THE INFLUENCE OF PHYSICIAN USE OF ANALOGIES ON PATIENT UNDERSTANDING AND PERCEPTIONS OF PHYSICIAN

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Grace M. Hildenbrand

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STATEMENT OF COMMITTEE APPROVAL

Dr. Evan K. Perrault, Chair

Brian Lamb School of Communication

Dr. Maria K. Venetis

Brian Lamb School of Communication
Rutgers University Department of Communication

Dr. Bart Collins

Brian Lamb School of Communication

Dr. Phillip E. Keller

Indiana University School of Medicine

Approved by:

Dr. Marifran Mattson

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ABSTRACT

Physicians must explain medical information to patients in a way that patients can understand, and physician use of analogies is one strategy that may help patients better understand health information. The present dissertation, guided by patient-centered communication, investigated whether the use of analogies by a physician within a medical encounter enhances participants' objective understanding, perceived understanding, and perceptions of clarity regarding information about a health condition, and perceptions of the physician in areas of liking, similarity, satisfaction, and affective communication. The experiment consisted of eight conditions with a 2 (familiar/unfamiliar health condition) x 4 (no analogies, diagnosis analogies, treatment analogies, both diagnosis and treatment analogies) design, and the conditions varied by being exposed to the familiar or unfamiliar health issue first. An actor physician delivered a 1-2 minute video-recorded message, diagnosing the participants, serving as analogue patients, with the familiar or unfamiliar health issue. After watching the video and responding to the dependent variable measures based on their perceptions of the physician and video message, U.S. adult participants read a vignette of another physician diagnosing them with the other (familiar or unfamiliar) health issue, and answered the same dependent variable measures regarding the physician and vignette message. Open-ended questions sought to understand what participants remembered from the message and whether they recalled analogies in their retelling of the physician messages, whether they (dis)liked the analogies, what they (dis)liked about the physicians and whether these perceptions differed by analogy conditions, whether they remembered any analogies from their own clinicians, and in which medical situations they found provider analogies to be useful. Findings indicated when including health literacy as a covariate, analogies did not enhance perceptions of clarity, perceived understanding, or objective understanding. Regarding positive perceptions, analogies did not

influence liking, similarity, satisfaction, or affective communication. There was no significant interaction between use of analogies and health issues, nor a difference in the effectiveness of the analogies based on whether they were used to describe diagnosis or treatment. Explanations containing analogies resulted in increased objective understanding for the vignette compared to the video format. When recalling the physician's message, participants rarely recalled analogies, nor explicitly mentioned them as something they liked or disliked. However, some participants recalled clinician use of particular analogies, and most of them indicated they found clinician analogies to be useful, especially when describing complex health issues that are difficult for patients to understand. The dissertation results indicate that healthcare providers may want to use analogies when interacting with patients, which could potentially improve the doctor-patient relationship.

CHAPTER 1. INTRODUCTION

"In fact, metaphors may be as necessary to illness as they are to literature, as comforting to the patient as his own bathrobe and slippers. At the very least, they are a relief from medical terminology. If laughter has healing power, so, too, may metaphor" (Broyard, 1992, p. 18).

Dealing with a medical diagnosis can be a stressful experience for patients. The experience of learning about one's health condition may feel even more overwhelming if patients do not understand what their physicians are telling them. The Medical Expenditure Panel Survey of U.S. adults with multiple chronic health conditions receiving non-emergency care indicated that only about 61% of participants felt their clinicians explained information in a way they could comprehend (Soni, 2015). Clinicians tend to use jargon without explanation (Bourquin et al., 2015; Castro et al., 2007) which decreases patients' comprehension of health messages (Schnitzler et al., 2017). Lay people even struggle to understand common phrases used in medical encounters, yet remain confident that they do understand the medical information shared with them in the encounter (Chapman et al., 2003). For instance, among patients being discharged from a hospital and their caregivers, 78% demonstrated inadequate understanding of their care and discharge instructions, while only 20% were aware that they had inadequate understanding (Engel et al., 2009). These instances illustrate the Dunning-Kruger effect, in which individuals with poor performance think they performed much better than they did (Dunning, 2011; Kruger & Dunning, 1999). Patients also struggle to correctly remember information immediately after it has been described to them (Lewkovich & Haneline, 2005). When patients do not remember health information given to them by their physicians, they are less likely to adhere to treatment recommendations (Watson & McKinstry, 2009), and this could lead to significant negative health

outcomes. Thus, there is a need for physicians to communicate health information in a way that patients can actually understand and ultimately remember.

1.1 Physician Use of Analogies

One way physicians can communicate with patients that may allow for greater comprehension of health information is by using metaphors or analogies to explain complex medical phenomena. Research examining provider use of metaphors and analogies tends to treat metaphors and analogies the same because of how they function to enhance patient understanding (Arroliga et al., 2002; Casarett et al., 2010). Thus, both research related to metaphors and analogies will be discussed interchangeably in the present study, as research on one type can be applied to the other. Physicians use metaphors as an explanatory device (Arroliga et al., 2002) and even note their usefulness in explaining health concepts (Galesic & Garcia-Retamero, 2013; Krieger et al., 2011; Schnitzler et al., 2017). Patients have higher ratings of physician communication when physicians use metaphors and analogies (Casarett et al., 2010). Analogies help people with varying levels of numeracy understand health risks (Galesic & Garcia-Retamero, 2013), and metaphors have influenced patients' intentions to participate in a randomized clinical trial (Krieger et al., 2011). Thus, physician use of metaphorical language may also enhance patients' comprehension of diagnosis and treatment information, as well as patients' perceptions of the physician in areas such as liking and similarity.

Physician communication strategies that increase patient understanding such as use of analogies could also lead to better health management among patients. For instance, good physician communication is associated with increased patient adherence to medication (Schoenthaler et al., 2017), with higher non-adherence rates found among patients whose physicians communicated using jargon (Haskard Zolnierek & DiMatteo, 2009).

1.2 Theoretical Framework: Patient-Centered Communication

Patient-centered communication (PCC) is a form of communication based in patient-centered care. The Institute of Medicine defines patient-centered care as "providing care that is respectful of and responsive to individual patient preferences, needs, and values and ensuring that patient values guide all clinical decisions" (2001, p. 6). PCC is useful in its own right as an outcome because good communication is desired by patients, but also as a means to achieve other positive outcomes (Epstein et al., 2005). Traditionally there has been a paternal model of health care in which the physician made decisions on behalf of the patient (Emanuel & Emanuel, 1992), and the biomedical model of health left little room for taking a patient's psychosocial context into account (Engel, 1977). PCC allows for the patient and provider to work together to make decisions, and also allows for taking the patient's psychosocial context into account. For instance, patients want providers to use PCC by giving information in an understandable way, being good listeners and responders, trying to understand what the patient is going through, considering patient ideas, using plain language, and working to establish a positive relationship (King & Hoppe, 2013; Mazor et al., 2013). PCC will be used as the guiding theoretical framework for this dissertation, as analogies may help to facilitate patient understanding and generate positive perceptions of a healthcare provider.

1.3 Additional Reasons Why Physician Communication is Important

One reason physician communication has received attention in the medical field is because it is evaluated on the hospital consumer assessment of healthcare providers and systems (HCAHPS) survey. HCAHPS is a survey sent to patients after staying at a U.S. hospital to evaluate their experiences. The results are publicly reported and used to determine hospital incentives (Centers for Medicare & Medicaid Services, 2017). The survey includes questions related to doctors'

communication in areas of respect, listening, and explaining information in an understandable way (HCAHPS, 2019). Additionally, the U.S. government's Healthy People 2030 has an objective dedicated to decreasing the percentage of individuals reporting that communication with their healthcare providers was poor (Office of Disease Prevention and Health Promotion, n.d.). Consequently, it is important for physicians to be able to explain medical information in a way that patients can comprehend, and analogies might be a useful strategy to attain this feat.

1.4 Methods Used in Clinician Analogy/Metaphor Research

Various methods have been utilized to study healthcare provider use of metaphors when communicating with patients. For some empirical studies that set out to study clinician metaphors in their interactions with patients, they utilize interviews (Krieger, 2014), or observational methods, in which recordings of the encounter are analyzed (Casarett et al., 2010; Macagno & Rossi, 2019; Magaña, 2019; Skelton et al., 2002). For example, recruitment consultations were recorded to analyze clinician explanations of clinical trial randomization (Jepson et al., 2018). Other researchers use surveys to obtain information about healthcare provider use of metaphors when explaining health concepts to patients (Arroliga et al., 2002; Bullen et al., 2018; Costas-Muñiz et al., 2020), with Demmen et al. (2015) analyzing use of metaphors in an online forum for providers as well as interviewing providers.

There is another body of literature in which the researchers did not set out to examine metaphors or analogies in their study aims, but clinician use of metaphors or analogies arose in the findings among other results. In a couple of instances, radiation therapists in two different studies used analogies to describe complicated terminology (Schnitzler et al., 2017; Smith et al., 2013). Other examples are studies indicating that clinicians used metaphors or analogies to describe plasma cell disorder (McShane et al., 2018), medically unexplained symptoms (olde Hartman et

al., 2009; Østbye et al., 2018), complex terminology associated with preterm infants (Redshaw & Harvey, 2016), ovarian cancer (Elit et al., 2015), and a heart device (Standing et al., 2016). Similarly, U.S. clinical trial recruiters used analogies as one strategy to explain clinical trial randomization (Morgan et al., 2016).

1.4.1 Commentaries

In addition to empirical research studies that have been conducted, there are many commentaries in which healthcare providers or other scholars discuss the usefulness of metaphors in a medical context. These commentaries cover various functions of metaphors or analogies, such as metaphors being helpful for educating other health professionals (Masukume & Zumla, 2012) including nursing students (Aldridge, 2018; Czechmeister, 1994), or lists of specific analogies that can be used to illustrate particular health issues (Lee et al., 2017; Vogel, 2015). Several commentaries address metaphors commonly used in a medical context such as the war metaphor for cancer or other diseases (Ellis et al., 2015; Nie et al., 2016; Slobod & Fuks, 2012; Wiggins, 2012). Specific potential benefits of provider use of metaphors and analogies mentioned in these commentaries are patient adherence (Mbugua, 2015), enhanced patient understanding and making the clinician seem less patronizing (Friedman, 2018), as well as making patients feel comfortable, and facilitating the provider-patient relationship (Brisson, 2018). Other authors of commentaries suggest metaphors are useful because they are relatable to patients, help them remember information (Trogen, 2017), make patients less afraid and more confident, and inspire them to engage in a particular health behavior (Harpham, 2010). While these commentaries suggest that many clinicians use analogies and that their use of analogies is generally valuable, there is a need for experimental research to actually test their effectiveness to provide empirical evidence for their claims.

1.4.2 Experimental Research Explicitly Testing Clinician Use of Metaphor

Some researchers set up experiments in which they tested healthcare providers' use of metaphors, but because of how the studies were designed, it is difficult to tell whether the metaphors were the reason for the outcomes obtained or whether the results were due to other factors. In one instance, a metaphor computer game was created to explain history taking to medical students, and students who completed the game had more satisfaction than those who received regular instructions, but the results could be due to the fact that the intervention was a game as opposed to the metaphors themselves (Alyami et al., 2019). Other studies consist of interventions using metaphors or analogies which reveal a positive influence on understanding (Davis et al., 2016a; Naik et al., 2011), knowledge (Gazzinelli et al., 2010; Louw et al., 2019a), psychological morbidity (Sumathipala, 2014), or smoking cessation (Raupach et al., 2010) after the intervention or compared to control groups, but because the metaphors are one part of the intervention, it is unclear whether the interventions would have had the same success without the metaphors.

While certain studies have used experimental methods to analyze clinician use of metaphors or analogies compared to conditions without metaphors or analogies, most of the outcomes of these studies are different from the outcomes studied in this dissertation. Outcomes that have been examined in these experimental studies include feelings of hopelessness and pain levels of patients (Bahremand et al., 2015), distress and insightfulness of college student participants (Hu et al., 2018), the ability of stroke recovery patients to walk correctly (Kleynen et al., 2019), participants' perceptions of the likelihood of an event (Barilli et al., 2010), participation in a clinical trial (Krieger et al., 2011), trying to solve a medical problem (Galesic & Garcia-Retamero, 2013), intent to get a vaccine (Scherer et al., 2015), and medical students' abilities to

correctly position a manikin for intubation (Brindley et al., 2010). Other experiments have examined patients' recall of health information (Martin et al., 2012; Reading Turchioe et al., 2019) and an experiment examining the influence of clinician analogies and positive or negative framing on patient comprehension of medical information (Gasteiger et al., 2020). Because these studies have not experimentally investigated the influence of provider analogies on outcomes such as patient perceived understanding, clarity, liking, similarity, affective communication, and satisfaction, the present dissertation will seek to address this gap.

1.5 Potential Implications

Medical school textbooks recommend best practices for clinician communication such as using short words, repeating or summarizing patients' words, and avoiding technical terminology (Bickley & Szilagyi, 2009; Fortin et al., 2012). However, these particular textbooks do not mention metaphors and analogies as a recommended clear communication strategy (Bickley & Szilagyi, 2009; Fortin et al., 2012). Yet, a medical doctor and professor in a medical school claim in their commentary that some medical textbooks use metaphors that have become a regular part of medical education (Masukume & Zumla, 2012). If analogies prove to be useful in enhancing patient recall of diagnosis and treatment information, then analogies could become more regularly incorporated into medical student textbooks and healthcare provider training for interacting with patients. For instance, one doctor believes medical schools should allow time to talk about use of analogies (Harpham, 2010), and over 100 third-year medical students who participated in an intervention which involved using visual analogies to describe clinical observation had an 80% increase in their utilization of visual analogies after the intervention (Jasani & Saks, 2013). Eventually analogies could potentially become a standard part of clinician protocol for communicating with patients in order to improve patient adherence and illness management.

CHAPTER 2. LITERATURE REVIEW

2.1 Analogies

One form of language which is likely familiar to patients is metaphorical language. Lakoff and Johnson (1980) argue in their contemporary theory of metaphor that metaphorical language is not merely language that is aesthetically pleasing, but plays a more significant role in thinking and reasoning processes. Metaphor allows people to understand information that is abstract or difficult to grasp (Lakoff, 1993). A metaphor is "a figure of speech...whereby a word or phrase ordinarily used in one domain is applied to another" (Hanne, 2015, p. 39). A metaphor draws a literal comparison, and uses "the form 'A is B'" (Sopory & Dillard, 2002, p. 383). An analogy extends understanding of a concept via comparison (Arroliga et al., 2002), and is an indirect comparison using words such as "like" or "as." The current dissertation's methods focus on analogies because analogies are used more clearly for an explanatory function and are slightly less confusing than metaphors, as they draw indirect comparisons rather than more literal comparisons.

Many people use metaphors to describe health issues, as can be seen in their usage in different forms of media as well as investigators' research on them. In a content analysis of tweets referencing hypertension and diabetes, 16% of them contained metaphors (Sinnenberg et al., 2018). Researchers have analyzed metaphoric descriptions of the Ebola virus in U.S. newspapers (Trčková, 2015), blogs, support groups, and other published narratives of cancer patients using metaphors (Brown & de Jong, 2018; Gustafsson & Hommerberg, 2018; Hommerberg et al., 2020; Semino et al., 2017), and YouTube videos and online support group narratives of individuals experiencing withdrawal from a psychoactive medication in which many of them used metaphors to describe their struggles (Fixsen & Ridge, 2017).

Metaphors have also been analyzed explicitly for their influence on individuals' health-related beliefs. For instance, using different types of metaphors to explain genes can influence the way individuals perceive genetics research (Parrott & Smith, 2014). Metaphors can even be persuasive in a health context, and can impact how people think about a new concept (Thibodeau et al., 2017). For example, framing a health risk as a metaphor was effective at enhancing perceived susceptibility to the risk of getting the Zika virus when severity for the risk was presented as high (Lu & Schuldt, 2018).

Some physicians use metaphors and analogies when describing medical information to their patients, believing metaphors strengthen interactions with patients (Arroliga et al., 2002; Casarett et al., 2010). As an example, in a study of physicians who conduct acupuncture, 80% of them used metaphors as a method for describing how acupuncture works to their patients (Fisher et al., 2019). Among a group of podiatrists in Scotland, all of them said they regularly use metaphors to explain concepts to patients (Bullen et al., 2018). Because patients are often learning about medical concepts that are unfamiliar to them or are difficult to visualize, analogies likely make these medical concepts clearer.

2.2 Theoretical Framework: Patient-Centered Communication

PCC includes both task and relational forms of communication (King & Hoppe, 2013). Analogies may align with the concept of PCC because they can be used by clinicians to explain medical information to patients.

2.2.1 Components of PCC

One component of PCC is obtaining the patient's viewpoint. PCC involves shared power, with the provider taking the patient's psychosocial factors into account (Epstein et al., 2005). A

specific behavior involved with obtaining the patient's viewpoint includes the provider asking for the patient's preferences, values and concerns (Epstein & Street, 2007; King & Hoppe, 2013; Robinson et al., 2012). Another relevant behavior is the provider asking the patient about their psychosocial environment, such as asking about family life (Epstein & Street, 2007).

A second component of PCC is information exchange by the provider and patient (Epstein & Street, 2007). Provider behaviors associated with information exchange are asking the patient about their level of knowledge or beliefs related to diagnosis and treatment using open-ended questions (Epstein & Street, 2007; King & Hoppe, 2013), or the provider giving medical information or resources related to diagnosis or treatment (Epstein & Street, 2007).

A third element of PCC is ensuring that the patient understands information about their health condition. This includes achieving shared understanding of the health issue and treatment by the patient and provider (Epstein et al., 2005). For providers to help patients understand, providers can avoid using jargon, use repetition to emphasize key points, or analyze patient understanding using a method such as teach-back (Epstein & Street, 2007; King & Hoppe, 2013). One way to promote better understanding of health information among patients is by providers demonstrating clarity. Clarity is a component of PCC which entails engaging in clear communication (Wanzer et al., 2004), and clarity will be measured as a dependent variable in this dissertation.

A fourth element of PCC is the provider and patient engaging in shared decision-making (McCormack et al., 2011), which involves the patient and provider working together to determine a plan of care for the patient. With shared decision-making, elements of the biomedical model and patient values are both considered (Epstein & Street, 2007; McCormack et al., 2011). When a patient mentions a treatment preference (Robinson et al., 2012), or when a provider and patient

create a treatment plan together (Epstein & Street, 2007), and agree on that treatment plan (King & Hoppe, 2013), this demonstrates shared decision-making.

A fifth and final component of PCC is paying attention to the patient's emotions (Epstein & Street, 2007) and working to facilitate a positive relationship between the provider and patient (McCormack et al., 2011). Specific behaviors include a provider empathizing with the patient's situation, comforting, reassuring, or encouraging the patient, asking how the patient is feeling, or validating the patient's emotions, and these behaviors can be enhanced nonverbally by maintaining eye contact, leaning forward, and nodding (Epstein & Street, 2007). PCC emphasizes aspects of affective communication such as attending to patient concerns, showing empathy, and building rapport (Saha & Beach, 2011). Therefore, affective communication will be measured as a dependent variable in this dissertation.

2.2.1.1 PCC Leads to Positive Outcomes

PCC is useful because patients want and expect good communication from their providers. PCC is also useful because it leads to increased patient satisfaction (Robinson et al., 2012; Wanzer et al., 2004). Wanzer et al. (2004) operationalized PCC based on patient perceptions of providers engaging in nonverbal immediacy, introducing themselves, using humor, demonstrating clarity, listening, and being empathetic. While overall PCC was positively related with satisfaction with care and doctor communication, doctor immediacy, listening, and empathy were most positively associated with satisfaction with doctor communication, while doctor clarity and listening were most positively associated with satisfaction with the care received (Wanzer et al., 2004).

PCC has also been linked with increased patient mental and physical health. For instance, patient perceptions of provider PCC are negatively related with patient discomfort and concern, and positively related with patient mental health, having fewer diagnostic tests, and having fewer

referrals to specialists (Stewart et al., 2000). Stewart et al. (2000) measured PCC based on patients' perceptions of a provider asking them about the illness and obtaining common ground; the common ground component was most positively related with the outcomes previously mentioned. Small relationships have also been found between PCC and improvements in blood pressure and blood glucose, and depression among patients, according to a narrative review of PCC studies (King & Hoppe, 2013). Orth et al. (1987) analyzed the association between PCC and blood pressure by looking at transcripts from medical encounters; they found that when patients stated what they were feeling and when providers effectively explained information to the patients, the patients had lower blood pressure. Upon coding behavior from physician-patient interactions, Kaplan et al. (1989) discovered when patients had more control over the interaction than the physician, engaged in more information seeking, and the physician and patient shared more feelings, this resulted in improved blood pressure and blood sugar levels for the patients. Finally, Fallowfield et al. (1990) interviewed breast cancer patients after talking with a surgeon about treatment and analyzed transcripts of the patient-surgeon encounter; when patients were given an option to get a mastectomy, they reported less depression than patients who were not given the option.

Additional aspects of mental health are influenced by PCC, as PCC is associated with less patient anxiety (Zwingmann et al., 2017), and positively associated with patient emotional well-being (Jiang, 2017). Zwingmann et al. (2017) had an oncologist display low or high PCC in a video, and PCC consisted of responding to patient feelings and concerns and being empathetic. Jiang (2017) measured PCC as a composite variable comprised of patient perceptions of doctors giving and receiving information, reacting to patient feelings, engaging in shared decision-making,

encouraging the patient to manage their health, explaining information in an understandable way, giving enough of their time, and addressing uncertainty.

Provider PCC also results in increased patient recall and adherence to treatment (King & Hoppe, 2013), as well as increased health self-efficacy among Americans with chronic conditions (Finney Rutten et al., 2016). Finney Rutten et al. (2016) operationalized PCC as how often participants perceived that medical professionals let them ask questions, attended to their feelings, engaged in shared decision-making, ensured the participants knew how to be healthy, addressed uncertainty, and whether the participants perceived the providers would take good care of them. Bartlett et al. (1984) analyzed videos of encounters to determine the degree to which physicians were responding to patient emotions, giving and receiving information, and keeping the encounter organized; these skills were positively associated with patient recall and indirectly associated with adherence to treatment via patient satisfaction and recall.

