

Texting While Stressed: Implications for Students' Burnout, Sleep, and Well-Being

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Text messaging has become an integral part of social life, especially among adolescents and young adults. As a potentially continuously accessible form of communication, texting may affect individuals' psychosocial functioning in interesting—and unexplored—ways. The current study examines links among interpersonal stress, text messaging behavior, and 3 indicators of college students' health and well-being: burnout, sleep problems, and emotional well-being. It was proposed that high rates of text messaging may exacerbate the effects of interpersonal stress on these aspects of students' health and well-being. Participants included 83 first-year undergraduate students. Results of hierarchical regression analyses indicated that higher levels of interpersonal stress were significantly associated with compromises in all 3 areas of functioning. A higher number of daily texts was directly associated with more sleep problems. The number of daily texts moderated the association between interpersonal stress and both burnout and emotional well-being; interpersonal stress was associated with poorer functioning only at higher levels of texting. Promising future directions for research on texting behavior are discussed.

Keywords: stress, text message, burnout, sleep, well-being

The use of mobile telecommunication devices has proliferated during the past several years, particularly among adolescents and young adults (Lenhart, 2012). According to a report from the Pew Internet Project, in 2010, 96% of undergraduate students owned cell phones, compared with 82% of adults (Smith, Rainie, & Zickuhr, 2011). In a massive multi-institutional study, 62% of undergraduates endorsed owning a smartphone in 2012, representing a 7% increase in ownership since 2011 and a whopping 5545% increase since 2004 (Dahlstrom, 2012). College students use text messaging more than any other form of mobile telecommunication and consider it to be an essential

aspect of their social lives (Skierkowski & Wood, 2012). In 2011, cell phone owners between the ages of 18 and 24 years reported an average of 109.5 text messages on a normal day (Smith, 2011), and among all adults 18 years and older, the percentage of cell phone owners who used their phone for text messaging rose from 50% in 2007 to 80% in 2012 (Duggan & Rainie, 2012). This trend has been observed among adolescents as well; Lenhart (2012) reported that the median number of 14- to 17-year-olds' daily text messages rose from 60 in 2009 to 100 in 2011.

This momentous shift in social behavior has emerged so swiftly and decisively that its psychosocial implications are not yet clear. Potential costs of increased cell phone use have been considered in terms of a variety of domains such as social relationships (Kabat-Zinn, 2005), communication skills (Drouin & Davis, 2009), academic performance (Junco, 2012), and personal and public safety (Drews, Yazdani, Godfrey, Cooper, & Strayer, 2009). However, few studies have examined how high levels of engagement in novel forms of wireless telecommunication, such as text messaging, are associated with individuals' quality of life.

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Text messaging has been described as an element of *digital sociality* (Thompson & Cupples, 2008), which refers to the ubiquitous, interdependent human-technology network that has changed the nature of social contacts across time and space. Pettigrew (2009) has described texting as “an important relational tool” (p. 71) because of its versatile capacities to foster interpersonal connections and shape interactions. Although text messages can be used for multiple interpersonal purposes, including relationship dissolution (Bergdall et al., 2012; Weiskirch & Delevi, 2012), content analyses have consistently pointed to relationship maintenance as their primary aim (Coyne, Stockdale, Busby, Iverson, & Grant, 2011; Faulkner & Culwin, 2005; Holtgraves, 2011; Thurlow, 2003).

Text messaging can build a sense of belonging, affection, and closeness in relationships (Coyne et al., 2011), but there are aspects of this phenomenon that may generate relational and/or psychological stress. Even when compared with other forms of mobile telecommunication, texting stands alone in its potential for perpetual access. Most forms of social contact are characterized by natural breaks in which an individual’s autonomy may be temporarily restored. However, at present, few natural or culturally established temporal and spatial boundaries seem to exist for text messaging, and this may generate interpersonal and/or intrapsychic tension.

There are several mechanisms that could produce a double bind for individuals who use text messaging as an essential form of communication. For instance, it is common to feel a sense of overwhelming curiosity to open a new text message when it is received (Pettigrew, 2009), regardless of one’s current surroundings or set of competing demands. Young adults perceive a social expectation that they will be accessible at all times via cell phone and feel they need to make excuses when immediate replies to calls or messages are not possible (Thomé, Dellve, Harenstam, & Hagberg, 2010). When young adults lose access to texting or even contemplate a lack of access, they report feeling disconnected, discombobulated, and anxious (Skiernkowski & Wood, 2012; Thomé et al., 2010). In a qualitative study of frequent cell phone users, young adults explained their frequent technology use by citing demands for achieve-

ment and availability related to, among other things, academic and social domains of functioning (Thomé et al., 2010). Participants acknowledged that the flexibility of wireless telecommunication can help to alleviate stress. However, they also described a seemingly unwinnable predicament of competing stressors associated with a cell phone lifestyle: experiencing an overload of social demand and contact with its access, but considerable distress when access is lost. Angster, Frank, and Lester (2010) found that among college students, sending more text messages was associated with finding text conversations less fulfilling; again suggesting that very frequent text messaging can create a kind of psychosocial trap.

