NM3237 Health Communication Final Report

Perceived Dimensions of Risks from Perceived Anthropomorphism in Chatbots Delivery of Healthcare Services

5840 words (Excluding In Text Citations)

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1 Introduction

1.1 Introducing the Background Problem

COVID-19 engendered the Great Resignation Trend around the world, and Singapore was no exception. About 1500 nurses, especially foreign nurses, resigned in the first half of 2021 ("The Great Resignation," 2022). The sudden shortage of healthcare workers could put Singapore in a vulnerable position when dealing with COVID-19 in the future, and other issues like an aging population (Cairns, 2021). Even though there have been monetary incentives to encourage nurses to stay, the increased burnout from harsh work conditions arising from long work hours, risk of COVID-19 exposure, underappreciation, and the inability to clear accumulated leave has taken a toll on healthcare individuals (Teo, 2021). A short-term solution could be to look for more foreign nurses or craft other methods to retain staff, but these still take time and do not resolve staff turnover issues (Tan, 2021; Teo, 2022). With a diminishing workforce and an increasing number of patients (Cairns, 2021), the pandemic has brought forward the need to reduce the burden on healthcare workers through contactless and remote healthcare solutions. One way to tackle the staffing shortage in the long term would be to look into the use of AI and robotics, exemplary in Changi General Hospital (Cairns, 2021).

1.2 Research Proposal to Uncover the Phenomena of Risk

The major benefit of AI is its ability to automate routine and time-intensive tasks in the delivery of healthcare services, freeing up medical professionals' time to focus on critical duties. However, AI comes with risks. The certainty that AI-based virtual assistants can offer the same degree of Patient-Centered Care (PCC) as a doctor during an in-person consultation is unknown. For instance, a chatbot may not be able to give proper medical interviews with a patient to understand his condition fully and is also unable to deliver information in the same manner as a doctor (e.g., delivery of bad news requires some "human connection" which a chatbot lacks). Thus, as much as a virtual assistant would be able to lighten the workload of healthcare workers regarding certain tasks, in the event that the quality of service provided is sub-par, that would defeat the purpose of having a virtual assistant in the first place.

The various challenges of using robotics and AI in healthcare have been brought up in existing literature, and this validates the concerns over the effectiveness of chatbots in healthcare

service delivery. One such concern is the patient's acceptance of a service robot, and the various factors that affect it are illustrated in Figure 1 below:

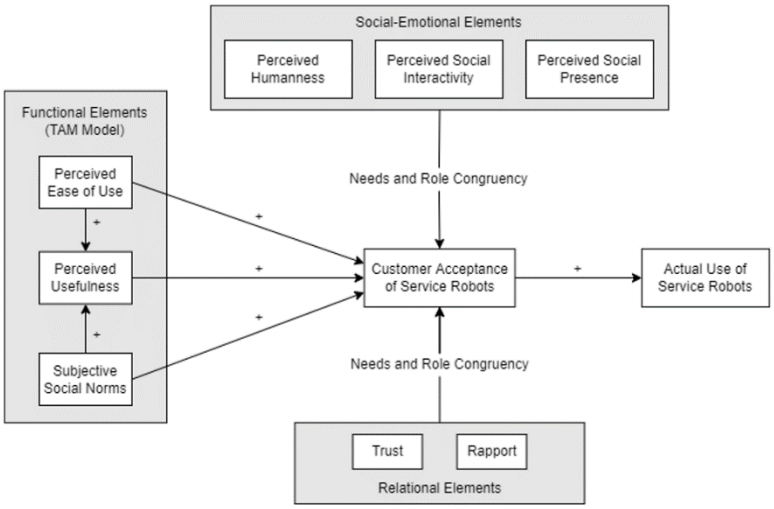

Figure 1

Service Robot Acceptance Model (SRAM) based on the Technology Acceptance Model (TAM) by adding social-emotional and relational needs. Adapted from "Brave new world: service robots in the frontline," by Wirtz, J., Patterson, P.G., Kunz, W.H., Grube T., Lu, V.N., Paluch, S. & Martins, A., 2018, *Journal of Service Management, 29*(5), p. 916.

Figure 1 reveals that perceived humanness, or perceived anthropomorphism is a contributing factor to the acceptance of service robots based on the Technology Acceptance Model (TAM). And to further break down perceived anthropomorphism, reference was made to the model in Figure 2, which describes the 4 main factors that make up perceived anthropomorphism (interactivity, voice capabilities, facial expressions, and physical appearance). Since perceived anthropomorphism is a relevant variable in patient-robot interaction, it can be said that perceived anthropomorphism would also influence the acceptance of a chatbot.

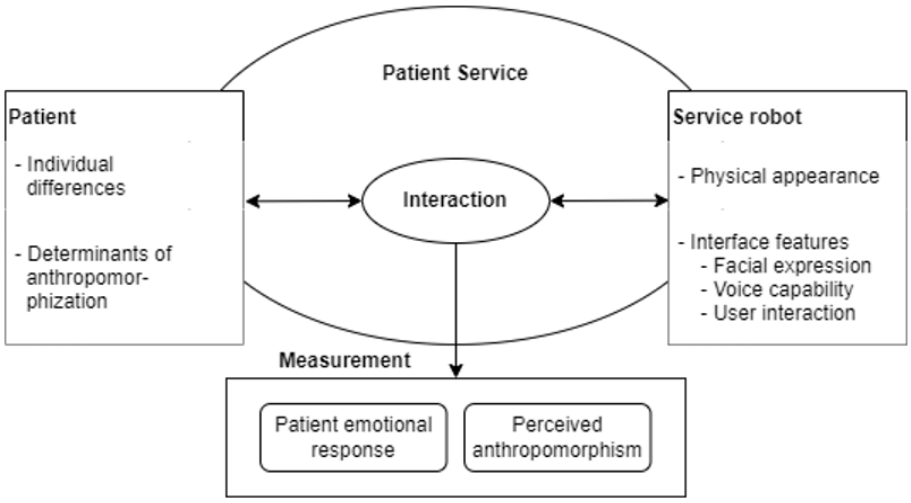

Figure 2

Note: Research framework addressing both the robot and the human user in service applications. Adapted from "Service Robot Anthropomorphism and Interface Design for Emotion in Human-Robot Interaction," by Zhang, T., Zhu, B., Lee, L., & Kaber, D., 2008, *4th IEEE Conference on Automation Science and Engineering*, p. 677.

However, given that chatbots do not typically possess such human-like qualities, this might negatively affect patients' acceptance of them, and therefore also the quality of healthcare provision.

Thus, this study aims to determine how perceived anthropomorphism (independent variable) influences the perceived dimensions of risk in patient-chatbot interaction (dependent variable). This is done by adding human-like traits to a chatbot and testing it among study participants in a healthcare context, in order to determine its feasibility as a virtual assistant in the healthcare field.

Research Question: How does the perceived anthropomorphism of a chatbot affect patients' perceived dimensions of risks in patient-chatbot interaction?

2 Literature Review

2.1 Association between Perceived Anthropomorphism and Perceived Risks Dimensions

Before testing the influence of perceived anthropomorphism on perceived dimensions of risks in patient-chatbot interaction, the validity of this relationship had to be established first. This was done with reference to existing research done by Zhang and Kaber (2008; See Figure 2). Zhang and Kaber's research revealed that a service robot that has human-like attributes elicited a positive patient emotional response. Examining the various aspects of a service robot that would influence perceived anthropomorphism, the same study found that "human perceptions of device functionality are largely influenced by anthropomorphic features" such as facial expressions, voice capabilities, interactivity with users, and having a human-like physical appearance (seen in Figure 2). The presence of these factors resulted in positive perceived anthropomorphism and thus, a positive patient emotional response.

Factors under Perceived Anthropomorphism

With reference to Surkamp's (2014) study regarding nonverbal communication, facial expressions can be classified under visual cues and kinesics, while voice capabilities can be classified under audio cues and paralanguage. Overall, we can thus conclude that audio and visual cues contribute to perceived anthropomorphism in patient-*robot* interaction (Figure 2). In this study, we attempt to see if this logic can be extended to a service *chatbot*.

Factors under Perceived Dimensions of Risks

Next, to determine what constitutes "perceived risk", reference was made to existing research conducted by Wirtz et al. (2018). This study concluded that the acceptance of service robots hinged on 3 elements – social-relational elements, functional elements (with reference to the Technology Acceptance Model), and rational elements (as seen in Figure 1 above). This model formed the basis for this study's initial research model. However, given the differences between this study and that of Wirtz et al., further literature reviews were required to refine the 3 dimensions of perceived risk.

Premise of Null Hypothesis:

Marlena et al, (2020) has stated that anthropomorphic robot behavior has led to increased positive emotions and willingness by humans to interact with them. Hence, we first hypothesize the following:

H-0: Perceived anthropomorphism of a chatbot interface is negatively associated with perceived risk of patient-chatbot miscommunication up to a certain point.

The "Uncanny Valley" Theory

However, Mori (1982) discovered that if a robot is too human-like, users would perceive it as "weird". This extends previous research by suggesting that communication with a service robot gets better the more human-like the robot is, but only until a certain point. This was referred to as the "Uncanny Valley" in the perception of anthropomorphic features. Hence, Mori (1982) concluded that the robot should be obviously artificial, yet interesting and appealing to interact with to avoid falling into the "Uncanny Valley".

2.2 Refining Perceived Socio-Emotional Dimensions of Risk

The sole aspect of socio-emotional elements to be studied in our paper is the perceived interactivity between patients and chatbots. Previous research has revealed how anthropomorphism influences interactions between computers and people. Holtgraves et al. (2007), Shawar and Atwell (2007), and Taddei and Contena (2013) conducted studies that concluded that people rely on social cues like language, interactivity, and the capability of expressing emotions when interacting with computers. Furthermore, the presence of these social cues positively influences the computers' perceived socialness, thereby leading to better understanding of what the computer is conveying and lower risk in communication (Mou & Xu, 2017). Thus, adapting these findings to our study, we propose the following:

H-1: Perceived anthropomorphism of a chatbot interface is positively associated with the chatbot's perceived interactive risk under Socio-Emotional Dimensions of Risk.