Face to face PCC can result in more future online interaction among patients and providers when patients are satisfied and trust the provider (Jiang, 2020). Physician use of PCC can also result in patients perceiving the physician to be more competent and trustworthy, and having an increased likelihood to take the action recommended by the physician compared to not using PCC (Saha & Beach, 2011). In this study, Saha and Beach (2011) measured PCC as a composite variable comprised of a cardiologist trained to demonstrate empathy, gather patient concerns, learn more about the patient's background, tailor the discussion, build rapport, use simple words, and be emotionally expressive. When cancer patients experienced a lack of PCC, this resulted in them perceiving they did not have necessary information, or the provider did not take the patient's perspective adequately into account, and patients perceived their overall quality of care was lower

(Street et al., 2019). Finally, PCC results in increased patient trust in their physicians (Zwingmann et al., 2017).

Overall, PCC elements associated with positive outcomes for patients include clinician behaviors that are associated with clarity (i.e., using simple words, providing information or giving clear explanations, etc.) and facilitating the provider-patient relationship (i.e., obtaining common ground, sharing feelings, using immediacy, and building rapport). However, these positive outcomes may not be achieved when clinicians use jargon.

2.3 Clinician Use and Implications of Jargon

Poor patient health outcomes may be a result of patients not understanding or remembering messages, especially when clinicians use jargon (Bourquin et al., 2015; Castro et al., 2007; Howard et al., 2013). Jargon consists of clinical terminology from a medical dictionary with a specified meaning, or terms that have one meaning when used in a lay context and a different meaning when used in a medical context (Castro et al., 2007). Jargon may also consist of medical abbreviations or acronyms (Pitt & Hendrickson, 2019). A sample of 108 medical students explained less than half of the medical jargon terms that they used when breaking bad news regarding cancer (Bourquin et al., 2015). In a standardized patient encounter, internal medicine residents in one medical residency program used an average of two jargon terms each minute, with 88% of the residents believing they used simple language (Howard et al., 2013). Castro et al. (2007) discovered that physicians used an average of four jargon terms per encounter in visits with low health literacy patients. Jargon may not only be used in verbal communication, but also in written communication. In an analysis of patient education brochures, readability levels ranged from 8th to 15th grade when including jargon, and after getting rid of the jargon terms, the readability levels ranged from 6th to 10th grade, which is a much lower readability level that would be easier for more

patients to interpret (Sand-Jecklin, 2007). Clinician use of medical jargon becomes problematic when patients cannot understand it.

Many patients do not understand medical jargon, and if medical jargon is used to describe a health condition, this means these patients cannot adequately understand important health information. For example, among patients visiting a breast cancer clinic for the first time and being asked to define breast cancer terms, over half of the terms were defined incorrectly by more than half of the participants (O'Connell et al., 2013). Lay individuals in the Netherlands only understood an average of 6.8 out of ten jargon terms related to cancer, and those who understood more terms had more confidence in their understanding of the terms (Pieterse et al., 2013). Hospital patients in the UK were asked to define cardiology jargon and partial to total correct definitions were only found for 18-25% of the least known terms, and physicians generally overestimated patients' knowledge of the jargon terms (Blackman & Sahebjalal, 2014).

There are other negative implications of physician use of jargon beyond inadequate patient understanding. Use of jargon results in increased worry among the lay public compared to explanations not containing jargon (Abramsky & Fletcher, 2002). Use of jargon by providers when interacting with patients with rheumatic diseases may influence patients' adherence to treatment (Goh et al., 2017). Unexplained jargon is especially concerning, since providers are not taking the time to define the technical terminology they are using, meaning patients may be less informed of their health conditions, and this practice is frequent among providers (Links et al., 2019). Surgeons working with children with sleep-disordered breathing used an average of 29 instances of unexplained jargon in each encounter (Links et al., 2019). Pediatric residents explaining genetic conditions to patients used 20 jargon words per interaction on average, and did not explain the jargon 83% of the time on average (Farrell et al., 2008). If patients do not know information about

their health condition, they may not sufficiently understand how to adhere to their treatments, meaning their health may not improve. Therefore, it is important for physicians to use simple language to avoid and/or explain medical jargon when interacting with patients. Analogies can be used as a way to explain medical jargon so that the terminology potentially makes more sense to patients.

2.3.1 Patient Comprehension and Health Literacy

Health literacy is the "degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" (U.S. Dept of HHS, 2000). Approximately 90% of U.S. adults have inadequate health literacy, meaning they have a difficult time comprehending and utilizing medical information that is complicated or new (CDC, 2019); 19% of U.S. adults have the lowest literacy level while 29% have the lowest numeracy level (U.S. Department of Education, 2017). Patients with low health literacy more frequently visit the emergency department, are less likely to take medications properly, and less likely to seek preventive care than patients with high health literacy (Berkman et al., 2011). Having low health literacy makes it difficult for patients to understand health information (Castro et al., 2007; U.S. Dept of HHS, n.d.). Patients aged 55-74 with low health literacy recall significantly less information than patients of the same age range with satisfactory health literacy (McCarthy et al., 2012). Analogies are likely useful as an explanation tool for patients with low health literacy (Talley, 2016), and a group of Australian radiation therapists even said they use analogies as a technique to describe complicated ideas to low health literacy patients (Smith et al., 2013). Analogies were also included as a clear communication strategy in a training for first-year medical students to use when communicating with patients who have low health literacy (Hildenbrand et al., 2020). However, analogies may influence participants' understanding

differently depending on their health literacy levels, as an experiment with 500 cancer patients indicated different metaphors were better at enhancing comprehension of clinical trial randomization based on whether the patients had low or high health literacy (Krieger et al., 2017). Because low health literacy patients tend to struggle to recall and understand medical information and they may have differences in understanding based on the analogies being used, it is important to consider including health literacy as a covariate in the dissertation analyses.

2.4 Analogies as PCC

Clinician use of analogies could be considered a form of PCC because of their potential influence on patient understanding, as well as their potential influence on facilitating a positive relationship with patients.

2.4.1 Analogies' Influence on Objective Understanding, Perceived Understanding, Clarity

One way utilization of analogies by healthcare providers could be considered a form of PCC is the fact that analogies are considered a patient-centered communication strategy. For example, among researchers in Australia working with Aboriginal patients, they used metaphors as a patient-centered tactic to describe health information in a way that is relevant to Aboriginal patients and their specific culture (Lin et al., 2016). Physician use of analogies could also be considered a form of PCC because analogies can enhance patient understanding of a medical concept. In their book *Metaphors We Live By*, Lakoff and Johnson (1980) explain, "Metaphor is principally a way of conceiving of one thing in terms of another, and its primary function is understanding" (p. 36). Analogies relate a concept being described to a different concept that a patient is likely already familiar with, which can enhance patient understanding. Analogies are also recommended as a strategy to help enhance learning (Azer et al., 2013).

Understanding is comprehension of a message by analyzing information contained in the message and obtaining the intended and/or accurate meaning from the information (Houts et al., 2006). In the present dissertation, objective understanding is defined as knowledge of information that participants are able to recall on a short-term basis upon being prompted with quiz questions. Perceived understanding is participants' perceptions of their own understanding, using the definition of understanding listed above (Houts et al., 2006), related to the information that was presented. Clarity is a situation when a physician explains health information in such a way that the meaning the physician intends is effectively stimulated in the mind of a patient (Chesebro & McCroskey, 2001) in an effort to enhance the patient's understanding. Patient understanding is significant because it can influence patient adherence, which can then influence patient health outcomes like mortality or remission (Street et al., 2009). Recall of information is also important, as among patients with depression who were receiving therapy as treatment, recall of treatment information was positively associated with adherence to treatment (Dong et al., 2017). Finally, regarding the significance of perceived understanding, among certain Korean adults aged 65 and over, when they perceived that pharmacists provided an adequate explanation of their medication, they were more likely to adhere to the medication (Jin et al., 2016).

2.4.1.1 Previous Survey Research

Prior research has analyzed clinician use of analogies, with some studies consisting of surveys completed by healthcare providers. As an example, Arroliga et al. (2002) surveyed over 20 pulmonary doctors and all but one of them claimed analogies are useful when communicating with patients. Likewise, Bullen et al. (2018) surveyed 16 podiatrists in Scotland regarding their use of metaphors when communicating with patients, and all of them said they regularly used

metaphors to explain medical concepts to patients. Lastly, in a survey of allied health faculty, they reported that use of metaphors would enhance learning among their students (Gess et al., 2020).

2.4.1.2 Previous Research Using Interventions and Other Methods

In addition to survey research, other studies have consisted of interventions using analogies, and evaluated their impact on participant comprehension. Over 70 Brazilian adults from a rural area with a low rate of literacy participated in a hookworm vaccine intervention involving analogies in which the facilitators compared the process of creating sweets to vaccines; after the intervention the participants had increased knowledge about hookworm and the vaccine (Gazzinelli et al., 2010). Among U.S. patients with Type 2 diabetes who completed a diabetes education course, the treatment group received an active learning session with a weather forecast metaphor to illustrate cholesterol and blood pressure levels while the control group received the regular lecture session. Those in the treatment group had significantly greater comprehension of diabetes than those in the control group (Naik et al., 2011). Next, individuals with intellectual disabilities and asthma in Australia completed an intervention teaching them how to correctly use inhalers; one strategy the instructor used was analogies to help them understand the correct positioning of the inhaler, and the instructor perceived that the analogies helped increase participants' comprehension (Davis et al., 2016a). As another example, a pain neuroscience intervention was implemented for 90 physiotherapy receptionists in the U.S. utilizing metaphors along with other strategies to describe chronic pain; their knowledge of pain increased by about 23% after the intervention (Louw et al., 2019a), and a year later most of the participants indicated the metaphors were helpful in enhancing their understanding (Louw et al., 2019b). Though these studies measure objective understanding or perceived understanding as outcomes, the present

dissertation is different because it does not contain an educational intervention, but rather a brief stimulus of a doctor-patient scenario.

Other studies have also been conducted using nonexperimental methods but still measuring the use of metaphors or analogies as an independent variable and understanding as a dependent variable. For example, use of metaphors in medical interviews among Italian patients and clinicians often resulted in poor understanding, as indicated in observations of medical encounters (Macagno & Rossi, 2019). As a second example, a clinician from Italy diagnosed 50 children with Leukemia using a garden analogy, and the analogy helped them to adequately comprehend the disease; in their retelling of their diagnosis which was scored for comprehension on a scale from 0-3, 25 of them scored 3, 20 scored 2, and 5 scored 1 (Jankovic et al., 1994). In addition to research related to analogies using nonexperimental methods, experimental research has also been conducted.

2.4.1.3 Previous Experimental Research

Experiments have been undertaken examining the influence of analogies on receiver recall. As one example, patients who were in the hospital due to heart failure were given four conditions to show the differences in their physical functioning (Reading Turchioe et al., 2019). They were shown just text, text with a number line, text with a line graph, or text with a visual analogy of a dial to show the direction of the changes. Then the patients were asked to recall their physical functioning levels and those in the visual analogy condition had the highest recall at 83% compared to 60-73% for the other conditions, and was significantly higher than the text only and the line graph recall (Reading Turchioe et al., 2019). As a second example, in an experiment with patients with rheumatoid arthritis and undergraduate students, they were given information about an imaginary drug to treat joint damage (Martin et al., 2013). Participants were assigned to one of

four conditions: statement alone, statement plus pictures showing how the disease progresses, a statement plus a frequency pictogram showing projected joint damage, and narrative plus a speedometer as a visual metaphor showing projected joint damage. The results indicated that those assigned to the speedometer condition had the greatest recall of information (Martin et al., 2012). These two experiments differentiate themselves from the dissertation because they are examining visual analogies with an image of a dial or a speedometer as opposed to verbal analogies. Next, Donnelly and Dumas (1997) had college student participants read scenarios involving a conversation between a patient and therapist and respond to cued recall items; using analogies to give advice resulted in better memory for the advice compared to not using analogies to give advice. In a final experiment comparing the act of teaching college students medical terms using analogies versus not using analogies, those students who were assigned to an analogy condition had better immediate and delayed recall of the terminology (Newby et al., 1995). Though these experiments analyze the influence of analogies on receiver recall, they have narrow samples as opposed to a U.S. adult general population sample, and do not include a video stimulus such as what is used in this dissertation.

In addition to examining recall as a dependent variable, other studies have examined the influence of speaker use of analogies on recipient understanding. In particular, individuals from New Zealand obtaining treatment for rheumatology-related issues were encouraged to switch to a different version of a medication they were taking; they were exposed to a condition with an analogy or a condition without an analogy, and positive or negative framing. The analogy did not influence their decision to change to the new medication or their comprehension of information regarding the medication (Gasteiger et al., 2020). Next, in an experiment containing challenging medical problems, use of analogies enhanced understanding for people with high numeracy and

for simple medical problems, analogies enhanced understanding for people with low numeracy (Galesic & Garcia-Retamero, 2013). These studies differentiate themselves from the dissertation because Galesic and Garcia-Retamero (2013) gave participants a medical problem to solve as opposed to having a physician explain a medical issue, and Gasteiger et al. (2020) included framing as part of their conditions; additionally, neither study examined additional elements this dissertation analyzed such as comparison of analogies for familiar versus less familiar health issues and use of analogies to describe diagnosis or treatment.

2.4.1.4 Research Specific to Clinical Trial Randomization or Genetics Understanding

Several articles have been written related to use of metaphor to enhance comprehension of clinical trial randomization or genetics information. Clinical trial recruiters often use a coin flip analogy to help individuals understand clinical trial randomization (Morgan et al., 2016), but patients do not perceive this analogy helps them understand (Jepson et al., 2018). As a related illustration, 500 U.S. individuals with cancer participated in a posttest only experiment in which they were assigned to one of four conditions that varied in how they described clinical trial randomization: simple language, coin flip metaphor, sex of baby metaphor, or control. For those with lower health literacy, the sex of baby metaphor resulted in greater understanding compared to the simple language and control groups, but for those with greater health literacy, the coin flip metaphor was more helpful at enhancing understanding compared to the sex of a baby metaphor (Krieger et al., 2017). While these studies describe clinical trial randomization, the dissertation describes diagnosis and treatment information, and more than one metaphor is used in each treatment condition.

For genetics information, authors in one commentary describe common metaphors used to explain genomics and suggest a new “communities” metaphor to promote more accurate

understanding (Perrault & O'Keefe, 2019). Among underserved women in a study testing genetic informational materials regarding risk for breast cancer in focus groups, they felt use of analogies helped them understand their risk as opposed to other forms of genetic information such as seeing risk numbers or family narratives (Lubitz et al., 2007). These genetics articles are not experimental in nature, and additional understanding measures such as objective understanding and clarity are not measured, which distinguishes them from the current dissertation. Overall, previous literature suggests that metaphors and analogies may be a useful tool for physicians to use to explain health phenomena to patients in order to enhance their understanding of the health phenomena.

2.4.1.5 Analogies Used to Teach Healthcare Providers

Another reason that analogies may be useful for enhancing patient understanding is because they are used to teach clinicians medical concepts, as well as students going into healthcare professions. As evidence, in a recent study of over 350 allied health faculty, 67% indicated they used metaphors the last time they taught clinical information to their students (Gess et al., 2020). Analogies are likely helpful for improving health professionals' recall (Masukume & Zumla, 2012), teaching nurses different medical concepts (Aldridge, 2018), teaching providers about dermatology (Frieden & Dolev, 2005), and teaching medical students about psychiatry (Selzer & Ellen, 2010). Additionally, Kanthan and Mills (2006) used metaphors, analogies, and similes to teach undergraduate medical students and dental students about pathology, and having the students draw visual metaphors helped them learn more medical information and improved their communication skills with patients. Finally, some medical concepts are illustrated or named using analogies as visual images to describe how the health condition looks (Gocmen et al., 2014), which may help clinicians better recognize them. For example, researchers came up with a series of fruits and vegetable metaphors to show how pressure ulcers progress to educate nurses about them

(Mackintosh et al., 2014). As another example, Gocmen et al. (2014) examined 40 visual metaphoric signs of brain issues from brain scans such as a zebra sign (meaning the brain scan looks like a zebra) for remote cerebellar hemorrhage. If analogies are helpful in teaching clinicians, then they are likely to be helpful in educating patients about health conditions.

H1: Participants who are exposed to a physician message containing analogies will have significantly greater objective understanding, perceived understanding, and perceptions of clarity than participants who are not exposed to a physician message containing analogies.

2.4.2 Analogies and a Familiar versus Unfamiliar Health Condition

The present proposal will compare the usefulness of analogies for a familiar health condition (hypertension) and an unfamiliar health condition (spontaneous pneumothorax). Hypertension affects about 45% of adults in the U.S. (National Center for Health Statistics, 2018), and it is likely a well-known health condition since it is so prevalent (Cohut, 2018). Spontaneous pneumothorax is much less prevalent, affecting 7.4-18/100,000 men and 1.2-6/100,000 women every year (U.S. National Libraries of Medicine, 2019). However, only participants familiar with hypertension and unfamiliar with pneumothorax were recruited for the present study to ensure fidelity with this hypothesis. Results from this dissertation will help determine whether use of analogies in particular situations are more effective than in other situations at enhancing patient understanding, which could ultimately influence patients' health outcomes.

Because participants will be familiar with hypertension, they may not need analogies to help them understand the health condition. For example, in a study examining use of familiar versus unfamiliar graphical context to explain global warming, results indicated that though there

was no effect on acquisition of knowledge or recall, those in the familiar condition experienced more knowledge application and motivation to learn about global warming (Song & Bruning, 2016). Individuals who are less familiar with a topic may find analogies to be more helpful in enhancing understanding compared to those who have lots of knowledge about the topic (Orgill & Bodner, 2005). For instance, instructions that are patient-centered are more helpful for explaining medications that are unfamiliar than for medications that are familiar among older adults experiencing chronic heart failure (Morrow et al., 2005). These patients were tested on their understanding and recall of instructions for medications they already take versus medications they were unfamiliar with. They were given instructions in a standard way versus patient-centered way (using fewer words). While recall was greater for the familiar versus the unfamiliar medications, the patient-centered instructions were understood significantly better for the unfamiliar medications than for the familiar ones (Morrow et al., 2005). As another example, use of a graphic threat as part of a fear appeal was more effective at increasing perceptions of seriousness for an unfamiliar versus a familiar health issue (De Pelsmacker et al., 2011), indicating people respond to health messages differently based on their level of familiarity with the health issue. Finally, diabetic patients recently taught about HbA1c had a significantly greater decrease in HbA1c if they were previously not familiar with the term "HbA1c" than patients who were previously familiar with it (Iqbal et al., 2008). This means clear communication strategies may be more helpful for participants who are unfamiliar with a topic than for those who are already familiar with that topic. Consequently, because participants will be unfamiliar with spontaneous pneumothorax, analogies may be more helpful in explaining pneumothorax.

H2: Use of analogies will be more effective at increasing participants' objective understanding, perceived understanding, and perceptions of clarity for the unfamiliar health condition (spontaneous pneumothorax) than for the familiar health condition (hypertension).

2.4.2.1 Analogies Could Hinder PCC if not used Properly

Though analogies can be considered a form of PCC, they can also be unhelpful if not used properly. Analogies can prevent PCC if patients do not understand or like the analogies. Metaphorical language can be misleading (Talley, 2016), cause confusion or misunderstanding (Hui et al., 2018; Macagno & Rossi, 2019), or potentially lead to overgeneralization (Newby et al., 1995) if not appropriately utilized. Use of metaphor means that only one part of the concept being explained is in focus, but at the same time the other parts of the concept are concealed that are not in line with the metaphor, so this results in incomplete comprehension of the concept being explained (Lakoff & Johnson, 1980). Metaphors might also result in stereotyping or stigma depending on their use (Czechmeister, 1994), decrease perceptions of the likelihood that a risk will occur (Barilli et al., 2010), or trivialize a situation in which a patient is dying (Spall et al., 2001). Additionally, not all analogies are equally useful to explain concepts. Analogies are not helpful if they do not have a familiar base (Van Stee, 2018). Analogies should not only be familiar, but also easy for one to visualize (Duit, 1991); in the context of science education if students do not know the analogy or cannot visualize it, they tend to be upset and do not pay as much attention to the message (Harrison, 2006). Furthermore, analogies are more effective when they come from different domains from whatever concept the analogies explain, as analogies from different domains are better remembered (Halpern et al., 1990; Tourangeau and Sternberg, 1981). For instance, use of a diabetes metaphor to describe depression can be problematic because the

conditions differ in too many ways even though they both come from a medical domain (McMullen & Sigurdson, 2014).

To summarize, in order to be most effective analogies should be familiar, easy to understand, easy to visualize for the receivers, and originate from a field other than medicine since the present study takes place in a medical context. In this dissertation the analogies utilized fit all of the aforementioned criteria: water flowing through a garden hose, high pressure in a pipe, a faucet flushing water down a drain, loosening a belt, oil between engine parts, a balloon being inflated, a vacuum pump, and a tire being sealed with a patch.

2.4.2.1.1 Patients Disliking Certain Analogies to Discuss Specific Health Issues

There are other concerns to be aware of when considering perceptions of the use of particular metaphors in a health context. For instance, underserved individuals do not find a coin flip metaphor to describe clinical trial randomization (Krieger, 2014) or the chance of inheriting a particular genetic mutation (Lubitz et al., 2007) to be useful. As another example, a Japanese prostate cancer patient did not like when a doctor compared the diagnosis to a bad present for the new year when breaking the news that he had cancer (Torishima et al., 2020). Finally, some cancer patients from the UK indicated that they liked the journey metaphor for cancer while others did not like the journey metaphor because they did not want to feel positively about having cancer, and they did not like the survivor metaphor to describe a person with cancer because it resembles being a victim (Appleton & Flynn, 2014).