A few studies have found significant associations between heavy cell phone use and compromises in adolescents’ health and well-being. Leena, Tomi, and Arja (2005) found that among 14- to 16-year-olds in Finland, there was a positive association between cell phone use and health-compromising behaviors such as alcohol use and smoking. More recently, cell phone use after “lights out” at night was linked with indicators of poor mental health in Japanese 10th through 12th graders (Oshima et al., 2012). Even in the absence of other health risk behaviors, the act of texting has been associated with significant increases in measures of physiological arousal such as heart rate, respiration, skin conductance, and muscle tension (Lin & Peper, 2009). Therefore, frequent texting could threaten an individual’s health by creating a physiological state that is inconsistent with relaxation or sleep in the short-term and may produce allostatic load across time. In fact, a prospective study of college students conducted in Sweden (Thomé, Eklöf, Gustafsson, Nilsson, & Hagberg, 2007) reported that higher levels of instant messaging at baseline were associated with higher levels of prolonged stress and sleep disturbance 1 year later. In a separate, large Swedish sample of young adults, Thomé, Harenstam, and Hagberg (2011) found that frequent cell phone use was cross-sectionally correlated with stress and predictive of sleep disturbance and symptoms of depression across time.

Given the integration of text messaging in our culture and potential costs and benefits of its use, it is important to investigate the conditions under which it may exert positive, neutral,

and/or negative effects on individuals' functioning. With that aim, the current study examined links among interpersonal stress, text messaging, and college students' health and well-being.

Among all of the stressors experienced by youth, interpersonal stressors are considered to be particularly salient (Clarke, 2006). Interpersonal stressors are negative experiences involving conflicts or difficulties in social relationships, and they have been positively correlated with symptoms of anxiety and depression (Bancila & Mittelmark, 2009; Connor-Smith & Compas, 2002). As communication technologies have evolved during the past decade, the nature and consequences of interpersonal stress may have changed as well. Electronic communication is characterized by increased potential for misunderstandings (Coyne et al., 2011), and thus high reliance on text messaging as a form of communication may perpetuate or exacerbate stress in a relationship. It is also possible that interpersonal stress is magnified by the perpetual access to communication that text messaging affords. Thus, individuals who are experiencing high levels of stress and who are engaging in high rates of texting behavior may be at risk of developing psychological burnout, compromises in emotional well-being, and/or disruptions in health-promoting processes, such as obtaining high-quality sleep.

The psychological state of burnout has been conceptualized as cynicism, reduced personal efficacy, and emotional exhaustion resulting from chronic stress (Maslach, Jackson, & Leiter, 1996). Historically, burnout has been studied in the workplace (Maslach & Leiter, 2008), but the social and academic demands of university life make burnout in these domains a relevant and intriguing aspect of students' well-being (Stoeber, Childs, Haywood, & Feast, 2011). Contemporary studies have investigated burnout among college athletes in the United States (DeFreese & Smith, 2013), undergraduate students in international samples (Li, Song, & Guo, 2009; Schaufeli, Martínez, Pinto, Salanova, & Bakker, 2002), and advanced students in specific helping professions (Dyrbye et al., 2010; Watson, Deary, Thompson, & Li, 2008), but correlates of burnout in the general undergraduate population in the United States deserve further investigation. It could be argued that compared with other indicators of adoles-

cent well-being, burnout may be particularly sensitive to an overload of social and cognitive engagement through heavy cell phone use; however, such associations have not been empirically examined thus far.

Aspects of positive mental health are correlated to, but distinct from, psychological dysfunction, and individuals significantly vary from one another in their levels of psychological health and well-being (Keyes, 2005). Measures of positive mental health can augment indicators of mental illness in predicting college students' academic and psychological dysfunction (Keyes et al., 2012). The construct of emotional well-being incorporates aspects of positive affect and life satisfaction, characteristics of mental health that have been linked with positive psychosocial outcomes ranging from good physical health (Pressman & Cohen, 2005) to personal success (Lyubomirsky, King, & Diener, 2005). However, it appears that no previous studies have examined links between text messaging behavior and emotional well-being among college students.