2.3 Refining Perceived Functional Dimensions of Risk

To refine the functional element of perceived risk in patient-chatbot interaction, we adapted the model in Figure 3 from a study by Esmaeilzadeh (2020). Esmaeilzadeh (2020) posited that technological concerns, ethical concerns, and regulatory concerns all affect perceived risk of using AI-based tools. Out of the three, technological concerns (i.e., performance anxiety and communication barriers) were found to be the most significant predictors of risk beliefs. That is to say, the higher the degree of performance anxiety and barriers to communication, the higher the risk of miscommunication. Thus, to incorporate ideas from Esmaeilzadeh (2020), our study assumes that the functional element of perceived risk constitutes perceived performance anxiety and the perceived communication barrier between chatbots and patients.

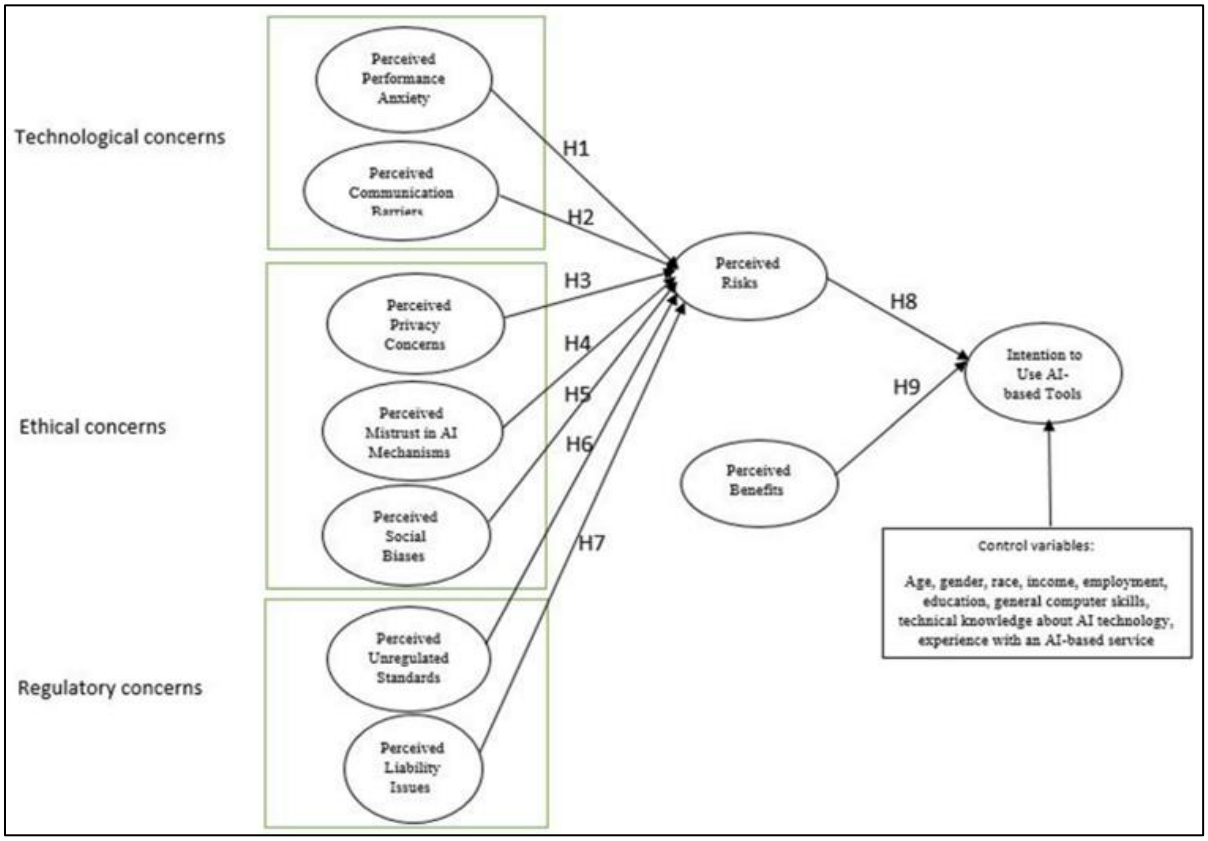

Figure 3: Use of AI-based tools for healthcare purposes: a survey study from consumers' perspectives (Esmaeilzadeh, 2020)

Taking into account that the study shows a positive relationship between perceived risk and perceived performance anxiety and perceived communication barriers independently

between a patient and chatbot, we hypothesize that each dimension of functional risk will also be negatively associated with perceived anthropomorphism:

H-2a: Perceived anthropomorphism of a chatbot interface is negatively associated with the chatbot's perceived performance anxiety under Functional Dimensions of Risks.

H-2b: Perceived anthropomorphism of a chatbot interface is negatively associated with perceived communication barriers under Functional Dimensions of Risks.

2.4 Refining Perceived Relational Dimensions of Risk

Finally, the relational elements that we examine in this study are trust and rapport that patients feel towards the chatbot. Existing literature has gone in-depth on how certain human-like traits in computers elicit certain positive attitudes towards them among humans. For instance, the addition of an avatar on a retail website increased buyers' purchase intentions because the avatar elicited a feeling of social presence among online shoppers, which led to greater trust, a better brand attitude, and higher satisfaction with the retailer (Holzwarth et al., 2006). Similarly, Bente et al. (2008) discovered that anthropomorphic agents represented by images or used human-like language let one feel more immersed within a virtual environment. This created positive social responses from humans. In the same vein, research by de Visser et al. (2016) proved that trusting beliefs toward virtual assistants can be created through the use of anthropomorphic agents who exhibit social behavior. Thus, it can be said that computers that are more human-like are found to be better communicators due to the trust and rapport with humans generated, thereby posing a lower interaction risk. Hence, our research follows the intuition of previous studies, and we seek to understand how trust and rapport influence perceived interaction risk between patients and chatbots.

H-3a: Perceived anthropomorphism of a chatbot interface is positively associated with Relational Dimensions of Risks from Lack of Trust towards a chatbot.

H-3b: Perceived anthropomorphism of a chatbot interface is positively associated with Relational Dimensions of Risks from Lack of Rapport towards a chatbot.

2.5 Overall Research Model

Given that perceived anthropomorphism comprises facial expression kinesics and voice capabilities paralanguage, based on the review of literature, we propose a research model in Figure 6 that addresses 3 elements of perceived risk of patient-chatbot miscommunication. Firstly, the socio-emotional element is made up of perceived interactivity of the chatbot. Next, the functional elements encompass the perceived performance anxiety and perceived communication barrier of the chatbot. Lastly, trust and rapport with the chatbot account for the relational elements. Overall, these factors should tell us whether there is any relationship between the perceived anthropomorphism of a chatbot interface and the perceived risk of patient-chatbot miscommunication.

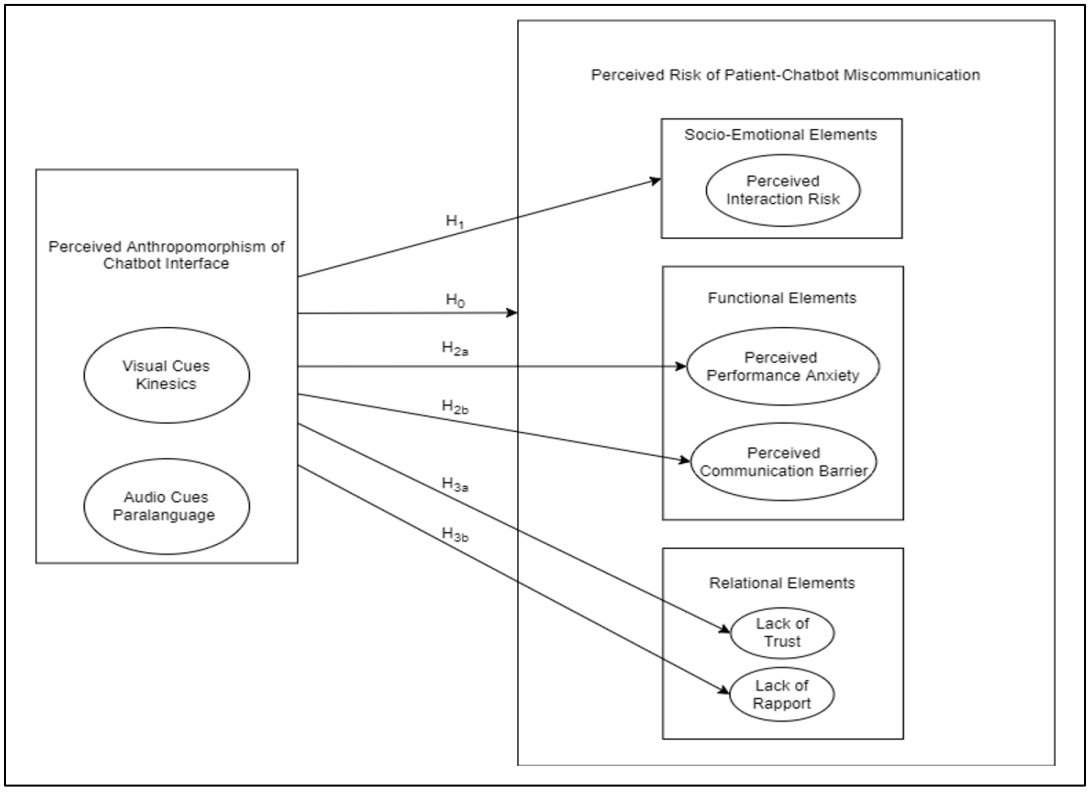

Figure 4: Conceptual Framework for Research Question

3 Research Design

A survey research design was used to explore how perceived anthropomorphism affects the dimensions of the perceived risk of miscommunication. To understand and construe perceptions of risk dimensions, the research design examined relationships between preexisting social phenomena within a random sample and identify associations between the constructs. This section discusses the operational definitions of the variables and constructed measures for dimensions of variables, followed by the participants, procedure, and sampling methods. Overall, the research was designed to describe perceived risk dimensions of miscommunication affected by perceived humanness in the delivery of healthcare services.

