Everyday couples' communication research:

Overcoming methodological barriers with technology

Maija Reblin,*[a] Richard E. Heyman,[b] Lee Ellington,[c]

Brian R.W. Baucom,[d] Panayiotis G. Georgiou,[e] Susan T. Vadaparampil,[a]

[a] Department of Health Outcomes & Behavior
Moffitt Cancer Center
Tampa, USA

[b] Family Translational Research Group
New York University
New York, USA

[c] College of Nursing
University of Utah
Salt Lake City, USA

[d] Department of Psychology
University of Utah
Salt Lake City, USA

[e] Ming Hsieh Department of Electrical Engineering
University of Southern California
Los Angeles, USA

*Corresponding Author at:
Department of Health Outcomes & Behavior
Moffitt Cancer Center
12902 Magnolia Drive
Tampa, FL 33612
USA
Tel: 813-745-8705
Fax: 813-745-6525
maija.reblin@moffitt.org

Abstract

Relationship behaviors are an important cause of compromised health or resilience. Everyday communication between intimate partners represents the vast majority of their interactions. When intimate partners take on new roles as patients and caregivers, everyday communication takes on a new and important role in managing both the transition and the adaptation to the change in health status. However, everyday communication and its relation to health has been little studied, likely due to barriers in collecting and processing this kind of data. The goal of this paper is to describe deterrents to capturing naturalistic, day-in-the-life communication data and share how technological advances have helped surmount them. We provide examples from a current study and describe how we anticipate technology will further change research capabilities.

Highlights

1. There is a historic lack of research on couples' everyday communication.
2. Study of everyday communication can provide important research insights.
3. Technology can address methodological barriers to studying everyday communication.
4. More research is needed to leverage large datasets toward intervention development.

Key Words

Communication; Technology; Data Collection; Caregivers; Home

1. Introduction

The home is often a place of privacy, safety, comfort, and control [1] and the center of everyday experience [2]. The home elicits deeply-ingrained patterns of behavior, including the flow of everyday activities and interactions [1, 3]. Everyday communication at home between intimate partners represents the vast majority of their interactions and can have a cumulative effect on relationship quality and satisfaction. Communication has been called “the common pathway to relationship [functioning]” [4] because it is the means to get needs met and to express intimacy, support, or displeasure (among other relationship processes). Studying everyday communication is important, but because of its continual, incessant nature, it can fade into the background; habituation and low salience can make it difficult to measure [5].

Studying communication at home becomes especially relevant when the home is transitioning to functioning as a healthcare setting. Effective patient-provider communication has been shown to impact health outcomes [6] but there has been a shift in healthcare away from inpatient services toward services relying on informal family caregivers at home, especially for longer term care and advanced illness [1].

As healthcare enters the home, roles and routines can shift. In advanced stages of disease, intimate partners often take on more care tasks, blurring the line between partner and provider. This is particularly true for cancer caregivers, who report providing an average of 32 hours of care per week, assisting the patient with an average of 2.4 activities of daily living (e.g., bathing) and 4.6 instrumental activities of daily living (e.g., shopping). Over 70% of cancer caregivers report assisting with medical/nursing tasks and over 60% are considered to be in high burden situations [7]. When intimate partners take on time- and emotionally-consuming roles as healthcare providers, it becomes even more important to assess how couples communicate with each other both about care and in general. There is a growing literature on patient-caregiver communication, but much of this work relies on more subjective self-report or interview data, rather than direct observation [8, 9] and even less research focuses on naturalistic communication in the home. These limitations can bias research findings.

Although the home is becoming a more important healthcare context, it is still clearly distinct and deserves more research into the communication content and processes that occur within. Researchers likely have been dissuaded from this research, however, by barriers in collecting, processing, and analyzing data, impediments that technology is slowly overcoming.

Our team is currently conducting a naturalistic, observational study of couple's communication in advanced cancer patients and their spouse caregivers. We have adapted a widely-used analogue conflict discussion task and collect "day-in-the-life" audio recordings, described below. The aim of this study is to identify quantity of total talk, communication content (e.g., whether couples' communication falls in the domains of cancer or their relationship), and communication process (e.g., who initiates exchanges, valence of responses) of advanced cancer patients and spouse caregivers. The goal of this paper is to describe the obstacles to capturing this data and share how technological advances have helped address those barriers in our ongoing study. We also discuss how we anticipate technology will further change research capabilities.