College students appear to experience an array of sleep problems, including irregular sleep patterns, short sleep duration, low sleep quality, and daytime sleepiness (Wolfson, 2010). Lund, Reider, Whiting, and Prichard (2010) found that perceived stress accounted for one-quarter of the variance in poor sleep among college students. During the first year of college, sleep habits change rapidly and markedly (Carskadon & Davis, 1989; Pilcher, Ginter, & Sadowsky, 1997), and sleep has been found to account for more variance than any other health-related behavior in first-year students' grade point average (Trockel, Barnes, & Egget, 2000). Poor sleep may be part of a constellation of symptoms of strain during the first year of college, as it has been positively correlated with stress and negative affect (Galambos, Howard, & Maggs, 2010; Lev-Ari & Shulman, 2012). In previous research on adolescents and young adults, the use of cell phones has been positively associated with a variety of types of sleep difficulty, such as trouble falling or staying asleep, shorter sleep duration, and daytime sleepiness (Punamäki, Wallenius, Nygard, Saarni, & Rimpela, 2007; Thomée et al., 2007, 2011). Although mechanisms for these associations rarely have been investigated, it is possible that text messaging behavior interacts with social, cognitive,

and/or affective processes to affect sleep. For instance, heavy text messaging could be particularly problematic in a context of interpersonal stress because it stimulates or maintains rumination or emotional upset, either of which may disrupt sleep.

The Current Study

This study tested a hypothetical model in which text messaging behavior was proposed to moderate the association between interpersonal stress and three indicators of college students' health and well-being: burnout, emotional well-being, and sleep problems. Three hypotheses were tested. First, higher levels of interpersonal stress were expected to be associated with poorer functioning (i.e., higher levels of burnout and sleep problems and lower levels of emotional well-being). Second, above and beyond the variance accounted for by interpersonal stress, higher levels of text messaging were expected to be associated with poorer functioning in these three domains. Finally, text messaging was expected to moderate the effects of interpersonal stress. Specifically, it was hypothesized that the combination of high levels of interpersonal stress and high levels of texting would be associated with the poorest functioning among students. Participants included only first-year college students, as this is a period of transition and adjustment that may involve a particularly high burden of interpersonal stress (Smith, Nguyen, Lai, Leshed, & Baumer, 2012).

Method

Participants

Participants included 83 first-year undergraduate students (56 female, 27 male) enrolled at

an academically rigorous, southeastern liberal arts college. Students' ages ranged from 18 to 21 years (mean age = 18.41, $SD = .58$). Race/ethnicity of participants was as follows: White (75%), Black/African American (5%), Hispanic/Latino (5%), Asian (4%), biracial (4%), and not reported (8%).

Procedure

Brief announcements about the study were made in courses across a variety of academic disciplines by research assistants. Interested students provided their e-mail address on a sign-up sheet and were contacted via e-mail to schedule an assessment appointment. Participants completed a 20- to 30-min online survey in a dedicated computer laboratory for small-group assessments. Research assistants were available to answer participants' questions. The first page of the survey was an informed consent form approved by the University's Institutional Review Board before the study. Extra credit was offered in some Psychology Department courses, and all participants had the opportunity to enter a lottery for a \$200 gift card. Data were collected during the 2011 to 2012 academic year.

Measures

Participants self-reported their age, gender, and race/ethnicity. Psychometric properties of primary study variables are provided in Table 1.

Interpersonal stress. The Bergen Social Relationships Scale (BSRS; Mittelman, Aarø, Henriksen, Siqueland, & Torsheim, 2004) is a 6-item scale designed to measure interpersonal stress in close relationships. BSRS items assess cognitive dissonance in relationships, which occurs when expectations of a relationship do not match with the perceived reality of it. This incongruence causes psychological distress and

Table 1
Psychometric Properties of Primary Study Measures

Variable	Range					
	<i>M</i>	<i>SD</i>	Items	Potential	Actual	α
Interpersonal stress	13.11	3.56	6	6–24	6–21	.77
Number of daily texts	114.54	114.46	2	n.a.	0–498 ^a	n.a.
Academic and social burnout ^b	1.96	.97	32	0–6	0.19–4.59	.93
Sleep problems	5.78	3.17	16	0–21	1–18	n.a.
Emotional well-being	11.92	3.05	3	0–18	1–15	.91

^a Three outlying responses were reassigned values one greater than 3 *SD* above the mean. ^b Mean of items on 0 to 6 scale.

may prompt efforts to reduce dissonance by changing one's cognitions and/or the relationship itself. Respondents were asked to think about everyone in their social network (e.g., parents, friends, siblings) and respond to six items, each of which includes two dissonant cognitions about a relationship (e.g., "There is someone I care about that expects more of me than I can manage"). Responses are made on a 4-point scale ranging from 1 (describes me very well) to 4 (does not describe me at all). Adequate reliability and validity for BSRS scores have been reported (Bancila & Mittelmark, 2009), and internal consistency was acceptable for BSRS scores in the current sample ($\alpha = .77$). In this study, items were reverse-coded and summed so that higher scores indicate higher levels of interpersonal stress.

Number of daily texts. Participants were asked "On an average day, how many text messages do you send and receive?" The estimated numbers of sent and received messages were summed to create a daily texts variable.