3.1 Definitions

Anthropomorphism describes people's tendency to attribute human characteristics to non-lifelike artifacts (Fink, 2012). For a virtual chatbot, perceived anthropomorphism may be operationally defined as measurable changes in two dimensions: visual and audio cues. Perceived risk of miscommunication arises when a potential communication participant perceives possible threats to successful communication, such as whether the message communicated was received and whether the information within the message was understood (Lee et al., 2007). In the context of human-chatbot interaction, perceived risk of miscommunication may be operationally defined as specifiable changes in five dimensions: perceived interactivity, perceived performance anxiety, perceived communication barriers, trust, and rapport. The operational definitions are based on the purpose of this research.

3.2 Constructing Measures for Dimensions of Variables

Perceived anthropomorphism in Visual Cues

Perceived anthropomorphism in visual cues was defined as the degree to which individuals attribute lifelike human characteristics to the non-human chatbot's facial expression capabilities such as the head, eyebrow, and mouth movements (Bartneck et al., 2009; Fink, 2012; Zhang et al., 2008).

Perceived anthropomorphism in visual cues was assessed using a scale adapted from the anthropomorphism construct of the Godspeed questionnaire by Bartneck et al. (2009). We used a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) to measure the following 4 items: (1) "The chatbot's appearance made the interaction feel natural" (2) "The chatbot's appearance made it feel humanlike"; (3) "The chatbot appearance made me feel that it is conscious"; (4) "The chatbot's appearance made the interaction feel lifelike." This was used because the Godspeed questionnaire is designed to test different human-robot interactions (HRI). The original semantic differentiation scale consists of five items: fake - natural, machinelike - humanlike, unconscious - conscious, artificial - lifelike, moving rigidly - moving elegantly. The last item was excluded in our scale because it is less relevant to chatbot avatars which do not move physically like service robots.

Perceived anthropomorphism in Audio Cues

Perceived anthropomorphism in audio cues was defined as the degree to which individuals attribute lifelike human characteristics to the non-human chatbot's volume, tone and pitch of its voice output. (Bartneck et al., 2009; Fink, 2012; Zhang et al., 2008).

Perceived anthropomorphism in audio cues was measured via the same four items adapted from the scale by Barnteck et. al (2019). A 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) was used to ask the following 4 items: (1) "The chatbot's responses made the interaction feel natural"; (2) "The chatbot's responses made it feel humanlike"; (3) "The chatbot responses made me feel that it is conscious"; (4) "The chatbot's responses made the interaction feel lifelike." This was used to see if users distinguish between human language and robot language from audio cues.

Perceived Interactivity

Perceived interactivity was defined as the individual's assessment of the chatbot's ability to actively participate and deliver content in a synchronous, two-way conversation (McMillan & Hwang, 2002).

Perceived interactivity was measured using a scale adapted from the Measures of Perceived Interactivity (MPI) by McMillan and Hwang (2002). A 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) was used to measure the following 4 items: (1) "I can hold a conversation with chatbots in real-time"; (2) "Chatbots are able to communicate a variety of content"; (3) "Chatbots are able to keep my attention"; (4) "Chatbots are able to give immediate answers to questions." These items were selected from MPI and readjusted to align with perceived interactivity of chatbots. The MPI consists of "real-time conversation", "no delay" and "engaging" scales, to represent three overlapping constructs central to interactivity: direction of communication, user control and time.

Perceived Performance Anxiety

Perceived performance anxiety was defined as the individual's assessment of their personal level of apprehension experienced during the chatbot interactions, such as processing the chatbot's output and providing input for the chatbot (Nomura et al., 2006).

Perceived performance anxiety was assessed using a scale adapted from the Subscale of Anxiety toward Discourse with Robots in the Robot Anxiety Scale (RAS) by Nomura et. al (2006). A 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) was used to measure the following 4 items: (1) "I feel anxious about how I should talk to chatbots"; (2) "I feel anxious about how I should reply to the chatbots when they talk to me"; (3) "I feel anxious about whether chatbots understand the contents of what I say to them"; (4) "I feel anxious about being unable to understand what the chatbot says to me." This was used because the RAS was developed for measuring anxiety that prevents individuals from interacting with communicative robots in their daily life (Nomura et. al, 2006).

Perceived Communication Barriers

Perceived communication barriers were defined as the individual's assessment of the chatbot's inability to communicate relevant information in a consistent, flexible and comprehensible manner (Nomura et al., 2006).

Perceived communication barriers were measured using a scale adapted from the Subscale of Anxiety toward Communication Capability of Robots in the Robot Anxiety Scale (RAS) by Nomura et. al (2006). A 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) was used to measure the following 4 items: (1) “I think that chatbots may talk about something irrelevant during conversation”; (2) “Chatbots may be inflexible to converse with”; (3) “Chatbots may not be able to understand complex stories”; (4) “I may not understand what the chatbot says to me.” This was used because perceived communication barriers applicable to robots are more congruent with research on RAS.

Trust

Trust was defined as the individual’s expectancy of the chatbot’s competency in completing a required task, the individual’s assessment of the adequacy and responsiveness of its functions and the individual’s expectancy of the chatbot’s consistency and predictability (McKnight et al., 2011)

Trust in medical chatbots was measured using a scale adapted from measurement instruments of trust in technology by Mcknight et al. (2011). The 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) included the following 6 items: (1) “Chatbots are reliable”; (2) “Chatbots have the functionalities I need”, (3) “Chatbots can provide competent guidance if needed”, (4) “I am comfortable with using chatbots”; (5) “I believe chatbots are effective at what they are designed to do”; (6) “I usually trust chatbots until they prove to me that I shouldn’t trust them.” This was used because the research by McKnight (2011) tests trust in a specific technology. The items were modified based on the research purpose and flow of the survey.

Rapport

Rapport was defined as the degree of an individual’s expectations of a friendly relationship with the chatbot in terms of levels of mutual attentiveness, positivity, and coordination (Nomura et al., 2016).

Rapport with medical chatbots was assessed using a scale adapted from the Rapport–Expectation with a Robot Scale (RERS) (Nomura & Kanda, 2016). The 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) included the following 6 items: (1) “It would be enjoyable to interact with chatbots”; (2) “The chatbot may understand me”; (3) “I will feel empathy towards the chatbot”; (4) “The chatbot would be a good conversation partner”; (5) “I

would like to try to treat the chatbot as if it were a human"; (6) "I can talk with the chatbot about serious things I cannot talk with others about." This was used because the RERS had sufficient internal consistency as a psychological measurement tool to distinguish whether a user expects to form a rapport with a robot, based on its value as a conversation partner and the value of the relationship with the robot (Nomura & Kanda, 2016).

3.3 Participants and Procedure

This research recruited 82 respondents located in Singapore through various social media platforms. The data collection began on 13 March 2021 and was completed on 20 March 2021. The online survey was described as "Survey on perceived anthropomorphism in health communication" and estimated to take 20 minutes to complete. It was designed in English using Google Forms. Before the start of the survey, participants had to give consent on general terms of data collection such as the use of their responses for the sole purpose of the study. The following are the steps executed by a respondent to complete the survey (see Appendix 1 for full survey questionnaire):

1. Answer questions on their demographic information, including gender, age, primary language, education level, employment status, tech-savviness, and familiarity with using virtual assistants.
2. Interact with a medical chatbot on the Sensely app by performing a task to ask for health advice.
3. Following the task, fill in the questionnaire on dimensions of perceived anthropomorphism
4. Fill in the questionnaire on dimensions of the perceived risk of miscommunication.

3.4 Sampling Methods

Non-probability sampling strategies were used to select the sample of 82 respondents in the final dataset. Convenience sampling was employed to recruit participants in the interest of time and also due to a lack of resources to carry out very extensive individual surveys. We shared the survey to family and friends, as well as across multiple online channels such as Facebook and Telegram groups/channels. We also employed snowball sampling by asking respondents to send the survey to their own friends and family members to garner an even larger pool of respondents.

4 Results and Analysis

4.1 Operationalizing Dimensions of Constructs

Two confirmatory factor analysis was conducted, one for the Independent variable and another for the Dependent Variable, to elicit the dimensions constructing each variable and prove the validity of the constructs within each variable. Principal Component analysis was used to reduce the dimensionality of our item measures within each variable, by distilling the item measures down to their most significant constructs where the data is simplified without losing important traits (Firmin, 2019). Varimax Rotation was then used to accentuate the clarity of the magnitude of each construct identified within each variable, through rotation on an orthogonal basis to align with coordinates that maximize high and low factor loadings and minimize mid-factor loadings (Robbins, 2005). Refer to Section A in the Appendix for more details.

4.1.1 Factor Analysis: Perceived Anthropomorphism

Our findings confirmed the identification of 2 factors, Audio Cues, and Visual Cues, that significantly contributed to the factor structure of the IV, Perceived Anthropomorphism. This takes into consideration that the Physical Features of the chatbot and the User Interaction with it have been controlled for in the implementation of our survey as well, therefore identifying only these 2 factors. All factors showed acceptable levels of reliability as well. 6 out of 8 items loaded clearly on both factors accounted for 76% of the variance. The first factor “Audio Cues” explained 68% of the variance with 4 items with high factor loadings of > 0.7, where $\alpha = 0.76$. The second factor “Visual Cues” explained 9% of the variance with 2 items with high factor loadings of > 0.7, where $\alpha = 0.91$.

