & Engel, 2015). Others, however, suggest that a better understanding of patient technology preferences and capacity is required before the full advantages of health care technology innovation can be realized (Donker et al., 2013; Karsh, Weinger, Abbott, & Wears, 2010).

Cross-sectional surveys in trauma-exposed patients have begun to assess patient preferences for technology-enhanced communications and interventions (Bush, Fullerton, Crumpton, Metzger-Abamukong, & Fantelli, 2012; Ranney et al., 2012). Initial investigation suggests a relatively high percentage of patients may have access to new technologies and that subgroups of patients have expressed an interest in technology supported intervention delivery (Ranney, et al., 2012). These findings have been taken to suggest that technology supported interventions may provide a feasible and acceptable means of delivering healthcare information to trauma-exposed patients.

Injured trauma patient populations include a substantial percentage of individuals from low-income, ethnoculturally diverse heritages (Stephens et al., 2010). National cross-sectional surveys suggest that low-income, diverse populations may be particularly inclined to utilize technologic innovations including cell phones with applications (i.e., smart phones) (Duggan & Smith, 2013). Recent commentary suggests that cell phone data can be used to inform assessments of important socio-demographic characteristics such as poverty that are strongly associated with health outcomes (Blumenstock, Cadamuro, & On, 2015). The current investigation aimed to assess technology preferences, use and capacity in a cohort of injured trauma survivors admitted to a US Level I trauma center who were at risk for the development of PTSD. The investigation sought to understand both computer and cell phone use and preferences. The investigation also explored the association between patterns of cell phone instability and the development of PTSD symptoms six months after injury.

METHODS

Setting and Participants

The current investigation was a secondary analysis of data derived from a randomized controlled trial of a technology-enhanced stepped collaborative care intervention targeting PTSD among injured inpatients (Zatzick et al., 2015).

The study was approved by the University's institutional review board prior to study initiation. Informed consent was obtained from each participant at bedside.

Procedures

Population-based electronic medical record PTSD screening—The study utilized an established electronic medical record (EMR) screening method to identify patients with a likelihood of developing high levels of PTSD symptoms; the EMR screen demonstrated adequate sensitivity (0.71), specificity (0.66), and area under the ROC curve (0.72) when utilized to predict scores on PTSD Checklist-Civilian Version (PCL-C)≥35.

Investigative laptop—All patients were given a study laptop while at baseline in the trauma ward. Patients were instructed to use the laptop for whatever purposes they found helpful after their injury including email, social network or obtaining informational material on post-injury medical and psychiatric problems. The internet browser homepage was set to the After Deployment website, a United States Department of Defense (DoD) Defense Centers of Excellent (DCOE) project to provide resources for survivors of traumatic life experience suffering PTSD and it's comorbidities (Bush, Bosmajian, Fairall, McCann, & Ciulla, 2011; Ruzek et al., 2011).

As a part of the informed consent process, patients were made aware that their laptop usage would be tracked and their website access analyzed. The K9 Web Protection software (Blue Coat Systems, Sunnyvale, CA) is content-control software that allows an administrator to view metadata related to web-browsing, including the website address and the time spent at each website. Each patient's website usage data were first filtered to remove non-pertinent websites such as advertisements and commercials. The websites each patient visited were then grouped by purpose.

Measures

Patient technology use and capacity—A series of patient self-report items were adapted from prior questionnaires administered to civilian emergency department patients and trauma-exposed veteran patients (Bush, et al., 2012; Ranney, et al., 2012). Patient preferences were assessed for the following types of healthcare-related communications: telephone, email, text messaging, internet website, and social networking sites, as well as more traditional methods of contact including US mail, postcards, appointment cards, and in-person discussions with doctors. The investigation also assessed patient interest and capacity in DVD or video-related communication.

Patients were also asked at baseline about their possession of a cell phone. Patients were asked to characterize their cell phone as either a basic cell phone or a smart phone. Patients were also queried about whether or not they ever used applications with their cell phone.

At follow-up interviews in order to assess cell phone instability, patients were asked about physical cell phone changes and cell phone number changes. Additionally, in order to triangulate patient self-reports of phone instability, follow-up interviewers tracked cell phone number and cell phone turnover over the course of the six-month longitudinal follow-up.

Cell phone instability was defined as one or more changes in physical cell phone or cell phone number over the course of the study.