Academic and social burnout. A modified form of the Maslach Burnout Inventory (MBI; Maslach et al., 1996) was developed for this study to assess college students' burnout in academic and social domains. The MBI is a 16-item scale measuring cynicism, decreased self-efficacy, and emotional exhaustion associated with chronic stress. Responses are made on a 7-point scale ranging from 0 (never) to 6 (every day). Adequate reliability for MBI scores has been reported across a variety of samples (De Hoogh & Den Hartog, 2009).

In the current study, the MBI was expanded to assess students' burnout with regard to academic and social domains of functioning. Items are presented in Table 2. Internal consistency of subscale and total scores were acceptable in academic (efficacy $\alpha = .75$; exhaustion $\alpha = .88$; cynicism $\alpha = .89$; academic burnout total $\alpha = .89$) and social (efficacy $\alpha = .84$; exhaustion $\alpha = .86$; cynicism $\alpha = .75$; social burnout total $\alpha = .89$) domains. Internal consistency of all academic and social burnout items was high ($\alpha = .93$), and therefore, after reverse-scoring efficacy items, all 32 items were averaged to form a student burnout variable with higher scores indicating higher levels of burnout.

Emotional well-being. Participants completed the 3-item emotional well-being subscale of the Mental Health Continuum-Short Form

(Keyes, 2005). Using a 6-point scale ranging from 0 (never) to 5 (every day), respondents rated the frequency with which they felt happy, interested in life, and satisfied during the past month. Adequate validity and reliability data for the emotional well-being subscale scores have been provided (Lamers, Westerhof, Bohlmeijer, ten Klooster, & Keyes, 2011), and internal consistency of scores in the current sample was high ($\alpha = .91$). Higher scores on this variable indicate higher levels of emotional well-being.

Sleep problems. Sleep problems were assessed with a modified version of the Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The PSQI is a widely used instrument constructed of seven component scores: subjective sleep quality, latency, duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Raw scores on these components are recoded to a range of 0 to 3. The seven component scores are summed to create a total score with higher scores indicating greater sleep difficulty.

Minor modifications were made to the PSQI in the current study to optimize the fit of items to a healthy college sample. Items 1 to 4, regarding usual bedtime, sleep latency, waking time, and actual hours slept, were assessed separately for weeknights and weekend nights. For the current analyses, weekday and weekend reports for each of these items were collapsed. First, weeknight estimates were multiplied by 5 and weekend estimates were multiplied by 2 to weight them by the number of days in the week. Next, these weighted scores were summed and divided by 7 to produce a weighted average for the item. These weighted averages were used in the construction of PSQI component scores.

Also, instead of assessing nine qualities of sleep disturbances during the past month, participants were queried about only four: cannot get to sleep within 30 min, wake up in the middle of the night or early morning, have to get up to use the bathroom, and had bad dreams. Responses to these four items were summed to form a raw total score with a possible range of 0 to 12. Raw total scores were transformed to the PSQI sleep disturbances component scale as follows: 0 coded as 0, 1 to 4 recoded as 1, 5 to 8 recoded as 2, and 9 to 12 recoded as 3.

After taking into account these modifications, the PSQI score was calculated according to the

Table 2
Student Academic and Social Burnout Scales

Academic burnout ($\alpha = .89$)

1. I feel emotionally drained from my academic work.
2. I feel used up at the end of a school day.
3. I feel tired when I get up in the morning and have to face another day of classes and studying.
4. Managing all of my academic work is really a strain for me.
5. I can effectively solve the problems that arise with my school work.
6. I feel burned out from my academic work.
7. I feel I am making an effective contribution in my classes.
8. I have become less interested in my studies since I started college.
9. I have become less enthusiastic about my learning.
10. In my opinion I am a good student.
11. I feel exhilarated when I accomplish something in my classes.
12. I have accomplished many worthwhile things at this University.
13. I just want to get my degree and not be bothered.
14. I have become more cynical about whether my studies really mean anything.
15. I doubt that all of this studying amounts to anything of significance.
16. I feel confident that I am effective at getting my academic work done.

Social burnout ($\alpha = .89$)

1. I feel emotionally drained from the social pressures at college.
2. I feel used up at the end of the day from trying to navigate the social scene.
3. I feel tired when I get up in the morning and have to face another day interacting with other people.
4. Staying socially engaged is a real strain for me.
5. I can effectively solve problems that arise in my social life.
6. I feel burned out from the social scene at college.
7. I feel I am making an effective contribution to my social groups and organizations.
8. I have become less interested in being socially active since I started college.
9. I have become less enthusiastic about my social life.
10. In my opinion I have good social skills.
11. I feel exhilarated when I make a new social connection or participate in a successful social event.
12. I have built many worthwhile relationships in college.
13. I just want to hang out with my friends and not worry about fitting in.
14. I have become more cynical about whether my relationships mean anything.
15. I doubt the significance of the social organizations and clubs in which I participate.
16. At college, I feel confident that I can handle things effectively in social situations.

standard method, by summing the seven component scores to create a total score with higher scores indicating more troubled sleep.