4.1.2 Factor Analysis: Dimensions of Perceived Risks

Our findings also confirmed the identification of 5 factors that significantly contributed to the factor structure of the DV, Perceived Risk Dimensions, with eigenvalues > 1 and whose 10 items out of the total 24 items accounting for 61% of the variance, and with high factor loadings. Most factors showed acceptable levels of reliability as well. The first factor “Perceived Interaction Risk” explained 10% of the variance, containing 2 items, where $\alpha = 0.63$. The second factor “Perceived Performance Anxiety” explained 22% of the variance, containing 3 items, where $\alpha = 0.85$. The third factor “Perceived Communication Barriers” explained 17% of the variance,

containing 2 items, where $\alpha = 0.87$. The fourth factor “Lack of Trust” explained 8% of the variance containing 2 items, where $\alpha = 0.53$. The fifth factor “Lack of Rapport” explained 6% of the variance, containing 1 item, where $\alpha = 0.79$.

4.2 Summary of Hypotheses

Simple Linear Regression was employed to test the null hypothesis, H0, on the premise that a negative relationship is predicted between perceived anthropomorphism and perceived risk because of the positive correlation between perceived anthropomorphism and service-robot acceptance. Subsequently, due to our Research Question, we proposed alternative hypotheses to H0 to predict a positive relationship between perceived anthropomorphism and the various perceived dimensions of risks, H1, H2a, H2b, H3a, and H3b. Our analysis revealed that we have enough evidence to reject H0 because of the significant positive correlation between perceived anthropomorphism and perceived risk dimensions as a whole ($p < 0.001$, $r = 0.419$). Subsequently, 5 Simple Linear Regressions were then conducted to explore the relationships and thus examine the hypotheses (H1, H2a, H2b, H3a, H3b) we have identified based on prior literature review, with results shown in Table 1.

4.2.1 Effects on Various Dimensions of Risk

H1 posits that there is a positive relationship between perceived anthropomorphism and perceived socio-emotional elements of risk and is supported with statistical significance ($p < 0.05$, $R = 0.21$). H2 posits that there is a negative relationship between perceived anthropomorphism and perceived functional elements of risk; within which H2a predicts a negative relationship with perceived performance anxiety and H2b predicts a negative relationship with perceived communication barriers. H2a is supported ($p < 0.05$, $r = 0.19$) while H2b are not supported($p > 0.05$, $r = -0.15$). However, H2 is overall not supported (H2: $p > 0.05$, $R = 0.03$). H3 posits that there is a positive relationship between perceived anthropomorphism and perceived relational elements of risk; within which H3a predicts a positive relationship with lack of trust and H3b predicts a positive relationship with lack of rapport. H3a is supported ($p < 0.001$; $r = 0.53$) while H3b is not supported ($p > 0.05$; $r = 0.15$). Overall, H3 is partially supported ($p < 0.05$; $R = 0.48$).

4.2.2 Accounting for Interaction Effects

To illustrate the potential of any dimensions of risk that could mediate the relationship between Perceived Anthropomorphism and Functional Elements of Risk and thus provide a significant pathway, Multiple Linear Regression is also employed to account for any interaction effects. Our analysis in Table 2 also revealed that even with the dependence of Functional Dimensions of Risk on other Dimensions of Risk, there is still no significant relationship between Functional Dimensions of Risk and Perceived Anthropomorphism ($p = 0.75 > 0.05$). Results from Tables 1 and 2 below are similar due to the use of Varimax Rotation.

Table 1: Results from Simple Linear Regression

Hypothesis and Variables		r	R
H1: Socio-Emotional Risks (Perceived Interaction Risk)		-	**0.21***
H2: Functional Risks	H2a: Perceived Performance Anxiety	**0.19***	**0.03**
	H2b: Perceived Communication Barriers	-0.15	
H3: Relational Risks	H3a: Lack of Trust	**0.53****	**0.48***
	H3b: Lack of Rapport	0.15	

Table 2: Results from Multiple Linear Regression

Hypothesis and Variables		β	B
H1: Socio-Emotional Risks (Perceived Interaction Risk)		-	**0.21***
H2: Functional Risks	H2a: Perceived Performance Anxiety	**0.19***	**0.03**
	H2b: Perceived Communication Barriers	-0.15	
H3: Relational Risks	H3a: Lack of Trust	**0.53****	**0.48***
	H3b: Lack of Rapport	0.15	

*p-value < 0.05

**p-value < 0.001

5 Discussion

5.1 Summary of Findings

The aim of our study is to examine if perceived anthropomorphism increases perceived risk, and if the former is proven true, it shall further uncover how it increases the five dimensions of perceived risks of miscommunication, namely, perceived interaction risk, perceived performance anxiety, perceived communication barriers, trust and rapport.

H0 posits there is a negative relationship between perceived anthropomorphism and perceived risk because increased service Robot Acceptance is an outcome of perceived anthropomorphism that is due to decreased risk. However, Mori's (1982) research found the uncanny valley effect that states that up to a certain point, the highly realistic anthropomorphic effect causes feelings of risk and revulsion. Hence we reject H0 and propose H1, H2 and H3 in favor of Mori's theory in order to uncover this phenomena of feelings of risk.

5.2 Perceived Anthropomorphism on Perceived Socio-Emotional Risk

The results found a positive relationship between anthropomorphism and perceived interaction risk, supporting H1. This is contrary to those in previous studies which found a positive effect of perceived anthropomorphism on socio-emotional aspects of perceived interactivity (Holtgraves et al., 2007; Shawar & Atwell, 2007; Taddei & Contena, 2013). Research in the area of perceived anthropomorphism and interactivity demonstrated people's preferences of personable human-like robots possessing a human-like voice, with the capacity to express emotion and engaging in eye-contact. However, the positive evaluation of perceived anthropomorphism and perceived interactivity is subject to a trigger point where excessively human-like robots actually give rise to negative evaluations such as perceived interaction risk (Dautenhahn et al., 2002).

In the context of our study, the participants relied on Molly's social cues such as language, interactivity and her expression of emotions in their human chatbot interactions, which mimics the characteristics of human conversation. The trigger point of negative evaluation of Molly by the participants could have been reached, resulting in increased perceived interaction risk with Molly's perceived anthropomorphism (Nass et al., 1997).

5.3 Perceived Anthropomorphism on Perceived Functional Risks

Perceived Performance Anxiety

There is no significant relationship between perceived anthropomorphism on the overall functional dimension of risk, thus rejecting H2. However, the results showed a significant positive effect of anthropomorphism and perceived performance anxiety, supporting H2-a. One possible explanation is the uncanny valley effect still holds where participants may experience slight discomfort with feelings of eeriness while interacting with Molly, increasing their perceived threat, further exacerbating their technological concerns, and resulting in elevated perceived performance anxiety (Mende et al., 2019). In future studies, Perceived Performance Anxiety could be classified under another dimension of risk, such as socio-emotional risks and test for its items for reliability.

Perceived Communication Barriers

The results also found no significant effect of perceived anthropomorphism on perceived communication barriers, rejecting H2-b. Molly's humanness had no significant effect on their perceived communication barriers pertaining to her inability to communicate information consistently, flexibly, and in a comprehensible manner. It is possible that the participants' intrinsic need for social connection with other human beings could have subconsciously influenced their preconceived notions on anthropomorphism, causing them to respond positively when presented with anthropomorphic depictions, thus associating Molly's anthropomorphism with an anticipated and realized ease in communication (Wood, 2019). Hence, the ease of communication with an anthropomorphic chatbot does not have a significant effect on perceived communication barriers.

5.4 Perceived Anthropomorphism on Perceived Relational Risks

Trust-Related Risks

The study found a significant positive relationship between perceived anthropomorphism and perceived risk due to trust-related issues, supporting H3-a. There was a lack of cognitive trust in perceiving Molly as a reliable, functional, competent, and effective chatbot. This could have been linked to the participants' unwillingness to disclose personal information during the symptom assessment based on a hypothetical medical condition of a headache. Besides, Molly's anthropomorphism depicted as human qualities with the ability to reason might have also led to high initial confidence and expectation of Molly by the participants in the initial interaction but was

not sustained throughout the whole interaction (Chen, 2021). H3-a is also supported as it is consistent with Christoforakos et. al (2021) study finding that increased anthropomorphism in a healthcare chatbot moderates the effect of perceived trust on an attributional level. Our study then adds on to this literature that perceived anthropomorphism beyond a certain level might in fact lead to greater trust issues and thus leading to greater perceived risks. This can be explained with patients requiring more knowledge first about how a robot operates in terms of its emotional intelligence before developing trust with it (Sellens et al, 2021)

Rapport-Related Risks

The results found no significant effect of perceived anthropomorphism on rapport-related issues with Molly that could contribute to perceived risks in this dimension. This is consistent with Qiu et al. (2020) findings that indicated that increased anthropomorphism of service robots had a positive effect on customer-robot rapport building and enhanced the hospitality experience. This is also consistent with Broadbent's (2018) research providing evidence that relationship building between robots and patients helps for critical health outcomes. This indicates also that increasing rapport-building efforts does not contribute to significant relational risk perceived.

5.5 Implications of Study

The results suggest that the design of anthropomorphism of chatbots for smartphone healthcare applications should consider the elements of perceived interaction risk and trust as they have important implications for the socio-emotional and relational dimension of perceived risks. Furthermore, perceived risks emanating from the functional element of communication barriers as well as the relational element of rapport might be inconsequential in the design of anthropomorphic chatbots according to the study.

In light of this, any incorporation of anthropomorphic features to mechanistic assistive and rehabilitative robots used in hospitals, should prioritize risk concerns such as perceived interaction risk and trust. Efforts should be made to attain an optimal level in the mix of anthropomorphism and mechanistic interactions, avoiding negative evaluations and adverse reactions by the patients. Even if the uncanny valley effect could have been slight, it is still important to ensure that it does not set in to induce fear and mistrust, which might further exacerbate the mental well-being of the patients who are facing physical and mental challenges in coping with their health conditions.

This would help to achieve enhanced health outcomes in patient-centered care through an improvement in the individual patient's health without compromising their psychosocial needs. The acceptance of anthropomorphic virtual nurses which are perceived as personable instead of repulsive by patients, would also facilitate the role of the robotic nurses in performing personalized monitoring and management of patients, alleviating the problem of healthcare worker shortage, and buffering the effects of the Great Resignation Trend.

