

Technology-assisted methods to assess the quality of the therapeutic alliance between health care providers and patients: a scoping review protocol

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ABSTRACT

Objective: The goal of this review is to identify and summarize technology-assisted methods that are being used in clinical, research, or educational settings to assess non-verbal behaviors that have been identified as contributors to the quality of the therapeutic alliance between health care providers and patients.

Introduction: A strong therapeutic alliance is a critical component of positive patient outcomes. A health care provider's non-verbal behaviors help build a strong therapeutic alliance, but practice with expert feedback is often required to develop desirable non-verbal behaviors. Advances in technology have been harnessed to assess and provide feedback to health care providers, but the technological tools can be difficult to find and compare. Technology-assisted feedback has the potential to help health care providers hone important clinical skills without requiring highly trained instructors, improving medical care overall.

Inclusion criteria: This review will consider quantitative and qualitative studies, as well as review articles. Participants must be health care providers (or students) who routinely conduct appointments with patients. Included studies must incorporate technology-assisted methods that are being used to collect or analyze information regarding at least one behavior associated with the therapeutic alliance in a clinical, research, or educational setting. Any type of patient encounter, whether actual, actor-based, virtual reality, or simulation-based, will be included.

Methods: Five bibliographic databases will be searched, with results limited to English-language articles published from 2010 to the present. The search strategy yielded 404 results in PubMed. The proposed methodology follows the JBI methodology for scoping reviews.

Keywords: artificial intelligence; assessment; health care provider; technology-assisted; therapeutic alliance

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Introduction

The relationship between a health care provider and a patient is called the “therapeutic alliance” (also known as the “patient-clinician relationship”). The concept of the therapeutic alliance was formally conceived in the field of psychotherapy early in the 20th century and generalized to medical settings beyond psychotherapy in 1979 by Bordin.¹ A therapeutic alliance is defined as a collaboration between patient and provider, the quality of which is framed

by agreement on tasks to be done and on the emotional bond between the two.¹

As suggested by the definition, the therapeutic alliance has a cognitive (task-related) component and an emotional, or affective, component.^{2,3} The cognitive component is more directly related to the verbal content of the interaction between a health care provider and a patient, which includes exchange of information, patient education, and agreement on the goals of a treatment.^{1,3} The emotional component is associated with the bond that forms between the health care provider and patient, which is based on perceptions of empathy, trust, respect, and acceptance. The emotional component has both verbal and non-verbal components, and there is evidence

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that information obtained by non-verbal communication can be more important than verbal communication in establishing a person's perception of an interaction.⁴

Establishment of a strong therapeutic alliance is a critical skill for professionals who work on an individual basis with patients. Benefits accrue to both health care provider and patient when the health care provider–patient relationship is strong. For example, the therapeutic alliance has been empirically shown to improve patient compliance,^{5–7} patient satisfaction with treatment,⁷ and a variety of treatment outcomes,^{6,8} including symptom resolution, blood pressure reduction,⁸ reported pain reduction,^{6,8,9} and improved quality of life.⁶ Health care providers also benefit from improved compliance and outcomes for their patients. Furthermore, health care providers who form strong therapeutic alliances are subject to fewer malpractice lawsuits.¹⁰

Measuring the therapeutic alliance between a health care provider and a patient has been approached in several ways. Psychometrically validated surveys such as the Working Alliance Inventory (WAI)¹¹ along with at least 31 others,¹² have been developed and used. However, survey-based instruments designed to measure therapeutic alliance have been criticized for having vague construction of subscales and unclear interpretation.¹² Surveys also depend heavily on the biased perceptions of the respondents. Additionally, respondent fatigue may lower reliability when surveys are administered multiple times for multiple health care providers or time points. Given the limitations of survey-based measures, other approaches to measuring therapeutic alliance have focused on analysis of transcripts, audio recordings, or video recordings.¹³ Using recordings to assess therapeutic alliance allows a health care provider to review his or her own interactions, but gaining an expert rater's quantitative or qualitative feedback regarding behaviors based on transcripts, audio recordings, or video recordings has generally involved significant effort to create and save recordings, extract transcripts, and score interactions for desired behaviors or verbal exchanges.^{14,15}

In recent years, technology for the recognition, extraction, and analysis of information from video and audio recordings has improved exponentially,¹⁶ which creates new opportunities for the automated acquisition and analysis of human interactions. It is increasingly possible to use technology-assisted

methodologies to look at both the cognitive component (through automatically transcribed text analysis) and the non-verbal emotional component (through video, filtered audio, or wearable technology analysis) of the therapeutic alliance.¹⁷ A critical first step toward harnessing technology-assisted methodologies to study or rate interactions between health care providers and patients is to define desirable and undesirable behaviors.