Results

A correlation matrix of primary study variables is presented in Table 3. Independent samples *T* tests revealed no significant differences in primary study variables by participant gender.

Hierarchical regression analyses were conducted to test hypotheses. Predictor variables were centered at their means. Separate regressions were conducted for the prediction of burnout, sleep problems, and emotional well-being. In the Step 1 of each regression model, interpersonal stress was entered, in Step 2, number

of daily texts was entered, and in Step 3, the interaction term (interpersonal stress \times daily texts) was entered to test moderation. Results are provided in Table 4.

In Step 1 of the first regression model, higher levels of interpersonal stress were significantly

Table 3
Intercorrelations Among Primary Study Variables

Variable	1.	2.	3.	4.	5.
1. Interpersonal stress	—	.06	.47***	.33**	-.30**
2. Number of daily texts		—	.02	.31**	-.03
3. Academic and social burnout			—	.41***	-.72***
4. Sleep problems				—	-.41***
5. Emotional well-being					—

** $p < .01$. *** $p < .001$.

associated with higher levels of burnout, accounting for 22% of the variance. In Step 2, number of daily texts did not predict burnout, but in Step 3, the interaction was significant. To decompose this interaction, first a tertile split was conducted on the number of daily texts variable. Separate simple regressions were conducted to assess the association between interpersonal stress and burnout for students with low (50 or fewer daily texts; $n = 28$), moderate (51–100 daily texts; $n = 27$), and high (greater than 100 daily texts; $n = 28$) levels of the moderator. Results are presented in Figure 1. In the low texting group, interpersonal stress was not significantly associated with burnout, accounting for 10% of the variance ($B = 0.37$, $SE B = 0.22$, $\beta = .32$, $p = .10$). In the moderate texting group, higher levels of interpersonal stress were significantly associated with higher burnout, accounting for 16% of the variance ($B = 0.33$, $SE B = 0.15$, $\beta = .40$, $p = .04$). In the high texting group, higher levels of interpersonal stress were significantly associated with higher burnout, accounting for 50% of the variance ($B = 0.62$, $SE B = 0.12$, $\beta = .71$, $p = .00$). Decomposing this significant interaction with simple slope analyses yielded a similar

pattern of findings. Interpersonal stress was significantly and positively associated with burnout for students with high daily texting behavior (1 SD above the mean; $B = .62$, $SE B = .12$, $\beta = .64$, $p < .001$) and average daily texting behavior ($B = .44$, $SE B = .10$, $\beta = .45$, $p < .001$), but not for students with low daily texting behavior (1 SD below the mean; $B = .26$, $SE B = .14$, $\beta = .27$, $p = .06$).

In Step 1 of the model predicting emotional well-being, higher levels of interpersonal stress were significantly associated with lower levels of well-being, accounting for 9% of the variance. In Step 2, number of daily texts was not a significant predictor, but in Step 3, the interaction was significant. Results are presented in Figure 2. In the low texting group, interpersonal stress was not significantly associated with emotional well-being, accounting for 5% of the variance ($B = -0.70$, $SE B = 0.62$, $\beta = -.22$, $p = .27$). Similarly, interpersonal stress was not a significant predictor of well-being in the moderate texting group, accounting for 2% of the variance ($B = -0.41$, $SE B = 0.63$, $\beta = -.13$, $p = .52$). In the high texting group, higher levels of interpersonal stress were significantly associated with lower levels of well-being, ac-

Table 4
Hierarchical Multiple Regression Analyses Predicting Burnout, Sleep Problems, and Well-Being

Predictors	R^2	ΔR^2	F	β	t	P
Criterion variable: academic and social burnout						
Block 1	.224	.224***	23.42***			
Interpersonal stress				.47	4.84	.000
Block 2	.224	.000	11.57***			
Number of daily texts				-.01	-.11	.913
Block 3	.263	.039*	9.40***			
Interpersonal stress \times number of daily texts				.20	2.03	.045
Criterion variable: sleep problems						
Block 1	.111	.111**	10.16**			
Interpersonal stress				.33	3.19	.002
Block 2	.195	.084**	9.69***			
Number of daily texts				.29	2.88	.005
Block 3	.200	.005	6.60***			
Interpersonal stress \times number of daily texts				-.08	-.73	.466
Criterion variable: emotional well-being						
Block 1	.087	.087**	7.70**			
Interpersonal stress				-.30	-2.78	.007
Block 2	.087	.000	3.81*			
Number of daily texts				-.02	-.15	.884
Block 3			4.32**			
Interpersonal stress \times number of daily texts	.141	.054*		-.24	-2.23	.029

* $p < .05$. ** $p < .01$. *** $p < .001$.