6 Limitations and Future Research

Limitations

Although the study yielded interesting findings, it is important to consider them in the context of its limitations. The use of a convenience sample leads to selection bias which restricts the generalizability of the findings. It is noted that this limitation is prevalent in numerous health communication research studies where a convenience sample is used.

The sample comprises participants in Singapore only. Future research examining perceived anthropomorphism and perceived risks of miscommunication in health chatbots across different countries and cultures would be informative to determine whether the findings in this study remain valid.

The majority of the sample were university students between the age of 19 to 26 years old. This age group comprising young adults may have significant generational differences in perceptions, habits and values from other age groups such as Generation X and Generation Alpha. The results related to the demographic in this study should be interpreted with caution as they cannot be generalized to all age groups. As such, future research examining the differences in perceived anthropomorphism and perceived risks of miscommunication in health chatbots in different age groups could be insightful.

This study was not conducted in a controlled laboratory setting. There was no experimental control over the circumstances in which the participants participated in the study. Additionally, the attentiveness of the participants to the chatbot stimulus throughout the walkthrough and the conscientiousness of the participants' completion of the survey could not be determined. In following the walkthrough for exposure to the chatbot stimulus, the participants may have technical problems in downloading or running of the application, enabling the application's full suite of audio-visual features, or navigating the interactions with the conversational chatbot. It is not possible to determine whether the participants proceeded to answer the survey questions without proper installation or correct use of the app, especially without an on-site guide to observe and assist them.

Another limitation of this study relates to sample mortality. Participants may have dropped out of the study given the ease of terminating participation in online survey studies. The

participants could also be deterred by a considerable number of instructions to follow in the walkthrough.

As the study was not conducted as an experiment, there was also no control group to demonstrate the differences in the subjective measure of perceived anthropomorphism across different healthcare chatbots.

Future Research

Future research could replicate this study as an experiment in a controlled laboratory setting to control the above limitations and possibly investigate causality in the hypotheses. However, it should be noted that the current healthcare conversational chatbot applications available utilize text-messaging functionalities with no kinetic humanoid avatars or audio capabilities. Static icons and pictures are utilized even if avatars are involved. The challenge of determining the appropriate chatbot stimuli for the control group is subject to the future availability of humanoid conversational chatbot applications.

In this study, perceived interactivity was measured. Future research could determine the participants' level of involvement with the chatbot by recording the participants' actual usage of the interactive input functions and other interactions on the application.

The Sensely application had conversational chatbot avatars varying in gender, ethnicity, accents, and languages, available for corporate clients only. However, the only chatbot avatar available for this study was Molly, who could be described as an English-speaking, late-twenties, female person-of-color with an American accent. Future research could present chatbots of varying characteristics to subjects and investigate the impact of the chatbot's gender, ethnicity, accent and language used on perceived anthropomorphism and perceived risks of miscommunication in health chatbots.

The walkthrough of the chatbot application in this study utilized a hypothetical scenario wherein participants consulted the chatbot on a stipulated singular health problem. Although the imposition of the hypothetical scenario was to ensure that the participants would have a standardized health issue to consult Molly, it could have influenced their engagement and relatability in the suspension of disbelief during the interaction. Future studies could be based on the actual health condition of the participants to address this concern.

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8 Appendices

Appendix A: Validity and Reliability for Constructs in Perceived Anthropomorphism

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.766	68.087	68.087	4.766	68.087	68.087	2.891	41.297	41.297
2	.620	8.855	76.943	.620	8.855	76.943	2.495	35.645	76.943

(Out of 8 items)

Rotated Component Matrix[a]

	Component	
	1	2
The chatbot responses made me feel that it is conscious	.939	
The chatbot's responses made the interaction feel lifelike	.829	
The chatbot's responses made the interaction feel natural	.721	
The chatbot appearance made me feel that it is conscious	.716	
The chatbot's appearance made the interaction feel lifelike		
The chatbot's responses made it feel humanlike		
The chatbot's appearance made it feel humanlike		.882
The chatbot's appearance made the interaction feel natural		.811

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.848
Bartlett's Test of Sphericity	Approx. Chi-Square	549.916
	df	28
	Sig.	<.001

Component 1: Audio Cues

Component 2: Visual Cues

Reliability for Perceived Anthropomorphism:

Audio Cues:

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.912	.912	4

Visual Cues:

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.769	.781	2

Appendix B: Validity and Reliability for Constructs in Perceived Dimensions of Risks

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.420	22.581	22.581	5.420	22.581	22.581	4.008	16.701	16.701
2	4.171	17.378	39.960	4.171	17.378	39.960	3.341	13.921	30.622
3	2.282	9.509	49.469	2.282	9.509	49.469	2.664	11.099	41.720
4	1.833	7.639	57.107	1.833	7.639	57.107	2.568	10.700	52.421
5	1.407	5.863	62.970	1.407	5.863	62.970	2.532	10.550	62.970
6	1.283	5.345	68.316						

(Out of 24 items)

Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
I feel anxious about how I should reply to the chatbots when they talk to me	.872				
I feel anxious about being unable to understand what the chatbot says to me	.809				
I feel anxious about how I should talk to chatbots	.786				
I feel anxious about whether chatbots understand the contents of what I say to them					
I may not understand what the chatbot says to me					
The chatbot may understand me					
I think that chatbots may talk about something irrelevant during conversation					
The chatbot would be a good conversation partner					
Chatbots have the functionalities I need		.800			
I can talk with the chatbot about serious things I cannot talk with others about		.788			
I would like to try to treat the chatbot as if it were a human					
I will feel empathy towards the chatbot					
I believe chatbots are effective at what they are designed to do					
Chatbots are able to keep my attention			.829		
It would be enjoyable to interact with chatbots			.715		
Chatbots are able to communicate a variety of content					
I can hold a conversation with chatbots in real-time					
Chatbots may be inflexible to converse with				.857	
Chatbots may not be able to understand complex stories				.850	
I am comfortable with using chatbots					.699
I usually trust chatbots until they prove to me that I shouldn't trust them					
Chatbots can provide competent guidance if needed					
Chatbots are able to give immediate answers to questions					
Chatbots are reliable					

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

Component 1: Perceived Performance Anxiety

Component 2: Perceived Communication Barrier

Component 3: Perceived Interactive Risk

Component 4: Lack of Trust

Component 5: Lack of Rapport

Reliability for Perceived Anthropomorphism:

C1: Perceived Performance Anxiety:

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.852	.852	4

C2: Perceived Communication Barrier:

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.875	.877	2

C3: Perceived Interactive Risk:

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.636	.630	3

C4: Lack of Trust

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.534	.532	3

C5: Lack of Rapport

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.796	.795	3

Appendix C: Simple Linear Regression and Multiple Linear Regression Models

Relationship between Perceived Anthropomorphism and Perceived Risk

Correlations

		Perceived Risk Dimensions
Pearson Correlation	Perceived Risk Dimensions	1.000
	Perceived Anthropomorphism	.419
Sig. (1-tailed)	Perceived Risk Dimensions	.
	Perceived Anthropomorphism	.000

Elucidating the various constructs of Risk with SLR and MLR:

		Perceived Anthropomorphism
Pearson Correlation	Perceived Anthropomorphism	1.000
	Perceived Performance Anxiety	.199
	Trust Factor	.526
	Perceived Interactive Risk	.215
	Perceived Communication Barriers	-.157
	Rapport Factor	.154
Sig. (1-tailed)	Perceived Anthropomorphism	.
	Perceived Performance Anxiety	.037
	Trust Factor	.000
	Perceived Interactive Risk	.026
	Perceived Communication Barriers	.079
	Rapport Factor	.084

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change
1	.641[a]	.411	.372	1.11349	.411

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	3.853E-17	.123		.000	1.000
	Perceived Performance Anxiety	.282	.124	.199	2.261	.027
	Trust Factor	.744	.124	.526	5.974	<.001
	Perceived Interactive Risk	.305	.124	.215	2.447	.017
	Perceived Communication Barriers	-.222	.124	-.157	-1.786	.078
	Rapport Factor	.218	.124	.154	1.750	.084

Elucidating the various dimensions of Risk with SLR and MLR:

		Perceived Anthropomorphism_X
Pearson Correlation	Perceived Anthropomorphism_X	1.000
	Relational Elements_Y3	.481
	Functional Elements_Y2	.030
	Perceived Interactive Risk_Y1	.215
Sig. (1-tailed)	Perceived Anthropomorphism_X	.
	Relational Elements_Y3	.000
	Functional Elements_Y2	.396
	Perceived Interactive Risk_Y1	.026

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change
1	.528[a]	.278	.251	1.21658	.278

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1.933E-17	.134		.000	1.000
	Relational Elements_Y3	.481	.096	.481	4.999	<.001
	Functional Elements_Y2	.030	.096	.030	.308	.759
	Perceived Interactive Risk_Y1	.305	.136	.215	2.240	.028

a. Dependent Variable: Perceived Anthropomorphism_X

Appendix D: Survey questionnaire

Introduction: Hello, we are a group of NUS students working on a Communications and New Media project to understand perceptions on anthropomorphism in health communication. Please be assured that all responses collected will be kept strictly confidential and used solely for the purpose of this study. This survey is **estimated to take 20 minutes** to complete. Thank you for your participation!