One common metaphor many patients believe is unhelpful is the war metaphor in the context of cancer or dementia (Brown & de Jong, 2018; Lane et al., 2013). This type of metaphor is problematic in this context because many patients will not survive (Wiggins, 2012), the metaphor makes it seem as though they have control over when they survive (Ellis et al., 2015),

and if they die there is an implication that they "lost," or that dying may be their fault (Lane et al., 2013; Slobod & Fuks, 2012; Sontag, 1978). Other issues with the military metaphor are that it does not assume patients have an active role in their treatment (Slobod & Fuks, 2012), and it can create greater perceptions among noncancer patients that there is not much a person can do to avoid getting cancer and that cancer treatment is challenging compared to use of a journey metaphor (Hauser & Schwarz, 2020). Thus, some recommend use of a journey metaphor instead (Nie et al., 2016). However, some studies indicate the military metaphor can be empowering depending on how it is used (Chircop & Scerri, 2018; Semino et al., 2017), and other potential benefits include indicating a desire to treat the cancer (Demmen et al., 2015), and feeling in control (Lane et al., 2013).

2.4.2.1.2 Cultural Appropriateness of Analogies

In addition to the importance of considering particular metaphors given the context of certain health issues, usage of metaphors varies depending on the culture in which they are utilized (Lakoff & Johnson, 1980), and the effectiveness of metaphor likely depends on cultural appropriateness. To illustrate, patients from Nepal with chronic pain used metaphors more frequently to describe their pain than U.S patients (Sharma et al., 2016). Relatedly, because Spanish speaking patients in the U.S. used different metaphors to describe mental health issues than a doctor, doctors could use metaphors specific to the Latino/a population when interacting with Spanish speaking patients (Magaña, 2019). Researchers working with individuals from various cultures have created, modified, or considered creating health interventions targeted toward these particular groups using metaphors appropriate to each individual culture. Specific cultural groups in which such research has been conducted include Australia Aboriginal communities (Haynes et al., 2019; Lin et al., 2016), an indigenous group of midwives in Mexico

(Bayles, 2008), Latino patients with cancer (Costas-Muñiz et al., 2020), first-generation patients from Turkey (Orhan et al., 2019), and patients in Sri Lanka with medically unexplained symptoms (Sumathipala, 2014). In the present dissertation, given that the sample consists of U.S. adults from the general population as opposed to a particular cultural group, the metaphors selected for the dissertation were deemed appropriate.

2.4.3 Analogies and Positive Perceptions

Analogies may also be considered a form of PCC because analogies consist of language that is likely familiar to patients and may help clinicians establish rapport with patients by decreasing the amount of social distance between them. Patients' perceptions of physicians are important to consider because they may result in patients wanting to visit the provider again in the future, which might result in greater continuity of care, and could allow for facilitating a positive provider-patient relationship. Additionally, because patients use metaphors, doctor use of analogies may allow for establishing a more personal connection with patients.

2.4.3.1 Patient use of Metaphor

Individuals across a variety of health issues use metaphors to describe their experiences, such as use of metaphors to explain symptoms (Skelton et al., 2002). As evidence, patients with idiopathic pulmonary fibrosis (Igai, 2019) and hypertension (Schuster et al., 2011) used metaphors to describe their experiences, and patients in an acupuncture clinic used metaphors to explain why they tried acupuncture (Fisher et al., 2019). Cancer has been described using metaphors by patients (Gibbs & Franks, 2002; Magaña, 2020), including Swedish cancer patients using metaphors to make sense of living with cancer and cope (Gustafsson et al., 2019). Similarly, patients with aphasia employed metaphors to describe good and bad parts of their experiences (Ferguson et al., 2010; Mitchell et al., 2011), and male veterans who had experienced a stroke used metaphors to

describe rehabilitation (Boylstein et al., 2007). Patients with epilepsy or who experienced seizures not due to epilepsy used metaphors to describe their seizures in medical visits with a neurologist (Plug et al., 2009; 2011). People who struggled with mental health issues also discussed their mental health issues and their recovery using metaphors (Beck, 2016; Charteris-Black, 2012; Cunningham et al., 2007; Foley, 2015; Mizock et al., 2014). Next, smokers used metaphors to describe trying to quit smoking (Akers et al., 2014), and users of psychoactive drugs utilized metaphors to discuss how the drug affected them and its consequences (Kaló et al., 2020). Palliative care patients explained their experiences of transcendence using metaphor (Arnold & Lloyd, 2014), eased into discussions on sensitive topics using metaphor, and shared metaphors to help them cope (Southall, 2013). Lastly, potential parents have made use of metaphors to describe their desire for expertise, independence, and connection regarding struggles with infertility and to discuss infertility in a socially acceptable way (Palmer-Wackerly & Krieger, 2015), and parents of premature babies used metaphors to discuss their perceptions of the care experience for their babies (Petty et al., 2019).

Many patients use analogies specifically to express pain they are feeling because pain is difficult to describe (Schott, 2004). Patients with various diagnoses have employed metaphors to describe their pain, such as patients with low back pain (Gustafsson et al., 2019), chronic pain (Munday et al., 2019), a missing limb or paralyzed body part with phantom pain (Nortvedt & Engelsrud, 2014), pain associated with sickle cell disease (Coleman et al., 2016), psoriasis (Ljosaa et al., 2020), breast cancer with pain from chemotherapy (Hellerstedt-Börjesson et al., 2016), musculoskeletal pain (Sharma et al., 2016), and pain associated with a heart attack (Jairath, 1999). Patients' utilization of metaphors to describe pain could help healthcare providers understand what patients are going through (Kortesluoma & Nikkonen, 2006), help patients cope (Nortvedt &

Engelsrud, 2014), and express to others that patients are managing their pain (Munday et al., 2019). Because patients use metaphors, they may appreciate when healthcare providers use analogies to explain medical concepts.

2.4.3.2 Liking

Physician communication likely influences patients' liking for the physician. Liking is a feeling of positive affect toward a physician based on a perception that the physician is nice, and that the participant would enjoy spending time with them (Ahearne et al., 1999). Liking is an important variable to consider because patients' liking toward doctors is positively related with enhanced satisfaction with the encounter (Hall et al., 2002). For instance, among almost 200 lupus patients, their ratings of working alliance, with one component of working alliance being liking for their healthcare provider, were positively related with compliance, satisfaction, and their perceptions of health (Bennett et al., 2011).

Physician use of analogies may positively influence patients' liking for the physician. For example, use of analogies to teach students chemistry resulted in students experiencing positive affect compared to not using analogies (Sarantopoulos & Tsaparlis, 2004), as well as being more motivated to learn (Orgill & Bodner, 2005). Among Chinese college students instructed to imagine a stressful situation, use of metaphorical restructuring of their situation led to decreased distress and increased insightfulness, which resulted in them experiencing less negative affect (Hu et al., 2018). Another group of researchers created a computer analogy to describe fibromyalgia for patients struggling with the condition, and patients liked the analogy (Hyland et al., 2016). For another example, a nurse created an intervention for adults addicted to substances utilizing analogies to describe the role of neurotransmitters in addiction, and she perceived that participants liked the analogies (Calleri, 1997). Lastly, Mexican immigrant women in the U.S. indicated they

liked analogies that were employed to explain medical concepts as part of a cervical health intervention (Hunter & Kelly, 2012), Even though some patients like analogies, it is unclear whether they also like the providers who use analogies to explain diagnosis and treatment information.

2.4.3.3 Similarity

Similarity involves feeling like one has characteristics in common with a physician, such as sharing similar attitudes (McCroskey et al., 2006). Benefits of patient perceptions of similarity with their physicians in terms of attitudes, beliefs, values, and goals include having greater treatment adherence, patient satisfaction, (Cvengros et al., 2007; Fuertes et al., 2015), enhanced perceptions of health (Jahng et al., 2005), and greater trust in the physician (Street et al., 2008). When patients trust their providers and feel similarity toward them regarding their beliefs, they experience less intense pain than patients who do not trust or feel similar to their providers (Losin et al., 2017). When patients perceive their providers are similar to them, they tend to like the provider more (Perrault & Silk, 2015), and patients are more likely to choose a provider who seems more similar to them than one who seems different (Perrault, 2016).

Because metaphors and analogies use relatable terminology (Elit et al., 2015; Troiano, 2005), and patients use analogies (Schott, 2004), this may enhance feelings of similarity among patients and physicians. Analogies compare new concepts to concepts that are part of daily life, and the concepts should be common experiences for recipients in order for the analogies to be effective (Niebert et al., 2012; Orgill & Bodner, 2005). In the context of science education, students are able to learn from analogies when they can associate prior understanding and/or draw upon familiar experiences from the analogies that allow them to make sense of the new concepts being described (Harrison & Treagust, 2006). When therapists pay attention to client metaphors, this

may increase patient perceptions of alliance with the therapist (Mathieson et al., 2017), so it is possible healthcare providers' use of their own analogies may also increase perceptions of similarity among patients. Yet, there is little research explicitly examining clinician use of analogies on patients' perceptions of their similarity with the clinician.

2.4.3.4 Satisfaction

Satisfaction involves participants being pleased with the interaction from a physician (Richmond et al., 1998). Patient satisfaction is significant to consider because it is positively associated with enhanced perceptions of health and quality of life (Baumann et al., 2011). Among Korean older adults, when they were more satisfied with their interactions with a pharmacist, they had greater adherence to their medications (Jin et al., 2016). In addition, when patients are dissatisfied with a medical visit, they are not as likely to see the provider again (Kessler & Mylod, 2011), and patient satisfaction is positively associated with continuity of care (Saultz & Albedaiwi, 2004).

Use of analogies may result in receivers being satisfied with the message. While not a patient sample, use of analogies when giving advice (Donnelly & Dumas, 1997) or giving information regarding climate change to college students (Raimi et al., 2017) was perceived by the students as being more useful than giving advice without analogies. Comparably, medical students who completed a metaphor computer game to learn history taking had greater satisfaction than those who received regular directions (Alyami et al., 2019). Moving to patient samples, patients with advanced cancer had greater satisfaction with their physicians' communication when the physicians used metaphors and analogies (Casarett et al., 2010). Additionally, a majority of U.S. cancer patients who were questioned after a medical interview perceived that when oncologists used metaphor to explain molecular testing that it was helpful (Pinheiro et al., 2017). Because

Casarett et al. (2010) and Pinheiro et al. (2017) conducted observational studies in which they analyzed medical encounters, their work is different from this dissertation, which uses an experiment to test the effectiveness of doctor use of analogies on understanding and other positive perceptions in addition to satisfaction.

2.4.3.5 Affective Communication

Affective communication consists of participants' perceptions that a physician engages in communication that makes them feel comfortable and respected (Galassi et al., 1992). Affectionate communication may be considered a form of affective communication, and physician affectionate communication is associated with patient satisfaction and adherence (Hesse & Rauscher, 2019). Among interactions between nephrologists and patients with chronic kidney disease, when the nephrologists engaged in less negative affective communication, the patients had greater medication adherence (Glenn et al., 2020).

Provider communication may result in enhanced patient perceptions of affective communication. For instance, nurse's aides used metaphors to describe the affective care and interaction they provide for nursing home residents (Berdes & Eckert, 2007), suggesting that there may be an association between metaphors and perceptions of affective communication. Similarly, ten women with low income and abnormal pap smears perceived clinicians as supportive when they used analogies they could understand, and perceived that the information was not supportive when the clinicians used too much technical terminology (Bertram & Magnussen, 2008). As additional evidence, using a metaphorical style of counseling by a counselor resulted in greater likelihood for participants to express emotions and experience affective engagement compared to using a literal counseling style (Tay, 2020a). Tay (2020a) had college students participate in an experiment in which they interacted with a counselor regarding academic concerns, and measured

skin conductance as a form of affective engagement. Overall, there is a paucity of research examining the influence of provider analogies on patient perceptions of provider affective communication. Given previous literature related to individuals liking or appreciating when others use analogies, there is an expectation that participants will have positive perceptions of a physician who uses analogies compared to a physician who does not use analogies.

H3: Participants who are exposed to a physician message containing analogies will have significantly greater liking for physician, perceptions of similarity, satisfaction, and perceptions of affective communication than participants who are not exposed to a physician message containing analogies.

2.5 Analogies to Explain Diagnosis versus Treatment

Healthcare providers tend to use analogies for explanation of both diagnosis and treatment, but researchers have not explicitly examined whether there are differences in their usefulness to explain diagnosis or treatment. For example, Hanne (2015) states that metaphors are useful for explaining diagnosis and treatment, but spends more time discussing use of metaphors early in the diagnosis process. Similarly, Arroliga et al. (2002) state that metaphors are useful for both diagnosis and treatment, but a majority of their examples of physician metaphors are focused on diagnosis over treatment. Analogies can be useful to explain chronic pain in the context of diagnosis using analogies such as an alarm system or technology glitch, and in the context of treatment to explain rehabilitation using analogies such as a seesaw or an athlete (Coakley & Schechter, 2013). The usefulness of certain analogies within particular scenarios has also been recommended by physicians such that they are useful when a physician must express large numbers, provide a visual, or explain new material (Periyakoil, 2019; University of Utah Health,

2017). However, none of these suggestions relate specifically to diagnosis and treatment. Understanding nuances involved with analogies in terms of whether they are used to describe diagnosis or treatment could allow for patients better comprehending information about their health.

RQ1: Are there differences in the usefulness of analogies at enhancing participants' objective understanding, perceived understanding, and perceptions of clarity depending on whether they are used to explain diagnosis or treatment?

2.6 Effectiveness of Written versus Spoken Analogies

Giving information in written versus spoken format may impact particular patient outcomes differently. For instance, in a study conducted in Italy analyzing informed consent for surgery, only 2% of participants said their decision for surgery was based on the written consent, while 67% said their decision was based on spoken information from a doctor (Agozzino et al., 2019). Research testing the efficacy of analogies has generally examined *only written* analogies in clinician explanations (Brindley et al., 2010; Galesic & Garcia-Retamero, 2013), or *only video* dissemination of metaphors or analogies in clinician explanations (Krieger et al., 2011). As evidence, individuals experiencing chronic pain obtained a pamphlet of metaphors related to pain or a pamphlet using cognitive behavior therapy strategies related to pain and discovered that those in the metaphor group had increased knowledge of pain biology (Gallagher et al., 2013). Written and face to face strategies have been compared for determining effectiveness on participant understanding of a health concept, but not specifically in the context of analogies. As an example, in a randomized study of pregnant women at risk for early delivery, researchers tested the effectiveness of a verbal message compared to a verbal message plus written materials and found

no significant difference in knowledge of short-term problems, but the verbal and written condition was superior for knowledge of long-term issues (Muthusamy et al., 2012). In another example, patient recall of illness information from a booklet was assessed compared to the booklet plus a face-to-face intervention. Those in the intervention condition had significantly better recall than those with only a booklet (Webber et al., 2001).

Though these studies examined the impact of written and face to face or video communication together, few studies have experimentally tested each channel separately from one another for a comparison on patient understanding. One example of an observational study comparing them is Curtis et al. (2016), who examined verbal compared to written prescription information for patients receiving a new medication. They measured participant understanding of the medication risks and side effects and found essentially the same level of understanding for those given only face to face or written instructions, but significantly greater understanding for those who received both types of instruction at the same time. A meta-analysis of studies evaluating patients' recall of discharge instructions upon leaving a hospital reported that recall was 47% for verbal instructions, 58% for written instructions, and 67% for video instructions, but there were no statistically significant differences based on the format of the instructions (Hoek et al., 2020). Thus, it is unclear whether there will be differences in understanding given the use of analogies in each format.

Testing each channel separately will allow for understanding each channel's individual contributions to comprehension and determining which is more effective, if there is a difference. Video messages may lead to more patient understanding than text because video allows for viewing nonverbal cues delivered via face-to-face communication (Daft & Lengel, 1984). However, written messages could also enhance understanding since participants can view the

information for a longer period of time and potentially review it more than once. In this study, video messaging will simulate face-to-face communication and vignettes will simulate written communication. Determining whether the format of the analogies influences patient understanding will further outline in which particular situations analogies are most effective for healthcare providers to use, and could potentially influence other outcomes such as patient compliance or health outcomes in the future.

RQ2: Are there differences in the usefulness of analogies at enhancing participants' objective understanding, perceived understanding, and perceptions of clarity depending on whether they are presented in a written versus a spoken format?

2.7 Recall of Analogies

While previous research suggests that analogies help individuals remember information about their health, it is likely that they may recall the actual analogies as well. If patients remember the analogies, this could mean they also remember the information the analogy is meant to explain, which could help enhance patient understanding of a health issue. Patients might better remember details about a health issue when metaphors are used to explain the health issue (Lin et al., 2016). For example, for several patients in the United Kingdom with low back pain, they better recalled what student osteopaths said about their diagnoses when the osteopaths used analogies because it was difficult for the patients to recall medical terminology (Thomson & Collyer, 2017). Likewise, other studies have indicated that use of analogies to describe a concept helps with receiver recall (Martin et al., 2012; Reading Turchioe et al., 2019). One set of researchers sought to investigate participants' recollections of how helpful particular metaphors were to explain medical concepts. Patients who participated in a pain neuroscience intervention were asked whether particular

metaphors used during the intervention that took place one year before were useful; while the participants found many of them to be useful, no metaphors were remembered as especially helpful compared to others (Louw et al., 2019b). Yet, little research has analyzed whether participants mention the analogies when recalling information and whether certain analogies are recalled more than others.

RQ3: a) What percentage of participants assigned to an analogy condition will recall analogies from the physician's message? b) Which analogies will they recall most frequently?

2.8 Analogies as a Reason for Liking/Disliking Physician

Knowing whether participants explicitly mention analogies as something they like or dislike about a healthcare provider may allow for determining how much attention they paid to the analogies, which will be another way of determining the analogies' potential impact. Even if participants do not explicitly mention liking or not liking the analogies, they may mention other qualities that are associated with analogies, such as having a clear explanation, being relatable, or avoiding technical terminology. Some patients like when providers use analogies (Casarett et al., 2010), so those assigned to a condition with analogies may mention that they liked the analogies. Patients also like when their providers explain information in a way that is easy to understand (Ahmed & Bates, 2016; Evers et al., 2017). For instance, when selecting a primary care provider, 91% of participants in one study indicated they wanted a provider who can explain medical conditions in an understandable way (McGlone et al., 2002). Physician use of analogies may allow for patients to believe that they better understand information (Schnitzler et al., 2017). Because use of analogies might result in patients perceiving they better understand information, participants

could mention analogies as a reason for liking the physician. Another possibility is that participants who are exposed to a condition with analogies could report that they like that the physician was clear (or another positive characteristic) more frequently than those exposed to a condition without analogies.

At the same time, participants could mention disliking the physician's use of analogies. For instance, particular metaphors by patients with aphasia, caregivers, and speech language pathologists were used to describe disempowerment (Ferguson et al., 2010), so analogies may have negative connotations. Analogies can also result in confusion or misunderstanding (Hui et al., 2018; Macagno & Rossi, 2019), or trivialization of a serious issue (Spall et al., 2001), which could lead to participants disliking them. The next research question attempts to understand whether participants will mention analogies as something they liked or did not like about the provider's message, and whether the reasons they list for liking or not liking the physician differ based on the condition to which they were assigned.

RQ4: Do participants assigned to an analogy condition mention analogies as a reason for a) liking, and b) not liking the physician? What reasons do participants mention for c) liking, and d) not liking the physician, and e) do they differ by analogy condition?

2.9 Analogies as Memorable Messages

Memorable messages are verbal messages that are able to be recalled for a long time, and that are perceived as influential (Knapp et al., 1981). These messages are often brief, given by someone of higher status, are personally relevant, and are delivered when the receiver needs help (Knapp et al., 1981; Stohl, 1986). Memorable messages have been studied with various health situations and topics, such as sexual health (Rubinsky & Cooke-Jackson, 2017), diet and exercise

(Dorrance Hall et al., 2016), nutrition (Davis et al., 2016b), mental health (Greenwell, 2019), prescription stimulants (Crook & Dailey, 2017), communicating mistakes in nursing (Noland & Carmack, 2015), breast cancer (Lauckner et al., 2012; Smith et al., 2009), international student perceptions of student health centers (Carmack et al., 2016), final conversations with a loved one (Keeley, 2004) and the H1N1 flu (Miczo et al., 2013).

Even though memorable messages have been studied in a health context, generally few participants in these studies mentioned healthcare providers as the source of the memorable messages. For instance, Smith et al. (2009) reported only about 15% of participants remembered a memorable breast cancer message from a healthcare provider, Rubinsky and Cooke-Jackson (2017) claimed only 7% of their sample shared a memorable message about sex from a provider, Crook and Dailey (2017) stated only 2% of their participants received a memorable message about prescription medications from a provider, and Miczo et al. (2013) discovered only 1.5% of their sample received a memorable message about the H1N1 flu from a provider. One exception is Willer (2014), who analyzed memorable messages solely from healthcare providers regarding infertility.

Memorable messages have not been studied in the context of doctor-patient communication regarding use of metaphorical language to enhance understanding of a health condition. Analogies could be considered to be memorable messages, but they have not been mentioned in memorable message literature. Memorable messages should be studied in the context of provider analogies because if analogies are considered memorable messages, this means they have a lasting impact on patients. Memorable messages may influence behavior, and studying them has implications for healthcare providers (Cooke-Jackson & Rubinsky, 2018). For instance, sexual health memorable messages may impact one's behavior and sense of self (Rubinsky & Cooke-Jackson, 2017),

diet/exercise messages received as a child may influence health behaviors in the future (Dorrance Hall et al., 2016), and memorable messages about getting help for mental illness may result in young adults perceiving that it is good to seek help (Greenwell, 2019). Receiving memorable messages from healthcare providers regarding breast cancer even resulted in greater willingness to do a breast self-exam and get a mammogram (Smith et al., 2009). Additionally, if analogies are a type of memorable message, this provides another form of communication to analyze (metaphorical language) when conducting memorable message research.