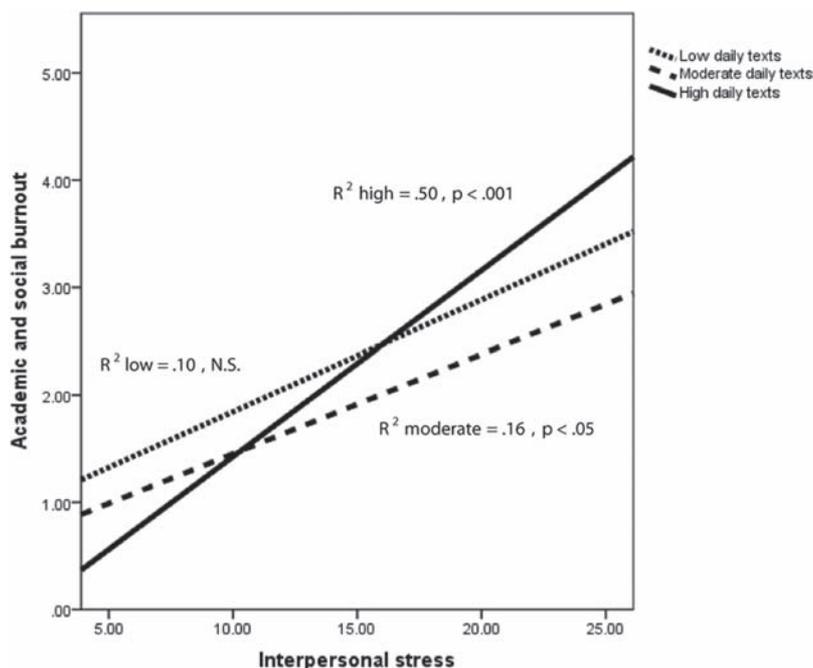


Figure 1. Differential association between interpersonal stress and burnout in low texting, moderate texting, and high texting groups.

counting for 26% of the variance ($B = -1.41$, $SE B = 0.47$, $\beta = -.51$, $p = .01$). Decomposing this significant interaction with simple slope analyses revealed that interpersonal stress was significantly and negatively associated with emotional well-being for students with high daily texting behavior (1 SD above the mean; $B = -1.48$, $SE B = .41$, $\beta = -.49$, $p = .001$) and average daily texting behavior ($B = -.82$, $SE B = .32$, $\beta = -.27$, $p = .01$), but not for students with low daily texting behavior (1 SD below the mean; $B = -.16$, $SE B = .46$, $\beta = -.05$, $p = .73$).

In Step 1 of the model predicting sleep, higher levels of interpersonal stress were significantly associated with higher levels of sleep problems, accounting for 11% of the variance. In Step 2, a greater number of daily texts was significantly associated with more sleep problems, accounting for a unique 8% of the variance over and above the variance accounted for by stress. The interaction of interpersonal stress and texts was not significant in the sleep problems model.

Discussion

Emerging adulthood is a developmental period characterized by transitions and stressors (Lev-Ari & Shulman, 2012) as well as high rates of cell phone use, especially text messaging (Harrison & Gilmore, 2012). To clarify some implications of frequent texting for emerging adults' health and well-being, this study examined the direct and interactive associations of interpersonal stress and text messaging behavior with first-year college students' academic and social burnout, emotional well-being, and sleep problems.

As predicted in the first hypothesis, higher levels of interpersonal stress were significantly associated with compromises in all three areas of functioning. Hypothesis 2 was supported only for the outcome variable of sleep problems; a higher number of daily texts was directly associated with poorer sleep. With regard to the third hypothesis, text messaging behavior moderated the association between interpersonal stress and two of the three outcome vari-