I give my consent to be involved in the study: Yes/No

Section A: Demographic information

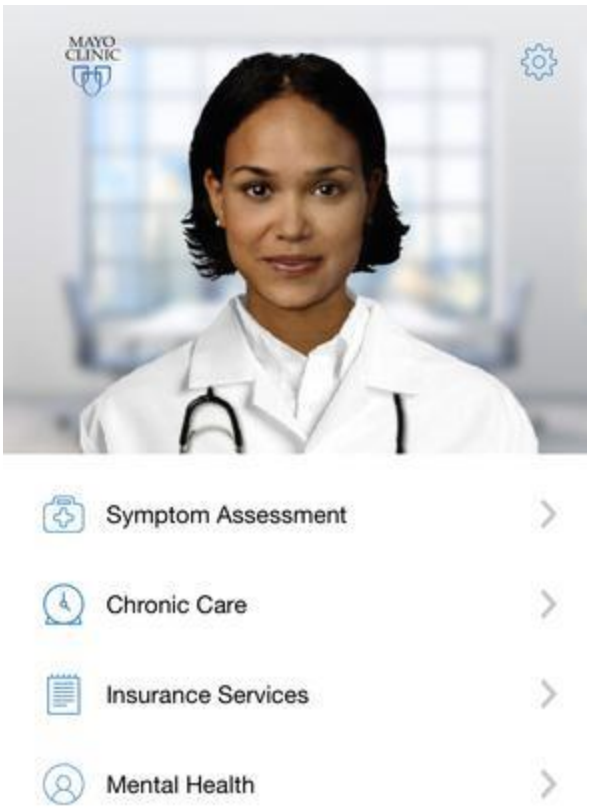
1. What is your age:
    a. ____years
2. What is your gender: Male/Female
3. Is English your primary language: Yes/No
4. What is your employment status:
    a. Employed full-time/ employed part-time/ self-employed/ unemployed/ retired/ student
5. What is your education level:
    a. Below Secondary/ Secondary/ Post Secondary (Non-Tertiary)/ University/ Masters/ Doctoral, PhD/ Other, please specify
6. On a scale of 1-5, rate how tech-savvy you consider yourself to be (1-5, not at all-very)
7. How familiar are you with using virtual assistants? (1-5, not at all-very)

Section B: Interaction task with chatbot (Brainstorm)

Task: Asking for health advice

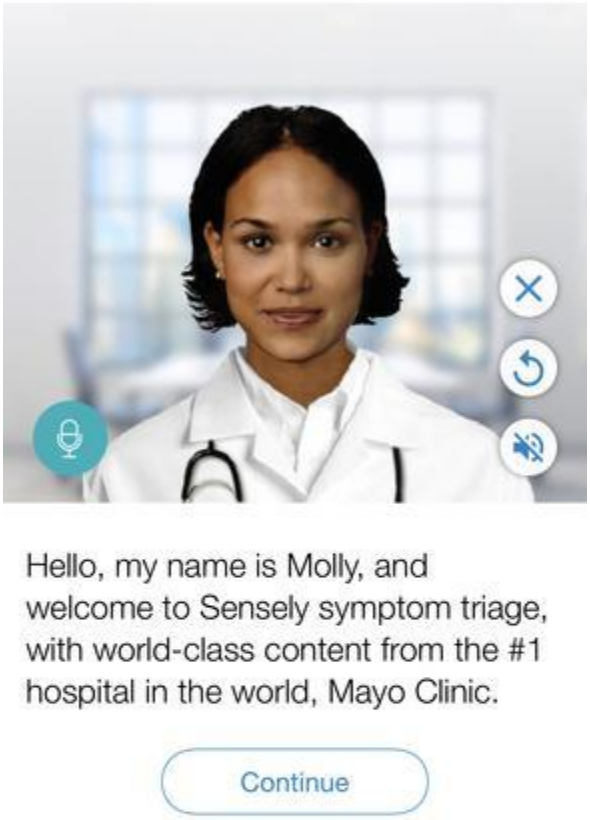
1. Download the Sensely app and sign up for an account

2. Select **Symptom Assessment** on the main page

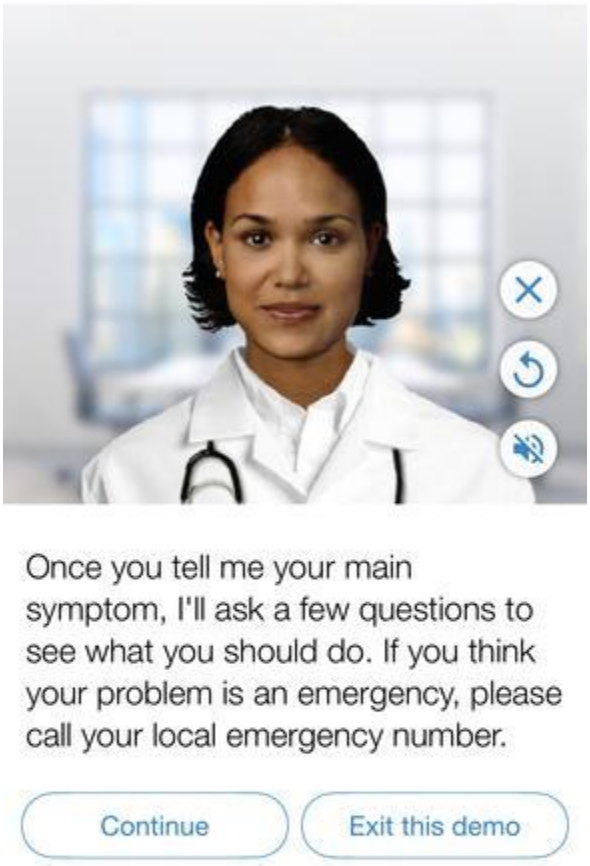


3. Ensure audio is on and tap on Molly to interact with her.

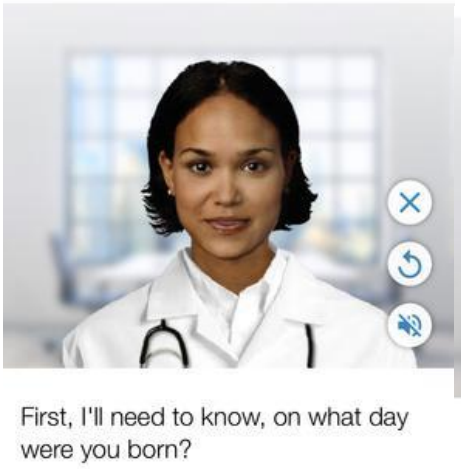
4. Select **Continue**



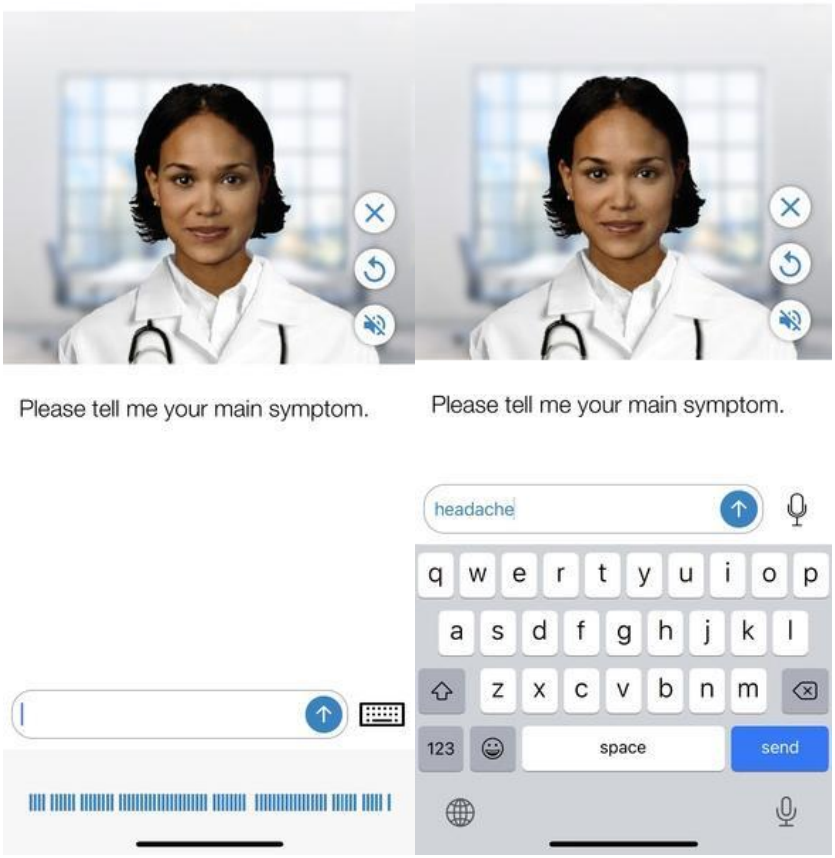
5. Select **Continue**



6. Input your birthday as **7 March 2000** and gender as **Male**



7. Input your main symptom as **headache**



8. Select **Skip to Symptom Check for “Headache”**

It sounds like the symptom you entered could be related to COVID-19. Our first task is to check for any COVID-19 risks. After that, we can look at your symptom.

Start COVID-19 screening

Skip to Symptom Check for "Headache"

9. Select **No**

Have you had a blow to the head or other head injury in the past 48 hours?

Yes

No

10. Scroll down and select **None of the above**

Of the following possible emergency symptoms, please choose all that apply to you.

- ◯ New confusion or inability to stay alert and awake
- ◯ Current or recent seizure
- ◯ Purple or red-colored pinpoint rash or larger blotches that stay when pressed by a ... r drinking glass (purpuric ra... etechiae is a rash of pinpoint-sized reddish-purple

don't lose color when you press on them. Both of these are the result of bleeding into the skin or mucous membranes.

- ○ New neck pain and difficulty bending the neck
- ○ Very sudden, severe headache with intense pain
- ○ Severe pain in one eye only
- ○ New blurry, dim or double vision or any vision loss
- ○ New weakness, numbness or tingling on one half of the body (an arm and leg)
- ○ New numbness or weakness of any part of the face or drooping on one side of the face
- ○ Suddenly losing balance or coordination
- ○ New difficulty speaking or slurred speech
- ✓ None of the above

Continue

11. Select **No**

Were you recently exposed in the home or workplace, to appliances that burn fossil fuels like gas, coal, wood, or oil?

Yes

No

12. Select **No pain at this time**

Which of the following best describes your headache pain?

