Connecting With Others in the Midst of Stressful Upheaval on September 11, 2001

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This study was originally planned from September tenth through twelfth to assess concurrent use of three real-time data sources during a usual day. When the World Trade Center towers collapsed, the plan expanded to describe 24-hour blood pressure and heart rate, natural environment word use, television viewing/radio listening, and self-reported diary feelings for six undergraduate students in the midst of stressful upheaval. Heart rate, "we" word-use and television viewing/radio listening increased over time. Higher negative and lower positive feelings/emotions occurred during morning hours on September 11. Students connected with others and shared good thoughts. Measurement with real-time data sources was informative.

ON SEPTEMBER 11, 2001, the World Trade Center Towers collapsed after being struck by two commercial jetliners; it was a day of stressful upheaval for Americans. This article will report the real-time day of undergraduate students who shared with the researchers and data collectors a common ground of making sense of senselessness and creating meaning in the midst of upheaval on this day. A rigorous methodological approach, which was used to assess the real-time experience of the day, included concurrent use of three measurement devices. Implications of the coexistence of upheaval and social connection are considered, as is the potential of the real-time measurement devices used in the study.

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BACKGROUND

Real-time reports about September 11 that have appeared in the literature are anecdotal chronicles, documenting the meaning of the events in relation to what was going on in the lives of the professionals who were reporting (Lipkin, 2002; Muller, 2001). Muller's (2001) chronicle occurs in the context of a meeting of 10,000 cardiovascular experts convened to discuss progress in atherosclerosis research; he reports the moments of the morning, focusing on the strength of international collaboration in a world with fading geographic boundaries. Lipkin's (2002) chronicle recounted the story of being an attending physician at Bellvue Hospital, when he was alerted that the World Trade Center was smoking; he notes conflict between his roles as doctor and father/husband, creating a "tension between serving and family"(p. 704).

The September 11 chronicle reported in this article is unique because it is synthesized from the perspective of undergraduate student research participants and nursing and social psychology researchers who were engaged in getting through the

day balancing previously made research plans with September 11 happenings. This chronicle is unique too because of the density of data collected. Acoustic traces (30-second tape recordings occurring every 12 minutes), documenting moments of time between September 10 and September 12; recurrent blood pressure (BP) and heart rate recordings (every 30 minutes) measured in natural environments over this 2-day period; and self-recorded feelings (every 30 minutes with each BP recording) occurring while awake and engaged in the 24-hour periods immediately before and immediately after the morning of September 11, comprise this data set. The immediacy of this data set has compelled the researchers to share what was learned and consider it in relation to other pertinent research. The reports of research about September 11 occurring within the few months after the event (Galea, et al., 2002; Schuster, et al., 2001) were surveys that documented people's experience of stress.

In a national telephone survey conducted with 768 adults (19 years and older) from September 14 to 16, Schuster and colleagues (2001) found that 44% reported at least one symptom of stress, and stress experience differed relative to gender (female, 50%; male, 37%), race (non-Hispanic white, 41%; nonwhite, 62%), and distance from the World Trade Center ($\leq$100miles, 61%; 101-1,000 miles, 48%; $\geq$1,001 miles, 36%). Population density and television viewing of the September 11 event were also related to stress experience with the greatest frequency of stress being reported by people who lived in the most densely populated areas and those who reported watching more than 13 hours of television on that day (Schuster, et al., 2001). These researchers also found that the majority (57%) of people coped by talking with others about how they were feeling.

Galea and colleagues (2002) focused on posttraumatic stress disorder (PTSD) and depression in telephone interviews conducted from October 12 to November 15 with 1,008 Manhattan residents. Gender, race, and social support in the previous 6 months were among the factors related to both PTSD and depression. Both PTSD and depression were highest in women and Hispanics and people with the lowest social support. Proximity to the World Trade Center was related to PTSD but not depression (Galea, et al., 2002). Stress was the common focus in both of these surveys, influenced by demographics and supportive social interaction. Television viewing was associated with stress experience in the time immediately after the September 11 event.

PURPOSE

This research was coincidentally planned for September 10 to 12, 2001, to evaluate the concurrent use of three real-time data sources (ambulatory BP; electronically activated recorder [EAR]; self-report diary) for capturing multidimensional experiences of a usual day. The nurse researchers believed that the combination of the EAR with ambulatory BP and diary recording showed promise for future research in practice settings in which these measurement devices could be used together for people with hypertension. The addition of the EAR to ambulatory BP would offer a perspective of daily experience, which did not rely on self-report. The events on the morning of September 11 shifted the original study intent and changed the context of data collection from usual to unusual. Although we were still evaluating the potential of using three real-time data sources to provide a multidimensional picture of daily experience, there was nothing usual about the day. Data were now being collected to explore the experience of undergraduate students living through a day unlike any they had previously experienced. The primary research focus shifted to a naturalistic observation describing what people go through in the midst of stressful upheaval. The survey literature about September 11 focused our descriptive analysis on the participants' stress experience and associated demographic, social interaction, and television viewing information.