The specific behaviors that affect the therapeutic alliance have been addressed in some detail in the scientific literature.^{7,18} Because the types of tasks, and therefore the technology, associated with the verbal and non-verbal components are likely to be vastly different, the focus of this scoping review will be on technology-assisted methodologies that address the non-verbal emotional component of an interaction between a health care provider and a patient. It is valid to separate the two, as survey-based analysis has revealed that the emotional component can be measured separately from the cognitive component,¹⁹ and deficits in the emotional component alone can lead to worse patient outcomes.²⁰ The systematic reviews authored by Pinto *et al.*¹⁸ and Henry *et al.*²¹ discussed non-verbal behaviors and outcomes related to interactions between health care providers and patients in the scientific literature, and the results are briefly reviewed here to identify the behaviors that will be considered in the scoping review. The systematic reviews revealed heterogeneity of outcomes related to particular non-verbal behaviors, but it is likely that some of the heterogeneity is culturally based²² and should therefore be considered an opportunity for future research rather than weak evidence for the importance of a particular non-verbal behavior.

Potentially important non-verbal behaviors were categorized into the areas of social touch, tone of voice, facial expression, eye contact or gaze, non-verbal encouragement, physical positioning, and synchrony between health care provider and patient. More social touch from physicians was associated with lower patient satisfaction in one study, but in the other two studies there was no effect. A friendly, warm, or supportive tone of voice was associated with patient satisfaction or treatment adherence in three separate studies, while a hostile physician voice was associated with worse physical health in patients. In a different study, angry or anxious physicians' voices were associated with greater patient

satisfaction. More facial expressiveness was associated with better patient outcomes in one study, and facial expressions suggesting negative emotions were associated with better patient outcome ratings in another. When the health care provider spent more time looking toward the patient, patients had either greater satisfaction (two studies) or there was no effect (four studies). There was mixed evidence regarding the impact of non-verbal encouragement, such as nods and gestures, with one study finding higher patient satisfaction associated with non-verbal encouragement and another associating non-verbal encouragement with lower patient satisfaction. Worse patient outcomes were associated with health care providers who shrugged more during the health care provider to patient interaction. Direct orientation toward the patient and physical positioning close to the patient were associated with higher satisfaction and comprehension of treatment plans in patients. A backwards lean away from the patient resulted in lower satisfaction ratings, while leaning forward was associated with positive ratings.¹⁰ Closed body language, such as crossed legs and asymmetrical arm posture, was associated with a lower quality therapeutic alliance. Finally, synchrony, where health care providers and patients mirror each other's movements, was shown to reduce and improve patient outcomes in separate studies.

A serious challenge to providing training in patient communications for students or professionals is that critiquing interactions requires expert raters, and it is both subjective and time-consuming. Adding technology-assisted methods to help health care providers and trainees understand and improve non-verbal communication can improve health care and relieve pressure on trainers and teachers of health care professionals and students who plan to enter health care professions. Without sufficient training, young medical professionals tend to be poor communicators.²³ Many communication problems could potentially be identified by technology-assisted methods to help health care providers and students hone skills in patient interaction. Training programs that provide feedback to medical students or professionals during electronically gathered replay have already been shown to have lasting impacts on health care provider behaviors and on patient satisfaction five years after the intervention; and trainees who received feedback outperformed those who were provided training that did not

include feedback.^{24,25} A notable advantage of technological feedback is that the high levels of repetition needed to achieve mastery can be supported for each health care professional or trainee.

The objective of this scoping review is to identify and summarize currently available and developing technologies that are being used to collect and/or provide automated feedback on non-verbal behaviors that are known to affect the quality of the therapeutic alliance between health care providers and patients. The technologies that will be the focus of this scoping review are exemplified by a recently reported method for rating human interactions.¹⁷ The investigators used wearable cameras to measure facial distances, body positioning, and eye contact (analyzed based on deep neural networks) during interactions between caregivers and patients. The analysis used an algorithm to rate caregivers based on defined criteria. The technologies that are used in this way are reported in publications focusing on the full range of medical fields, humanism, and engineering; they are therefore not accessible to most interested parties in their current dispersed form. The review will inform teachers, trainers, or health care employers who are responsible for developing or improving non-verbal communication skills to help implement technologies to improve education that will lead to success for patients and health care providers. The identified technology-assisted methods also have the potential to provide a consistent data collection method for research on specific behaviors and patient outcomes relative to contextual factors, such as the setting and the identity of the health care provider, during a clinical interaction.