No pain at this time

Mild pain

Moderate pain

Severe pain

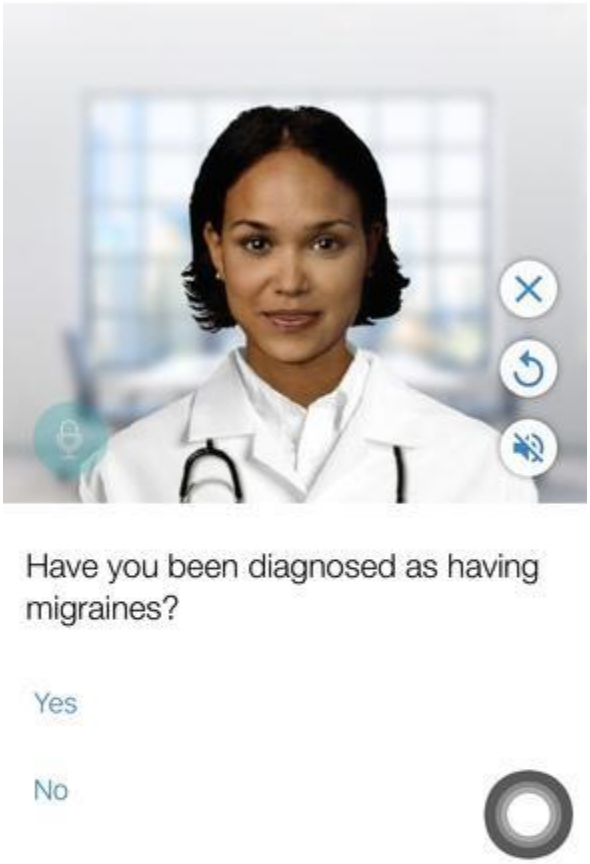
13. Select **No**

Is this the worst headache of your life? This kind of headache generally makes it impossible for someone to carry on daily activities.

Yes

No

14. Select **No**



15. Scroll down and select **None of above**

Of the following, please check all that applied to you in the 24 hours before the headache started.

- ◯ A lumbar puncture (spinal tap) or epidural procedure
- ◯ Dental or medical procedure anywhere on the head
- ◯ A large amount of alcohol
- ◯ Sharp drop in usual caffeine intake

Continue


Of the following, please check all that applied to you in the 24 hours before the headache started.
A lumbar puncture (spinal tap) or epidural procedure
Dental or medical procedure anywhere on the head
A large amount of alcohol
Sharp drop in usual caffeine intake
Not drinking enough fluids
Spending a long time in a very hot environment
Taking a new medication or a change in medication dosage, including over the counter or herbal medications as well as prescription medications
None of the above
Continue

16. Select **No**

Has a health care provider already evaluated this particular set of symptoms?

Yes

No

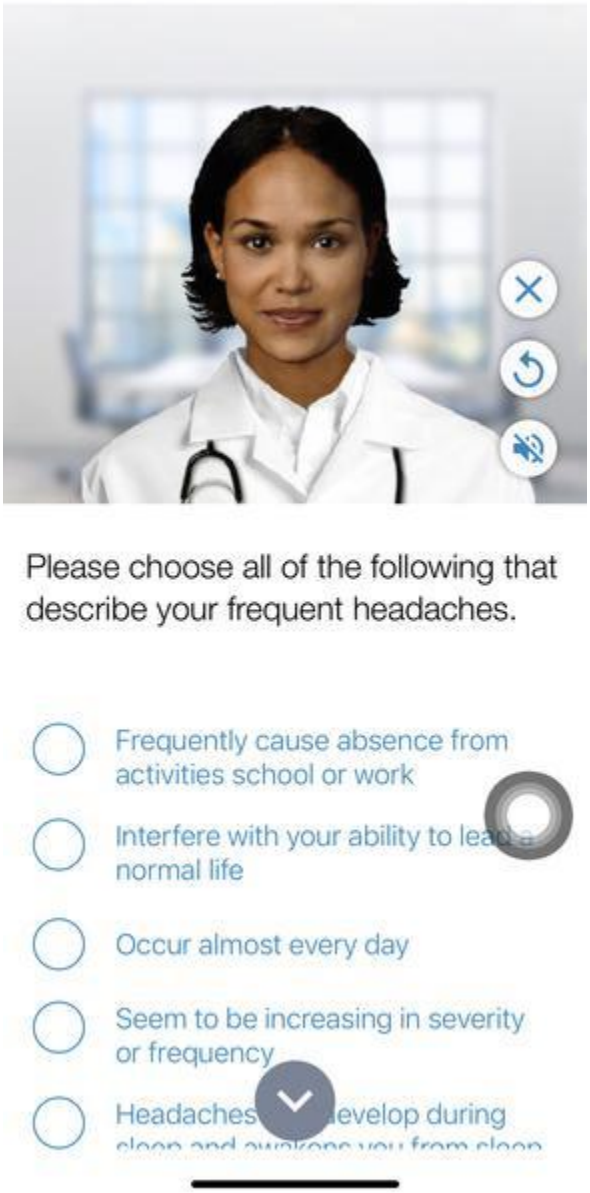
17. Select **Yes**

Do you experience frequent recurrent headaches similar to this?

Yes

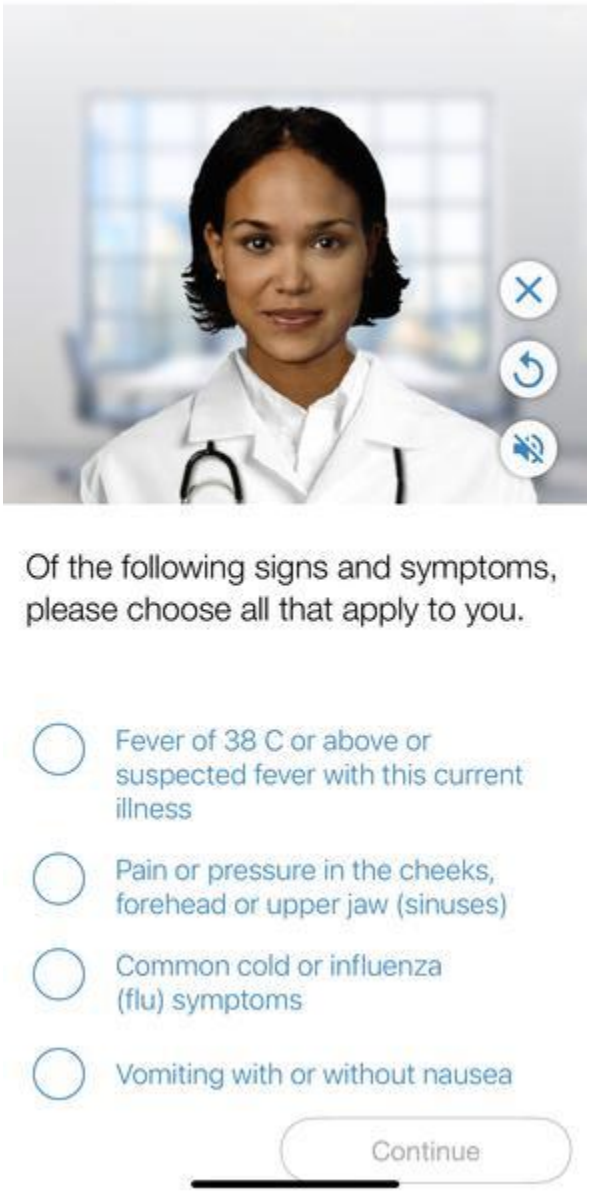
No

18. Scroll down and select **None of the above**




Please choose all of the following that describe your frequent headaches.
Frequently cause absence from activities school or work
Interfere with your ability to lead a normal life
Occur almost every day
Seem to be increasing in severity or frequency
Headaches that develop during sleep and awakens you from sleep
Need to use a combination of over-the-counter and prescription pain relievers more than 10 days each month, or use of only over-the-counter medications more than 15 days each month, to treat the headaches.
None of the above
Continue