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cols with research participants and stopping to debrief with each other about the most recent news from New York. In the midst of research activities, we were reaching out to our families and trying to make sense of what happened. To some extent, this research report is our chronicle of September 11, an ongoing process of creating meaning. The study of undergraduate students with resulting descriptive data will be presented followed by evaluation of findings relative to existing literature and implications for practice and research.

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METHODS

Design and Recruitment

The evaluation of the feasibility of using three real-time data sources (ambulatory blood pressure, diary checklist, electronically recorded environment sounds) was originally planned to include a sample of 24 subjects, collected in four cohorts, each including six subjects. A descriptive report of blood pressure, diary-recorded feelings, word use, and television viewing/radio listening for the first six participants from the morning of September 10 to the afternoon of September 12 is presented here. Students were recruited through flyers on campus and announcements in psychology classes. They came to a single office by noon on September 10, 2001, where the components of the study, including instructions regarding the measurement instruments, were reviewed, questions were answered, and consent forms signed. Consistent instruction for both the ambulatory BP and EAR monitor included the importance of keeping the instruments dry and wearing them for as much of their day as possible. Monitors were applied, and each participant had a trial run with the BP and diary recording. They were instructed to return the monitors on the morning of September 12 and to stop at the research office on the morning of September 11, allowing researchers an opportunity to assess the experience of the concurrent monitoring, including imposition of the equipment and compliance with the protocol. When participants arrived on September 11, time was spent inquiring about willingness to continue. One participant had removed the ambulatory BP monitor and discontinued diary recordings by the time he arrived on September 11. He said he was very upset and could not endure the burden of continued BP monitoring.

Instruments

Cardiovascular monitoring. Blood pressure and heart rate were measured with a Spacelabs 90207 monitor, which was programmed to record BP every 30 minutes during the day. The original design included nighttime monitoring, but participants were told they could remove BP monitors before going to bed on September 11 and they did. The ambulatory BP monitor is small and quiet and is worn on a belt around the waist. It has shown validity and reproducibility (White, Lund-Johansen, & Omvik, 1990). BP and heart rate are accepted modalities for assessing stress experience.

Sampling of natural language use. Participants' language use in their spontaneous conversations was monitored with the EAR (Mehl, Pennebaker, Crow, Dabbs, & Price, 2001). The EAR is a modified microtape recorder designed to capture ambient sounds in the immediate environment. The EAR comes on for 30 seconds every 12.5 minutes, and the participant is unaware of specific timing of tape-recorded segments. The EAR is either attached to a belt or carried in a small purse (camera case) while an individual goes about normal daily activities. A lapel microphone is clipped to the clothing. To ease privacy concerns, participants were told to erase anything that they considered objectionable before the EAR data were submitted to the investigators. In preliminary testing, Mehl and colleagues (2001) found only 2 subjects of 54 chose not to participate after hearing about privacy protection plans and only 2 turned the EAR off during the day, during conversations with their significant others. More detailed information on how the EAR is applied, the data collection, and the handling of ethical issues in recording other

people are provided in the original article describing EAR use (Mehl, Pennebaker, Crow, Dabbs, & Price, 2001). The EAR has proven to be a minimally obtrusive behavior sampling tool that results in highly naturalistic data.

Linguistic analysis. Information on participants' word use was extracted from the verbatim transcripts of their spontaneous conversations captured by the EAR. All transcripts were submitted to Linguistic Inquiry and Word Count (LIWC), a word-based computerized text analysis software. LIWC analyzes a given text document by comparing each word to an internal dictionary consisting of over 70 linguistic categories (eg, pronouns, articles, prepositions, emotion words, cognitive words, swear words) (Pennebaker & King, 1999). The LIWC output depicts the percentage of words of the analyzed text document that fell into each of the more than 70 categories. According to the focus of this project, percentage of words per hour was calculated for a subset of the categories, suggested to be important by the early survey literature (Galea, et al., 2002; Schuster, et al., 2001), addressing the events of September 11, 2001 (stress; social interaction; television viewing/radio listening). Positive and negative emotions were selected to address divergent anchors related to the stress experience. The positive emotion category includes words such as happy, joy, and good. The negative emotion category includes words such as afraid, stress, and tense. Number of words spoken and the use of "we" words were selected to represent social interaction. The internal consistency of the positive and negative emotion word-use categories has been reported as .71 and .79, respectively, when coefficient alpha was averaged across writing samples from students, inpatients and psychologists (Pennebaker & King, 1999). The "we" word category had an average alpha reliability of .66 (Pennebaker & King, 1999) with these same writing samples. In recent work, Mehl and Pennebaker (2003a) found that undergraduate's ($n = 52$) language use as sampled with the EAR is consistent across time and context providing a psychometric foundation for adopting the EAR as a promising indicator for real-time daily experience.

