Pain Medicine
Pain Medicine 2015; 16: 667–672
Wiley Periodicals, Inc.

Brief Research Report

Text Messaging Reduces Analgesic Requirements During Surgery

Jamie E. Guillory, PhD,* Jeffrey T. Hancock, PhD,* Christopher Woodruff, MD, FRCPC,†‡ and Jeffrey Keilman, MD†‡

*Cornell University, Ithaca, New York, USA; †McGill University, Montreal, QC; ‡LaSalle Hospital, LaSalle, QC, Canada

Reprint requests to: Jamie E. Guillory, PhD, Center for Tobacco Control Research & Education, University of California, 530 Parnassus Ave., Suite 366, San Francisco, CA 94143-1390, USA. Tel: 415.476.8982; Fax: 415.514.9345; E-mail: jamie.guillory@ucsf.edu.

Disclosure: No financial conflicts of interest.

Abstract

Objective. This study aims to determine whether communicating via short message service text message during surgery procedures leads to decreased intake of fentanyl for patients receiving regional anesthesia below the waist compared with a distraction condition and no intervention.

Methods. Ninety-eight patients receiving regional anesthesia for minor surgeries were recruited from a hospital in Montreal, QC, between January and March 2012. Patients were randomly assigned to text message with a companion, text message with a stranger, play a distracting mobile phone game, or receive standard perioperative management. Participants who were asked to text message or play a game did so before receiving the anesthetic and continued until the end of the procedure.

Results. The odds of receiving supplemental analgesia during surgery for patients receiving standard perioperative management were 6.77 ($P = 0.009$; N = 13/25) times the odds for patients in the text a stranger condition (N = 22/25 of patients), 4.39 times the odds for those in the text a companion condition ($P = 0.03$; N = 19/23), and 1.96 times the odds for those in the distraction condition ($P = 0.25$; N = 17/25).

Conclusion. Text messaging during surgery provides analgesic-sparing benefits that surpass distraction techniques, suggesting that mobile phones provide new opportunities for social support to improve patient comfort and reduce analgesic requirements during minor surgeries and in other clinical settings.

Key Words. Fentanyl; Psychosocial Factors; Social

The Beatles 1967 lyric "I get by with a little help from my friends" connotes a deeper meaning than just getting someone through a bad day. Social support, defined here as perceived and actual support from known others, often during aversive experiences [1], facilitates mental and physical health. People who experience lower levels of loneliness and relationship disruptions are less likely to suffer detriments to immune system functioning and depression [2–5]. Social support is correlated with reduced pain perceptions (e.g., childbirth and postoperative pain) [6,7], and experimental research shows a causal link between social support and pain. People are able to endure pain longer and perceive pain as less severe with social support [8,9]. Even a minimal representation of social support (e.g., a loved one's photograph) attenuates pain [9].

What is it about social support that leads to these positive effects? One possibility is that support activates psychosocial resources that change people's appraisal of their ability to cope with stressors [10]. In early research, cognitive reappraisal of anxiety-provoking events prior to surgery helped people to have less negative experiences during and after surgery and request fewer painkillers and sedatives after surgery [11]. Indeed, in most medical contexts, whether office visits or discussions of diagnosis or treatment plans, social support is used and encouraged because of its positive benefits. Social support from family and friends is not possible, however, in other anxiety-provoking medical contexts, such as minor surgery where patients are insensate from the waist down, but awake. Patients are routinely given analgesics to manage anxiety and breakthrough pain during these surgeries. Researchers have long explored alternative, nonpharmacologic methods for anxiety and pain management during surgery.

Early research used auditory stimuli (e.g., nature sounds) as a distraction technique to significantly reduce adult patients' anxiety and fentanyl intake during surgeries requiring regional anesthesia compared with patients who received no auditory stimuli [12].

Music has also been studied as a distraction technique. In one study, adult surgery patients receiving spinal anesthesia required significantly less propofol and alfenanil (a drug with similar effects to fentanyl) for sedation when they listened to music compared with patients who did not [13]. More recently, researchers have used video games as a distraction technique to reduce preoperative anxiety for pediatric surgery patients compared with patients who either received oral midazolam to manage anxiety or had a parent present [14].