Doctor messages could be perceived as memorable messages by patients because they align with some of the requirements for memorable messages. Specifically, physicians typically have more biomedical expertise than patients, potentially making them higher in status, the messages are highly relevant because they are health-related, and the patients are in need of assistance. Using analogies helps people remember information (Halpern et al., 1990; Newby et al., 1995), and this means that people probably also remember the analogies themselves in addition to whatever concept the analogies are meant to explain. Analogies could potentially be considered memorable messages because they likely draw attention to a message which allows patients to better remember the message. When patients remember accurate messages about their health, this could help them improve their health.

Physicians use analogies to describe particular health issues, which may be useful for helping patients remember health information, or helping patients remember the analogies themselves. For instance, Scottish podiatrists indicate they use metaphors such as walking on honeycomb or a lightbulb breaking to describe foot conditions related to diabetes (Bullen et al., 2018). Another specific use of metaphor is a peanut butter cup analogy to explain a dermatological surgery procedure to patients that is recommended by a group of researchers (Lee et al., 2017).

Other researchers have analyzed categories of provider metaphors as opposed to specific individual metaphors. Metaphors frequently used by providers in the U.S. are the patient as a consumer, the body compared to a machine, and disease as war, but these specific metaphors may not be used by patients (Plotnikoff, 2004). Common metaphor categories that have been used in psychotherapy include war, the mind as breakable, bodily experiences, steam engine, and conduit metaphors (Berlin et al., 1991). In Latino/a patient consultations with one doctor about mental health, the doctor tended to use metaphors based on physical directions or containers (Magaña, 2019). Additionally, general practice physicians in the UK used metaphors describing disease as a puzzle or the body as a machine (Skelton et al., 2002). Though many physicians use analogies, and there even exists a comprehensive list of commonly used physician analogies (Altoona Family Physicians, n.d.), it is not clear which analogies patients prefer and remember most. The following research question seeks to understand which metaphors or analogies are most commonly remembered by patients.

RQ5: What messages do participants remember in which a physician used helpful metaphors and/or analogies to explain a medical concept?

2.10 Perceptions of the Usefulness of Analogies to Explain Medical Concepts

Patients may have preferences for how and when providers use analogies. Understanding these preferences may allow for providers to establish a more positive relationship with patients. Patients might desire analogies to be used for a particular purpose, such as providers using analogies in a persuasive manner to convince patients to make healthy choices or comply with a treatment plan. For instance, use of metaphor is effective at convincing individuals to get a flu shot (Scherer et al., 2015), and enhancing perceptions of susceptibility to getting the Zika virus (Lu &

Schuldt, 2018). Analogies may also be useful to illustrate concepts visually that may be hard to picture (University of Utah Health, 2017), or explain illness to patients (Skelton et al., 2002). Additionally, metaphors might make discussions more personal with patients (Hui et al., 2018). Among clinicians in England working in hospice, use of clinician and/or patient metaphor served multiple purposes such as assisting with avoiding a topic, patient comprehension, and helping to facilitate the provider-patient relationship (Spall et al., 2001).

Patients could believe analogies are more helpful in certain medical situations over others, or equally helpful in all medical situations. Previous research indicates that providers use metaphors in various health contexts. For example, doctors use analogies to describe pulmonary issues (Arroliga et al., 2002), medical students used them to describe vaccines (Chase et al., 2020), healthcare providers use them to explain acupuncture to patients (Fisher et al., 2019), and providers also use metaphors to explain molecular testing to cancer patients (Pinheiro et al., 2017). Additionally, a group of clinicians decided when to use analogies to describe a plasma cell disorder based on the age, educational level, and intellectual capacity of the patient (McShane et al., 2018). Similarly, a medical doctor explains that she uses analogies to help patients when they seem confused or are skeptical (Harpham, 2010). Yet, little research has investigated patients' perceptions of when clinicians' use of analogies is helpful. Because little research has asked patients in which medical situations they think analogies would be useful, it is unclear whether they will have preference for certain purposes regarding provider use of analogies.

RQ6: Under which medical conditions or situations do participants find analogies to be most helpful?

CHAPTER 3. METHODS

3.1 Design

The present study includes a posttest-only control group design[1], with eight conditions consisting of six treatment conditions with analogies and two control conditions without analogies (see Table 1). A familiar (hypertension) and an unfamiliar (spontaneous pneumothorax) health condition will be tested. The design is a 2 (health condition: hypertension/spontaneous pneumothorax) x 4 (no analogies, diagnosis analogies, treatment analogies, both diagnosis and treatment analogies).

Table 1. Dissertation Conditions

Condition	**Description**
Condition 1	Hypertension Video/Pneumothorax Vignette: No analogies
Condition 2	Hypertension Video/Pneumothorax Vignette: 2 diagnosis analogies
Condition 3	Hypertension Video/Pneumothorax Vignette: 2 treatment analogies
Condition 4	Hypertension Video/Pneumothorax Vignette: 4 analogies-diagnosis/treatment
Condition 5	Pneumothorax Video/Hypertension Vignette: No analogies
Condition 6	Pneumothorax Video/Hypertension Vignette: 2 diagnosis analogies
Condition 7	Pneumothorax Video/Hypertension Vignette: 2 treatment analogies
Condition 8	Pneumothorax Video/Hypertension Vignette: 4 analogies-diagnosis/treatment

[1] A posttest only design is utilized because the experiment is short enough that participants would likely remember the information from the pretest while completing the posttest, and having a pretest might change how participants pay attention to the stimulus video.

3.2 Variables

3.2.1 Independent Variables

The independent variables are use of analogies (no analogies, diagnosis analogies, treatment analogies, or both diagnosis and treatment analogies), health condition (hypertension/spontaneous pneumothorax), and delivery format (video/vignette), and the variables are manipulated in each condition/script (see Appendix A).[2]

3.2.1.1 Health Issue Familiarity Qualifying Question

A qualifying question was incorporated to the start of the survey in order to only allow participants who were familiar with hypertension and unfamiliar with spontaneous pneumothorax to complete the survey. The question was "Which of the following health conditions have you heard of?" It was presented in a "select all that apply" format, with answer options of the two health issues from the dissertation (hypertension and spontaneous pneumothorax) along with other real or fake health issues in an effort to conceal the inclusion criteria and weed out poor quality responses. Answer options were: "bacterial groloma;" "bileana;" "diabetes;" "fibromyalgia;" "hypertension;" "oglioitis;" "peripheral sammopilia;" and "spontaneous pneumothorax."

The reason to only recruit participants who are familiar with hypertension and unfamiliar with pneumothorax is that hypothesis 2 is based on the premise that most people are familiar with hypertension and unfamiliar with spontaneous pneumothorax, and excluding participants based on familiarity will ensure that familiarity with the health issue is accurately being tested.

[2] The vignettes use the same script/wording as the videos.

3.2.2 Dependent Variables

Dependent variables consist of items measuring participant understanding-related variables, as well as participant perceptions of the physician. A covariate of health literacy is also described.

3.2.2.1 Objective Understanding

Medical information related to spontaneous pneumothorax (Mayo Clinic, 2019, "Pneumothorax") and hypertension (Mayo Clinic, 2018), and information listed in the stimulus scripts was used to generate the items for the objective understanding measures. The measures consist of a recall quiz with five items for hypertension and seven items for spontaneous pneumothorax in an open-ended format (see Appendix B). Both objective understanding measures for each health condition contain the following questions: "What is the official name of the health condition you are being diagnosed with?" "What medical issue(s) can your health condition lead to in the future?" "How many treatment option(s) were provided?" and "What were the treatment option(s)?" The hypertension measure also asks: "Which two factors influence the strong force of blood pushing against the artery walls?" The pneumothorax measure also asks: "What has happened to the lung?" "What part of the lung/chest area has developed a hole in it?" and "Which treatment option did the doctor recommend starting with (i.e., which one to try first)?"

Each participant received a score on the quiz for each health condition ranging from zero to eight. Most questions were worth one point, but some were worth two points; participants could receive partial credit by obtaining one point for the two-point question(s). An example of a two-point question is: "What were the option(s) the doctor gave you for treatment?" because there were two treatment options for each health condition that are mentioned in each scenario. Participants received just one point if they correctly recalled only one of the treatment options. This quiz format

allows for having an objective measure of understanding to supplement and compare with participants' perceived understanding.

3.2.2.2 Perceived Understanding

Perceived understanding was measured using three separate items (see Appendix C). Participants indicated on a scale from 0-100, with 0 being no understanding and 100 being complete understanding, the degree to which they felt they understand the diagnosis, understand the treatment options, and understand the message given by the physician. This is based on a similar procedure for measuring patient understanding conducted by Heisler et al. (2002). This measure allows for a wide range of perceptions and is on an even scale that is easy for participants to imagine and comprehend. Other studies have either used the same items or a 0-100 scale. For instance, Quinn et al. (2011) used the same items in their scale to measure diabetes self-management among patients. Researchers in a study of chronic disease self-management used a 0-100 scale to measure self-management (Córdova et al., 2017). In a study of diabetes self-care, the researchers measured understanding of diabetes self-care on a 5-point Likert scale but then rescaled it to be a 0-100 scale (Dyke et al., 2013). Both an objective and subjective measure of understanding will be utilized because previous research measuring learning or recall has used multiple strategies. For instance, self-reported perceived learning (Violanti et al., 2018) and a recall quiz consisting of open-ended and/or closed ended questions (Chesebro, 2003; Lewkovich & Haneline, 2005) have been utilized to measure participant understanding or recall.

3.2.2.3 Physician Clarity

Participant perceptions of physician clarity were measured using a scale developed by Street (1992) to measure the degree to which a doctor adequately explained information. The scale consists of four items that were measured on a Likert scale from 1 (*strongly disagree*) to 7 (*strongly*

agree). Items include: “The doctor...” “fully disclosed the health problem;” “offered a thorough explanation;” “was very informative;” and “was clear and easy to understand.” This scale allows for measuring the informative elements of PCC. Reliability for the main study data was adequate (video only α=.90; video and vignette data- video clarity α=.89; video and vignette data- vignette clarity α=.90).

3.2.2.4 Liking for Physician

Participant liking for physician was measured with four Likert-type items based on a liking instrument from Jayanti and Whipple (2008) used to measure the association between participant liking for physician and participant scores of physicians on service evaluations. The items were measured on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*). Items are as follows: “This doctor seems...” “likeable;” “pleasant;” “nice;” and “interesting.” The wording is easy to understand, and the scale is reliable (Jayanti & Whipple, 2008). Reliability was satisfactory for the main study data (video only α=.92).

3.2.2.5 Satisfaction

To measure satisfaction, Richmond et al.’s (1998) three item satisfaction with physician scale was used. Participants specified how “displeased/pleased;” “dissatisfied/satisfied;” or “uncomfortable/comfortable” they would feel visiting with the doctor on a 7-point scale. Richmond et al. (2001) report that the scale is reliable (α=.94) This scale was selected because there are only three items and it has adequate reliability. Reliability for the satisfaction measure based on the main study data was sufficient (video only α=.94).

3.2.2.6 Perceived Similarity

Perceived similarity was measured using the attitude subscale of McCroskey et al.'s (1975) perceived homophily scale. The items ask participants to rate whether the physician "doesn't think like me/thinks like me;" "doesn't behave like me/behaves like me;" is "different from me/similar to me;" and is "unlike me/like me." Items are measured on a semantic differential 7-point scale. This scale is also brief in terms of number of items, similarly formatted to other dependent variable scales used in this dissertation, and is easy for participants to understand. For the dissertation main study data, the reliability was satisfactory (video only α=.94).

3.2.2.7 Physician Affective Communication

An affective subscale related to provider communication (Galassi et al., 1992) was adapted to measure physician affective communication. This scale consists of five items which reference the physician. Items are as follows: "Was warm and caring toward me;" "Made me feel comfortable discussing personal issues;" "Really respected me;" "I did not feel insulted when talking to this doctor;" and "Seemed interested in me as a person." The items were measured on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*). The scale is brief and connects with the relational component of PCC. The scale is also reliable based on the main study dissertation data (video only α=.88).

3.2.2.8 Health Literacy (Covariate)

Participant health literacy was assessed using three items from the BRIEF health literacy screening tool (Haun et al., 2009). Items include: "How often do you have someone help you read hospital materials?;" "How often do you have problems learning about your medical condition because of difficulty understanding written information?;" and "How confident are you in filling out medical forms by yourself?" The first two items were measured on a scale from 1 (*always*) to

7 (*never*), and the last item was measured on a scale from 1 (*not at all confident*) to 7 (*extremely confident*). These items were selected because they are significantly and positively correlated with other common measures of health literacy such as the short test of functional health literacy in adults and the rapid estimate of adult literacy (Haun et al., 2009; Wallace et al., 2006). Additionally, the measure is much shorter than most health literacy measures. Wallston et al. (2014) indicate the scale is reliable. The reliability for the main study data is acceptable (video only α=.69; video and vignette α=.69).

3.2.3 Other Quantitative Variables

Other variables consist of variables that are not formal independent variables or dependent variables but they were still measured within the survey because they were used for other purposes in the dissertation.

3.2.3.1 Manipulation Checks

As a manipulation check to determine if participants noticed the analogies, participants were asked to identify from a list of 12 objects which of the objects they could remember being mentioned in the doctor's message regarding hypertension, with a separate list of 12 objects for pneumothorax. These items were select all that apply format with "none" and "other (please specify)" options, and the objects aligned with the analogies utilized for each condition (hypertension-faucet, hose, belt, pipe; pneumothorax-balloon, pump, tire, oil), along with other random objects (ball, hat, car, dog, bird, brush, blanket, card, dresser, sky, candle, phone, cat, kite, picture, and ring). Raimi et al. (2017) asked participants to recall from a passage they read which of the following things were used to explain climate change, and then listed things such as medical disease, court room trial, and home protection.

3.2.3.2 Attention Checks

In order to determine whether participants were being conscientious as they were completing the survey, three attention check items were incorporated into the survey. After the video section participants were asked to indicate whether they watched the video in its entirety, with options of "Yes" or "No." The same question was asked after they read the vignette except that it asked whether they read the vignette in its entirety. Then later in the survey, participants were asked another attention check item. For this item they were asked if they visit the doctor at least once per year with options of "Yes" or "No." They were told to select both responses and the item was set up as select all that apply format.

3.2.3.3 Realistic Stimulus

To determine whether participants found the stimulus materials to be realistic, they were asked two separate items upon completing the video and vignette sections of the survey. They were asked to indicate the degree to which the scenario presented in the video/vignette was realistic, and the degree to which the doctor in the video/vignette was realistic on a scale from 1 (*not realistic at all*) to 7 (*extremely realistic*).

3.2.3.4 Nonverbal Immediacy

In an effort to ensure that the nonverbal behavior of the actor was relatively consistent across the conditions, participants were asked to complete nonverbal immediacy items after viewing the video stimulus. Participants completed five items from McCroskey et al.'s (1995) nonverbal immediacy scale to evaluate the physician on eye contact, gestures, vocal variety, and other nonverbal behaviors. These items correspond to nonverbal behaviors that are observable within the video clip. Items consisted of: "The doctor..." "gestured while talking;" "looked at me while talking" "smiled at me while talking;" "had a very relaxed body position while talking to

me" and "used a variety of vocal expressions when talking to me." Items were measured on a scale from 1 (*never*) to 7 (*always*).

3.2.4 Demographic Questions

Some of the demographic questions (sex/gender, age, race/ethnicity, and education level) were asked in the pre-survey screening along with the qualifying question in an effort to make it less obvious what the inclusion criteria were to participants. The other demographic questions were asked at the end of the survey.

3.2.4.1 Biological Sex/Gender

Participants were asked to identify their biological sex/gender, with options of "male;" "female;" "transgender;" "other (please specify);" or "prefer not to specify."

3.2.4.2 Age

Age was measured by having participants select their age from a dropdown menu with range options of 18-100.

3.2.4.3 Race/Ethnicity

Participants were asked to identify their race/ethnicity using a "select all that apply" format. Response options were "Caucasian;" "African American;" "Hispanic;" "Asian;" "Native American;" "Pacific Islander;" and "Other (please specify)."

3.2.4.4 Education Level

Education level was measured by asking participants "What is the highest level of education you have completed?" Answer options were: "never completed high school; "high school or GED;" "2 year college degree;" "4 year college degree;" and "graduate degree." This

question was not asked to the student sample used for the pilot study because they indicated their student classification instead.

3.2.4.5 Income

To evaluate participant income for the main study, they were asked to select their income from a list of $0-$100,000+ presented in increments of $10,000.

3.2.4.6 Health Insurance

Participants were asked if they had health insurance with answer options of "Yes" and "No."

3.2.4.7 Residence

Participants recruited from Amazon Mechanical Turk (MTurk) were asked to select from a dropdown list which U.S. state in which they primarily reside.

3.2.5 Open-Ended Questions

The following questions from the survey involved using frequencies and/or coding of open-ended data for analysis, so they are listed separately from the other variables.

3.2.5.1 Research Question 3: Recall of Analogies

For research question 3, participants were asked to recall everything they can remember from the physician's message, imagining they had to explain it to a family member or friend. Recall was measured using the following open-ended prompt: "Now that you have heard the doctor's message regarding your health condition, please imagine that you have to explain what the doctor said to a significant other, close friend, or other family member. Please use the space below to type out how you would explain the diagnosis and treatment information regarding your specific health issue." Responses were analyzed to determine whether they recalled any of the

analogies, and if so, which analogies were recalled. This method of measuring recall has been used in prior literature. Lewkovich and Haneline (2005) asked patients to recall as much information as they could from a health procedure they just had completed. Dargue and Sweller (2018) had participants watch a video of a person telling a story, and after completing an unrelated filler task, they were asked to recall everything they could remember from the story. Frequencies were counted for the number of analogies mentioned in each condition, as well as frequencies for which specific analogies were mentioned in each condition.

For the video portion of the question, of the 1,221 participants who provided a response, 127 responses were removed for providing a bogus response (e.g., copying something from the internet, "no" or "none," etc.), and 5 responses were removed for saying "I don't know," leaving 1,089 responses for analysis. For the vignette portion of the question, of the 1,091 participants who responded to the question, 84 responses were removed due to being a bogus response, leaving 1,007 responses for analysis.

3.2.5.2 Open-Ended Questions Requiring Coding

To analyze the following research questions, the responses were open coded to look for emergent themes (Braun & Clarke, 2006). Then separate coding schemes were created for each question (see Appendix D), and an undergraduate researcher was trained in the coding process. Each researcher coded approximately 15% of responses in multiple rounds as a form of training until adequate interrater reliability was attained for most categories and the coders felt comfortable with the coding schemes. Then the two researchers independently coded the rest of the data. After each round of coding for each research question the researchers met to resolve disagreements until 100% agreement was obtained.

3.2.5.2.1 Research Question 4: Like and Dislike About Physician

For research question 4, participants were asked to state in two separate questions what they like and what they dislike about the doctor from the video or vignette after watching the video, and then again after reading the vignette. To determine whether analogies were mentioned, the author counted frequencies for each time analogies were mentioned for each condition. For this research question, separate coding schemes were created for "like" and "dislike" parts of the question. Responses were also separated by video and vignette, and coded separately, but the same coding schemes were used for the video and vignette data.

For the "Like" vignette data, 1,089 participants responded to this question. Irrelevant responses were deleted before coding (e.g., "N/A;" "I could read it;" n=57), as well as responses indicating the participant did not know what to say (Ex: "I don't know;" "hard to tell;" n=14), and participants saying that they did not like anything (Ex: "Nothing;" "none;" n=18), leaving a sample of 1,000 responses to code. Two rounds of training were conducted with 150 responses each until the coders felt comfortable with the coding scheme and data. Then the coders independently coded the rest of the responses for the "Like" vignette data, and had satisfactory interrater reliability ($\kappa \geq .80$ for each category for the final round of coding).

For the "Like" video data, 1,226 participants responded to the question. Responses were deleted due to being irrelevant (n=49), solely commenting on nonverbals or appearance of the actor (n=65), saying they did not like anything (n=27), or saying they did not know what they liked (n=2). After removing these responses, 1,083 responses remained to be coded. After completing the "Like" vignette coding, the researchers independently coded the "Like" video data in one round using the same coding scheme, and had adequate reliability ($\kappa > .85$ for each category).

For the "Dislike" vignette data, 1,086 participants responded to this question. Irrelevant responses were again removed before data collection (*n*=188), as well as responses indicating the participants did not know what to say (*n*=11), and responses indicating the participants did not dislike anything (*n*=450), leaving 437 responses for coding. Two rounds of coding were conducted with 65 responses coded in each round until the coders mastered the coding scheme. The coders independently coded the rest of the responses for the "Dislike" vignette data, and had adequate intercoder reliability ($\kappa > .73$ for each category for the final round of coding).

For the "Dislike" video data, 1,224 participants responded to the question. Responses were removed due to being irrelevant (*n*=58), only commenting on nonverbals or appearance of the actor (*n*=258), saying they did not dislike anything (*n*=447), and saying they did not know what to say (*n*=6), leaving 455 responses to be coded. After completing the "Dislike" vignette coding, the researchers independently coded the "Dislike" video data in one round using the same coding scheme, and had adequate intercoder reliability ($\kappa \geq .87$ for each category except for "Timing"[3]).

3.2.5.2.2 Research Question 5: Analogies as Memorable Messages

For research question 5, participants were asked to recall and describe memorable messages regarding provider use of analogies. They were given a definition of memorable messages, a definition of metaphors/analogies, a sample metaphor/analogy, and then were asked to see if they could recall a time when a provider used a metaphor or analogy, and if so, to share the analogy. Two separate coding schemes were created for this research question; one coding scheme was used to analyze the *health conditions* the analogies were used to describe, and the other coding scheme was used to analyze the *analogies* themselves. Regarding responses, 989 participants answered the question. Responses were removed before coding due to copying parts

[3] Only percent agreement is reported for "Timing" (93.41%) because it was such an infrequently occurring code.

of the question prompt word for word (Ex: "kidney is like a filter;" *n*=29), providing an irrelevant response (*n*=68), not being able to think of an analogy (*n*=614), or the response not actually being an analogy (*n*=35), leaving 243 responses for analysis.