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Television viewing/radio listening. The EAR data were also used to gather information about television viewing/radio listening. Use of the EAR to capture environmental sounds other than spoken words has been tested in previous work (Mehl, Pennebaker, Crow, Dabbs, & Price, 2001). Analysis of tapes from the EAR includes judges ratings of each 30-second recorded segment to determine occurrence of conversation (eg, talking, laughing; telephone) and activity (eg, television viewing/radio listening, computer work, eating) and to determine the context for the segment (eg, home, class, outdoors). Interrater reliability (judges' ratings) for the activity of television viewing/radio listening was above .85 in a sample of 52 undergraduate students who wore the EAR twice for 2 days separated by 4 weeks (Mehl, Pennebaker, Crow, Dabbs, & Price, 2001). In a separate analysis that included the data of the six participants in this study, 6 research assistants separately coded 392 EAR sound files; interrater reliability for television viewing/radio listening was above .90 (Mehl & Pennebaker, 2003b).

Self-reported momentary feelings. Diary-recorded feelings were self-reports occurring at the time of each awake BP measurement. A diary entry required designating "yes" or "no" for each feeling on the diary list (happy, irritable, angry, rushed, accomplishing things, excited, stressed, sad, neutral, relaxed, bored, interested). A "yes" response for the five diary-recorded feelings of happy, accomplishing things, excited, relaxed, and interested was summed to create the hourly positive feeling score. A "yes" response for the five diary-recorded feelings of angry, irritable, rushed, sad, and stressed was summed to create the hourly negative feeling score. Positive and negative diary-recorded feelings, like positive and negative emotion word use, were indicators related to stress experience. There was one diary page for each feeling list and the 3-in $\times$ 5-in diary was easily carried with the EAR.

Analysis

Three time segments were selected to display the descriptive data: 1 PM until 5 PM on September 10, 9 AM until noon on September 11, 1 PM until 5

Table 1. Means and Standard Deviations for Word Use, Television/Radio Use, Ambulatory Blood Pressure and Heart Rate, and Diary Recorded Feelings for September 10 (1 PM to 5 PM) and September 11 (9 AM to 12 PM, 1 PM to 5 PM) for 5 Undergraduate Students

	10 September, PM	11 September, AM	11 September, PM
EAR Monitoring LIWC Analysis			
Word count	67.1 ± 66.7	63.8 ± 51.8	67.9 ± 53.3
We	.62 ± 1.2	.96 ± 1.4	1.9 ± 1.9
Positive emotions	2.1 ± 3.6	1.0 ± 1.3	2.8 ± 5.1
Negative emotions	.62 ± 1.1	1.6 ± 2.7	1.1 ± 1.8
Television/radio	.14 ± .25	.42 ± .39	.51 ± .41
Ambulatory BP and heart rate monitoring			
Systolic blood pressure	118.9 ± 6.4	121.4 ± 7.0	121.5 ± 8.9
Diastolic blood pressure	75.1 ± 6.5	74.2 ± 7.4	73.3 ± 8.9
Heart rate	79.3 ± 15.4	83.9 ± 16.7	86.7 ± 19.6
Diary monitoring			
Diary positive feelings	1.9 ± 1.3	1.5 ± 1.3	1.9 ± 1.5
Diary negative feelings	.72 ± 1.2	1.8 ± 1.5	1.0 ± 1.7

PM on September 11. These segments allow a balanced pre-, during-, and post-recording with approximately equal time periods and matching times of day. Each hour of the three segments had BP data, word-use data, diary data, and television viewing/radio listening data for each student. Average BP, word-use, positive and negative diary-recorded feelings, and television viewing/radio listening were calculated for each time segment (September 10, 1 PM to 5 PM; September 11, 9 AM to noon; September 11, 1 PM to 5 PM).