PTSD symptoms—PTSD symptoms were assessed with the PCL-C (Weathers, Keane, & Davidson, 2001), which has established reliability and validity across trauma-exposed populations (Weathers, et al., 2001).

Other assessments—The investigation determined injury severity at baseline during the index admission from the medical record *International Classification of Disease—9th Revision* (ICD-9) using the Abbreviated Injury Scale and Injury Severity Score. Race and ethnicity were assessed through patient self-report. Laboratory toxicology results, insurance status, length of hospital and intensive care unit (ICU) stays, and other clinical characteristics were abstracted from the EMR.

Data Analyses—The investigation first described the demographic and clinical characteristics of the patients. Next the investigation examined patterns of patient self-reported technology use and preferences for care. K-9 tracking data was used to assess composite patient laptop activity and associated time patients spent with each category of activity (e.g., email, social networking sites, After Deployment) (Bush, et al., 2011). In order to assess cell phone instability, the investigation next assessed patterns of physical phone turnover and phone number changes.

Exploratory regression analyses assessed the association between cell phone instability and PTSD symptom levels at the 6-month post-injury time point. An initial regression analysis controlled only for baseline PTSD symptom levels in the assessment of the association between instability and PTSD symptoms. A second regression model adjusted for baseline PTSD symptoms, age, gender, ISS, treatment group, education and insurance status.

RESULTS

One hundred and twenty-one patients were recruited in the study and 86.8% (n = 105) attained 6-month follow-up; the demographic, injury and clinical characteristics of the study sample have been previously reported (Zatzick, et al., 2015). The median age was 43.2 years (SD=14.7) and 35.5% (n=43) were female. Race was self-reported: 45.4% (n=55) of patients identified as White, 21.5% (n=26) identified as Black, 15.7% (n=19) identified as American Indian, 12.4% (n=15) as Hispanic and 5.0% (n=6) identified as Asian. Of the 121 patients, 100 patients reported annual income levels; the most frequently reported income level was $0-4999 (32%, n=32) and the median individual income reported was $10000-14999.

Laptop Usage

Of the 121 patients, 57.9% (n=70) of patients used the study laptop. Social networking sites (e.g., Facebook) were the most frequently occurring category of use; laptop use also included the afterdeployment.org website and other internet sites.

Cell Phone Capacity and Characterization

At baseline 71.9% (n=87) patients reported current cell phone ownership, 16.5% (n=20) reported not possessing a cell phone, and 11.6% (n=14) of patients reported losing their phone during the event that led to the current trauma admission. At the time of injury, most patients possessed basic cell phones without applications (58.2%, n=46). Other ownership groups were: smart phones with applications (29.0%, n=35), smart phones without applications (10.7%, n=13), basic phones with applications (5.8%, n=7) or no phone (16.5%, n=20).

Of the 121 patients, 32.3% (n=39) reported average cell phone use for personal reasons greater than 20 hours per week, 6.6% (n=8) reported between 11–20 hours per week, 13.2% (n=16) reported between 6–10 hours per week, 33.1% (n=40) reported between 0–5 hours per week, and 14.9% (n=18) reported no use at all.

Health Information Communication Preference

The vast majority of patients expressed interest in using their cell phone for information about health-related appointments and medication (Table 1). Few patients expressed concerns regarding access, cost, or confidentiality of cell phone use, but did express concern about access, and difficulty in use for texting and social networking sites (Table 2).

Cell Phone Instability

Over the course of the six months post-injury 27.3% of patients (n=33) reported two or more phone number changes, 33.9% of patients (n=41) reported one number change and 38.0% of patients (n=46) reported no changes. With regard to physical phone turnover, 36.4% of patients (n=44) reported two or more changes of their physical phone, 31.4% of patients (n=38) reported one change and 27.3% (n=33) reported no change. Overall only 19.0% of patients (n=23) reported not changing either their physical phone or phone number over the course of the six months after injury.

In regression analyses examining the association between cell phone instability and six month PTSD symptom levels, a significant interaction was observed between physical phone and phone number changes and higher PTSD symptom levels ($F=16.7$ (1,100), $P<0.001$). This association persisted in models that accounted for demographic and clinical characteristics ($F=13.7$ (1,94), $P<0.001$).