A scoping review was undertaken because the topic encompasses disparate sub-topics that must be categorized and evaluated, and the fast-changing nature of technology necessitates an open review of available tools rather than a well-defined but potentially antiquated systematic review question. On July 30, 2020, a search of PROSPERO, MEDLINE (PubMed), CADTH, Cochrane Library, and *JBI Evidence Synthesis* was performed and revealed no systematic review or proposals in progress on this topic.

Review questions

What technology-assisted methods are being used in clinical, research, or educational settings to assess non-verbal behaviors that build a high quality

therapeutic alliance between health care providers and patients? To answer the overall question, the following sub-questions will be considered:

- What technology-assisted methods can collect non-verbal behaviors of health care providers in a clinical, research, or educational setting?
- What technology-assisted methods can interpret non-verbal behavior data to provide feedback to health care providers?
- Which non-verbal behaviors known to build a therapeutic alliance between health care providers and patients can be assessed by the identified technology-assisted methods?

Inclusion criteria

Participants

This review will consider studies that collect behaviors of health care providers, or students who aspire to be health care providers, who routinely conduct appointments with patients as part of their practice. Clinicians such as allopathic and osteopathic physicians, physician assistants, nurse practitioners, therapists, and dentists will be included. Matriculated students or trainees in programs that prepare them to practice in the aforementioned health care professions will also be included. No limits will be placed on the type of patient encounter (real, simulated, virtual reality, etc.) included in the study. Studies that focus on patient behaviors rather than physician behaviors will be excluded.

Concept

The concept of interest is technology-assisted methods that are being used to assess at least one behavior associated with a therapeutic alliance in a clinical, research, or educational setting. For the purpose of this review, a behavior associated with a positive provider-patient relationship is defined as any health care provider behavior that has been identified in a systematic review or meta-analysis of health care provider-patient interactions as having a positive or negative influence on the relationship between health care providers and patients. Specifically, the following non-verbal behaviors will be included: social touch, tone of voice, facial expression, eye contact or gaze, non-verbal encouragement, physical positioning, and synchrony between health care provider and patient. The term “technology-assisted methods” will be broadly defined as any technology that can either collect information about one or more

of the behaviors identified here or can analyze and interpret information about such behaviors to provide a rating or feedback. For the purposes of this review, only technology-assisted methods that can either collect or interpret non-verbal health care provider behavior with minimal direct interaction by a human will be considered.

Minimal direct interaction by a human is defined as requiring only set-up or simple report extraction under normal operating conditions. Any technology-assisted method that requires constant supervision during the non-verbal behavior data acquisition process (eg, a camera operator) or customized human analysis (eg, an expert providing a rating or comments associated with a video, or a data analyst) will be excluded. In assessing whether a technology requires minimal direct interaction by a human, the acquisition of non-verbal behaviors and the interpretation of non-verbal behaviors will be considered separately, so it is possible that some technology-assisted methods have an acquisition method that meets the inclusion criteria and an interpretation method that does not. In such cases, the reason for exclusion of the interpretation method will be noted in the data extraction tool. It is anticipated that technology-assisted methods, such as audio or video collection devices and software, wearable technology, computers, and software that are able to analyze audio or video files, and/or algorithms that use machine learning or artificial intelligence to interpret human interactions and behavior, might all be important components of a system that can assess non-verbal health care provider-patient interactions.

Context

For this review, real or simulated clinical interactions, research settings, and educational settings that are designed to mimic clinical interactions will be included. There will be no geographical limitations because the purpose of the review is to identify technology. Since cultural context can also affect the impact of behaviors on patient outcomes,²² the behaviors that will be included are broadly defined to maximize the utility of the scoping review.

Types of sources

This scoping review will consider qualitative, quantitative, and mixed methods study designs, as well as literature reviews that meet the inclusion criteria. Gray literature will be included, but opinion articles

will not. Included studies must be published in English, with publication dates between 2010 to present. A 10-year window was chosen because the topic under review involves rapidly changing technology, and information quickly becomes obsolete.

Methods

The proposed scoping review will be conducted in accordance with JBI methodology.²⁶

Search strategy

The search strategy will aim to locate both published and unpublished studies. An initial limited search of MEDLINE (via PubMed), Embase (via Elsevier), and Scopus (via Elsevier) was undertaken to identify articles on the topic in August of 2019 and again during May, June, and July of 2020. The search strategy was significantly reworked after reviewer comments and peer review by a second librarian using Peer Review of Electronic Search Strategies (PRESS) guidelines.²⁷ The search strategy employs keywords and controlled vocabulary, including MeSH, for the three components of the review question: health care provider (in the broadest sense, including students), technology-assisted methods, and therapeutic alliance. The concepts were derived using a PCC framework. Search terms were individually tested and reviewed by the authors to determine relevance for inclusion in the overall strategy (Appendix I). The search strategy, including all identified keywords and index terms, will be adapted to meet the specifications for each included information source. Finally, the reference lists of all studies selected will be screened for additional studies.

