Methodological approaches applicable to patient-provider interaction analysis: A mini-review

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Online platforms and smartphone applications that facilitate patient-provider communication are examples of how digital technologies support human interaction. Telehealth enables clinical encounters when physical consultations are not possible, and evidence confirms that face-to-face and remote healthcare encounters have comparable efficacy. Furthermore, research shows that patient-provider communication and relationship influence patient outcomes. However, we lack studies on what happens during these interactions, particularly in text-messages conversations, from a linguistic or behavioral perspective. Our research methods will evolve alongside our communication channels. Currently, there is an overall preference for qualitative methods in patient-provider communication research. Some authors argue that quantitative measures (clinical measurements, questionnaires) lack an understanding of the patients' experiences, whereas qualitative approaches (interviews, focus groups) provide the full picture. Others suggest their combination to interpret interactions thoroughly. As a result, it is often difficult for a communication researcher to choose between one or more approaches. We conducted a mini-review of qualitative approaches, such as corpus linguistics and conversation analysis, as well as quantitative approaches, such as analysis of variance and temporal pattern detection, for patient-provider communication analysis. Additionally, we distinguish relevant communicative features in synchronous or live interactions, such as video-calls, and asynchronous interactions, such as non-instant messaging. We further discuss these methods' potential for combination and their applications in digital communication research. We aim to guide researchers to choose a methodology for digital interaction studies. Our recommendations are based on these approaches' ability to answer a research question, and we suggest a mixed-methods approach in future digital communication research.

KEYWORDS

communication, digital health, patient-provider, conversation analysis, online interaction

Introduction

Information and communication technologies experience a steady rise since as they have proven to be an innovative, yet reliable, channel for human interaction (Rogers, 1986). These technologies provide new opportunities in our day to day life, and healthcare is a large field where they are constantly applied, particularly in terms of software applications (apps) (Mosa et al., 2012; Ventola, 2014), and instant messaging (Ezra et al., 2020; Nascimento et al., 2020). Furthermore, research has shown that telemedicine is a viable alternative to face-to-face consultations that is rapidly evolving in clinical interactions, particularly during the COVID-19 outbreak (Monaghesh and Hajizadeh, 2020). Today, both Healthcare Professionals (HCPs) and patients use digital communication on a regular basis. Telehealth facilitates clinical encounters when physical consultations are not possible, such as patients living in remote or rural areas (du Toit et al., 2019), and optimizes clinical appointments (Rienzo Renato, 2019). In addition, several studies have demonstrated a comparable efficacy when comparing face-to-face and remote encounters (Shigekawa et al., 2018), though these outcomes vary depending on the population, disease addressed, and methods used (Dellifraine and Dansky, 2008), as well as on their cost-effectiveness (Ekeland et al., 2010). Therefore, our research methodologies will evolve alongside these new communication channels. Patient-provider communication is an important component of clinical consultations that influences patient outcomes significantly (Street et al., 2009). Because of the dynamic nature of the interaction, each conversation is a one-of-a-kind result of its variables and how the parties construct the conversational sequence (Koudenburg et al., 2016). There is a preference for qualitative methods for analyzing content exchange during patient-provider communication, and how the interaction is organized sequentially (Finset, 2008). Some authors argue that quantitative measures (clinical measurements, questionnaires, or scales) lack an understanding of the patients' experiences, whereas qualitative approaches provide a full picture through more in-depth methods, such as interviews and focus group (Ngenye and Kreps, 2020). Inui and Carter started a debate about the optimal methodology for patient-provider interactions in 1982 after publishing their research on healthcare interaction analysis (IA) and its link with patient outcomes (Carter et al., 1982; Inui et al., 1982). Their investigations were inspired by the previous work on interactional processes in conversation by Bales (1950), Roter and Hall (1989), and Stiles and Putnam (1989). Patient IA can be combined with more traditional, qualitative methods to achieve a complete understanding of communication in a clinical setting that allows for improvement of patient outcomes (Mazzi, 2011; Vogl, 2017). Nevertheless, given the complexities of combining qualitative and quantitative methods, it is far from simple for a researcher to decide on the best methodology to investigate these interactions (Schegloff, 1993). To begin, it is important to distinguish between qualitative and quantitative methods, and determine their strengths and weaknesses. Figure 1 shows an overview of the framework presented on this paper.