Several other studies have explored virtual reality (VR) (i.e., computer simulations of realistic environments that allow participant interaction) [15] as a distraction technique for adults and children. In an early case study, researchers demonstrated that dental patients in VR conditions reported mild pain during periodontal scaling, compared with more severe pain ratings reported by patients in a movie distraction and a no distraction condition [16]. Research has also demonstrated that VR helps to reduce burn patients' pain perceptions compared with no intervention or video game distraction techniques [16]. Children receiving chemotherapy with a VR distraction also reported more positive treatment experiences with VR distraction compared with no distraction treatment experiences [17].

The extensive evidence that distraction techniques (e.g., music, video games, VR) can be used to decrease pain and analgesics required during surgery [12–18], raises the question: can social support be used for this purpose? In this research, we use a novel approach that explores the use of text messaging as a minimal representation of social support to reduce need for analgesics during surgery.

One important consideration for this research is how a minimal support representation (e.g., a photograph) can be transferred to a clinical setting. Text messaging via a mobile phone provides opportunities for continued engagement with a social support contact without disrupting surgery. Text messaging has also become common among the majority (81%) of cell phone owners (97% of 18- to 29-year-olds, 94% of 30- to 49-year-olds; 75% of 50- to 64-year-olds; 35% of 65+ year-olds) [19]. Furthermore, patients can text with a companion without interfering with medical equipment [20]. Nonverbal cues (e.g., facial expressions) of face-to-face communication are unavailable in text, but communicators adapt in mediated contexts by sharing socio-emotional information verbally [21]. We hypothesized that allowing patients to text with a companion during surgery would reduce analgesic requirements compared with standard perioperative management in a similar way that having a physically present social support contact would.

A second important consideration is whether social support must be from a companion for these effects to occur. In Brown et al.'s [8] research, companions and strangers had the same effect on pain tolerance, whereas in Master et al.'s [9] study, stronger pain attenuation occurred with companions than strangers. In the present study, we also explore the effect that texting with a stranger has on analgesic requirements during surgery. Although strangers may not provide the same type of support as companions, interacting with strangers may induce a positive emotional state, which increases pain tolerance [22] and reduces anxiety. Research shows that interactions between strangers online can be hyperpositive (i.e., have heightened or exaggerated positive social affect) [23]. In these cases, people take limited positive information about a communication partner and use it to engage in idealistic and overly positive attributions [23]. Conversation with a stranger has the added benefit of excluding anxiety that a friend or family member may be feeling about their companion's surgical experience. We hypothesized that having patients text with a stranger during surgery would reduce analgesic requirements compared with standard perioperative management. To examine contrasting mechanisms behind support from a companion vs stranger, we examined the linguistic properties of text conversations.

A final question that this research attempted to answer was whether social support provides greater benefit than distraction techniques (e.g., video games) used in previous research for reducing analgesic requirements.

Method

Participants

Institutional review board approval with patient written consent and support from the Director of Professional Services at the data collection site was obtained. Participants were 98 adult surgical patients at LaSalle Hospital in Montreal, Quebec. Eligibility criteria included: 1) owning a cell phone that had short message service (SMS) texting capability and being a regular user of SMS text messaging; 2) being at least 18 years old; 3) being scheduled to receive neuroaxial regional anesthetic technique for a same-day surgical procedure; and 4) speaking English or French (see Table 1 for baseline characteristics). Of the 110 patients approached for the study, seven patients (6%) did not meet eligibility criteria (six patients [5%] did not use SMS texting on their phone; one patient [>1%] did not speak English or French). Of the 103 eligible participants, five patients (5%) did not want to participate.