2. Barriers

2.1 Access

The first barrier to day-in-the-life communication research is gaining access to participants at home. In our study, couples are recruited from clinics at a National Cancer Institute (NCI)-designated Comprehensive Cancer Center; interested couples are offered two options for participation. Those who live within a 1-hour drive are offered the option of a home visit; those living further away or otherwise prefer it can do a structured portion of the study at the cancer center, scheduled to coincide with other clinic appointments, then are sent home with recording equipment to set up later. This allows couples to participate in a way that is most convenient for them, without necessarily having to invite the research team to their home.

In both the home and clinic visits, participants sit together, either on a couch or at a table. After written consent is obtained and questionnaires are completed, the research assistants help set up and explain the recording equipment to participants, including how to turn the recorder on and off. The couple then completes an analogue structured discussion task based on previous research [10], included to provide a comparison to the unprompted, naturalistic, communication. The task comprises (a) a 10-minute neutral discussion (describe your typical schedule for the week) and (b) a 10-minute stressor discussion (discuss a cancer-related problem). Although both individuals wear recorders, a third back-up recorder also captures audio data. After each discussion, participants are asked to complete measures rating their emotions as a manipulation check (i.e., the cancer discussion is meant to be more stressful than the schedule discussion).

2.2 Obtaining key communication data

Analogue observations are common ways for researchers to obtain an approximation of naturalistic communication (e.g. [11]). Investigators prompt couples to engage in “typical” discussions, usually around areas of conflict (e.g. [5, 12-15]). The benefit is that researchers ensure that some target communication is captured in a convenient way (i.e., when the investigators’ video is rolling). Knowing when and for how long the interaction occurs reduces the need for data storage space and simplifies coding. Couples are able to engage in typical discussions [16] and their communication is predictive of relationship outcomes [4].

Although the analogue method works well to study conflict, by design it involves encouraging less frequent, but highly salient, interactions. This is the antithesis of studying the everyday home environment. Additionally, there is some evidence that interaction in the lab underestimates differences between distressed and non-distressed couples, compared with audio recordings made in couples’ homes [17, 18]. This approach also assumes that couples would engage in these discussions if unprompted. Yet many couples avoid or withdraw from discussing conflict, which can uniquely impact relationship outcomes [19-21].

To address the limitations to analogue tasks, our study also includes recordings of true naturalistic discussion. Upon completion of the structured discussion task, home visit participants simply keep the recording equipment on after the research staff members leave. Clinic visit participants are sent home with the equipment and select a day (usually within the week) to complete the home, day-in-the-life portion of the study. The research team schedules a reminder call that morning to help set up equipment remotely. For all participants, staff is available to answer questions throughout the day. Participants are instructed to remove and power down equipment (if still on) when they go to bed. Participants are either met at their next clinic appointment (if within the week) by a research staff member to collect the equipment, or are supplied with a pre-paid box to return equipment by mail. Upon receipt, the research staff checks and uploads audio data (by USB) to a secure network drive before deleting files from devices.

Two previously insurmountable barriers to this type research existed until recently. First, recording devices could not be easily carried by participants. Thus, researchers set up stationary recording devices in limited areas within the home, often dining areas [22], instead of on the person. However, participants tend to be mobile and alternate talking with extended periods of silence. Communication that occurred outside of designated areas or while participants were on the move was not captured. Second, device data storage limited the length of recordings. Thus, some studies targeted key times when participants would be more likely to communicate (e.g., mealtimes; [23, 24]). However, communication that occurred outside the designated times was not captured.