Qualitative methods

Qualitative content analysis is the most used methodology in psycho-social research for analyzing human communication in a systematic and intersubjective manner (Mazzi, 2011). As described by Hsieh and Shannon, qualitative content methods can be grouped into three types according to the analytical approach: *conventional* if categories are generated during data analysis, *directed* if existing research is used to code the content, and *summative* if single words are individually screened for a pattern. The research objects should be both mutually exclusive and exhaustive (Hsieh and Shannon, 2005). Furthermore, Bell and Kravitz (2014) added two additional classifications in a patient-provider setting: first, the *coding approach*, which is considered *comprehensive* when every single unit of communication—or utterance—is classified or *focused* when only a particular communication element is coded e.g., a specific behavior; and second, *the coding dimension*, which can be *process*- or *content*-based. Processes describe abstract aspects of communication such as "asking for information", whereas content is dependent on the topic of the conversation, such as medication. Other authors use the terms *process theory*, which studies a series of dependent variables or events that lead to an outcome, and *variance theory*, which focuses on the relationship between independent and dependent variables to explain changes in the communication system (Poole, 2007). For these qualitative content analysis purposes, some researchers have developed specific coding tools in the context of patient-provider communication research, such as MEDICODE (Richard and Lussier, 2006) and TORP (Taxonomy of Requests by Patients) (Kravitz et al., 1999).

Conversation analysis (CA) is a broadly used qualitative methodology based on a sociolinguistic approach to human interactions. CA's research object is how two identically constructed utterances can have a different meaning, depending on the actions that take place during the conversation, both verbal, such as telling or asking, and