Procedure

Patients were randomly assigned to one of four conditions. In the *companion* condition, patients used their phone to exchange SMS texts with a close friend or family member who would be available to text during their procedure. Prior to coming to the hospital, patients chose a supportive partner (e.g., friend or family member) who would be

Table 1 Baseline characteristics of patients in all groups*

Variable	Text Companion (N = 23)	Text Stranger (N = 25)	Game (N = 25)	Control (N = 25)
Male sex—no. (%)	9 (39)	6 (24)	5 (20)	8 (32)
Age—years	32.74 ± 2.39	36.92 ± 2.30	38.32 ± 2.30	37.80 ± 2.30
Surgery—no. (%)				
Minor orthopedic	12 (52)	9 (36)	11 (44)	10 (40)
Minor urogenital	0 (0)	0 (0)	0 (0)	1 (4)
Minor gynecological	3 (13)	1 (4)	1 (4)	3 (12)
Minor general	8 (35)	15 (60)	13 (52)	11 (44)
OR time—mins	60.13 ± 35.27	60.88 ± 34.03	59.60 ± 32.40	48.12 ± 28.35
Mobile frequency—1–7	5.72 ± 1.71	6.00 ± 1.63	5.84 ± 1.34	4.91 ± 2.31
Intraoperative fentanyl—mcg	10.87 ± 25.92	6.00 ± 16.58	21.30 ± 41.75	33.00 ± 41.28
Intraoperative midazolam—mg	0.27 ± 0.63	0.13 ± 0.46	4.70 ± 20.78	0.76 ± 0.83

* Plus-minus values are means ± standard deviation. There were no significant differences among groups with regard to baseline characteristics.

available to communicate during surgery. In the *stranger* condition, patients used their phone to text with a bilingual research assistant hired for the study who was instructed to focus on topics typical of a "getting to know you" conversation (e.g., hobbies and interests). The research assistant was blind to the study conditions and hypotheses. In the distraction condition, which was used to determine whether social support had a stronger effect on analgesic requirements than distraction techniques similar to those used in previous research, patients played the game *Angry Birds* on a phone provided by the researchers. *Angry Birds* was chosen because it is a well-known, easy-to-play game. In the *standard therapy* condition, patients did not use their phone during surgery. In the texting and distraction conditions, patients began their task before receiving the anesthetic and continued throughout surgery.

With the exception of the third author, the 10 treating anesthesiologists were unaware of the hypotheses, or study outcome variables. All anesthesiologists were blinded to the three conditions involving a phone but could distinguish those conditions from the standard therapy condition, which did not involve a phone. All anesthesiologists asked patients if they were having pain initially after incision, again within the first 5–10 minutes of surgery, and throughout the procedure regardless of their condition and treated it accordingly. An effort was made to ensure that a patient who was engaged with their phone was not ignored under the assumption they were busy, but as with any patient, treatment was left to the discretion of the anesthesiologist.

Measures

The primary dependent measure was the dosage of opioid required during surgery. The analgesic used was fentanyl, an opioid that is approximately 100 times more potent than morphine and is used to manage anxiety and breakthrough pain during surgery. Dosing of medication for sedation or analgesia was left at the discretion of the treating anesthesiologist based on their clinical judgment. Dosing decisions were made at the beginning of the case and throughout based on observations and asking patients how they felt.

Before surgery, patients completed a preoperative anxiety scale (Cronbach's $\alpha = 0.83$) [24] and social support scale (Cronbach's $\alpha = 0.96$) [25]. Patients also indicated on a seven-point scale how frequently they used their mobile phone (1 = less than once daily, 7 = many times daily). Midway through surgery, patients reported perceived pain level on an 11-point visual analog scale (0 = no pain, 10 = worst pain imaginable) and anxiety on a 5-point scale (1 = not at all anxious, 5 = extremely anxious). After surgery, a medical resident recorded patients' surgery type, the treating anesthesiologist during surgery, and total operating room time (see Table 1).

Linguistic Analysis

Language of text conversations was analyzed using Linguistic Inquiry and Word Count [26], which counts the frequency of linguistic and psychologically meaningful dimensions. We were unable to retrieve all transcripts from patients who texted with companions, but available transcripts (N = 26) provided sufficient power to observe differences between the two texting conditions.

Results

Preliminary analyses revealed that patients did not differ across conditions for preoperative anxiety ($F[3,94] < 1$, $P = 0.543$), perceived social support ($F[3,94] = 2.00$, $P = 0.120$), frequency of mobile phone use ($F[3,94] = 1.73$, $P = 0.167$), operating room time ($F[3,94] = 0.96$, $P = 0.416$), anesthesiologist ($\chi^2[30] = 23.14$, $P = 0.810$), and surgery category ($\chi^2[9] = 7.65$, $P = 0.569$) suggesting that random assignment was effective on these dimensions and that these variables did not differentially influence fentanyl intake by condition.