Though there were two separate coding schemes, the health conditions and analogies were coded simultaneously. Coding training was completed in three rounds with 40 responses per round until the coders felt comfortable with the coding schemes. Then the rest of the responses were coded independently. For health condition, intercoder reliability was satisfactory for the final round of coding ($\kappa > .75$ for each category). For analogies, intercoder reliability was acceptable for the final round of coding ($\kappa \geq .65$ for each category except for "Medical/Body Part;"[4] 86-99% agreement).

3.2.5.2.3 Research Question 6: When Analogies are Helpful

For research question 6, participants were asked if they think use of analogies by healthcare providers to explain complex medical information is helpful, with response options of "Yes," "No," or "Maybe." Then they were asked under which medical conditions or situations they think healthcare provider use of analogies are helpful. A coding scheme was created to answer this research question by analyzing the open-ended data. Initially, 1,057 participants answered the question about when they think analogies are helpful. Responses were removed for being irrelevant (*n*=68), participants being unsure of what to say (*n*=32), and participants believing analogies are not helpful (*n*=30), leaving 927 responses to analyze. Coding training was conducted in 3 rounds with 130 responses in each round until the coders felt confident in using the coding scheme. Then

[4] Only percent agreement is reported for "Medical/Body Part" (97.58%) because it was such an infrequently occurring code.

they coded the rest of the responses independently. For the final round of coding, intercoder reliability was adequate ($\kappa \geq .74$ for each category except for "Group" and "Not Serious.")[5]

3.3 Procedures

Data for the main study were collected in September 2020. The study proposal was approved by Purdue University's institutional review board and the survey was conducted using the online platform Qualtrics. MTurk workers who were U.S. adults aged 18 and older with a HIT approval rate over 95% and greater than 50 HITs approved were recruited to participate. To make the best use of the dissertation funding, and to try and increase the chances of collecting high quality data, a pre-survey screening was designed to only allow participants who were familiar with hypertension and unfamiliar with spontaneous pneumothorax to continue on to complete the survey. The fact that there were unpaid qualifying questions was clearly indicated in the MTurk study title and description in order to decrease the chances for participant backlash. Only participants who selected hypertension (they could also select or not select the other real health issues- diabetes, fibromyalgia), and did not select spontaneous pneumothorax (and did not select any of the other fake health issues- bacterial groloma, bileana, oglioitis, or peripheral sammopilia) were allowed to complete the rest of the survey. For those who did not make it past the screening questions, they were shown a message telling them they do not qualify for the study, thanking them for their time, and notifying them they needed to return the HIT and their MTurk rating would not be negatively impacted. Then they were directed to the end of the survey and were not compensated for completing the pre-survey. For participants who made it past the pre-survey screening, they were allowed to continue on to complete the rest of the survey.

[5] Only percent agreement is reported for the "Group" and "Not Serious" categories (97.02% for "Group" and 98.88% for "Not Serious") because they were infrequently occurring codes.

Participants who met the inclusion criteria read through and provided informed consent (see Appendix E). They were then instructed to ensure that they had a good internet connection, that the sound was on and working at their computer, and that they had to watch the entire video clip that was presented to them. Individuals served as analogue patients, imagining they were experiencing particular symptoms and visiting a doctor. Qualtrics randomly assigned participants to one of the eight conditions. The experimental design includes two control conditions with no analogies, two conditions with two diagnosis-related analogies, two conditions with two treatment-related analogies, and two conditions with four analogies related to diagnosis and treatment. First participants viewed a 1-2 minute video of one of the health conditions, and then they completed dependent variable measures for that video. Then participants were assigned to view a vignette for the other health condition, and completed the same dependent variable measures for the vignette. Within each condition that participants viewed, both the video and vignette contained the same number and type of analogies. (Ex: if participants were exposed to only diagnosis analogies in the video clip, then the vignette also contained only diagnosis analogies). Then respondents completed the other measures and demographics. Participants were paid $1.00 for completing the 15-minute Qualtrics survey.

3.3.1 Quality Measures

Because Amazon Mechanical Turk was used to collect data, measures were taken to try to ensure high quality data from the start, and a lot of the data had to be deleted after data collection because of being low quality. Several mechanisms were put into place to identify low quality data and try to increase the chances of obtaining high quality data. First, nearly double the number of desired participants were allowed to complete the survey (N=2,857) in case up to half of the data was of poor quality. Fake health conditions were included in the qualifying question to try and

combat responses from participants who were not paying attention, and those who selected any of them (indicating they had heard of them) were not allowed to continue with the survey. There was a captcha question used with the MTurk sample to avoid collecting data from robots. Participants were instructed to ensure that they had a good internet connection and that the sound was working on their devices in order to be able to hear and watch the video clip. When reading the scenario instructions, watching the video clip, and reading the vignette, participants were required to stay on the page until enough seconds had passed that were required to adequately read or watch the instructions or scenario. During the open-ended recall question, participants were instructed not to Google responses and that it was okay to type "I don't know" rather than making up a bogus response.

During data collection, the MTurk sample was given a code at the end of the survey, and if any participants submitted the wrong survey code, their data were not used. After data collection and during data cleaning, responses were analyzed for poor quality data, and many responses were removed. An attention check question asked participants to indicate whether they visit the doctor at least once a year, and they were instructed to select both "Yes" and "No" as the response; if participants answered this question incorrectly, their data were not used. Another pair of attention check items asked participants to indicate whether they watched the video or read the scenario in its entirety with options of "Yes" and "No." For any participants who responded "No" to the video item or did not answer it, their responses were removed from all analyses. For participants who responded "No" to the vignette item or did not answer it, their data were not analyzed for the research questions related to the vignette. The IP addresses and geographical coordinates were examined to determine whether the same person was completing the survey multiple times, and duplicates were removed. Data were also cleaned to get rid of responses with less than half

complete data, and responses with over half bogus or irrelevant responses to the open-ended questions were deleted. Responses were checked to see how much time participants spent on the survey, and responses completed in less than 7 minutes were deleted. Seven minutes was determined as the quickest possible time it would take participants to complete the survey after taking into consideration the length participants were required to stay on certain survey pages (approximately 1.5-2 minutes total), and the length and number of the remaining questions on the survey.

3.3.2 Stimulus Script

Participants were instructed to imagine that they had recently been experiencing particular symptoms, and they decided to see a doctor. Some of the analogies used in the scenarios in the present study were selected from metaphors or analogies that physicians say they commonly use. For instance, blood flowing through arteries as water flows through a garden hose (Aaltoona Family Physician, n.d.), and the lungs being like balloons because of how they inflate (Arroliga et al., 2002) have been used by physicians to explain medical concepts to patients. A physician and faculty member at a large midwestern medical school reviewed the scripts to verify that the medical information was convincing and accurate. For instance, he suggested one of the analogies describing the lining of the lung to be modified from a jacket analogy to describing the fluid around the lung using an oil/engine parts analogy instead.

A 65-year-old White male was recruited to play the role of physician for the video conditions. Among U.S. White physicians aged 65 and older, 79.3% of them are male; additionally, 56.2% of all U.S. physicians are White and 64.1% are male (Association of American Medical Colleges, 2019). The actor delivered a message as the "physician" that lasted 1-2 minutes. In all conditions, the script involved the sample physician telling the participants that they had a

spontaneous pneumothorax or hypertension, explaining what the health condition is, and going over two treatment options. The video clips were filmed in an examination room in a student health center at the University of Kansas. The room at the student health center contained white and brick walls, an examination table, various medical devices and tools, an anatomy poster, and a rolling stool that the actor sat on. The doctor was dressed in business attire with a white coat (see Figure 1).

Figure 1. Actor Physician and Video Background

3.3.3 Pilot Study

In the pilot study, college students at a large midwestern university from a communication student participation pool pretested the script and were offered extra credit for participation. Pilot data were collected from April-August 2020. This pilot test served as formative research, for determining if the Qualtrics survey elements such as the videos and randomization were working properly, if the scales were reliable, and whether the actor and scenario were convincing. The pilot

test also allowed to see whether the nonverbal behavior of the actor was consistent across conditions.

3.3.3.1 Pilot Participants

Three-hundred forty-three students completed the pilot survey. Participant responses were removed for completing less than half of the survey (*n*=34), providing bogus/irrelevant responses to the open-ended questions (*n*=2), being familiar with pneumothorax (*n*=133), being unfamiliar with hypertension (*n*=67), or not watching the video in its entirety (*n*=12). This left a final sample of 95 responses for pilot analyses. There were 12 participants in condition 1, 18 in condition 2, 10 in condition 3, 7 in condition 4, 9 in condition 5, 12 in condition 6, 13 in condition 7, and 14 in condition 8, with a range of 7-18 participants per condition.[6]

The pilot participants were aged 18-22 (*M* = 19.67, *SD* = 1.29). A majority of participants were female (*n*=53; 56.4%), followed by male (*n*=39; 41.5%), with two participants identifying as "Other" or preferring not to specify. For race/ethnicity, a majority of students identified as Caucasian (54.7%; *n*=52), followed by Asian (30.5%; *n*=29), African American (10.5%; *n*=10), Hispanic (4.2%; *n*=4), Pacific Islander (1.1%; *n*=1), and Other (2.1%; *n*=2).[7] For student classification, 34% were first years (*n*=32), 22.3% were second years (*n*=21), 19.1% were third years (*n*=18), 21.3% were fourth years (*n*=20), with one fifth year+ and two identifying as "Other."

3.3.3.2 Pilot Results

The following tests were conducted to determine whether the stimulus and survey could be used in the main study.

[6] For any pilot analyses related to the vignette conditions, five more participants were removed (*N*=90) because they failed or did not answer the vignette attention check, indicating they did not read the scenario in its entirety.
[7] Because race/ethnicity was measured in a "select all that apply" format, the percentages equal more than 100%.

3.3.3.2.1 Reliability Analyses

Pilot test reliabilities were as follows: clarity (video α=.91; video and vignette data- video α=.91; video and vignette data- vignette α=.94), satisfaction (video α=.95), similarity (video α=.90), liking (video α=.92), affective communication (video α=.87), immediacy (α=.73) and health literacy (video data α=.32; video and vignette data α=.33). The pilot study reliabilities were all satisfactory except health literacy, which led to a minor wording change in the main study (see below).

3.3.3.2.2 Realistic Scenario and Actor

A series of one-sample *t*-tests were conducted to determine whether the scenario and actor were adequately realistic. These tests were used to determine whether the means were significantly above the midpoint of the scale (4), meaning participants perceived the scenarios to be more realistic. The results (based on the video only data), indicated that participants perceived the video scenario to be adequately realistic: $M = 5.54$, $SD = 1.24$, $t(94) = 12.12$, $p < .001$, as well as the vignette scenario (based on the video and vignette data): $M = 5.87$, $SD = 1.06$, $t(89) = 16.67$, $p < .001$. The actor in the video (based on the video only data) was perceived as realistic: $M = 5.04$, $SD = 1.62$, $t(94) = 6.26$, $p < .001$; and the doctor in the vignette (based on the video and vignette data) was also perceived as realistic: $M = 5.52$, $SD = 1.29$, $t(89) = 11.18$, $p < .001$.

3.3.3.2.3 Consistency in Nonverbal Communication

A one-way ANOVA was conducted with the independent variable of condition and the dependent variable of nonverbal immediacy using the video only data to make sure there were no significant differences between conditions. The results indicated there were no significant

differences in perceptions of physician nonverbal immediacy between conditions: $F(7,87) = .669$, $p = .698$; means ranged from 3.71-4.32.[8]

Overall, the pilot results indicated that the survey and randomization were working properly, the nonverbal communication of the actor was consistent across conditions, the scenario and actor were perceived as realistic, and most scale reliabilities were adequate.

3.3.3.3 Changes to Main Study Made Based on Pilot Study

Because the reliability was low for the health literacy items, the response options were flipped for two of the items to be consistent so that all lower numbers aligned with lower health literacy and all higher numbers aligned with higher health literacy. For question 2 of the pneumothorax objective understanding quiz, the item was reworded because participants did not seem to adequately understand the question based on reading through their open-ended responses. The question was originally: "How would you describe the condition (i.e., what has happened to the lung)?" The wording was simplified to: "What has happened to the lung?"

[8] The nonverbal immediacy of the actor physician in the video was also analyzed in the main study, and there were no significant differences in perceptions of the physician's nonverbal immediacy between conditions: $F(7, 1222) = .74$, $p = .636$; means ranged from 4.09-4.30.

CHAPTER 4. RESULTS

4.1 Main Study Participants

Participants lived in the U.S., and were aged 18 years and older. Participants were recruited from MTurk for the main study in September 2020. G*Power 3.1 was used to conduct an a priori power analysis. For a small effect size, with alpha set at .05 and power set to .80, with eight groups, 1,443 total participants would ideally be needed. This means there would need to be approximately 180 participants per group. To achieve this amount of data for analysis and ensure an adequately powered study knowing some low-quality data would have to be deleted due to using an online panel, and given the funding provided for the dissertation, 2,857 participants were paid for participating in the main study. MTurk workers recruited for the study had an approval rate greater than 95% and more than 50 HITs approved. Participants were paid $1.00 for participation.

4.1.1 Data Cleaning

When the study was closed-out on MTurk, 7,901 participants' responses were in the dataset. To ensure integrity of the data, first, responses were removed due to being from duplicate IP addresses (n=3,800) and from duplicate GPS coordinates (n=1,157). Next, responses were removed due to not making it past the pre-survey screening (n=803). Then responses were removed for completing less than half of the survey (n=435), failing the generic attention check item (n=376), failing the attention check specific to watching the video or not answering that question (n=12), or completing the survey in less than 7 minutes (n=3). Then the open-ended responses were analyzed for responses with over half bogus or irrelevant answers (e.g., "no," "good," "health," "speech," etc.), and 84 more responses were removed. This resulted in 1,231 adequate responses left for analysis. The range of responses per condition is 133-182; Condition

1: *n*=159, Condition 2: *n*=152, Condition 3: *n*=182, Condition 4: *n*=167, Condition 5: *n*=138, Condition 6: *n*=151, Condition 7: *n*=149, and Condition 8: *n*=133.

Participants ranged in age from 18-82 (*M* = 41.40, *SD* = 13.05). There was a majority of female participants (58.2%; *n*=717), with 40.3% male participants (*n*=496), and .7% identified as transgender (*n*=9), while the remaining participants identified as "other" (*n*=6) or preferred not to respond (*n*=3). Regarding race/ethnicity, a majority of participants identified as Caucasian (78.5%; *n*=966), followed by African American (10.7%; *n*=132), Asian (6.7%; *n*=82), Hispanic (5.0%; *n*=62), Native American (2.3%; *n*=28), Pacific Islander (.3%; *n*=4), or another race/ethnicity (1.1%; *n*=13).[9] Regarding education level, .4% of participants never completed high school (*n*=5), 20.4% completed high school or GED (*n*=251), 16.2% had a 2-year college degree (*n*=200), 41.6% had a 4-year college degree (*n*=512), and 21.4% had a graduate degree (*n*=263). The median income was in the $40,000-49,000 range. A large majority of participants indicated that they had health insurance (88.5%; *n*=950) compared to those who did not (11.5%; *n*=124). Participants lived in all U.S. states except for Alaska and North Dakota, and some resided in Washington D.C.

For parts of the dissertation that analyze vignette data (research question 2, and parts of research questions 3 and 4), a slightly smaller dataset was used. This is because participants also had to be removed who did not pass the attention check regarding reading the vignette in its entirety or did not respond to that question (*n*=127), leaving 1,104 responses for analysis.

4.2 Analyses

The results for each hypothesis and research question are outlined below. The reason a MANOVA is utilized for some of the hypotheses and research questions in this study as opposed

[9] Race/ethnicity was presented in a "select all that apply" format, so the percentages add to more than 100%, and the Ns add up to more than the total number of participants.

to a series of independent-samples t-tests or ANOVAs is because this allows for keeping the Type I error rate lower, as completing multiple t-tests or ANOVAs results in a high chance of making a Type I error and does not account for intercorrelations among the dependent variables (Warner, 2013). Additionally, the groups of dependent variables are similar enough that they could be analyzed together in a MANOVA, and fewer tests allow for a more parsimonious study.

4.3 Hypothesis 1, Hypothesis 2, and Research Question 1

The first hypothesis predicts that physician video messages that contain analogies will generate more objective understanding, perceived understanding, and perceptions of clarity among participants than the physician messages that do not contain analogies. The second hypothesis anticipates that physician use of analogies in the video will be more helpful at enhancing objective understanding, perceived understanding, and perceptions of clarity among participants for the unfamiliar health condition than for the familiar health condition. The first research question asks whether there are differences in the usefulness of analogies at enhancing participant objective understanding, perceived understanding, and clarity based on whether they are used to describe diagnosis or treatment in the video message.

To analyze these hypotheses and the research question, a two-way MANCOVA was conducted, with independent variables of analogies (none, diagnosis, treatment, both) and health condition (pneumothorax or hypertension), and dependent variables of objective understanding, perceived understanding (3 separate/individual items), and perceptions of clarity. To determine whether health literacy should be used as a covariate, Pearson correlations were conducted (see Table 2), and health literacy was significantly and positively associated with clarity, all 3 perceived understanding items, and understanding at $p < .01$. Thus, health literacy was included as a covariate.

For analogies the overall MANCOVA was not statistically significant: Pillai's Trace = .02,[10] $F(15, 3288) = 1.41$, $p = .13$.[11] For health condition the overall MANCOVA was statistically significant: Pillai's Trace = .03, $F(5, 1094) = 6.44$, $p < .001$, $\eta^2_p = .03$, with a medium effect size. The overall MANCOVA for the interaction between analogies or not and health condition was not statistically significant: Pillai's Trace = .02, $F(15, 3288) = 1.27$, $p = .21$. Because there was no main effect for analogies, nor an interaction effect between analogies and health condition, these effects were not further analyzed (see Figures 2-6).[12]

[10] Pillai's Trace is reported for any analyses in which the Box's M test is statistically significant because it is recommended for use when Box's M test is significant, which indicates a violation of the assumption of homogeneity of variances and covariances (Warner, 2013).

[11] For RQ1, a one-way MANCOVA was also conducted comparing participants assigned to only diagnosis analogies (Conditions 2/6) and only treatment analogies (Conditions 3/7) on the understanding-related variables, with health literacy as a covariate. The overall MANCOVA was not significant: Wilks' $\Lambda = .96$, $F(5, 565) = .62$, $p = .69$.

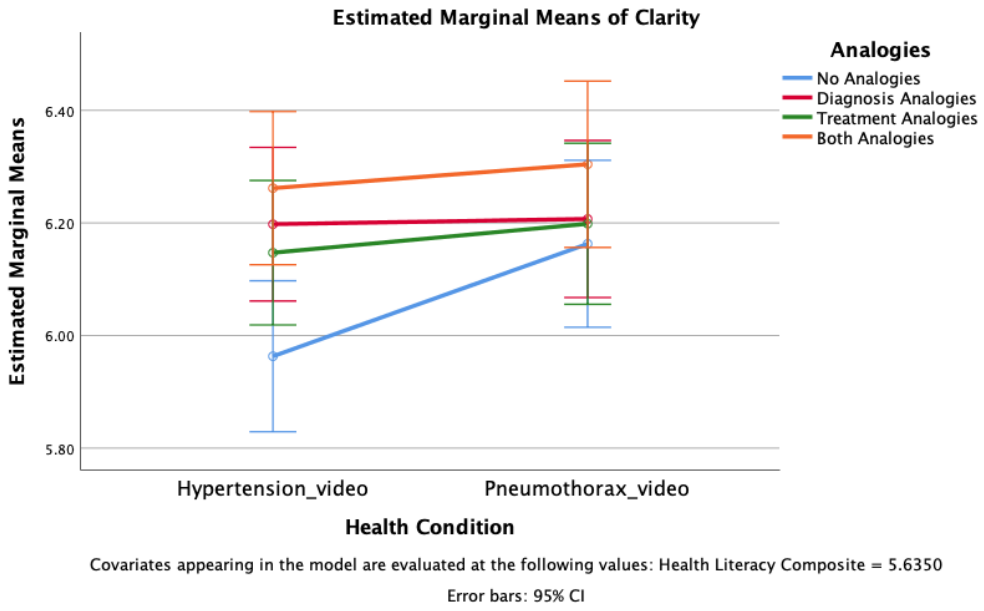
[12] The same two-way MANCOVA was also conducted after removing participants indicating they worked in healthcare (n=127) or who did not respond to that item (n=155); new n=949. The MANCOVA was not significant for analogies: Pillai's Trace = .02, $F(15, 2811) = 1.19$, $p = .27$. The MANCOVA was significant for health condition: Pillai's Trace = .04, $F(5, 935) = 7.74$, $p < .001$. The only significant dependent variable was objective understanding: $F(1, 939) = 18.23$, $p < .001$, $\eta^2_p = .02$; objective understanding was greater for pneumothorax ($M = 5.46$, $SD = 1.97$) than hypertension ($M = 4.82$, $SD = 2.15$). The MANCOVA was not significant for the interaction between analogies and health condition: Pillai's Trace = .02, $F(15, 2811) = 1.46$, $p = .11$.