Findings

Five participants (4 women, 1 man) completed data collection. All were Anglo-American, living in a city of just above 600,000 people, approximately 1,750 miles from the World Trade Center. Table 1 summarizes the descriptive data. Heart rate, television viewing/radio listening, and use of the word "we" progressively increased from the afternoon of September 10 to the afternoon of September 11. Fewer words were spoken on the morning of September 11 than either before or after. Positive feelings (diary) and positive emotions (word use) dipped on the morning of September 11 but rebounded by the afternoon. The opposite pattern occurred for negative feelings and emotions. There was a slight but persistent decrease in diastolic blood pressure over the three time periods (Table 1) and an increase in systolic blood pressure on the morning of September 11, which continued in the afternoon.

DISCUSSION

September 11 was a stressful upheaval event in the lives of these students. When the researchers shifted the primary study intent to pursue a description of this day with only six participants, it was done with recognition that this would be a narrow view. Still, the large amount of data provided by the concurrently used real-time measures and the ability to record experience during this real-life upheaval promised information not readily available in standard laboratory stress reactivity testing. The positive and negative feelings and emotions of the five participants showed that a dip in positive and rise in negative feelings and emotions on the morning of September 11 equilibrated by the afternoon. Thomas L. Friedman in a *New York Times* editorial (May 19, 2002) suggested that Americans tend to be naively optimistic. He commented on the "positive feeling in America after 9/11 particularly among young Americans"[p. 15].

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One of the students in this study wrote the note "chaos has struck" in the diary accompanying the 10:30 AM 9/11 entry. That student wrote detailed notes during the rest of the day, recounting students' active efforts to shift to positive: "People are constantly checking the internet, posting good thoughts and plans to gather . . . ." Because naturalistic real-time feeling data are generally unavailable as people move through upheaval like September 11, this emphasis on the positive provides a window into the experience with little empirical comparison. Stone and Pennebaker (2002) reported a drop in positive emotion chat room words in the week after the death of Princess Diana, which equilibrated by the fourth week after her death. The occurrence and timing of feelings during stressful upheaval is likely to be related to personal and contextual qualities, such as age, gender, location, and scope of the upheaval event. A first question for continuing research may be whether a negative-positive feeling shift routinely occurs with stressful upheaval and how this shift may be related to health and physiologic indicators, such as BP and heart rate.

In this study, heart rate, but not blood pressure continued to rise over the 2-day period. This is not surprising because these were mostly females and young adult females tend to be heart rate rather than blood pressure responders when exposed to stress (Allen, Stoney, Owens, & Matthews, 1993). From the perspective of heart rate, the morning stress of September 11 intensified in the afternoon after the self-reported diary feelings and electronically recorded emotion words equilibrated. The sample size prohibits inference, but these descriptive data generate questions about the match between physiology, spoken words, and self-reported feelings. Liehr and colleagues (2002) have previously noted higher diastolic blood pressure when adolescents who are talking about an experience of anger use fewer anger words. So, a mismatch between word use and experience was associated with higher blood pressure. Elevated heart rate data on the afternoon of September 11 may be reflective of a similar mismatch. Systolic BP, which rose in the morning on September 11, remained elevated in the afternoon. So, students hadn't gotten "back to normal" but remained at a generally higher level of cardiovascular arousal since the morning events. Increased systolic BP combined with decreased diastolic BP resulted in a widening pulse pressure. Because increases in stress-related pulse pressure have been associated with long-term cardiovascular outcomes (Jokiniitty, Tuomisto, Majahalme, Kahonen, & Turjanmaa, 2003), this finding deserves attention in future work.

The fewest number of words were spoken on the morning of September 11 (Table 1) but there was an increase in "we" words from September 10 to the morning of September 11 to the afternoon of September 11. In another evaluation of word use at this time, Pennebaker and Lay (2002) found that Mayor Giuliani's use of the word "we" increased around September 11, as he referred to his connection with the citizens of New York City. The rate of "we" use on the afternoon of September 11 approximately doubled usual use for this population (Mehl & Pennebaker, 2002). It is common to find increases in social connecting in times of stress. Stone and Pennebaker (2002) referred to the "collective orientation" indicated by the higher use of words such as "we" in chat room participants grieving the death of Princess Diana. A walk around campus in the late morning hours of September 11 was surprisingly quiet despite groups of students collected to watch a television positioned on a sidewalk, or share with speechless others, who hadn't yet heard about the morning's events. Words were few despite a collective orientation shown by campus prayer vigils and research participants' unsolicited diary notes about checking on friends and family and comfort found in hugs.