non-verbal, such as voice tone and facial gestures (Have, 2007). These actions reflect the speakers' behaviors and follow an order of turns, which forms the turn-taking structure. According to the conversational norm, each party speaks at a time (their turn), and all the parties co-construct and organize the sequence structure as the conversation moves forward. Their participation reflects their understanding and their reaction

FIGURE 1
Schematic diagram of our dyadic interaction analysis framework.
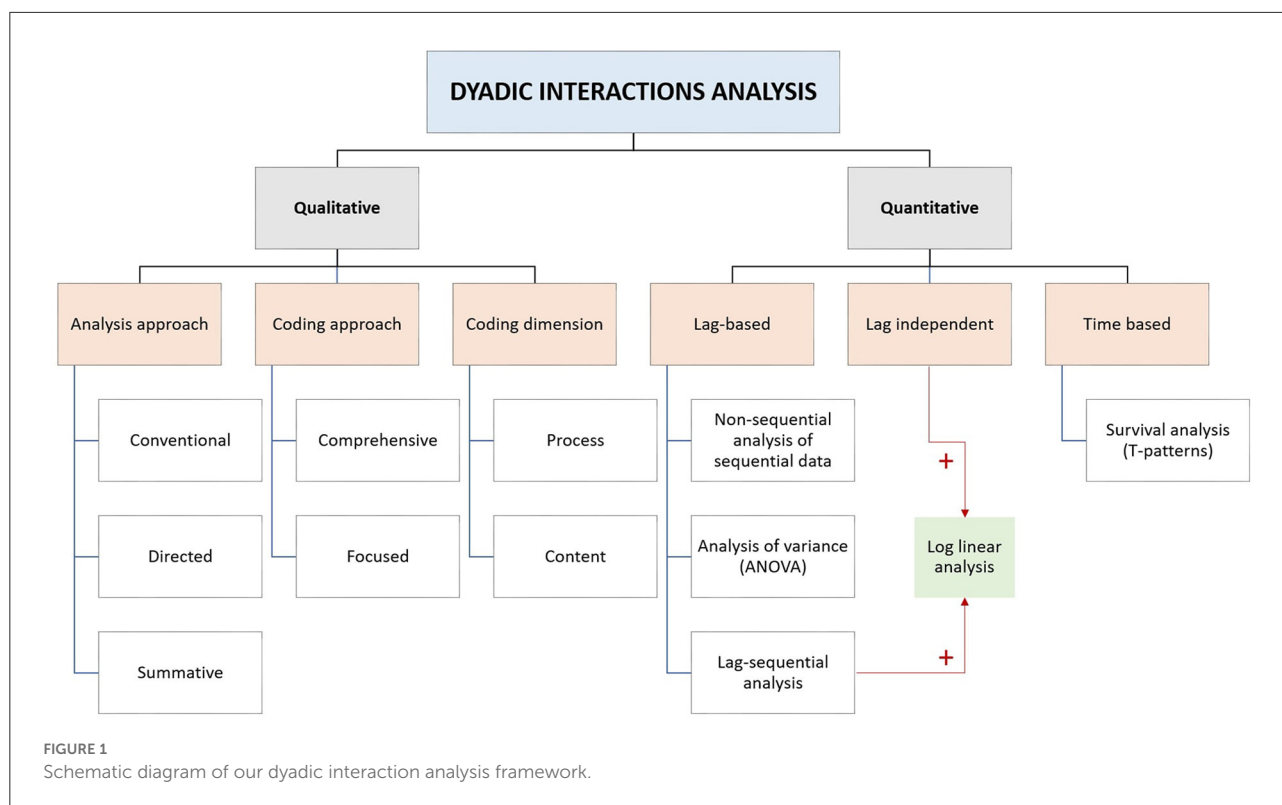
to the previous utterances. However, any of the speakers can deviate from the norm, for example, by interrupting or whispering to a speaker next to them (Hoey and Kendrick, 2017). CA has been successfully applied to several settings, such as classrooms, emergency calls, and clinical consultations (Symon and Cassell, 2012). There are two forms of CA: pure and applied (Chris, 2014). When we use a pure CA approach, we define the categories as the analysis takes place. According to Harvey Sacks and colleagues, this approach is a conventional qualitative analysis method (Sacks et al., 1974). Throughout the years, CA has become one of the most used methodologies for IA. The work of analysts in numerous conversations using CA over the years has facilitated the creation of standard categories. These categories correspond with *pure CA*, which includes the most found conversational structures in human interaction. Subsequently, *applied CA* has emerged as a qualitative analysis method where we use existing categories to code discipline-specific interactions. Additionally, it is possible to generate new categories during the analysis. Antaki (2011) differentiates six applied-CA categories: *foundational, social-problem oriented, communicational, diagnostic, institutional*, and *interventionist*. Out of these, the diagnostic, the institutional, and the interventionist CA are the most suitable to patient-provider communication analysis. Diagnostic-applied CA connects sequential speech features with clinical disorders, such as aphasia. Institutional CA observes