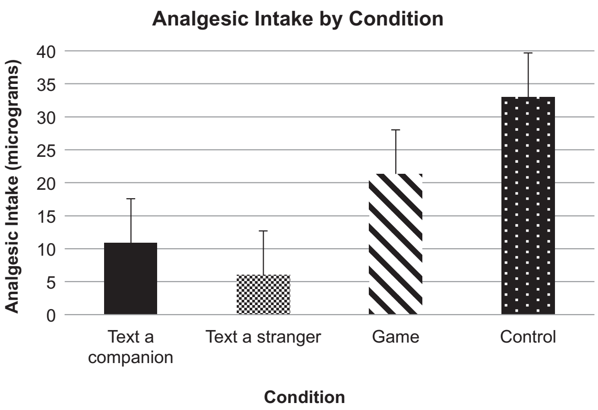

Figure 1 Analgesic intake (micrograms of intraoperative fentanyl) during surgery as a function of experimental condition.

Analgesic Requirements

The distribution of our primary dependent variable, analgesic requirements, was not normally distributed but positively skewed (*skewness* = 2.73, standard error [SE] = 0.34), thus nonparametric statistics were used in the analyses to compare intake across conditions.

The descriptive data are provided in Figure 1. Analysis revealed that analgesic administration differed across conditions (Kruskal–Wallis one-way analysis of variance, $P = 0.017$). Patients in the text a companion condition required less analgesic than patients in the standard therapy condition ($P = 0.026$) but not the distraction condition ($P = 0.132$). In contrast, patients in the stranger condition required less analgesic than both the standard therapy ($P = 0.004$) and distraction conditions ($P = 0.043$). Finally, analgesic requirements did not differ across the two texting conditions, nor did the two control conditions (distraction and standard) differ from one another. Thus, although both texting conditions reduced analgesic requirements relative to standard perioperative management, only texting a stranger reduced it beyond the distraction control.

Given that only 27 of the 98 patients (27.6%) required supplemental analgesia, another analytic approach was used to estimate the odds ratio that the texting manipulation reduced the probability that a patient would require supplemental analgesia. A logistic regression with condition as predictor was significant, $\chi^2(3) = 9.82$, $P = 0.020$, and confirmed the analysis above, revealing that the odds of receiving supplemental analgesia during surgery for patients receiving standard perioperative management are 6.77 ($P = 0.009$; N = 13/25) times the odds for patients in the text a stranger condition (N = 22/25 of patients), 4.39 times the odds for those in the text a companion condition ($P = 0.03$; N = 19/23), and 1.96 times the odds for those in the distraction condition ($P = 0.25$; N = 17/25).

Results also held when controlling for anesthesiologist, surgery category, and operating room time, $\chi^2(17) = 30.20$, $P = 0.025$. Of the control variables only operating room time was a significant predictor ($P = 0.036$), with longer surgeries more likely to require supplemental analgesia.

As expected, analgesia requirements correlated positively with self-reported pain ($r = 0.22$, $P = 0.017$) and self-reported anxiety ($r = 0.29$, $P = 0.006$). Further analysis of self-report data is not valid given that once analgesics were administered patient's perception of pain was altered.

Linguistic Analysis

Can the content of the messages explain why exchanging text messages with a stranger was the most effective means of reducing analgesic requirements? On average, the text messaging conversations involved 528.62 words (SE = 70.89), and word count did not differ across conditions. As described in Table 2, stranger conversations were more emotionally positive, with a higher rate of positive relative to negative affect words. Companion conversations, in contrast, involved significantly more biological terms than stranger exchanges, suggesting that these conversations were more likely to focus on the surgery itself.