The following bibliographic databases will be searched: MEDLINE (PubMed), Embase (via Elsevier), CINAHL (via EBSCO), ERIC (via EBSCO), and Scopus (via Elsevier). Sources of unpublished studies and gray literature to be searched include Embase (via Elsevier) and Scopus (via Elsevier).

Study selection

Following the search, all identified citations will be collated and uploaded into RefWorks (ProQuest LLC, Ann Arbor, USA). Duplicates will be removed. Titles and abstracts will then be screened by two independent reviewers for assessment against the inclusion criteria for the review. Potentially relevant studies will be retrieved in full and their citation

details imported into the JBI System for the Unified Management, Assessment and Review of Information (JBI SUMARI; JBI, Adelaide, Australia).²⁸ The full text of selected citations will be assessed in detail against the inclusion criteria by two independent reviewers. Reasons for exclusion of full text studies that do not meet the inclusion criteria will be recorded and reported in the systematic review. Any disagreements that arise between the reviewers at each stage of the study selection process will be resolved through discussion or with a third reviewer. The results of the search will be reported in full in the final systematic review and presented in a Preferred Reporting Items for Systematic Reviews and Meta-analyses for Scoping Reviews (PRISMA-ScR) flow diagram.^{29,30}

Data extraction

Data will be extracted from papers by two independent reviewers using the customized data extraction tool in Appendix II. The tool includes specific details about the health care providers and patients, the data collection methods, the methods for automated analysis of the data, the health care provider behavior(s) and (if relevant) the patient outcome that was studied, and any comparisons or other type of methodological validation reported in the paper. During data extraction, any disagreements that arise between the reviewers will be resolved through discussion or with a third reviewer. Authors of papers will be contacted to request missing or additional data where required.

Data presentation

The findings will be presented in narrative form, including tables and figures to aid in data presentation as appropriate.

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Appendix I: Search strategy

Database: PubMed

Search conducted on July 29, 2020

Filters: 2010–2020, English language

Search #1: Participants

Search #2: Technology-assisted methods

Search #3: Therapeutic alliance

Search #4 was peer reviewed.

Search number	Query	Results retrieved
1	("Doctor*" [tiab] OR "Surgeons" [tw] OR "primary care provider" [tiab] OR "Dentists" [tw] OR "GP*" [tiab] OR "Nurses" [tw] OR "Clinician*" [tiab] OR "Therapist*" [tiab] OR "Physicians" [tw] OR "physician assistant" [tw] OR "students, medical" [tw] OR "students, nursing" [tw] OR "general practitioner*" [tw] OR "health personnel" [tw] OR "internship and residency" [tw])	534,616
2	("artificial intelligence" [tw] OR "virtual reality" [tw] OR "pattern recognition, automated" [tw] OR "electronic tool*" [tiab] OR "biomedical technology" [tw] OR "digital tool*" [tiab] OR "computer-assisted instruction" [tw] OR "technology-assisted method*" [tiab])	40,680
3	("Physician-Patient Relations" [tw] OR "professional-patient relations" [tw] OR "nonverbal communication" [tw] OR "therapeutic alliance" [tiab] OR "patient-clinician relations*" [tiab] OR "empathy" [tw] OR "relationship*" [tiab] OR "Interpersonal Relations" [tw] OR "rapport*" [tiab] OR "patient-centered" [tiab])	664,884
4	1 AND 2 AND 3	404

Appendix II: Data extraction instrument

The data extraction instrument will include the following fields:

Study information:

- Author
- Year
- Title

Participants

- Health care provider type
- Level of health care provider (student, resident, working professional)
- Patient type (model, virtual, real clinical interaction)

Context

- Country where study took place
- Setting (school, hospital, clinic, research laboratory)

Concept

- Technology-assisted method(s) for collecting health care provider-patient interactions
 - Included behaviors that were collected
- Technology-assisted method(s) for analyzing and interpreting health care provider-patient interactions
 - Type of feedback given to user
- Outcomes
 - Changes to health care provider behaviors
 - Changes to patient opinions or outcomes

Other validation of the data or feedback provided by the technology-assisted methods