DISCUSSION

This study provides novel insight into the technology use and preferences and potential for technology-supported interventions for diverse injured patients. The study found that almost 90% of participants expressed an interest in medical follow-up communication by telephone. These findings corroborate and extend prior observations from other trauma-exposed emergency department and veteran patients that suggest heterogeneous technology preferences that include a desire for communications about technology via phone (Ranney, et al., 2012; Zatzick, et al., 2015).

Longitudinal study data suggested marked cell phone instability as characterized by over 80% of patients experiencing either a change in their cell phone number or physical phone. The investigation observed an independent association between these markers of cell phone instability and the development of PTSD symptoms six months after the injury hospitalization. These observations bring into question the ease to which innovative technology-based platforms can be readily integrated into intervention delivery platforms for low-income, ethnoculturally diverse injured patients; future clinical investigation could productively explore both the feasibility of technology-supported intervention delivery and the extent to which markers of technology instability can be used to predict adverse outcomes in trauma patients (Blumenstock, et al., 2015; Duggan & Smith, 2013; Zatzick, et al., 2015).

The investigation is limited by the recruitment of a relatively small sample of patients from a single Level I trauma center; future studies could productively integrate patient technology assessments across multiple trauma center sites. Also, the investigation used a novel and not extensively studied marker of cell phone instability: patient experiences of cell phone and cell phone number turnover. Further investigation may be required to refine markers of technology instability, particularly as they relate to key posttraumatic symptomatic and functional outcomes.

Beyond these considerations, this investigation contributes to an evolving literature on technologic innovation in trauma-exposed patient populations. The American College of Surgeons has demonstrated the capacity to issue policy guidance regarding screening and intervention procedures for mental health and substance-related disorders (Resources for the Optimal Care of the Injury Patient, 2014). Orchestrated investigative and policy efforts could not only evaluate the effectiveness of such procedures but also the optimal patient and system technological supports for these evidence-based practices Resources for the Optimal Care of the Injured Patient (Van Eaton, et al., 2014).

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TABLE 1

Health Information Communication Preferences of Injured Trauma Survivors (N=121)

Information Source	Information about upcoming appointments		Information about medication instructions		
	Prefer this source %(n) [a]	Prefer this as *primary* source %(n) [a,b,c]	Prefer this source %(n) [a]	Prefer this as *primary* source %(n) [a,b,c]	Concern with this source %(n) [a]
Phone Call	89.2(107)	44.2(53)	84.3(102)	33.1(40)	15.7(19)
Email	53.3(64)	16.7(20)	51.2(62)	16.5(20)	42.1(51)
Text Message	47.9(58)	10.8(13)	32.2(39)	5.8(7)	40.5(49)
Internet Website	26.4(32)	1.7(2)	32.2(39)	6.6(8)	38.0(46)
Social Networking	16.5(20)	4.2(5)	12.4(15)	1.7(2)	69.4(84)
Postal Mail	74.4(90)	13.3(6)	—	—	—
Card/Brochure	57.0(69)	7.5(9)	70.2(85)	14.9(18)	—
Provider Visit	20.7(25)	1.7(2)	67.8(82)	18.2(22)	—
DVD/Video	—	—	24.8(30)	0.8(1)	—

%(n) may not equal 100(121):

[a] Patients could express more than one preference.

[b] Patients may have preferences even if they do not want to receive information from a specific source.

[c] Not all patients responded to all questions.

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TABLE 2

Health Information Communication Concerns (N=121)

Category of Technology	Any Concern %(n)	Cost %(n)	Access Difficulty %(n)	Too Complicated %(n)	Too Much Time %(n)	Confidentiality %(n)	Other %(n)
Phone call	15.7(19)	0.8(1)	2.5(3)	0(0.0)	1.7(2)	5.0(6)	8.3(10)
Text	40.5(49)	0.8(1)	19.8(24)	9.1(11)	1.7(2)	5.8(7)	10.7(13)
Email	42.1(51)	0.8(1)	21.5(26)	7.4(9)	2.5(3)	2.5(3)	13.2(16)
Social networking	69.4(84)	0(0.0)	29.8(36)	12.4(15)	0.8(1)	25.6(31)	14.0(17)
Internet website	38.0(46)	1.7(2)	17.4(21)	12.4(15)	0.8(1)	9.1(11)	9.9(12)

%(n) may not equal 100(121): Patients could express more than one concern.