Discussion

This study provides the first evidence of analgesic-sparing benefits of social support from text messaging in a surgical setting. This is also the first evidence of using text-based communication as a substitute for typical social

Table 2 Mean percent of total words in linguistic categories by texting condition*

	Companion	Stranger	*P*
Positive emotion	10.24% ± 1.16	18.69% ± 2.00	0.033
Negative emotion	4.84 ± 1.05	2.19 ± 0.26	0.001
Biological	7.47 ± 0.85	3.60 ± 0.43	0.000
Body	3.64 ± 0.57	0.84 ± 0.18	0.000

* Plus-minus values are means ± standard error.

support in clinical settings. Patients who text messaged with a companion during surgery required less supplemental analgesia than patients receiving standard therapy. Furthermore, patients who text messaged with a stranger also had lower analgesic requirements than those who played a distracting game.

These findings suggest that the simple act of communicating with a companion or stranger provides an analgesic-sparing effect that surpasses standard perioperative management during surgery. The data also suggest that text-based communication with a stranger is more effective in reducing analgesic requirements than a video game distraction technique.

Although the observation that texting a stranger produced a larger analgesic-sparing effect than texting a companion may seem at odds with previous research, which shows that the presence of a companion can provide a more effective aid for pain attenuation than a stranger [9], differences in the content of the messages exchanged between companions and strangers provide an explanation for this outcome. In conversations with a companion, the discussion focused on the surgery, with more words related to biology, the body, and negative emotion, suggesting that the companion was also anxious about the surgery, which may have produced an anxiety feedback loop [27] that limited the psychosocial support provided by the companion. Conversations with strangers, in contrast, included more positive emotion words. Indeed, a closer examination of the transcripts revealed that patients in the stranger condition wrote more about self-affirming topics, which involve receiving positive feedback from others and reflection on positive aspects of the self [28]. Consistent with this finding, research suggests that engaging in self-affirming activities helps people to endure a pain tolerance task longer [29].

A major strength of this study is that it explores the analgesic benefits of social support in a medical context where this intervention could be readily implemented with few costs to medical professionals. This study also provides the first evidence of using text-based communication as a means for reducing the need for analgesic medication during surgery. This study extends research exploring the impact of social support on pain perceptions and the need of narcotic analgesics by implementing a text-based intervention, rather than requiring social support contacts to be physically present. This extension is important as the physical presence of a social support contact is not feasible during many minor surgery procedures.

Future research will be important to addressing the methodological limitations in this work. First, it is unclear whether the act of communicating with a social support contact (friend or stranger), or simply the experience of positive affect, is driving the analgesic sparing effects observed in this study and these effects will need to be teased apart in future studies. Second, it is possible that the get-to-know-you conversations that participants had in the stranger condition were less varied and more scripted than those with family members, and as the analysis revealed, had more positive affect. These points should be considered in the development of future interventions. For example, can certain conversation topics, such as self-affirming subjects (e.g., personal values), intensify the effect? A final limitation to this work was the fact that treating anesthesiologists were aware that patients in three of the four experimental conditions were using phones during their procedure, though they were blinded to the study conditions and outcomes.

Although distraction is a well-established, nonpharmacological intervention (an effect that was likely not observed here due to the study's sample size), our findings suggest that text messaging may be a more effective intervention that requires no specialized equipment or involvement from clinicians. Even more importantly, text-based communication may allow for the analgesic-sparing benefits of social support to be introduced to other clinical settings where this type of support is not otherwise available, such as radiological, diagnostic, and therapeutic procedures. These findings could have significant implications in these settings to improve comfort and reduce analgesic requirements.

Acknowledgment

This research was supported by Cornell University.

References

1 Cutrona CE, Suhr JA. Controllability of stressful events and satisfaction with spouse support behaviors. Communic Res 1992;19(2):154–74.

2 Kiecolt-Glaser JK, Garner W, Speicher C, et al. Psychosocial modifiers of immunocompetence in medical students. Psychosom Med 1984;46(1):7–14.

3 Kiecolt-Glaser JK, Fisher LD, Ogrocki P, et al. Marital quality, marital disruption, and immune function. Psychosom Med 1987;49(1):13–34.

4 Kiecolt-Glaser JK, Ricker D, George J, et al. Urinary cortisol levels, cellular immunocompetency, and loneliness in psychiatric inpatients. Psychosom Med 1984;46(1):15–23.

