

Technological Characteristics of Conversational Agents Used for Health-Related Purposes – A Systematic Review

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Abstract

Despite the growing popularity of conversational agents, little is known about how these systems are being used for health-related purposes. We conducted a systematic review of studies evaluating conversational agents used to support patients, consumers, or healthcare professionals. We found 17 articles describing the evaluation of 14 conversational agents. The majority of conversational agents had limited dialogue flexibility. Personalization features and discourse awareness were present in 7 and 8 conversational agents, respectively.

Introduction

Advances in voice recognition, natural language processing, and artificial intelligence have led to the increasing use of conversational agents—systems that mimic human conversation using natural language¹. Considering the expanding capabilities of these systems, they are expected to play an increasingly important role in the health domain, such as assisting clinicians during consultations and supporting consumers with their self-care tasks, among others. Our aim was to systematically review studies of conversational agents used for health-related purposes to identify common features and technical approaches to dialogue management.

Methods

We searched PubMed, Embase, CINAHL, PsycInfo, and ACM Digital using search terms related to “conversational agents”, “dialogue systems”, and “chatbots”. Studies were included if they focused on patients, consumers or healthcare professionals, and evaluated a conversational agent. Studies were screened by two independent reviewers; Cohen’s kappa measured inter-coder agreement. Any remaining disagreements about inclusion or exclusion of an article were resolved by a third investigator. In a narrative synthesis of the results, the conversational agents were characterized according to their technical characteristics, focusing on aspects related to dialogue flexibility.

Results

The database search retrieved 1513 citations; 17 articles (evaluating 14 different conversational agents) met the inclusion criteria. Two studies were randomized controlled trials^{2,3}, one was cross-sectional⁴, and the remaining were quasi-experimental. Half of the conversational agents supported consumers with self-care tasks^{2,4-9}, 4 supported clinicians’ work (e.g. autonomously conducting clinical interviews)^{3,10-12}. Three were used in applications supporting both clinicians and patients (e.g. telemonitoring)¹³⁻¹⁷. Conversational agents were supported by different types of technology, including apps delivered via mobile device, web, or computer^{2-6,8,9,11,12}, short message service⁷, telephone¹²⁻¹⁸, and a multimodal platform¹⁰.

Dialogue flexibility was dependent on several factors, including dialogue initiative (i.e. ability to lead the conversation), presence and type of personalization (i.e. capacity to adapt and tailor the conversation based on user characteristics and information), and discourse awareness (i.e. ability to consider previous utterances in the same conversation, in order to understand and maintain conversational context). Dialogue initiative belonged to the system in 6 conversational agents^{3,5,10,11,13-15,18}, it was mixed in 7 agents^{2,6-9,12,16,17}, and belonged to the user in one system⁴.

Personalization was available for 7 of the 14 conversational agents. For 2 of these, the personalization was static, where the system tailored the conversation based on information provided by the users at the setup stage (e.g. the user’s name and current medications)^{4,7}. For the other 5 conversational agents, the personalization was dynamic, where the agents adapted their responses based on information they acquired about the user during interactions (e.g. measures of the user’s level of expertise using the system; blood pressure)^{2,8,13-18}.

Discourse awareness describes the capacity for a conversational agent to store information about the user and the context of the situation and then use it to inform its responses in subsequent turns of the conversation. Discourse awareness was present in 8 conversational agents^{2,6-8,12-18}. We found no evidence that the dialogue systems used in the other 6 conversational agents were able to engage in multi-turn conversations^{3-5,9-11}.

Conclusion

This is an emerging field of research, where the few published studies were mainly quasi-experimental. The majority of conversational agents used for health-related purposes had limited dialogue flexibility. Personalization and discourse awareness were present in around half of the evaluated conversational agents.

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