Technological advances have led to smaller, more economical, recording devices with greater data storage capacity and battery power, making it possible to capture naturalistic home-based interactions across time. This was often done using Ecological Momentary Assessment (EMA), also called Experience Sampling Method (ESM). Perhaps the best-known tool for collecting EMA audio data is the Electronically Activated Recorder (EAR), which has facilitated many types of naturalistic studies [5] in a variety of settings, including couples in which one partner is diagnosed with cancer [25-28]. The EAR records 30 seconds of data every 12.5 minutes across 48 hours in the default sampling pattern [29], creating snapshots of everyday life. The goal of this approach is to balance the desire to capture more data and the resources required to analyze it. EMA can provide excellent information about everyday activity, social interaction, and self-reported psychological states [30]. Using “thin slices” of communication has been shown to have good predictive validity when compared to full samples in a variety of contexts, with the caveat that more or larger slices usually provide more predictive capability [31-34].

Despite the gains made to ecological validity using EMA methods, there are occasions in which the simplification of the approach limits the ability to fully answer a particular research question, such as when the phenomenon of interest involves potentially infrequent, spontaneous behavior. Although the EAR can capture somewhat low base-rate behaviors such as laughing or singing [5], there are even less frequent behaviors that may be missed completely using this data collection approach. For example, in our study our goal is to examine spontaneous talk couples engage in regarding cancer and their relationship, such as plans to cope with news delivered at an upcoming doctor’s appointment or their feelings for each other. Often, this occurs during very brief discussions or with little introductory context (e.g. “I’m not sure what we’ll do if those results come back positive.” “If I’m going out, I just want to spend time with you on the boat. Remember all those fishing trips…”). Short statements or the context setting conversations up as domain-relevant could be missed when using EMA.

Naturalistic discussions are critical to study because they provide an important perspective on how couples naturally cope together with cancer, plan together, or use their relationship as a resource and source of support. Researchers have identified these phenomena as important for patient and caregiver intimacy, quality of life, and health outcomes [8, 35-39]. However, little prospective research has been conducted on naturalistic all-day communication in couples. Meanwhile research suggests that couples often avoid difficult conversations [40-42]. In a setting with multiple competing demands and behavioral options, couples likely discuss specific topics a few minutes per day, if at all. Thus, there is a high likelihood that the EMA methods would completely miss, or only partially capture, this talk. For these extreme low-frequency spontaneous discussions, there is scientific value to continuous audio recording.

Digital recorders are now pocket size and have sufficient battery power and memory to store 18+ hours of data. They are also simple to operate, allowing participants to pause their own recordings. While we still allow participants to review their audio data, putting participants in control of their data in real time further ensures their privacy. By continually recording, we also avoid the uncertainty that can accompany use of the EAR about whether or not a particular conversation or event was captured.

In our study, we use Sony Digital Recorders (ICD-UX533), which have 4GB of internal memory and are relatively small (0.6x1.4x4”). Battery life, rather than memory, dictates the length of recording, typically up to 18 continuous hours. Often there is noise interference (e.g. television/radio), that limits the utility of voice-activated recording. Participants can carry the recorder in a pocket, with a lavalier microphone (Olympus ME-52W) clipped near the face to capture audio. Patient and caregiver each carry their own recording device, although data will be duplicated when the couple is together. Some researchers may consider using Bluetooth, GPS, or RFID technology to determine proximity and imply possible communication. However, in our study, we asked couples to participate on a day when they were planning to spend most of the day at home together. Thus, GPS would not likely be sensitive enough to show proximity and requires line of sight for accuracy. Additionally, we anticipated couples would frequently be proximal, but not talking (e.g. patient is napping, caregiver watching TV). Not using location technology increases processing time in that audio must be analyzed by humans to identify when communication occurs before codes can be assigned.

2.3 Coding

Perhaps the greatest current limitation to collecting continuous audio data is the resource use required in analysis. Many studies, including ours, use trained coders to identify behaviors within recordings. Often, this can be done directly from audio recordings, which can reduce transcription costs and provide contextual cues, such as tone of voice, improving validity. Software (e.g. Noldus Observer [43]) can assist in the coding process by allowing the researcher to timestamp the audio file to identify different codes (e.g. 3:15:24 to 3:17:45 is cancer talk). We can also specify modifiers for the code (who started the conversation, who else was involved, what valence) and make notes (e.g. providing more specificity about the topic). The software is able to handle large file sizes, assuming appropriate computer storage and processing speed.