Table 2. Descriptive Statistics and Correlations for Health Literacy and Dependent Variables for Video Only Sample

Variable	*n*	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1. Health Literacy	1,108	5.63	1.14	--									
2. Clarity	1,231	6.17	.85	.12**	--								
3. Perceived Understanding 1 (Diagnosis)	1,231	85.28	16.13	.30**	.55**	--							
4. Perceived Understanding 2 (Treatment)	1,231	85.48	17.03	.26**	.58**	.77**	--						
5. Perceived Understanding 3 (Overall Msg.)	1,230	86.79	15.89	.28**	.61**	.81**	.81**	--					
6. Objective Understanding	1,230	4.76	2.34	.40**	.17**	.35**	.30**	.31**	--				
7. Affective Communication	1,231	5.37	1.06	-.02	.54**	.36**	.39**	.44**	-.00	--			
8. Liking	1,231	5.46	1.09	-.04	.48**	.30**	.34**	.38**	-.01	.86**	--		
9. Similarity	1,231	4.62	1.36	-.15**	.25**	.16**	.21**	.22**	-.13**	.60**	.59**	--	
10. Satisfaction	1,231	5.78	1.24	.01	.57**	.42**	.45**	.51**	.06*	.78**	.75**	.58**	--

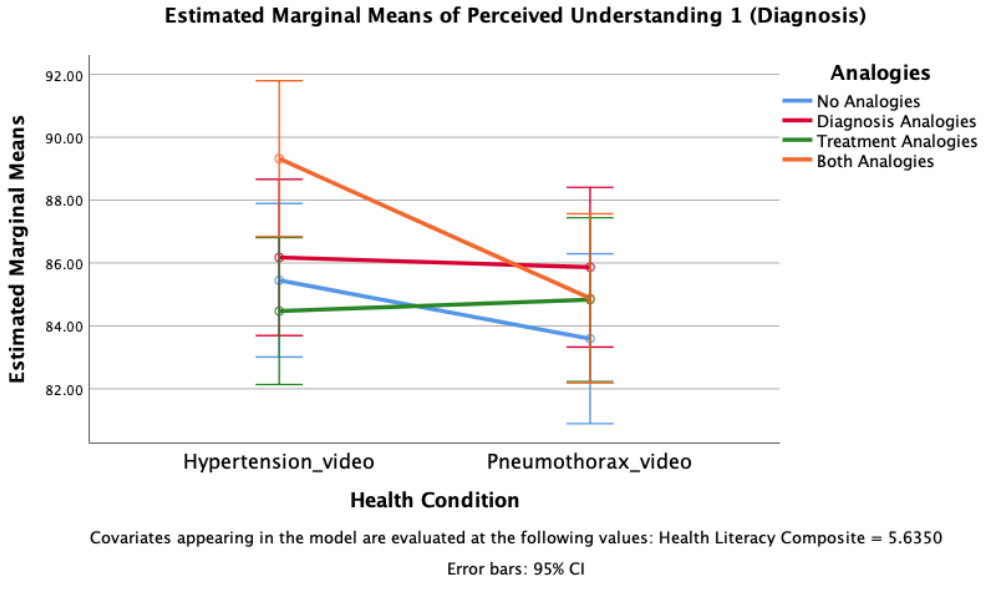
*$p < .05$. **$p < .01$.

Figure 2. Hypothesis 2 Line Graph for Clarity



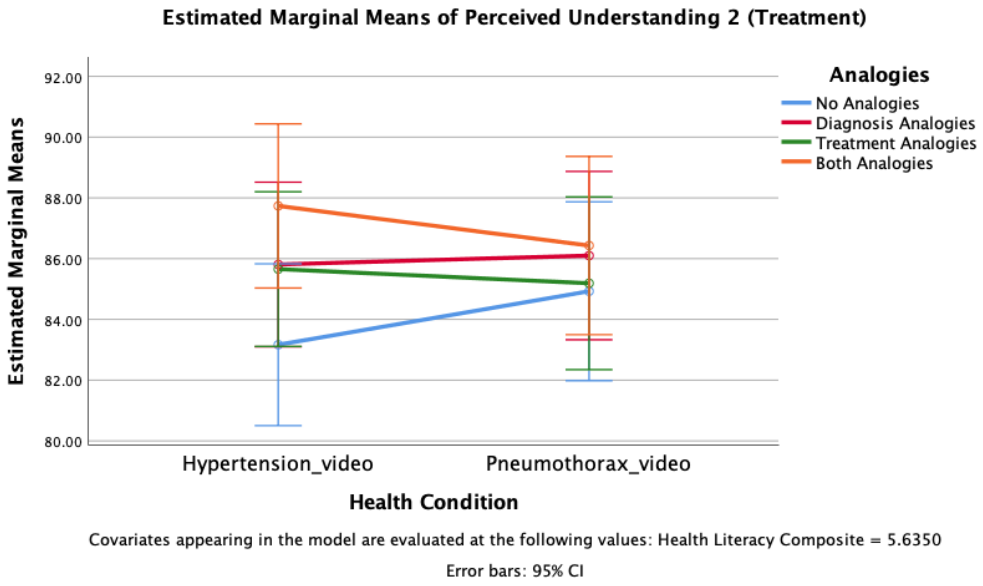
Note. The vertical axis is only showing a range of 5.8-6.5 in order to allow for better seeing the lines and error bars more clearly, but the entire scale is 1-7.

Figure 3. Hypothesis 2 Line Graph for Perceived Understanding 1 (Diagnosis)



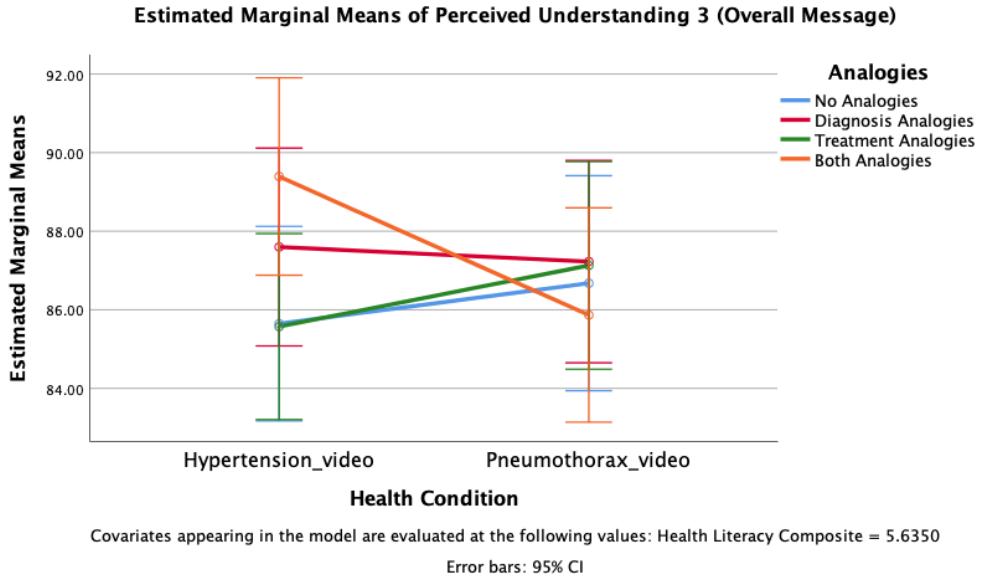
Note. The vertical axis is only showing a range of 80-92 in order to allow for better seeing the lines and error bars more clearly, but the entire scale is 0-100.

Figure 4. Hypothesis 2 Line Graph for Perceived Understanding 2 (Treatment)



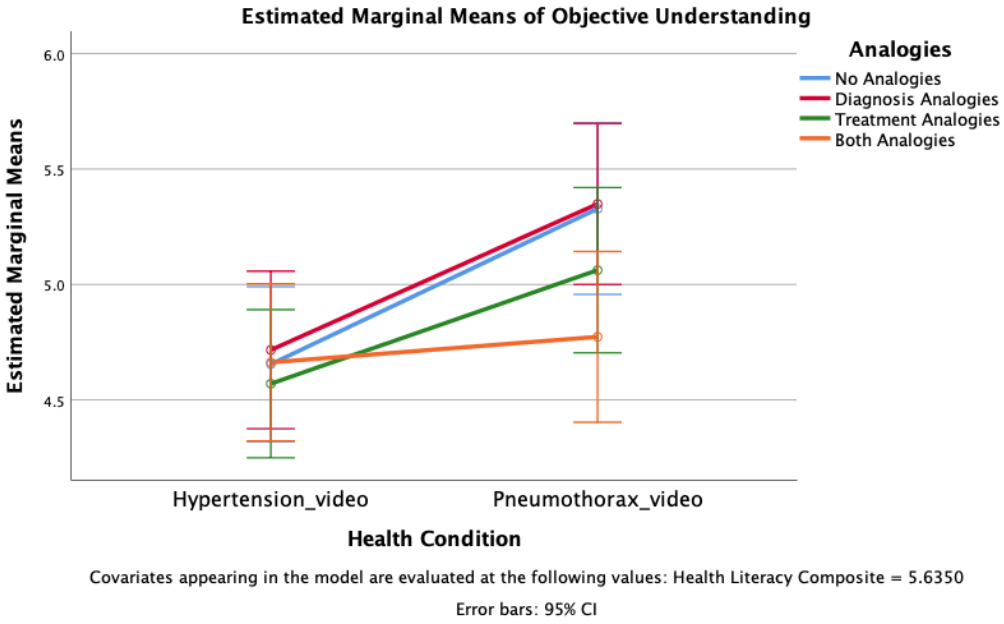
Note. The vertical axis is only showing a range of 80-92 in order to allow for better seeing the lines and error bars more clearly, but the entire scale is 0-100.

Figure 5. Hypothesis 2 Line Graph for Perceived Understanding 3 (Overall Message)



Note. The vertical axis is only showing a range of 82-92 in order to allow for better seeing the lines and error bars more clearly, but the entire scale is 0-100.

Figure 6. Hypothesis 2 Line Graph for Objective Understanding



Note. The vertical axis is only showing a range of 4-6 in order to allow for better seeing the lines and error bars more clearly, but the entire scale is 1-7.

Because there was a main effect for health condition, the dependent variables were analyzed (see Table 3). A significant effect was found for objective understanding: $F(1, 1098) = 14.39$, $p < .001$, $\eta^2 = .01$, with a small effect size. Those assigned to a spontaneous pneumothorax health condition video had greater objective understanding ($M = 5.19$, $SD = 2.22$) compared to those assigned to a hypertension health condition video ($M = 4.60$, $SD = 2.29$). No significant effects were found for clarity, or for any of the three perceived understanding items.

Table 3. Hypothesis 1 and 2, and Research Question 1 Means, Standard Deviations, and ANOVA Results (N=1,107)

	Hypertension										Spontaneous Pneumothorax							
Depend. Variable	No Analogy (*n*=148)		Diagnosis Analogies (*n*=143)		Treatment Analogies (*n*=162)		Both Analogies (*n*=144)		Analogies ANOVA		No Analogy (*n*=121)		Diagnosis Analogies (*n*=137)		Treatment Analogies (*n*=130)		Both Analogies (*n*=122)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	η^2	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Clarity	5.97_{a}	1.02	6.19_{ab}	.73	6.14_{ab}	.79	6.25_{b}	.86	3.18*	.01	6.16	.86	6.22	.91	6.21	.70	6.32	.76
Perceived Unders. 1 (Diag.)	85.8	16.6	86.0	15.6	84.0	19.0	88.6	12.5	1.76	.01	83.3	16.8	86.5	15.3	85.2	14.8	85.4	15.3
Perceived Unders. 2 (Treat.)	83.5	18.1	85.7	16.4	85.2	18.4	87.1	14.0	1.55	.00	84.6	19.0	86.7	17.0	85.5	16.7	86.9	16.9
Perceived Unders. 3 (Overall Msg.)	86.0	16.5	87.4	16.2	85.1	18.0	88.7	13.5	.63	.00	86.4	16.6	87.8	15.2	87.4	15.2	86.4	16.0
Objective Unders.	4.72	2.29	4.69	2.21	4.48	2.44	4.53	2.23	1.37	.00	5.27	2.16	5.46	1.98	5.12	2.28	4.87	2.45

*$p < .05$, **$p < .01$, ***$p < .001$

Note. Some means and standard deviations are rounded to 1 decimal place to save space.

Note. Means with different subscripts differ significantly from one another at $p < .05$ based on the Sidak adjustment for multiple comparisons.

Note. The df are not listed in the table to save space. For Analogies ANOVA: *F*(3, 1098). For Health Condition ANOVA: *F*(1, 1098).

Table 3 continued

Depend. Variable	Hyperten. (n=597)		Spontan. Pneumoth. (n=510)		Health Condition ANOVA	
	M	*SD*	*M*	*SD*	*F*	η^2
Clarity	6.14	.86	6.22	.81	2.27	.00
Perceived Unders. 1 (Diag.)	86.0	16.2	85.1	15.5	2.91	.00
Perceived Unders. 2 (Treat.)	85.3	16.9	85.9	17.4	.01	.00
Perceived Unders. 3 (Overall Msg.)	86.8	16.2	87.0	15.7	.13	.00
Objective Unders.	4.60_a	2.29	5.19_b	2.22	14.39***	.01

*$p < .05$, **$p < .01$, ***$p < .001$

Note. Some means and standard deviations are rounded to 1 decimal place to save space.

Note. Means with different subscripts differ significantly from one another at $p < .05$ based on the Sidak adjustment for multiple comparisons.

Note. The df are not listed in the table to save space. For Analogies ANOVA: $F(3, 1098)$. For Health Condition ANOVA: $F(1, 1098)$

Use of analogies does not influence perceptions of clarity of a physician's message, or objective or perceived understanding. Hypothesis 1 was not supported. Hypothesis 2 was not supported in that there was no interaction effect such that use of analogies for the unfamiliar health condition was not greater at enhancing understanding compared to use of analogies for the familiar health condition. However, objective understanding was higher for the spontaneous pneumothorax conditions compared to the hypertension conditions. For research question 1, there does not appear to be a significant difference in objective understanding, perceived understanding, or perceptions of clarity based on use of diagnosis or treatment analogies.

4.3.1 Post Hoc Analysis

Because the overall MANCOVA for hypothesis 1, hypothesis 2, and research question 1 did not allow for testing frequency/number of analogies, a post hoc test unrelated to the hypotheses or research question was conducted. A two-way MANCOVA was conducted based on number of analogies (0 analogies, 2 analogies, 4 analogies) and health condition on the understanding-related dependent variables, including health literacy as a covariate. The MANCOVA for number of analogies was significant: Pillai's Trace = .02, $F(10, 2194) = 1.86$, $p = .046$. Clarity was significant for number of analogies: $F(2, 1100) = 4.69$, $p = .009$, $\eta^2_p = .008$. As the number of analogies increased, perceptions of clarity increased: 0 analogies ($M = 6.05$, $SD = .96$), 2 analogies ($M = 6.19$, $SD = .79$), 4 analogies ($M = 6.28$, $SD = .82$). The MANCOVA for health condition was significant: Pillai's Trace = .03, $F(5, 1096) = 7.10$, $p < .001$. Significant dependent variables included perceived understanding 1 (diagnosis): $F(1, 1100) = 4.52$, $p = .034$, $\eta^2_p = .004$, and objective understanding: $F(1, 1100) = 11.38$, $p = .001$, $\eta^2_p = .01$. Perceived understanding (diagnosis) was higher for hypertension ($M = 86.03$, $SD = 16.25$) than pneumothorax ($M = 85.13$, $SD = 15.54$), but objective understanding was higher for pneumothorax ($M = 5.19$, $SD = 2.22$) than

hypertension (M = 4.60, SD = 2.29). The MANCOVA for the interaction between number of analogies and health condition was not significant: Pillai's Trace = .02, $F(10, 2194) = 1.66$, $p = .085$. The more analogies the physician used, the greater participants' perceptions of clarity of the physician's message.

4.4 Hypothesis 3

The third hypothesis predicts that physician video messages that contain analogies will generate more liking for the physician, perceptions of similarity, satisfaction, and perceptions of affective communication among participants than the physician messages that do not contain analogies. To analyze this hypothesis, a one-way MANOVA was conducted with the independent variable being analogies (none, diagnosis analogies, treatment analogies, or both) and dependent variables being liking, similarity, satisfaction, and affective communication. To determine whether health literacy should be included as a covariate, Pearson correlations were conducted (see Table 2), and health literacy was only significantly associated with similarity with a small to medium effect size (r = -.15), but not liking, satisfaction, or affective communication, so it was not included as a covariate.

The results indicated that the overall MANOVA was not statistically significant: Wilks' $\Lambda = .99$, $F(12, 3238.69) = .71$, $p = .74$.[13] Thus, the individual dependent variables were not analyzed; however, the results are still reported in Table 4. Use of analogies did not influence perceptions of a physician in terms of affective communication, liking, satisfaction, or similarity. Hypothesis 3 was not supported.

[13] The same one-way MANOVA examining the influence of analogies on perceptions of the physician was conducted using the dataset without individuals who work in healthcare (n=949). The MANOVA was not significant: Wilks' $\Lambda = .99$, $F(12, 2492.59) = .65$, $p = .80$.

Table 4. Hypothesis 3 Means, Standard Deviations, and ANOVA Results (N=1,231)

Variable	No Analogies (*n*=297)		Diagnosis Analogies (*n*=303)		Treatment Analogies (*n*=331)		Both Analogies (*n*=300)		ANOVA	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*(3, 1227)	*p*
Affective Communication	5.37	1.04	5.41	1.05	5.32	1.05	5.39	1.09	.37	.77
Liking	5.47	1.03	5.46	1.11	5.44	1.09	5.46	1.13	.06	.98
Satisfaction	5.76	1.24	5.81	1.22	5.80	1.27	5.73	1.23	.26	.85
Similarity	4.55	1.32	4.64	1.34	4.64	1.40	4.65	1.40	.34	.80

4.4.1 Post Hoc Analysis

Because the overall MANOVA for hypothesis 3 did not allow for testing number of analogies, a post hoc test unrelated to the hypothesis was conducted. A one-way MANOVA was conducted based on number of analogies (0 analogies, 2 analogies, 4 analogies) on the physician perception-related dependent variables. The overall MANOVA was not statistically significant: Wilks' $\Lambda = .996$, $F(8, 2450) = .69$, $p = .705$. Number of analogies did not influence perceptions of the physician regarding affective communication, liking, satisfaction, or similarity.

4.5 Research Question 2

The second research question asks if there are differences in the usefulness of the format of analogies in terms of written versus spoken analogies at enhancing objective understanding, perceived understanding, and perceptions of clarity among participants. The independent variable is format (written or spoken), and the dependent variables are objective understanding, perceived understanding, and clarity. The results were analyzed using a one-way repeated-measures MANCOVA. Only participants who were assigned to analogy conditions were included in the

analysis (those assigned to Conditions 2-4 or 6-8), and the "vignette" dataset was used here, and the sample size is also smaller due to participants being removed for not paying attention to the vignette (n=828). Health literacy was included as a covariate because all dependent variables (both video and vignette versions) were significantly, positively correlated with health literacy at $p < .001$ for the sample with participants removed due to not paying attention to the vignette and only those assigned to analogy conditions.

The overall MANCOVA was statistically significant: Wilks' $\Lambda = .98$, $F(5, 822) = 3.94$, $p = .002$, $\eta^2_p = .023$, with a small effect size. Most of the univariate tests of within-subjects effects were not significant after including health literacy as a covariate (see Table 5). For objective understanding, there was a significant effect: $F(1, 826) = 16.22$, $p < .001$, $\eta^2_p = .02$, with a small effect size. Participants had lower objective understanding from watching the video ($M = 4.86$, $SD = 2.28$) compared to reading the vignette ($M = 5.61$, $SD = 2.20$).[14] No significant effects were found for clarity or any of the perceived understanding items.

The results indicate that there were no differences in perceptions of clarity or perceived understanding for any of those three items. Yet, for objective understanding, the vignette information was better understood than the video information for those assigned to analogy conditions.

[14] The same repeated-measures MANCOVA was conducted using the dataset without individuals who work in healthcare (n=941); again, only responses from participants assigned to analogy conditions were analyzed (n=703), and health literacy was included as a covariate. The overall MANCOVA was significant: Wilks' $\Lambda = .97$, $F(5, 697) = 5.10$, $p < .001$, $\eta^2_p = .035$, with a medium effect size. A significant effect was found for objective understanding: $F(1, 701) = 16.29$, $p < .001$, $\eta^2_p = .023$, with a small effect size. Objective understanding for the vignette ($M = 5.87$, $SD = 1.93$) was higher than objective understanding for the video ($M = 5.11$, $SD = 2.09$).

Table 5. Research Question 2 Means, Standard Deviations, and Repeated-Measures ANOVA Results (N=828)

Variable	Video		Vignette		ANOVA		
	M	*SD*	*M*	*SD*	*F*(1, 826)	*p*	η^2_p
Clarity	6.22	0.80	6.05	0.84	1.11	.29	.00
Perceived Understanding 1 (Diagnosis)	86.06	15.45	85.02	17.19	.52	.47	.00
Perceived Understanding 2 (Treatment)	86.24	16.51	85.63	16.79	.13	.72	.00
Perceived Understanding 3 (Overall Message)	87.20	15.65	86.28	16.07	.99	.32	.00
Objective Understanding	4.86	2.28	5.61	2.20	16.22	< .001	.02

4.6 Research Question 3

Research question 3 asks what percentage of participants will remember analogies from the physician's message and which analogies they will recall most frequently. Participants were asked to recall what they could remember separately from the video, and from the vignette. Any mention of analogies was naturally occurring as opposed to prompted in the survey. Responses were analyzed using frequencies. Only responses that were explicitly analogies (ex: "like a vacuum;" or "similar to sealing a tire with a patch") were counted, as opposed to those that referenced an analogy but were stated in a more literal manner (ex: "vacuum out the air;" or "seal the hole with a patch.")

For the video question (N=1,089), though only some participants were assigned to analogy conditions, a few participants from no analogy conditions used analogies when recalling the physician's message. Seventy-one participants out of the total number of participants (6.52%)

provided an analogy when recalling the video message. A two-way chi-square was conducted comparing whether participants assigned to an analogy condition (yes/no) were more likely to use an analogy (yes/no) in their recall of the physician's message. The results revealed a statistically significant difference (see Table 6): $\chi^2(1) = 13.70$, $p < .001$, Cramer's $\Phi = .11$, with a small effect size; those assigned to a condition with analogies more frequently mentioned an analogy when recalling information about their health condition (*n*=67, 8.1%) than participants not assigned to an analogy condition (*n*=4, 1.6%).