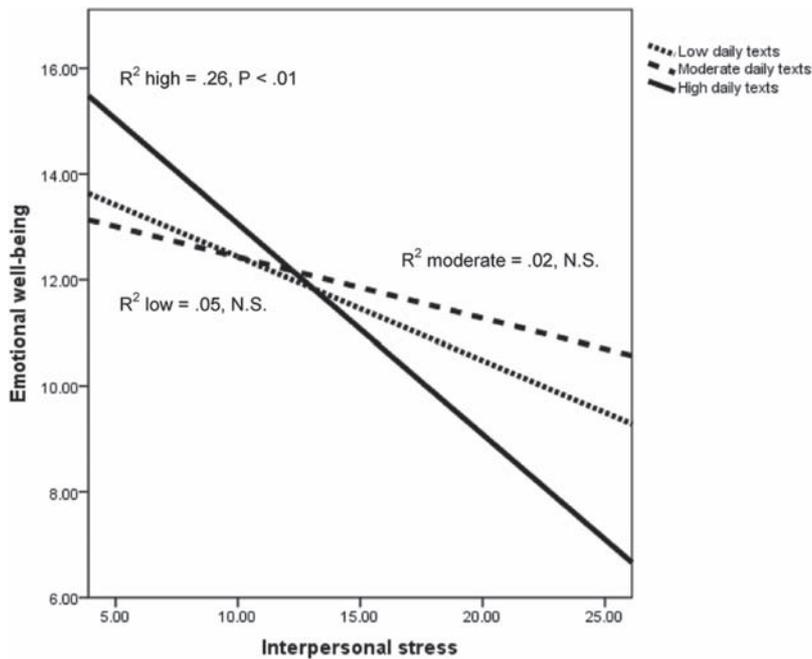


Figure 2. Differential association between interpersonal stress and emotional well-being in low texting, moderate texting, and high texting groups.

ables being investigated: burnout and emotional well-being.

Texting as a Moderator of Interpersonal Stress for Burnout and Emotional Well-Being

As expected, interpersonal stress accounted for the most variance in students' academic and social burnout and emotional well-being at higher levels of texting. For burnout, interpersonal stress was not a significant predictor at low levels of texting. However, higher levels of interpersonal stress were associated with greater burnout, accounting for significant and increasing amounts of variance, at moderate and high levels of texting. For emotional well-being, interpersonal stress was not a significant predictor at low or moderate levels of texting, but it was associated with significant compromises in well-being at high levels of texting. Thus in the current sample, frequent text messaging was associated with first-year college students' greater psychological vulnerability to interpersonal stress.

These correlational findings provide an initial indication that heavy text messaging could be problematic during times of stress. Although speculative, it could be argued that text messaging is a uniquely unsuitable mode of communication for coping with interpersonal stress in close relationships. The use of "textese" (Drouin, 2011), the abbreviated vocabulary often used in text messages, may not effectively capture nuances that would facilitate successful communication about sensitive topics. Also, text messages lack nonverbal cues, which carry crucial information in face-to-face communication (Coyne et al., 2011). Even the pacing of text messaging may magnify interpersonal stress; an absent or delayed response to a text message may be interpreted as a form of communication in and of itself. Thus, text messaging may carry a high risk of producing or maintaining misunderstandings and/or unproductive interactions during periods of stress. When interpersonal stress involves conflict, the conditions required for productive communication may be particularly difficult to achieve through

texting. A heavy text messaging “lifestyle” may fail to invite or even afford a sufficient break in contact between the conflicting parties for calm and objectivity to be restored. That is, a strong impulse to text message and a shared relational expectation that one can text message at any time may promote nonoptimal communication in times of stress. This “lifestyle” may also perpetuate stress-related negative affect or prevent recovery from physiological arousal associated with unpleasant interpersonal events, both of which may compromise psychological well-being.

Finally, text messaging may magnify the negative effects of interpersonal stress because of the investment of energy, effort, and time it requires. The act of text messaging is an activated physiological state that causes strain on the body (Lin & Peper, 2009), takes time, and carries a cognitive and attentional load (Schwebel et al., 2012). It is not surprising that higher levels of interpersonal stress are related to higher levels of burnout even in conditions of moderate texting. Texting could be viewed as work in and of itself that may contribute to overload and burnout, particularly during the transitions involved in the first year of college.

Although the current research questions focus on interactive effects of interpersonal stress and text messaging, it could be proposed that high levels of stress somehow generate the need for or the tendency toward engaging in more frequent text messaging, which in turn negatively impacts functioning (i.e., a mediational model). However, it is notable that in this sample, the number of daily texts was not significantly correlated with interpersonal stress, burnout, or emotional well-being. Therefore, these data provide no cross-sectional evidence for texting as a mediator in the associations between interpersonal stress and these psychological outcomes. Instead, it is the combination of high stress and high texting that appears to be problematic.

Direct Association of Texting With Sleep Problems

Texting did not function as a moderator of the association between stress and sleep, but it was a direct predictor of sleep problems. Even after interpersonal stress accounted for a significant 11% of variance, a higher number of daily texts

was associated with more sleep problems, accounting for 8% of unique variance. This conservative test reinforces previous evidence of direct associations between cell phone use and poor sleep in adolescents and emerging adults (Punamäki et al., 2007; Thomée et al., 2007, 2011).