However, manual coding does come with scalability and cost issues. Depending on the complexity of the coding scheme, it can take several times the length of a recording to code. For example, for simplistic coding systems (e.g. noting communication presence/absence), annotation may take a negligibly longer amount of time than the recording. But, for more complex coding systems, (e.g. RIAS, where every utterance is coded [44]), highly experienced coders will take 2-3 times the length of the recording, while less experienced coders may take significantly longer to identify a unit of analysis and determine the appropriate code [45].

In our study, we use coder teams. Coding partners are trained together, attend weekly coding meetings, and are encouraged to communicate with each other and the PI frequently to increase validity and reliability. Finding coders to analyze audio recordings is not generally difficult on university campuses, where many students are interested in gaining research experience. In addition, often students report that their coding experience is useful and provides perspective on the lives of individuals that can inform their future clinical and/or research careers.

Although coders associated with university laboratories may or may not be paid, all require resources in terms of time for training and professional development in addition to time associated with supervision of the actual coding. Also, thought must be given to the amount of coding a single individual is capable of. Even using simple coding systems and listening to less emotionally-draining conversations, coders can experience fatigue after a few hours, even with breaks and opportunities to rest and reflect [46]. It can be difficult to consistently code more than 10-15 hours/week; thus, a single "day in the life" recording can realistically represent an entire week's worth of work for one coder. Because of the need to establish reliability, multiple people code the same recording and to discuss and reconcile differences. Thus, it is imperative to budget monetary and time resources appropriately to support a large staff.

3. Future Directions: The Promise of Behavioral Signal Processing

While coding "day in the life" continuous audio recordings can be a challenging undertaking requiring a large staff, emerging technology again will open new doors to research by adding automation to elements of the coding process. For example, Behavioral Signal Processing (BSP) techniques can be used to process large amounts of data in a highly efficient, reliable, and precise manner [47, 48]. BSP involves the measurement, analysis, and modeling of human behavior signals, such as verbal and nonverbal communication like pitch or fundamental frequency. Using a cyclical and iterative design process of partial and targeted annotations by human coders, machine-learning BSP algorithms are developed and refined. This enables scalable and objective behavioral quantification.

For example, significant work has been done in couples therapy to analyze language [49-52], acoustics [53, 54], and the dynamics of the interaction [55-60]. Lexical behavior analysis in this work has shown that machine learning methods can achieve or surpass the levels of human coder reliability and validity. Further, automated methods are able to better predict therapy outcomes than behavioral coding by humans [61, 62]. This was despite human behavior coding being by multiple (>3) experts and employing audio-visual streams, in contrast to machine algorithms employing only acoustic information. This work is being extended in the field of Suicide Risk Assessment where spousal support and scalable observation are critical in prevention [63, 64].

Other fields have leveraged BSP algorithms to inform and enable human assessment and move towards intervention. For example, tools to assess Motivational Interviewing for Addiction have enabled scaling up behavioral coding [65-70] and are currently being applied to therapist fidelity assessment. In children's communication development, a repository of day-long recordings of children has been developed [71] and tools based on this data have been developed to deliver feedback to parents to increase quantity and quality of talk. Parallel work has also looked into automated autism diagnosis in children [72-74].

4. Conclusion

Collecting naturalistic audio data from couples allows for analysis of everyday communication. Daily natural communication can have important cumulative effects for healthy couples, but may have even greater impact for couples coping with advanced cancer. Capturing infrequent but meaningful behaviors, such as naturalistic discussions of cancer or the relationship, can lead to better conclusions about how communication impacts coping, relational processes, and health. This data is critical for future communications interventions to improve outcomes for both patients and their caregivers.

A primary barrier to conducting continuous longitudinal communication research is the extensive human effort required for analysis. However, similar to how evolving technology has eased barriers around battery and storage capacity in recording devices, we already see new technological solutions emerging, such as BSP. Further, technology can be leveraged into intervention development. Importantly, data needs to be collected before these tools can be developed. The time is ripe to advance the field of couples' communication.

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