Table 6. RQ3- Chi-Square Results for Mentioning Analogies- Video (N=1,089)

	No Analogy Condition (*n*=258)		Analogy Condition (*n*=831)			
Mentioned Analogy	*n*	%	*n*	%	$\chi^2(1)$	*P*
No	254	98.4	764	91.9	13.70	< .001
Yes	4	1.6	67	8.1		

Of those assigned to an analogy condition (*n*=831), 74 analogies were mentioned from the video they were assigned (see Table 7). Sample responses are as follows: "I have a spontaneous pneumothorax or collapsed lung. It's caused when the outer membrane of the lung gets a hole in it and it allows the space to fill with air so *my lung cannot inflate like a balloon*..." and, "I have been diagnosed with hypertension. This means that as blood is flowing through my arteries, it is not able to flow normally like water due to a large amount of blood and a narrowing of the arteries; *it is more like water coming through a spigot that is only slightly open*..." The range of the Ns mentioned for each individual analogy are: 3-18 (.98%-7.17%). The most frequently recalled analogies were Vacuum (*n*=18, 7.17%), and Spigot/Hose (*n*=18, 6.29%), followed by Tire/Patch (*n*=17, 6.77%), Pipe (*n*=5, 1.75%), Belt (*n*=5, 1.62%), Balloon (*n*=4, 1.57%), Oil/Engine (*n*=4, 1.57%), and Faucet (*n*=3, .98%).

Table 7. RQ3: Frequencies for Participants' Recall of Analogies- Video Message (N=1,089)

	Hypertension- Diagnosis		Hypertension- Treatment			
	Pipe	Spigot/Hose	Faucet	Belt	Other	Condition Total
Condition 1 (*N*=138)	-	1 (.72%)	-	-	2 (1.45%)	3
Condition 2 (*N*=135)	3 (2.22%)	7 (5.19%)	-	-	0	10
Condition 3 (*N*=156)	-	-	3 (1.92%)	2 (1.28%)	1 (.64%)	6
Condition 4 (*N*=151)	2 (1.32%)	11 (7.28%)	0	3 (1.99%)	0	16
Analogy Total	5 (1.75%)	18 (6.29%)	3 (.98%)	5 (1.62%)	3	

	Pneumothorax- Diagnosis		Pneumothorax- Treatment			
	Oil/Engine	Balloon	Vacuum	Tire/Patch	Other	Condition Total
Condition 5 (*N*=120)	-	-	-	-	1 (.83%)	1
Condition 6 (*N*=138)	2 (1.45%)	4 (2.90%)	-	-	0	6
Condition 7 (*N*=134)	-	-	9 (6.72%)	5 (3.73%)	0	14
Condition 8 (*N*=117)	2 (1.71%)	0	9 (7.69%)	12 (10.26%)	1 (.85%)	24
Analogy Total	4 (1.57%)	4 (1.57%)	18 (7.17%)	17 (6.77%)	2	

Note. There were no analogies in the Condition 1 video, but the hose analogy was mentioned by someone on their own, which is why there is no "-"
Note. For the "Analogy Total" column, those percentages are based on the number of analogies mentioned for analogy type divided by the total *N* for each condition that used each analogy (Ex: the total *N* for "Pipe" and for "Spigot/Hose" is based on the Condition 2 *N* plus the *N* for Condition 4, so the total for each of those two analogies are *N*=286). The "*N*" for the analogy mentioned in Condition 1 is not counted in the "Analogy Total" because it was not mentioned as a result of hearing it from the video.
Note. Percentages are not listed for "Condition Total" because a few participants mentioned more than one analogy, so it does not make sense to divide by the total number of participants per condition.

For the vignette question (*N*=1,007), 59 participants out of the total number of participants (5.86%) provided an analogy when recalling the vignette message. A two-way chi-square was conducted comparing whether participants assigned to an analogy condition (yes/no), were more likely to use an analogy (yes/no) when recalling the physician's message. The results revealed a statistically significant difference (see Table 8): $\chi^2(1) = 17.55$, $p < .001$, Cramer's $\Phi = .13$, with a small effect size; those assigned to a condition with analogies more frequently mentioned an

analogy when recalling information about their health condition (*n*=58, 7.5%) than participants not assigned to an analogy condition (*n*=1, 0.4%).

Table 8. RQ3- Chi-Square Results for Mentioning Analogies- Vignette (N=1,007)

	No Analogy Condition (*n*=246)		Analogy Condition (*n*=761)			
Mentioned Analogy	*n*	%	*n*	%	$\chi^2(1)$	*P*
No	245	99.9	703	92.4	17.55	< .001
Yes	1	0.4	58	7.6		

Of those assigned to an analogy condition (*n*=761), 57 analogies were from the vignette they were assigned (see Table 9). Sample responses are as follows: "I have a hole in my lung lining that makes my lung collapse, this can lead to a reoccurrence of the lung collapsing in the future. I can either get a small tube inserted which allows air, so the lung can inflate, or get surgery to fix the leak, *like a patch on a tire*;" and "So it turns out that I have hypertension aka high blood pressure. That is where the blood rushes through the artery very quickly. I can start a medicine that helps flush out the artery *like water going down a sink* or the second option is to take an ACE inhibitor to *'loosen' the artery like you would a belt*." The range of the Ns mentioned for each individual analogy are: 1-15 (.41%-5.56%). The most frequently recalled analogy was Tire/Patch (*n*=15, 5.56%), followed by Spigot/Hose (*n*=12, 4.96%), Vacuum (*n*=11, 4.07%), Belt (*n*=6, 2.58%), Balloon (*n*=5, 1.93%), Oil/Engine (*n*=4, 1.54%), Faucet (*n*=3, 1.29%), and Pipe (*n*=1, .41%).

Table 9. RQ3: Frequencies for Participants' Recall of Analogies- Vignette Message (N=1,007)

	Pneumothorax- Diagnosis		Pneumothorax- Treatment			
	Oil/Engine	Balloon	Vacuum	Tire/Patch	Other	Condition Total
Condition 1 (*N*=134)	-	1 (.75%)	-	-	0	1
Condition 2 (*N*=128)	2 (1.56%)	1 (.78%)	-	-	0	3
Condition 3 (*N*=139)	-	1 (.72%)	7 (5.04%)	11 (7.91%)	1 (.72%)	20
Condition 4 (*N*=131)	2 (1.53%)	4 (3.05%)	4 (3.05%)	4 (3.05%)	1 (.76%)	15
Analogy Total	4 (1.54%)	5 (1.93%)	11 (4.07%)	15 (5.56%)	2	

	Hypertension- Diagnosis		Hypertension- Treatment			
	Pipe	Spigot/Hose	Faucet	Belt	Other	Condition Total
Condition 5 (*N*=112)	-	-	-	-	0	0
Condition 6 (*N*=130)	1 (.77%)	10 (7.69%)	-	-	0	11
Condition 7 (*N*=121)	-	-	2 (1.65%)	5 (4.13%)	1 (.83%)	8
Condition 8 (*N*=112)	0	2 (1.79%)	1 (.89%)	1 (.89%)	0	4
Analogy Total	1 (.41%)	12 (4.96%)	3 (1.29%)	6 (2.58%)	1	

Note. There were no analogies in the Condition 1 vignette, or for Condition 3 pneumothorax diagnosis, but the balloon analogy was mentioned by a couple of participants on their own, which is why there is no "-" for those conditions.

Note. For the "Analogy Total" column, those percentages are based on the number of analogies mentioned for analogy type divided by the total *N* for each condition that used each analogy (Ex: the total *N* for "Oil/Engine" and for "Balloon" is based on the Condition 2 *N* plus the *N* for Condition 4, so the total for each of those two analogies are *N*=259). The "*N*" for the analogy mentioned in Condition 1 (and Condition 3 "Balloon") is not counted in the "Analogy Total" because it was not mentioned as a result of hearing it from the video.

Note. Percentages are not listed for "Condition Total" because a few participants mentioned more than one analogy, so it does not make sense to divide by the total number of participants per condition.

In order to determine whether there were differences in the recall of analogies from the scripts based on video and vignette, a two-way chi-square was conducted: format (video/vignette) and recalled an analogy from the script (yes/no). Only responses from participants assigned to analogy conditions were analyzed since only analogies from the scripts were analyzed. There was no difference based on the format of the message on participants' likelihood to recall an analogy from the script in their description (see Table 10): $\chi^2(1) = .39$, $p = .53$.

Table 10. RQ3: Chi Square Results Comparing Video and Vignette on Mention of Analogies (N=1,592)

	Video (*n*=831)		Vignette (*n*=761)			
Mentioned Analogy	*n*	%	*n*	%	$\chi^2(1)$	*P*
No	764	91.9	706	92.8	.39	.53
Yes	67	8.1	55	7.2		

Overall, analogies were not mentioned frequently in participants' messages, and among the analogies that were mentioned, some were mentioned more frequently than others (vacuum pump, tire/patch, and hose/spigot). Analogies were more often mentioned among participants assigned to an analogy condition than those who were not assigned to an analogy condition. Likelihood to mention analogies when recalling the physician's message did not differ based on the message being in a written versus video format.

4.7 Research Question 4

Research question 4 asks whether participants mention use of analogies as a reason for liking or not liking the physician, what their reasons are for liking/disliking the physician, and whether those reasons differ by analogy condition. They were asked what they liked and disliked about the physician separately after watching the video, and after reading the vignette. Participants were not explicitly asked about analogies, so any mention of analogies arose naturally as opposed to being prompted in the survey. Responses were analyzed using frequencies, and were counted if they mentioned "analogies," "metaphors," "comparisons," or "examples" that were used to explain the health conditions. Responses were also analyzed for themes regarding what they liked and disliked, and were coded into the themes. In addition to frequencies and percentages, the themes were analyzed quantitatively using chi-square analyses.

4.7.1 Frequencies for Mentioning Analogies

For the video "like" question, out of the total number of participants who were assigned to an analogy condition (*n*=818), 3.42% (*n*=28) mentioned liking the doctor's use of analogies (see Table 11). Sample responses were: "He explained what it was and gave a realistic example like the oil in a car engine...;" "I like the explanation with the garden hose. That made for an extremely good visual in my head and allowed me to imagine what the pressure in my arteries looked like;" and "The analogies were very helpful." The range of the *N*s mentioned for each condition are: 2-7 (1.56%-6.19%). Analogies were most frequently mentioned in condition 8 (*n*=7, 6.19%) and condition 2 (*n*=7, 5.30%), followed by condition 4 (*n*=5, 3.45%), condition 6 (*n*=4, 2.88%), condition 3, (*n*=3, 1.89%), and condition 7 (*n*=2, 1.56%).[15]

Table 11. RQ4: Frequencies for Participants Liking Analogies- Video Message (N=818)

	Pneumothorax
Condition 2 (*N*=132)	7 (5.30%)
Condition 3 (*N*=160)	3 (1.88%)
Condition 4 (*N*=145)	5 (3.45%)
Like Total (*N*=437)	15 (3.43%)
	Hypertension
Condition 6 (*N*=139)	4 (2.88%)
Condition 7 (*N*=128)	2 (1.56%)
Condition 8 (*N*=114)	7 (6.14%)
Like Total (*N*=381)	13 (3.41%)

[15] One participant assigned to condition 5 mentioned that they liked the analogies, but there were no analogies presented in that condition, so the response was not counted.

For the vignette "like" question, out of those assigned to an analogy condition (*n*=757), 5.02% (*n*=38) said they liked the doctor's use of analogies (see Table 12). Example responses were: "I like how they used simple metaphors to describe the treatment options;" "Used imagery to explain my condition;" and "When he told me it was like a punctured tire, I could visualize what he meant." The range of *N*s mentioned for each condition are 2-13 (1.57%-11.71%). Analogies were most frequently mentioned in condition 8 (*n*=13; 11.71%), followed by condition 6 (*n*=11, 8.40%), condition 4 (*n*=6, 4.51%), condition 7 (*n*=3, 2.65%), condition 3 (*n*=3, 2.11%), and condition 2 (*n*=2, 1.57%).

Table 12. RQ4: Frequencies for Participants Liking Analogies- Vignette Message (N=757)

	Pneumothorax
Condition 2 (*N*=127)	2 (1.57%)
Condition 3 (*N*=142)	3 (2.11%)
Condition 4 (*N*=133)	6 (4.51%)
Like Total (*N*=402)	11 (2.74%)
	Hypertension
Condition 6 (*N*=131)	11 (8.40%)
Condition 7 (*N*=113)	3 (2.65%)
Condition 8 (*N*=111)	13 (11.71%)
Like Total (*N*=355)	27 (7.61%)

For the video "dislike" question, out of the total number of participants who were assigned to an analogy condition (*n*=303), only 1.65% (*n*=5) said they did not like the doctor's use of analogies. Two responses were from condition 2, and the other three were from condition 4, both of which related to hypertension. Example responses are as follows: "He kept explaining the

diagnosis using metaphors and I feel like that could be confusing to some people;" and "The comparisons to hoses, faucets, and so on were somewhat patronizing."

For the vignette "dislike" question, out of the total number of participants who were assigned to an analogy condition (n=316), only 0.95% (n=3) said they did not like the doctor's use of analogies. One person responded each from conditions 2, 4, and 7 saying they did not like the analogies. Sample responses are: "Also, the pipes and tires and analogies with car mechanics doesn't inspire confidence in a doctor;" and "I don't quite follow the belt metaphor." A couple of participants in condition 2 mentioned that they wanted analogies or examples to explain, suggesting that they did not notice the analogies. These participants stated: "He did not give any analogies or any attempts to simplify things;" and "I don't like how little he explained without an example or provide more detail."[16]

Overall, use of analogies was not frequently mentioned as something that participants liked or disliked about the physician from the video of vignette. Though only a small percentage of participants explicitly mentioned liking the analogies, many of them mentioned other qualities that could be associated with the analogies. For instance, some participants said they liked that the doctor used simple or easy to understand language, or they did not like that the doctor came across as condescending. It is possible that participants were more likely to say things like this in analogy conditions compared to conditions without analogies. Thus, after all responses for research question 4 were analyzed for themes, chi square analyses were conducted to see if there were differences in what they liked and disliked based on the analogy condition to which they were assigned.

[16] One participant assigned to condition 7 said that they liked the analogies, but because this was the "dislike" part of the question, their response was not counted.

4.7.2 What Participants Like About the Doctor Themes

For what participants liked about the doctor (*N*=2,083), five themes arose from the data (see Table 13).

Table 13. RQ4: Themes for What Participants Liked About the Doctor (Video and Vignette) (N=2,083)

Themes	Kappa (% Agreement)	*n* (%)	Examples
Clear/Easy to Understand	Video: .92 (95.94) Vignette: .91 (96.00)	Total: 829 (39.80) Video: 448 (41.37) Vignette: 381 (38.10)	"Broke down the issue in clear to understand language." "Good analogies to my condition and the treatments." "He spoke clearly and explained the treatments clearly." "It was pretty easy to understand everything he had to say."
Competent	Video: .86 (93.44) Vignette: .80 (90.14)	Total: 757 (36.34) Video: 380 (35.09) Vignette: 377 (37.70)	"He diagnosed the problem and accurately described it and the recommended solutions." "He did not just jump to surgery as the first treatment." "I also like the fact that he wanted to try a diuretic first before automatically putting me on an ACE inhibitor." "I liked how informative the doctor was."
Took Time	Video: .88 (95.57) Vignette: .92 (96.71)	Total: 565 (27.12) Video: 291 (26.87) Vignette: 274 (27.40)	"Explained the problem in detail." "He didn't seem like he was in a rush." "S/he takes the time to explain the condition and treatment options in detail." "The doctor was very thorough in their explanation of the problem and treatment options."
Caring	Video: .90 (95.38) Vignette: .85 (98.00)	Total: 438 (21.03) Video: 358 (33.06) Vignette: 80 (8.00)	"Calm and thoughtful." "He or she spoke in a way that was helpful to me, but not condescending." "He seemed down to earth and not a person who sticks up his nose to other people." "Seems nice."
Concise/Honest	Video: .95 (98.71%) Vignette: .93 (97.86)	Total: 332 (15.94) Video: 161 (14.87) Vignette: 171 (17.10)	"Direct with minimal fluff." "He seemed very matter of fact..." "He wasn't too long winded." "He was straightforward about the treatment options."
Other	Video: (99.45) Vignette: (99.57)	Total: 11 (.53) Video: 5 (.46) Vignette: 6 (.60)	"Doctor is a god." "Everything." "He is a human instead of A.I."

Note. The total *N* for video only is 1,083. The total *N* for vignette only is 1,000.
Note. Only percent agreement is reported for "Other" because it occurred so infrequently.

4.7.2.1 Clear/Easy to Understand

The most prevalent theme (*n*=829; 39.80%) was for participants mentioning that the doctor provided a clear explanation, and was easy to understand. For instance, "Clear explanation and well organized;" and "Clearly explained the medical issue." This theme also included participants liking that the doctor used simple language (including analogies) or avoided jargon. For example: "He explained things in layman's terms and did not use a lot of medical jargon to appear intelligent;" and "It was clear, and it had an understandable real-world description. When he told me it was like a punctured tire, I could visualize what he meant."

4.7.2.2 Competent

Many participants indicated that they liked the doctor because the doctor seemed competent, professional, informative, or trustworthy (*n*=757; 36.34%). Examples include: "He is smart;" "He offered the diagnosis and the treatment in a professional manner;" and "The doctor was very informative and wanting the patient to understand that this is a serious issue that can lead to bigger issues if left untreated." Some also said they liked the treatments the doctor suggested, being given multiple options for treatment, or liked something else the doctor did. For instance, "I like that he gave two options."

4.7.2.3 Took Time

For some participants, they appreciated that the doctor took their time, was not rushed, or was patient, thorough, detailed, or elaborate (*n*=565; 27.12%). Sample responses are: "He explained everything thoroughly;" "He took the time to explain the problem and all of the solutions;" and "...took his time to explain in detail." Other participants mentioned liking that the doctor shared a large amount of information. For example: "Gave me a lot of information."

4.7.2.4 Caring

A perception that the doctor came across as caring, nice, friendly, calm, down to earth, or approachable was indicated by some of the respondents (n=438; 21.03%). Example comments were as follows: “Appeared friendly enough;” “He seemed to care about me and my well being;” and “They seemed a bit more casual and down to earth.” Participants also mentioned that the doctor was not judgmental or did not talk down to them. This comment illustrates the second part of the theme: “I liked that he talked to me like an equal not like an idiot.”

4.7.2.5 Concise/Honest

A smaller percentage of participants liked the doctor because the doctor was honest, no nonsense, matter of fact, blunt, direct, concise, to the point, or straightforward (n=332; 15.94%). For example, “Direct and to the point;” “He is speaking honestly;” “He spoke matter of factly, and did not waste words;” and “Was very upfront with the diagnosis.”

4.7.3 What Participants Dislike About the Doctor Themes

For what participants dislike about the doctor (N=892), six themes arose from the data (see Table 14).

Table 14. RQ4: Themes for What Participants Disliked About the Doctor (Video and Vignette) (N=892)

Themes	Kappa (% Agreement)	*n* (%)	Examples
Uncaring	Video: .93 (96.48) Vignette: .89 (94.79)	Total: 420 (47.09) Video: 236 (51.87) Vignette: 184 (42.11)	"Cold and dry way of communicating." "He didn't really show any sign of friendliness or caring" "He acted like a robot! There was not acknowledgement of the patient he was speaking to." "I felt like my doctor was wikipedia."
Poor or Missing Information	Video: .87 (95.38) Vignette: .83 (92.83)	Total: 249 (27.91) Video: 104 (22.86) Vignette: 145 (33.18)	"Could have provided a little more information about the ACE inhibitors treatment option." "Discuss my eating and health habits with me before jumping to medication." "He didn't explain the cause of the spontaneous pneumothorax..." "The doctor was quick to want to put me on medications instead of offering other options."
Unclear/Hard to Understand	Video: .89 (97.36) Vignette: .88 (96.74)	Total: 126 (14.13) Video: 63 (13.85) Vignette: 63 (14.42)	"Explanation a little technical." "He should have used visual aids." "He used a lot of big words." "I don't quite follow the belt metaphor."
Lack of Interaction	Video: .89 (97.36) Vignette: .74 (95.11)	Total: 113 (12.67) Video: 66 (14.51) Vignette: 47 (10.76)	"Didn't ask me if I had any questions." "He never started with a hello..." "I didn't like that the doctor didn't ask questions about what I was experiencing, before giving a diagnosis." "There wasn't any checking-in with the patient."
Poor Timing	Video: (93.41) Vignette: .73 (95.44)	Total: 99 (11.10) Video: 49 (10.77) Vignette: 50 (11.44)	"He seemed rushed." "I thought in some ways the example was too lengthy and became irrelevant." "The explanation of hypertension was perhaps too detailed. It is a widely understood condition." "The video was kind of short, he could have expounded further."
Condescending	Video: .92 (99.12) Vignette: .83 (99.35)	Total: 35 (3.92) Video: 27 (5.93) Vignette: 8 (1.83)	"He almost over explained as if I was extremely uninformed on what high blood pressure means..." "He spoke to me like I'm stupid." "I felt their explanations of the treatments were patronizing." "Seemed a bit condescending."
Other	Video: .85 (99.34) Vignette: (98.70)	Total: 17 (1.91) Video: 10 (2.20) Vignette: 7 (1.60)	"Again, he seemed too good to be true." "Everything." "I don't like doctors in general." "He had pretty bad news for me."

Note. The total *N* for video only is 455. The total *N* for vignette only is 437.
Note. Only percent agreement is reported for "Poor Timing"/Video and "Other"/Vignette because those themes occurred so infrequently.