the interaction development in society's institutions, e.g., a medical setting. Furthermore, interventionist-applied CA identifies communication issues during an interaction e.g., a clinical consultation. Such CA approaches provide a deeper understanding of context-associated challenges to advice on how to manage them.

The nature of the communication will determine the methods we choose: synchronic interactions, such as video calls, are similar to face-to-face interactions, and thus their analysis is similar. Text messages can have the form of either synchronous or asynchronous written communication, depending on whether they are sent back and forth instantly or after a delay. The receiver is not expected by the sender to respond immediately in asynchronous communication, and has time to review and answer the message (Walther and Burgoon, 1992). Applied CA is suitable for the analysis of digital written interactions. However, some of the written language features differ from the spoken language. First, these interactions are "persistent" in time: messages remain visible for the respondent while they construct a reply and can be used for textual quotation, although quotation is possible in spoken interactions as well (Giles et al., 2015). Second, oral interaction has three distinct elements: message repair, paralinguistic cues, and number of speakers. In written communication, the responder may edit their message before sending it. The receiver is not able to see these repairs, as

they are an offline function. Likewise, the online speaker cannot display paralinguistic cues in a text setting, but they can imitate them through punctuation marks and emoticons (Herring and Androutsopoulos, 2015). Accordingly, the channel shapes the interaction. There are digital-specific features such as character limitations, links, GIFs, photos, #hashtags, and so on, that may include oral communications, e.g., videos and/or voice recordings (Arminen et al., 2016). The third difference between spoken and written language concerns conversation opening and turn adjacency (Meredith, 2017). Turns are adjacent when they are associated to each other. The speaker demonstrates their understanding of the prior turn in their current turn, what constitutes an adjacency pair. If this phenomenon does not take place, turn adjacency is disrupted and it might lead to miscommunication (Sacks et al., 1974). Herring raised this issue in a digital communication setting, particularly in interactions that involve more than two participants (Herring, 1999). Besides the variable number of participants in online conversations, these may be public or private. Forums and social networks are good examples considered by digital writing research (Lindemann et al., 2016), where digital CA has emerged as a form of applied CA (Reeves and Brown, 2016; Warren, 2018). To date, digital interactions research has primarily used standard qualitative methods, such as interviews and focus groups (Hefner et al., 2019), or intervention–relevant outcomes, such as weight loss (McVay et al., 2019) or pain (Seppen et al., 2020). Surveys and self-questionnaires are helpful to assess the behavioral effects, i.e., interaction and communication outcomes. However, these methods fail to analyse the actual communication processes that occur between the provider and the patient (Verhoeven et al., 2010; de Jong et al., 2014). Some authors have recently used CA in an asynchronous digital communication context, which may appear problematic given CA's innate synchrony. However, McHoul demonstrated that the sense-making processes and methods that take place while we read a text are comparable to those described by Sacks in spoken interactions (McHoul, 1982). A text follows a structure or "reading path" (Have, 1999) that the participants negotiate during an online, written discussion in a forum, a group, or a dyadic conversation (Gibson, 2009). Garcia and Baker Jacobs (1999) conducted the first analysis of written digital communication using CA in a "quasi-synchronous" setting, a group chat. They concluded that the nature of this quasi-synchronous turn-taking system is not better or worse, but "differently abled". In addition, that, as we previously described, this system has different features from spoken language. For example, participants write their messages with no competition for the right to post a message, and the other way around. Conversation participants receive an unalterable message, although repair is possible in further messages for any of the speakers. Furthermore, Garcia and Jacobs predicted that chat and asynchronous messages would become more familiar in day-to-day interactions as we know

them today. Likewise, some authors have applied CA to digital learning environments by classifying the utterances, e.g., long-answer, short-answer, and task-oriented questions, for utterance frequency and patterning recognition studies (Irani and Chalak, 2016). Others have explored the use of conversational features such as agreements, personal experiences, and stories, and cognition verbs in this asynchronous setting (Paulus et al., 2018). Virtanen and Kääntä combined digital CA (Giles et al., 2015) and written-dialogue methods from the Textual Interaction Studies (TIS) field. Their results illustrated the dynamics of asynchronous online interactions and proved the affinity of those two perspectives (Virtanen and Kääntä, 2018). The most recent research on the topic has investigated the linguistic and paralinguistic elements (Rendle-Short, 2015; Vázquez-Cano et al., 2015) and orthographic errors (Vázquez-Cano et al., 2019) in digital communication. Another area of study are the specific resources in instant messaging conversations, such as laughter and emoticons (Petitjean and Morel, 2017; König, 2019). However, little research has been conducted on asynchronous, digital patient-provider interactions.

Quantitative methods

There is a variety of quantitative methods to statistically associate qualitative categories and patient outcomes (Street et al., 2009), and to investigate whether these are influenced by specific factors such as gender (Schmid Mast et al., 2011; Shin et al., 2015), race (Mujica et al., 2020), or age (Gilbert and Hayes, 2009). Roter's Interaction Analysis System (RIAS) (Roter and Larson, 2001) is the most widely used. As we explained previously, the unit of analysis in IA is the frequency of utterances. RIAS defines specific categories for the doctors' and the patients' utterances, which coders register in a sequential order that includes time. The quantitative analysis of those categories includes percentages and doctor to patient ratios that contribute to the speakers' interaction profiling. However, there is no defined methodology for the exploration of these sequential records in a meaningful way, as stated by Roter and Larson (2002). Others authors have described sequential approaches for patient-provider conversation dynamics (Abbott, 1995; Zimmermann et al., 2007; Bensing and Verheul, 2009) and behavioral research IA (Mazzi, 2011). For example, the Relational Communication Control Coding System (RCCS) (Ericson and Rogers, 2004) codes utterances in pairs, with the second utterance categorized in relation to the preceding one. Additionally, the General Sequential Querier (GSEQ) software enables the identification of sequential patterns in the interaction coded by RCCS (Bakeman and Quera, 1995). Connor et al. (2009) conducted a critical review of existing methods for sequential analysis in dyadic interactions. These authors differentiate three analysis categories: lag-based, lag-independent, and time-based. A *lag*