Television viewing/radio listening increased—again, not surprising. As the work and school day came to a close, Americans headed home to watch over and over what happened in an effort to grasp the reality and try to understand. Television assumed a powerful position in creating the experience of the day. The students told us that viewing often occurred with friends and incorporated "speculating and trading information" to ease "nervousness." It is possible that escalating heart rate was associated with television viewing/radio listening. Although this sample size prohibits correlation analysis, other research has indicted that television viewing on 9/11 and the few days afterward was strongly related to distress felt up to 2 months later (Schlenger, et al., 2002).

These young people shifted to positive and relied on caring others in the midst of stressful up-

heaval. All five students recorded "stressed" as their feeling at 9 AM on September 11. This 100% agreement by all five participants occurred only at this one time during the 2-day period, which was naturally represented by a range of feelings at each other data point. All but one participant continued participating. Participating was a way of responding to September 11, which offered a chance to create meaning in the midst of their upheaval. They talked about a sense of purpose in participation as their blood pressure monitors were removed on September 12.

IMPLICATIONS

The original intent of this study was to assess the concurrent use of three real-time data sources (ambulatory BP, EAR, self-report diary) for capturing the experience of a usual day. The events of September 11 shifted the primary study purpose to description of human experience during an unexpected stressful upheaval and evaluation of concurrent monitoring became secondary.

Research Implications

The upheaval of the day prompted one participant to quit wearing the ambulatory BP monitor, but he continued to wear the EAR. Accomplishment of monitoring with the remaining 5 participants suggests that concurrent use of these multidimensional data sources is feasible, providing information unavailable with retrospective self-report. There is evidence that retrospective self-report, affected by human factors such as memory and social desirability, is inadequate for assessing ongoing experience in everyday life (Stone, Turkkan, Bachrach, Jobe, Kurtzman, & Cain, 2000). Use of the EAR with the ambulatory BP monitor creates a sort of multidimensional video recording of the day, unaffected by either memory or social desirability. It enables documentation of environmental factors and words, which reflect emotions, cognitive processes, and time frame.

Despite the potential of the EAR to collect ongoing environmental and word-use data, there continues to be a place for a self-report diary when collecting ambulatory BP data. For instance, data such as position (eg. sitting, lying, standing) are important for interpretation of BP recordings. When using a self-report diary, there are always questions about the burden of recording and whether diary entries were made when BP readings occurred or "filled in" maybe even hours later. With the addition of the EAR to ambulatory BP research protocols, it may be possible to simplify the format of the diary, limiting its burden. For instance, most of the activities (eg, talking on phone, watching TV, eating) on the diary list are identified with EAR data. In this observation, the positive and negative feeling emotion data for the diary and EAR followed similar patterns (Table 1). If feeling data entry can be eliminated from the diary, the burden is significantly reduced for the research subject.

Practice Implications

Over the last several years, ambulatory BP monitoring has increasingly moved from the research to the practice arena. Interpretation of ambulatory BP reports is limited without a record of the circumstance of each individual BP recording. The time-consuming job of transcribing and preparing EAR data makes it impractical for use in health care practice. However, in this evaluation the EAR provided data, allowing comparison with diary-recorded feelings. The descriptive comparison (Table 1) suggests that the subjective diary recordings mirrored the more objective EAR recordings for positive and negative feelings/emotions. So the research participants' diary-recorded positive and negative feelings followed the same pattern as positive and negative emotion word use concurrently collected with the EAR. This preliminary indication of diary validity warrants further study in future research but, as is, offers promise for the meaningful use of diaries when monitoring ambulatory BP in practice.

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As nurses caring for persons experiencing stressful upheaval, these data direct attention to what comforts and focuses attention on social relationships. Most of nurses' time, especially in acute care settings, is spent with people who are experiencing stressful upheaval, whether related to their own health or to the health of a loved one. It is not new information, but it is a potent reminder

that one of the most important ways to get through stressful upheaval is by connecting with caring others. Nursing effort directed to assess patients' social networks and to support their interactions with caring others continues to be a critical health-promoting activity.

A naturally occurring comfort for the students in this study was connection with others. Even the student, who stopped participating in the ambulatory BP component of the study but continued to wear the EAR, came to the equipment return and debriefing session with the other students. In this time of stressful upheaval, participation in research became one more way of connecting with the larger purpose of creating meaning. For the researchers, the meaning of September 11, 2001, occurred in relationship with research participants. The willingness of the participants to stay engaged expanded the original instrument evaluation intent of the study. Although numbers were small, it seemed important to share these data as one slice of life in America on September 11, 2001.

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