Further research needs to investigate the multiple pathways that have been proposed to drive an association between cell phone use and sleep disruption in college students. For instance, technology may be used at night, causing a delay in bedtime, longer sleep latency, and/or daytime sleepiness, and it may be paired with ingestion of caffeinated products that independently cause sleep problems (Calamaro, Mason, & Ratcliffe, 2009; Lund et al., 2010). Furthermore, exposure to a bright screen may impede the release of melatonin, a hormone that regulates the sleep–wake cycle (Wood, Loughran, & Stough, 2006). Nighttime wakings may be caused by auditory notifications on cell phones that are stored within earshot during sleeping hours, a practice that appears to have become the norm. In a study of cell phone proximity, Dey et al. (2011) recently reported that 89% of participants kept their phone in their bedroom at night, with 56% keeping it within arm’s reach. Similarly, Lenhart, Ling, Campbell, and Purcell (2010) found that 86% of 14- to 17-year-olds who owned cell phones slept with the phone in their room, commonly under their pillow or in their hand, and teenagers who used text messaging were 42% more likely to do so compared with those who did not text. Given that sleep problems have been associated with compromises in first-year college students’ academic and emotional functioning (Lev-Ari & Shulman, 2012; Trockel et al., 2000), and with clinically significant burnout in adults (Söderström, Jeding, Ekstedt, Perski, & Åkerstedt, 2012), it is imperative for pathways between cell phone use and sleep problems to be clarified in future studies.

Strengths and Limitations

The current study relied on self-reports of college students. As noted elsewhere (Underwood, Rosen, More, Ehrenreich, & Gentsch, 2012), validation of these findings with objective measures of texting behavior would be ideal. Although the current measure of sleep is

widely used and well-validated, a more complete picture of college students' sleep would be provided with objective and subjective measures of a variety of qualities of sleep (e.g., sleep variability, weekday vs. weekend patterns, daytime sleepiness). It would be helpful for future models of college students' sleep prediction to include covariates that are uniquely related to student life, such as the use of caffeine, stimulants, sleep aids, and/or other substances that may affect sleep. The external validity of these findings is limited due to the nature of the sample. Data were collected from first-year students at a small, private, academically rigorous liberal arts college, some of whom were able to earn a small amount of extra course credit for participating. The first year of college involves transitions and new experiences that may affect interpersonal stress levels, cell phone use, and indicators of health and well-being, and thus the current findings may not generalize to other points in the college experience. Furthermore, patterns of cell phone use and text messaging behavior are likely to continue changing across time and thus, findings regarding these behaviors may not generalize across age cohorts. Future research should investigate associations among stress, texting behavior, and health and well-being among a more ethnically and socioeconomically diverse sample. Also, future studies should explore how patterns of texting behavior are associated with transitions in friendships and family relationships that are characteristic of the first year of college.

Conclusions and Future Directions

Taken together, these findings indicate that although the implications of texting behavior on indicators of psychological well-being depended on the concurrent level of interpersonal stress, more texting was associated with poorer sleep regardless of the level of stress.

Text messaging is embedded in American culture and plays a central role in younger generations' sense of social relationships. It would be overly simplistic to characterize it as a uniformly positive or negative phenomenon (Skierkowski & Wood, 2012); instead, it will be important for future research to untangle the conditions under which it is most and least adaptive. Future studies should clarify who, and under what conditions, is at risk for engaging in problematic texting behavior. For instance, low

self-esteem has been identified as a correlate of problematic use of cell phones, and it is proposed that low self-esteem may predispose individuals to use their cell phones as a way to avoid or escape situations that are aversive (Bianchi & Phillips, 2005). Individuals with social anxiety prefer texting to calling (Reid & Reid, 2007) and are also more prone to using avoidant coping strategies (Olatunji, Moretz, & Zlomke, 2010), and the combination of these characteristics may place them at risk for overusing text messages and experiencing associated compromises in health and well-being. Likewise, significant correlations between extraversion and both overall and problematic cell phone use may be mediated through extraverts' tendency to seek social contact to reduce underarousal (Bianchi & Phillips, 2005). A recent study of young adult drivers showed that individuals with higher levels of trait mindfulness (i.e., awareness and acceptance of present moment experience, thoughts, and feelings) reported lower levels of texting-while-driving, and this association was mediated through their lower levels of motivation to use text messaging for purposes of reducing negative emotion (Feldman, Greeson, Renna, & Robbins-Monteith, 2011). It would be useful to understand how texting may function as an attempt at coping with such challenges, ranging from interpersonal stress to internal states such as boredom. Importantly, research should investigate the short-term and long-term consequences of texting as a method of coping with stress.

Future research should also examine development- and gender-specific aspects of associations among stress, texting behavior, and health and well-being. For instance, adolescent girls appear to experience higher levels of interpersonal stress than boys (Shih, Eberhart, Hammen, & Brennan, 2006) and respond with more distress to it (Charbonneau, Mezulis, & Hyde, 2009). Although research on gender differences in texting behavior has yielded somewhat inconsistent findings (Underwood et al., 2012) and no significant gender differences were found in the current sample, some evidence suggests that female students text more frequently than male students (Junco, Merson, & Salter, 2010). It is possible that the functions and implications of interpersonal stress and texting behavior differ across developmental periods and/or between males and females. To clar-

ify the range of adaptive mobile technology use among college students, such subtleties must be better understood.

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