is an interval of time that precedes an utterance. There are three lag-based methodologies: *non-sequential analyses of sequential data*, for example, the proportion of utterances that respond to a specific process; *analysis of variance (ANOVA),* to compare utterances and detect changes in sequential processes; and *lag-sequential analyses,* that record the frequency between utterances and report statistically significant sequences. This last category is the largest in Connor et al.'s classification and can be combined with log linear analysis to draw a relationship between the lags and two or more categorical variables. A categorical variable has two or more values, and is either nominal or ordinal. For example, sex, educational level, or the groups in a randomized study (Allen et al., 2008). *Lag-independent methods* (for example, utterances- and turns-based) are also compatible with log linear analysis to find associations with categorical variables. These methods, however, do not consider time. If we are interested on this variable, common time-based methodologies apply what in statistics is called a survival analysis (Clark et al., 2003). This kind of analysis measures the time until an event occurs; in our context, an utterance. The timespan between utterances, known as (T-) pattern, is useful to predict the next utterance or to detect temporal patterns. For additional guidance, Allen et al. (2008) have developed a comprehensive manual for quantitative methods in communication.

Discussion

This mini-review provides an overview of the methodologies that are applicable in digital health communication. The most extended approach in communication research, as we previously noted, is qualitative research, mostly because of its flexibility and adaptability. Qualitative methodologies are suitable for exploratory research on a subject that is largely un-investigated and/or calls for a human interpretation or generation of ideas (Denzin and Lincoln, 2017). This is often the case with communication research. For example, content analysis classifies the conversation themes, while quantitative approaches offer a numerical perspective of how communication unfolds. The latter facilitates the reproducibility and generalization of results, and can be used to develop a theory to explain how a phenomena occurs (Allen et al., 2008). For example, establishing the common behaviors that deal with anxiety in childhood. However, there are communication approaches that may use a qualitative and/or a quantitative approach. Similar to CA, *corpus linguistics* studies the meaning made through a sequence of words, although this approach is characterized by the analysis of a large language corpora ("body" in Latin). Corpus linguistics searches for lexical and grammatical patterns, such as frequency of words or sentences. This quantitative data may be interpreted qualitatively, for

example, categorizing the topics or situations in which these patterns take place and why (Bennett, 2010). For these reasons, the choice between qualitative and quantitative methods is dependent on the research question that we try to answer. When the question is built upon the "how" it is convenient to rely on qualitative research (Britten, 2011). For example, "how is empathy expressed in text messages communication?" or "how do coaches build a relationship with their clients?". Questions starting with "what" are common in quantitative studies (Allen et al., 2008), such as "what are the most common infections among pregnant women?" or "what is the relationship between TV time and child obesity?". Nonetheless, "what" is also applicable to qualitative research questions such as "what opinions do European citizens share about refugees?". Although they are inclined to use qualitative approaches to study communication, many communication researchers use statistical calculations. We can quantify qualitative data, for example, as the number of times that a behavior occurs, the frequency of emotions in percentages, or even the number of words. There are various approaches for this (Pope et al., 2000; Frericks, 2022). A digital setting such as text messaging facilitates the mixed-methods data collection and analysis. The use of correlations or relationships analyses can help us understand the mechanisms of communication-related elements. There is recent work that supports this statement about research in online communication. Yip performed a content analysis of types of social support in online groups for anxiety and depression, and subsequently applied CA to account for the sequential structure. He presented his results in tables showing the frequency and proportions of categories (Yip, 2020). Those results allowed him to draw conclusions about the individuals' emotions (qualitative) and to generalize how people with anxiety and/or depression use these online support groups (quantitative). Gieselmann and his team interviewed patients in an RCT for chat-based vs. face-to-face psychotherapy for insomnia (Gieselmann et al., 2021). They performed a content analysis of the interviews' transcripts and subsequent statistical difference analyses to allow for generalization of the treatment outcomes, i.e., sleep quality. Others have combined thematic analysis and quantitative language analysis methods such as keywords and collocation patterns (Lustig et al., 2021). Collocation is present in CA and corpus linguistic analyses, and studies word-combination units, where two or more words co-occur with a higher frequency than would be expected (Sinclair, 1991). Moreover, a recent mixed-methods systematic review conducted by Luo et al. (2021) on physical activity promotion *via* conversational agents (such as chatbots or virtual agents) showed the increasing need for mixed methods studies appraisal in future reviews. This highlights not only the increasing need for applying mixed methods in future research, for also for improving their understanding and systematic reviewing, in order to evaluate these type of studies.

Author contributions

ERV conducted the mini-review, synthesized the results, and prepared and edited the manuscript until submission. HP contributed to the data analysis and interpretation processes and participated in the manuscript reviewing process. TS conceived the research, supported the interpretation and discussion of results, and reviewed the final manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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