19. Scroll down and select **Sensitivity to light**

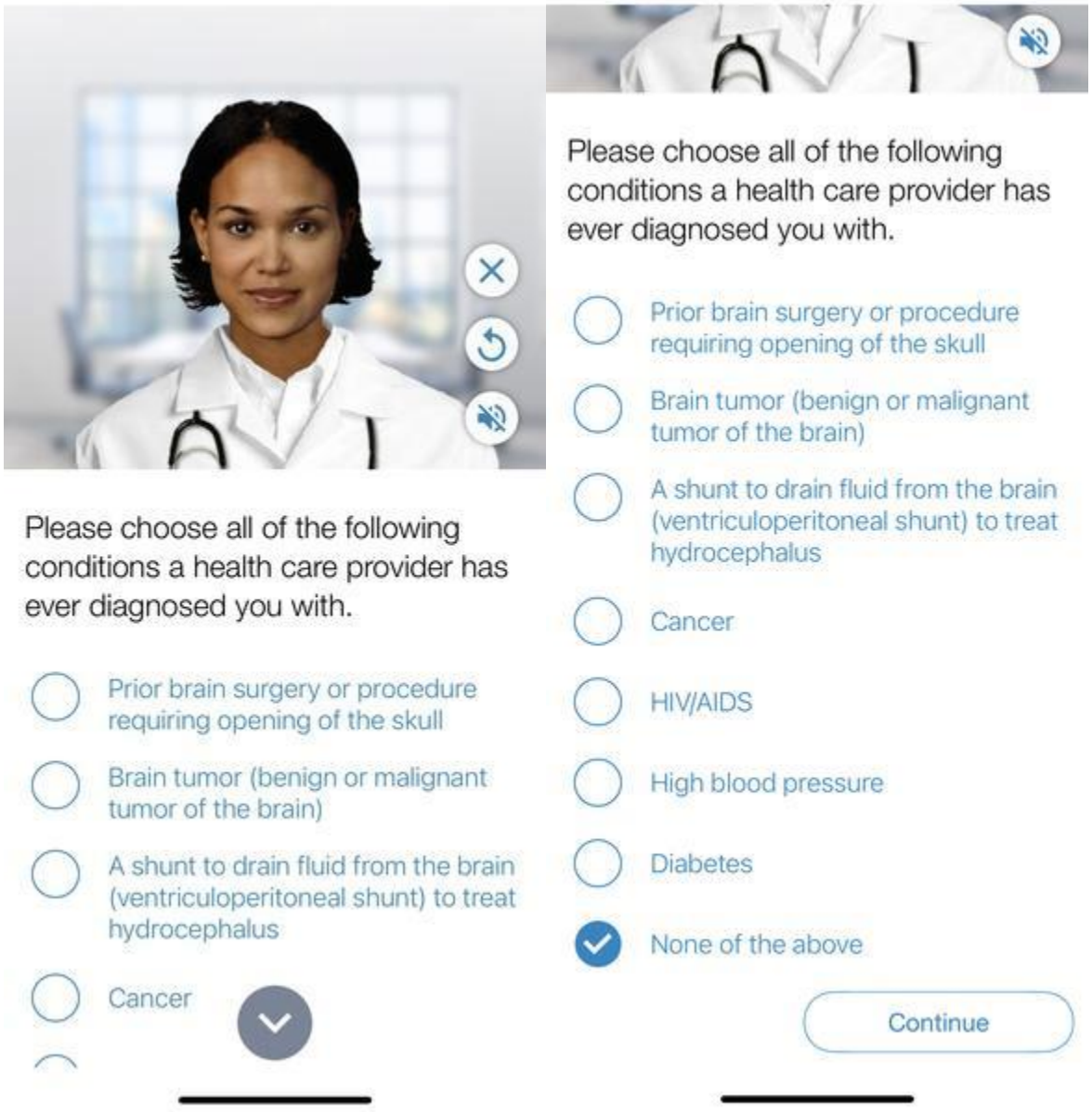


Of the following signs and symptoms, please choose all that apply to you.

- [ ] Fever of 38 C or above or suspected fever with this current illness
- [ ] Pain or pressure in the cheeks, forehead or upper jaw (sinuses)
- [ ] Common cold or influenza (flu) symptoms
- [ ] Vomiting with or without nausea
- [ ] Nausea
- [x] Sensitivity to light
- [ ] Sensitivity to sound
- [ ] None of the above

Continue

20. Select **None of the above**



21. Select **No**

Has your blood pressure been measured in the past hour while you were feeling relaxed?

Yes

No

22. Select **No**

Have you had a blow to the head or other head injury in the past six months?

Yes

No

23. Select **Less than 3 hours**

How long has the headache lasted without it going away?

Less than 3 hours

3 to 72 hours

More than 72 hours

24. Select **No**

Is the headache getting progressively worse?

Yes

No

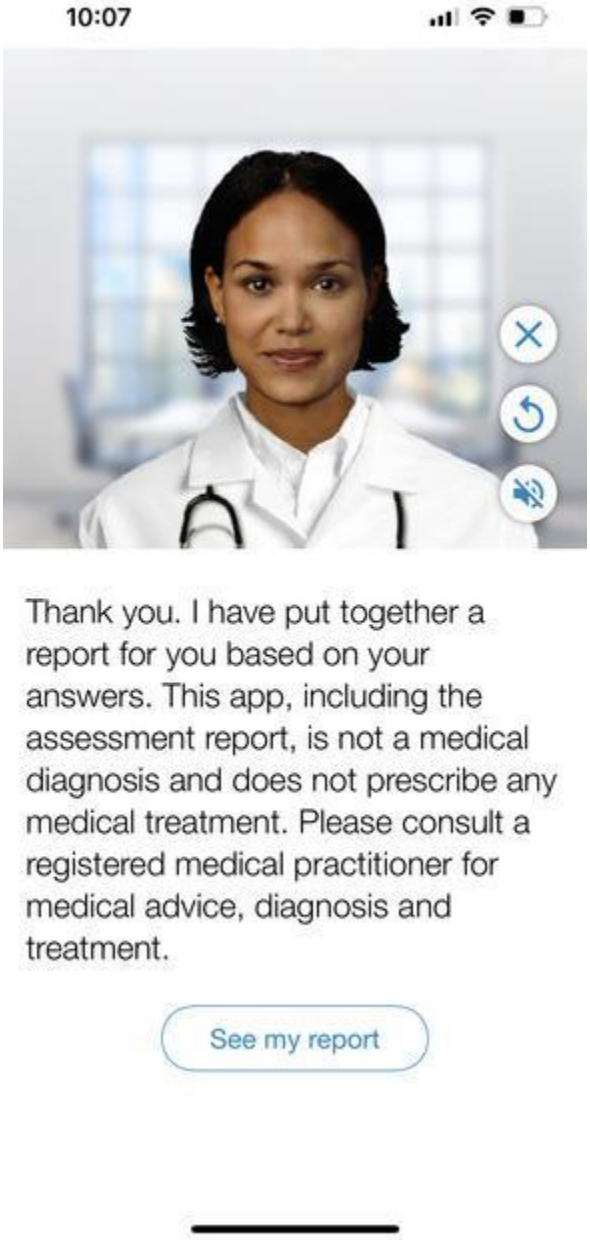
25. Select **No** (engaged in sexual activity)

Did your headache start after coughing, exercising or engaging in sexual activity?

Yes

No

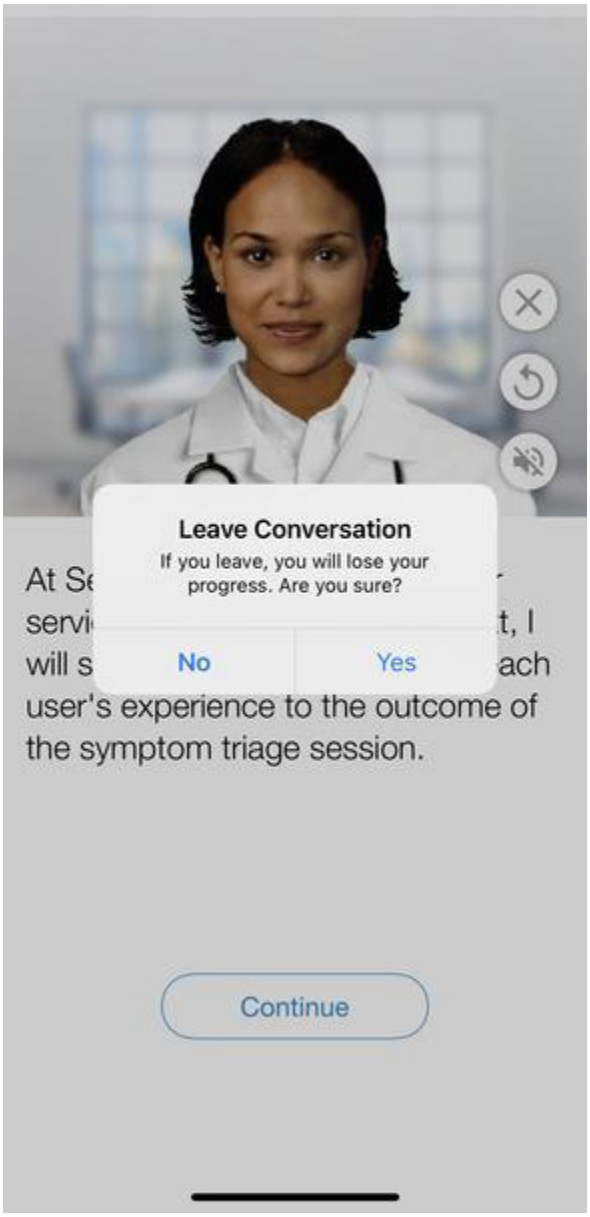
26. Select **See my report**



27. Select **Done**

28. Select the “**X”**

29. Select **Yes** to end the session



Section C: Perceived anthropomorphism

Questions on a 5-point Likert scale: 1 (Strongly disagree) to 5 (Strongly agree)

Subsection 1: Facial expression kinesics (visual cues)

1. The chatbot's appearance made the interaction feel natural
2. The chatbot's appearance made it feel humanlike
3. The chatbot appearance made me feel that it is conscious
4. The chatbot's appearance made the interaction feel lifelike

Subsection 2: Voice paralanguage (audio cues)

5. The chatbot's responses made the interaction feel natural
6. The chatbot's responses made it feel humanlike
7. The chatbot responses made me feel that it is conscious
8. The chatbot's responses made the interaction feel lifelike

Section D: Perceived risk of miscommunication

Take note that all of the following questions apply to chatbots used for **purposes of health communication.**

Questions on a 5-point Likert scale: 1 (Disagree) to 5 (Agree)

Subsection 1: Perceived performance anxiety

1. I feel anxious about how I should talk to chatbots
2. I feel anxious about how I should reply to the chatbots when they talk to me
3. I feel anxious about whether chatbots understand the contents of what I say to them
4. I feel anxious about being unable to understand what the chatbot says to me

Subsection 2: Perceived communication barriers

5. I think that chatbots may talk about something irrelevant during conversation
6. Chatbots may be inflexible to converse with
7. Chatbots may not be able to understand complex stories
8. I may not understand what the chatbot says to me

Subsection 3: Perceived interactivity

9. I can hold a conversation with chatbots in real-time
10. Chatbots are able to communicate a variety of content
11. Chatbots are able to keep my attention
12. Chatbots are able to give immediate answers to questions

Subsection 4: Trust

13. Chatbots are reliable
14. Chatbots have the functionalities I need
15. Chatbots can provide competent guidance if needed
16. I am comfortable with using chatbots
17. I believe chatbots are effective at what they are designed to do
18. I usually trust chatbots until they prove to me that I shouldn't trust them

Subsection 5: Rapport

19. It would be enjoyable to interact with chatbots
20. The chatbot may understand me
21. I will feel empathy towards the chatbot
22. The chatbot would be a good conversation partner
23. I would like to try to treat the chatbot as if it were a human
24. I can talk with the chatbot about serious things I cannot talk with others about

End of Survey

Thank you for taking the time to do our survey!