5 Nolen-Hoeksema S, Ahrens C. Age differences and similarities in the correlates of depressive symptoms. Psychol Aging 2002;17(1):116–24.

6 Hodnett ED. Pain and women's satisfaction with the experience of childbirth: A systematic review. Obstet Gynecol 2002;186(5):S160–72.

7 Kulik JA, Mahler HI. Social support and recovery from surgery. Health Psychol 1989;8(2):221–38.

8 Brown JL, Sheffield D, Leary MR, Robinson ME. Social support and experimental pain. Psychosom Med 2003;65(2):276–83.

9 Master SL, Eisenberger NI, Taylor SE, et al. A picture's worth: Partner photographs reduce experimentally induced pain. Psychol Sci 2009;20(11):1316–8.

10 Lazarus R, Folkman S. Cognitive appraisal processes. In: Lazarus R, Folkman S, eds. Stress, Appraisal, and Coping. New York: Springer; 1984:22–52.

11 Langer EJ, Janis IL, Wolfer JA. Reduction of psychological stress in surgical patients. J Exp Soc Psychol 1975;11(2):155–65.

12 Durham N. The effect of an auditory distraction on anxiety in ambulatory surgical patients experiencing regional anesthesia. AANA J 1987;55(4):333–5.

13 Koch ME, Kain ZN, Ayoub C, Rosenbaum SH. The sedative and analgesic sparing effect of music. Anesthesiology 1998;89(2):300–6.

14 Patel A, Schieble T, Davidson M, et al. Distraction with a hand-held video game reduces pediatric preoperative anxiety. Paediatr Anaesth 2006;16(10):1019–27.

15 Latta JN, Oberg DJ. A conceptual virtual reality model. Computer graphics and applications. IEEE 1994; 14(1):23–9.

16 Hoffman HG, Garcia-Palacios A, Patterson DR, et al. The effectiveness of virtual reality for dental pain control: A case study. Cyberpsychol Behav 2001;4(4):527–35.

17 Hoffman HG, Patterson DR, Magula J, et al. Water-friendly virtual reality pain control during wound care. J Clin Psychol 2004;60(2):189–95.

18 Schneider SM, Workman ML. Virtual reality as a distraction intervention for older children receiving chemotherapy. Pediatr Nurs 2000;26(6):593–7.

19 Duggan M, Rainie L. Cell Phone Activities 2013. Washington, DC: Pew Research Center's Internet & American Life Project; 2013.

20 van Lieshout EJ, van der Veer SN, Hensbroek R, et al. Interference by new-generation mobile phones on critical care medical equipment. Crit Care 2007;11(5):R98–103.

21 Walther JB, Loh T, Granka L. Let me count the ways the interchange of verbal and nonverbal cues in computer-mediated and face-to-face affinity. Journal of language and social psychology 2005;24(1):36–65.

22 Zelman DC, Howland EW, Nichols SN, Cleeland CS. The effects of induced mood on laboratory pain. Pain 1991;46(1):105–11.

23 Walther JB. Computer-mediated communication impersonal, interpersonal, and hyperpersonal interaction. Communic Res 1996;23(1):3–43.

24 Moerman N, van Dam FS, Muller MJ, Oosting H. The Amsterdam Preoperative Anxiety and Information Scale (APAIS). Anesth Analg 1996;82(3):445–51.

25 Zimet GD, Dahlem NW, Zimet SG, Farley GK. The multidimensional scale of perceived social support. J Pers Assess 1988;52(1):30–41.

26 Tausczik YR, Pennebaker JW. The psychological meaning of words: LIWC and computerized text analysis methods. Journal of Language and Social Psychology 2010;29(1):24–54.

27 Guillory JE, Spiegel J, Drislane M, et al. Upset Now?: Emotion Contagion in Distributed Groups. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2011, 745–8). New York, NY: ACM; 2011.

28 Sherman DK, Cohen GL. The psychology of self-defense: Self-affirmation theory. Adv Exp Soc Psychol 2006;38:183–242.

29 Schmeichel BJ, Vohs K. Self-affirmation and self-control: Affirming core values counteracts ego depletion. J Pers Soc Psychol 2009;96(4):770–82.