4.7.3.1 Uncaring

The most common response was for participants to mention disliking the doctor because he came across as uncaring, cold, robotic, impersonal, unfriendly, or boring (*n*=420; 47.09%). For example: “A bit robotic, didn’t seem to have any warmth or concern;” “He showed very little emotion. I didn’t feel connected;” and “Kind of impersonal.” This theme also includes mentioning the doctor seeming dry, too straightforward, blunt, matter of fact, detached, disinterested, and so on. An example of this part of the theme is: “I didn’t like how he didn’t sugar coat it he told me straight up.”

4.7.3.2 Poor or Missing Information

For many respondents they did not like the doctor because they wanted the doctor to give more or other information, or they criticized the information that the doctor provided (*n*=249; 27.91%). For instance, “As with the first doctor, there was a lack of subjective analysis; “He did not discuss the future complications of the problem;” “He could have given me the numbers of my high blood pressure;” and “Would like to have other options.”

4.7.3.3 Unclear/Hard to Understand

Some participants believed the explanation given by the doctor was difficult to understand or confusing, or did not like that the doctor used technical terminology (*n*=126; 14.13%). Responses illustrating this part of the theme include: “His explanation wasn’t that good. I’m still confused;” “The doctor was giving the information in a way that was very technical so it didn't really feel as much like it was coming from a person;” and “Used difficult wording.” Other participants mentioned not liking the analogies or wanting a visual aid to help them better understand the message. An example of this part of the theme is: “I disliked maybe not being

shown a diagram of what was happening since a picture could probably better explain the situation to some people."

4.7.3.4 Lack of Interaction

For some respondents they did not appreciate the lack of interaction with the patient within the doctor's message (*n*=113; 12.67%). These respondents wanted to ask questions or wanted the doctor to ask questions. For example, "Again, he didn't pause for me to say anything;" "He never paused to ask if I understood what he was sharing or if I had any questions (that's important);" and "I suppose he could have asked some questions during the explanation." Some of them wanted the doctor to provide a greeting or introduction. A sample response includes: "The doctor didn't make any small talk just jumped right in."

4.7.3.5 Poor Timing

Another theme consisted of participants not liking the timing, in terms of the doctor going too fast or too slow (*n*=99; 11.10%). Regarding going too slow, participants said the doctor was too detailed, thorough, or long-winded. For instance, "It was too much information to take in at once;" and "They didn't seem to elaborate enough." Regarding going too quickly, participants commented that the doctor was too concise or did not go into enough detail. Sample responses are: "A little brief;" and "He didn't take the time to look for other symptoms, causes, or history before making a rushed diagnosis."

4.7.3.6 Condescending

The most infrequently occurring theme was for some people indicating they disliked the doctor because they felt the doctor was condescending, patronizing, treating them like a child, or overexplaining information (*n*=35; 3.92%). Responses illustrating this theme are: "Assumes I

know nothing from the beginning;" "He also seemed just a tad condescending; "He spoke to me as if I were a child and explained things to me as if I was dumb;" and "...it reads like the doctor is speaking down a bit."

4.7.4 Chi Square Analyses

Chi square analyses were conducted to determine whether the prevalence of the like and dislike themes varied based on the use of analogies.

4.7.4.1 Like About Doctor

Video and vignette conditions were analyzed separately for the "Like" portion of research question 4.

4.7.4.1.1 Video Conditions

To determine whether there were differences in each theme for what participants liked about the doctor from the video based on use of analogies and health condition, a series of three-way chi-squares were conducted (see Table 15); 2 (no analogies/analogies) x 2 (hypertension/pneumothorax) x 2 (theme present/not present). For caring, there was a significant result for pneumothorax: $\chi^2(1) = 4.58$, $p = .03$. Cramer's $\Phi = .095$, with a small effect size. Participants who were not assigned to analogy conditions more frequently indicated that they liked that the physician was caring (41.1%) than those assigned to analogy conditions (30.7%). There were no other significant results. For all themes except caring, there were no differences in the analogy versus no analogy conditions based on the health condition to which the participants were assigned in their perceptions of themes that they liked about the physician from the video.

Table 15. Research Question 4 Like- Video Frequencies and Chi-Square Results for Present Themes (N=1,083)

Theme	Hypertension					Pneumothorax				
	No Analogy (*n*=141)		Analogy (*n*=437)			No Analogy (*n*=124)		Analogy (*n*=381)		
	n	%	*n*	%	$\chi^2(1)$	*n*	%	*n*	%	$\chi^2(1)$
Caring	42	29.8	148	33.9	.80	51	41.1	117	30.7	4.58*
Clear	52	36.9	162	37.1	.00	54	43.5	180	47.2	.51
Competent	54	38.3	155	35.5	.37	42	33.9	129	33.9	.00
Concise/ Honest	19	13.5	52	11.9	.25	21	16.9	69	18.1	.09
Took Time	47	33.3	117	26.8	2.26	34	27.4	93	24.4	.45

*$p < .05$

4.7.4.1.2 Vignette Conditions

To determine whether there were differences in each theme for what participants liked about the doctor from the vignette based on the use of analogies and health condition, a series of three-way chi-squares were conducted (see Table 16); 2 (no analogies/analogies) x 2 (hypertension/pneumothorax) x 2 (theme present/not present). For caring, for pneumothorax the result approached significance: $\chi^2(1) = 3.46$, $p = .063$, Cramer's $\Phi = .086$, with a small effect size. Participants assigned to conditions without analogies more frequently indicated that they liked that the physician was caring (11.9%) compared to those assigned to analogy conditions (6.5%). No other results were significant or approached significance. For all themes except caring, which was marginally significant, there were no differences in the analogy versus no analogy conditions based on the health condition to which participants were assigned in their perceptions of the themes that they liked about the physician from the vignette.

Table 16. Research Question 4 Like- Vignette Frequencies and Chi-Square Results for Present Themes (N=1,000)

Theme	Hypertension					Pneumothorax				
	No Analogy (*n*=134)		Analogy (*n*=402)			No Analogy (*n*=109)		Analogy (*n*=355)		
	n	%	*n*	%	$\chi^2(1)$	*n*	%	*n*	%	$\chi^2(1)$
Caring	10	7.5	34	8.5	.13	13	11.9	23	6.5	3.46
Clear	46	34.3	149	37.1	.33	41	37.6	145	40.8	.36
Competent	47	35.1	162	40.3	1.15	41	37.6	127	35.8	.12
Concise/ Honest	26	19.4	63	15.7	1.01	23	21.1	59	16.6	1.15
Took Time	41	30.6	106	26.4	.90	29	26.6	98	27.6	.04

*$p < .05$

Note. Though not statistically significant, for caring- pneumothorax, the chi square approached significance ($p = .063$, Cramer's $\Phi = .086$).

4.7.4.2 Dislike About Doctor

Video and vignette conditions were also analyzed separately for the "Dislike" portion of research question 4.

4.7.4.2.1 Video Conditions

To determine whether there were differences in each theme for what participants did not like about the doctor from the video based on the use of analogies and health condition, a series of three-way chi-squares were conducted (see Table 17); 2 (no analogies/analogies) x 2 (hypertension/pneumothorax) x 2 (theme present/not present). There were no significant results for this set of chi-squares for either health condition. For all themes, there were no differences in the analogy versus no analogy conditions based on the health condition to which participants were assigned in their perceptions of the themes that they did not like about the physician from the video.

Table 17. Research Question 4 Dislike- Video Frequencies and Chi-Square Results for Present Themes (N=455)

Theme	Hypertension					Pneumothorax				
	No Analogy (*n*=64)		Analogy (*n*=193)			No Analogy (*n*=41)		Analogy (*n*=157)		
	n	%	*n*	%	$\chi^2(1)$	*n*	%	*n*	%	$\chi^2(1)$
Condescending	3	4.7	19	9.8	1.63	2	4.9	3	1.9	1.16
Interaction	11	17.2	23	11.9	1.16	7	17.1	25	15.9	.03
Poor Info	19	29.7	50	25.9	.35	10	24.4	25	15.9	1.60
Timing	6	9.4	23	11.9	.31	3	7.3	17	10.8	.44
Uncaring	29	45.3	94	48.7	.22	21	51.2	92	58.6	.72
Unclear	11	17.2	22	11.4	1.44	6	14.6	24	15.3	.01

*$p < .05$

4.7.4.2.2 Vignette Conditions

To determine whether there were differences in each theme for what participants did not like about the doctor from the vignette based on the use of analogies and health condition, a series of three-way chi-squares were conducted (see Table 18); 2 (no analogies/analogies) x 2 (hypertension/pneumothorax) x 2 (theme present/not present). For most of the analyses there were no significant effects. For condescending, hypertension, no analyses were conducted because no participants expressed that they did not like that the physician was condescending. However, for unclear, pneumothorax there was a significant effect: $\chi^2(1) = 5.06$, $p = .02$, Cramer's $\Phi = .16$, with a small effect size. Participants assigned to conditions without analogies more frequently reported that they did not like that the physician was unclear (22.9%), than those assigned to conditions with analogies (10.2%). For all themes except for unclear, pneumothorax, there were no differences in analogy versus no analogy conditions based on the health condition to which participants were assigned in their perceptions of the themes that they did not like about the physician from the vignette.

Table 18. Research Question 4 Dislike- Vignette Frequencies and Chi-Square Results for Present Themes (N=437)

Theme	Hypertension					Pneumothorax				
	No Analogy (*n*=73)		Analogy (*n*=169)			No Analogy (*n*=48)		Analogy (*n*=147)		
	n	%	*n*	%	$\chi^2(1)$	*n*	%	*n*	%	$\chi^2(1)$
Condescending	0	0.00	0	0.00	--	2	4.2	6	4.1	.00
Interaction	7	9.6	14	8.3	.11	6	12.5	20	13.6	.04
Poor Info	27	37.0	47	27.8	2.02	15	31.3	56	38.1	.73
Timing	9	12.3	19	11.2	.06	3	6.3	19	12.9	1.61
Uncaring	33	45.2	78	46.2	.02	17	35.4	56	38.1	.11
Unclear	9	12.3	28	16.6	.71	11	22.9	15	10.2	5.06*

*$p < .05$

Overall, the chi-square analyses from research question 4 indicate that for the most part, participants did not have significant differences in what they liked or disliked about the physician from the video or the vignette based on the health condition and analogy condition to which they were assigned. The only significant results were found between analogies and no analogies for the pneumothorax conditions; a greater percentage of participants indicated the video physician was caring in the no analogy conditions compared to the analogy conditions, and the same effect was nearly significant for the vignette physician. Finally, a greater percentage of participants indicated the vignette physician was unclear in the conditions without analogies compared to the conditions with analogies.

4.8 Research Question 5

Research question 5 asks what physician messages participants remember that contained helpful metaphors or analogies to explain a medical concept in order to determine whether analogies can be memorable messages. 24.57% of participants who answered the question recalled

a valid analogy (*N*=243). The messages were coded separately for the health issues the analogies described in addition to the analogies themselves.

4.8.1 Health Conditions

For the health conditions that were described using analogies mentioned by the participants, the themes were organized by system or part of the body most affected by the health conditions, resulting in 10 themes (see Table 19).

4.8.1.1 Cardiovascular System

One-quarter (*n*=61; 25.10%) of the health issues that were mentioned in the analogy messages were health issues associated with the cardiovascular system, related to the heart, veins, blood vessels, blood, etc. Sample responses include: "I can remember one time a doctor commenting on my resting pulse of 60 being 'like clockwork;'" and "My heart is like a car engine that runs on 4 valves."

Table 19. RQ5: Analogies as Memorable Messages/Analogies Patients Remember-**Health Issue** (N=243)

Themes	Kappa (% Agreement)	*n* (%)	Examples
Cardiovascular	.91 (96.77)	61 (25.10)	"A doctor described **veins** like highways for **blood**." "**Heart** is like a pump."
Musculoskeletal	.79 (94.35)	38 (15.64)	"**Bones** get rusted when not used properly..." "**Tendons** are like ropes that hold the joints and muscles together."
Digestive	.87 (97.58)	29 (11.93)	"**Liver** is the poison control center of the body." "**Not eating healthy** is like putting water in your gas tank and expecting your car to run."
Dental/Eye/Skin	1.00 (100.00)	26 (10.70)	"A doctor once told me that my **retinal detachment** is like having a rip in the wallpaper lining my **eye**." "My **dentist** told me about my **tooth** being connected to nerves that are like 'wires.'" "**Skin** is red as a beet."
Nervous System	.86 (96.77)	26 (10.70)	"**Bulging discs** are like jelly donuts that are squished..." "The **brain** is about the size of two fists placed together."
Mental Health	.76 (97.58)	15 (6.17)	"**Anxiety** is like a bad day you can't forget about..." "That a person who has **dementia**, their brain is like swiss cheese."
Reproductive	.88 (98.39)	15 (6.17)	"I was getting an IUD, and a gynecologist once sketched a rough drawing of a uterus, being like a balloon." "The **cervix** being tied up with a drawstring like a sack..."
Urinary	.85 (98.39)	14 (5.76)	"Having a **kidney stone** is like giving birth." "Your **bladder** is like a water balloon and is sometimes difficult to fully empty."
Endocrine	1.00 (100.00)	9 (3.70)	"My PCP told me I had **hypothyroidism** and said it was like my **thyroid** was sleepy and needed a stimulant." "The **thyroid** is like a mood regulator..."
Respiratory	1.00 (100.00)	9 (3.70)	"A **pulmonologist** once told me the cells in my **lungs** behaved like little balloons filling up and going down." "**Asthma** is like drowning without water."
Other	(98.39)	4 (1.65)	"A doctor once explained to me that my body was fighting a battle against a **virus** I had." "**Marijuana** acts as pain medicine."

Note. Only percent agreement is reported for "Other" because it occurred so infrequently.

4.8.1.2 Musculoskeletal System

Another theme represents health issues associated with the musculoskeletal system (*n*=38; 15.64%). These health issues related to muscles, tendons, bones, and joints. However, if it was a spine issue that was mentioned, it was classified under "Nervous System" instead. Sample comments representing this theme are: "One time a provider explained to me that my torn ACL was like a rubber band that snapped under pressure;" and "The cartilage in the foot will dissolve and the bones will collapse like cards falling."

4.8.1.3 Digestive System

Some of the health conditions mentioned by respondents were associated with the digestive system or an organ in the digestive system (*n*=29; 11.93%), such as the stomach, colon, liver, pancreas, intestines, esophagus, or gallbladder. For instance, "I remember a doctor using an analogy of a pump when talking about my stomach;" and "When I had my gall bladder removed the doctor described the gall bladder as being your body's grease trap similar to like the grease trap under a sink."

4.8.1.4 Dental, Eye, or Skin Conditions

The next theme describes health issues associated with the teeth/mouth, eyes, or skin, or those that mention the analogy was delivered by a dentist, optometrist, or dermatologist (*n*=26; 10.70%). Sample responses are as follows: "A dentist described using their tool like sandpaper to scrape off the rough edges of my teeth;" "Cataract is like having wax paper over your eyes;" and "I remember a doctor telling me that stitches were like a seal to help the wound close."

4.8.1.5 Nervous System

Some of the health issues mentioned by the participants were associated with the nervous system (*n*=26; 10.70%); specifically, the brain, nerves, or spinal cord. For example, “Once I had my spine looked at, and it turned out I had damaged either my L5 or L6. The way the doctor described it to me was that it looked like ‘a squished Oreo cookie, with the filling squeezing out the sides;’” and “My sinus headache was like having ice pics in my eyes.”

4.8.1.6 Mental Health Conditions

Several respondents recalled analogies being used to describe mental health diagnoses (*n*=15; 6.17%) such as anxiety, depression, bipolar disorder, or dementia. Example responses illustrating this theme are: “A doctor once told me that bipolar can feel like a see-saw; One moment you’re feeling up and the next you’re feeling down;” and “I was speaking to my psychiatrist, and he explained anxiety is a ‘fight or flight’ reaction, as though we feel there is a tiger around ready to get us, but there is no tiger.”

4.8.1.7 Reproductive System

Health conditions associated with the reproductive system were mentioned by some participants (*n*=15; 6.17%); specifically, issues relating to the reproductive organs or to giving birth. Sample responses include: “A woman’s uterus is like a balloon...the more children you have the more it gets stretched out of its original shape;” and “When my doctor placed my IUD he compared the strings to fishing line.”

4.8.1.8 Urinary System

Just over 5% of the responses (*n*=14; 5.76%) related to organs associated with the urinary system such as the kidneys or bladder. For instance, “Once I had a high amount of, lactic acid I

think clogging up my kidneys. The doctor used an analogy about Michael Phelps working out and swimming to explain how this happened to me;" and "Your bladder is like a water balloon and is sometimes difficult to fully empty."

4.8.1.9 Endocrine System

Fewer participants mentioned a health issue related to the endocrine system or thyroid (*n*=9; 3.70%). For example, "The physician made an analogy between certain endocrine cells and a hose, suggesting that the endocrine cells were like a hose for endocrine hormones;" and "When I was diagnosed with thyroid disease my doctor explained to me that my thyroid is shaped like a butterfly with the wings extending to each side of my neck."

4.8.1.10 Respiratory System

The next theme is for health issues associated with the respiratory system (*n*=9; 3.70%), including breathing, asthma, or any issues relating to the lungs. Sample responses are: "My doctor described that my lungs are like a balloon that blows up, and then releases air. They don't blow up to the same size every time, but they are constantly blowing up and deflating;" and "When my doctor was talking to me about my allergies, she spoke about the hair in my nose being like a brush that catches the allergens but it needs to get washed out with nasal irrigation from time to time."

4.8.2 Analogies

In addition to the health issues that were described being analyzed, the analogies used to describe them were separately categorized into eight themes (see Table 20).

Table 20. RQ5: Analogies as Memorable Messages/Analogies Patients Remember-**Analogies** (N=243)

Themes	Kappa (% Agreement)	*n* (%)	Examples
Mechanical/Machine	.81 (93.55)	62 (25.51)	"Brain is **like a computer**." "My eye doctor had explained the eye to me in terms of a **clock**, with the retina being **like the inner workings**."
Act/Feeling/Experience	.65 (86.29)	60 (24.69)	"Migraines are **like when you get lost on a road and don't know where you are**." "The Dr was telling me about my hip and he said it's going to be **like walking on an uneven ground all the time**."
Random Object	.73 (89.52)	51 (20.99)	"I had a dermatologist once tell me that my skin was **like a giant saran wrap** for my whole body." "That the brain of a child is **like a sponge, they absorb everything** even when they don't seem like they are."
Structure	.69 (95.97)	20 (8.23)	"My dentist told me that the **roof** of my mouth **was gone but the basement is good**." "Your vessels are **like walls** if they are too close, that can cause high blood pressure."
Food	.94 (99.19)	17 (7.00)	"I had a Dr once describe hypertension as blood being too thick, **like syrup**." "I was with a family member and the Dr. compared a tumor to be **about the size of a mango**."
Nature	.73 (96.77)	16 (6.58)	"The doctor saying how skin is **like the Earth's layers**." "Your tailbone has snapped **like a twig hanging from a branch**." "Perineural nerve invasion (PNI) can **hop like a bunny** through the nerves..."
War/Battle	.83 (98.39)	12 (4.94)	"A brain aneurysm is **like an invisible ticking time bomb**." "I have had doctor's describe vaccines by talking about how vaccines **'teach'** the body **to recognize an invader**."
Medical/Body/Medicine	(97.58)	8 (3.29)	"A doctor once described to me the heart **as a muscle which needs to be built with exercise** over time." "My provider used the analogy for my bones being broken like a **skeleton being dismantled** just a little and everything is out of line."

Note. Only percent agreement is reported for "Medical/Body/Medicine" because it occurred so infrequently.

4.8.2.1 Mechanical/Machine

The most frequently occurring category was for participants recalling an analogy referencing something mechanical, part of a system, or something electrical (*n*=62; 25.51%). This category encompasses references to computers and plumbing, as well as parts of a machine such as a filter, valve, or pump. Sample responses are: "AV Block was like an electrical current that didn't pass the electrical charge as fast as it should;" and "There was one time where a doctor gave an analogy to me about the tendons in our body acting like a pulley and lever system...allowing you to move certain parts of your body."

4.8.2.2 Act/Feeling/Experience

About one-fourth of participants (*n*=60; 24.69%) remembered an analogy consisting of an act, experience, event, or feeling that occurs. This theme also includes personification in terms of a body part doing humanlike things. Examples representing this theme are: "Had a Doctor describe schizophrenia as someone in a room with 8 radios around them all playing a different station;" and "With respect to my diabetes: 'You are falling out of an airplane and it's time to pull the parachute!"'

4.8.2.3 Random Object

This theme is for analogies that are objects that do not fit into one of the other categories (*n*=51; 20.99%). The most frequently mentioned object in the analogies was a balloon, but other examples of objects mentioned were glass, rope, drum, glue, band aid, rubber band, or a football. For instance, "My doctor described my husband's aortic aneurysm as a balloon ready to pop;" and "You really shattered your finger bones like a broken glass."

4.8.2.4 Structure

Some participants shared analogies that related to a structure, shape, infrastructure, or architecture (*n*=20; 8.23%). These analogies referenced things like a wall, bridge, house, slit, bulge, or pocket. Example comments from this theme include: "A doctor told me that I have a bone spur in the joint of my big toe. He said it was similar to a draw bridge that wouldn't close all the way causing pressure;" and "Your joints are like hinges."

4.8.2.5 Food

A food analogy was mentioned by some respondents to describe their health issues (*n*=17; 7.00%). For example, "A doctor said that the meat in the bottom of your foot was like a honeycomb;" and "Yes, once I was shown fluid taken off a joint (swollen knee). He explained it was like cooking oil and is very slick feeling. This helps with lubrication of the joint."

4.8.2.6 Nature

Other participants mentioned analogies related to nature, or less frequently, an animal or insect (*n*=16; 6.58%). Trees were mentioned most often in this category. Sample responses are: "My doctor while explaining the process of getting my periods and why women go through them referred to the uterus as a nest. The blood was the bedding being replaced every month in order for the nest to be ready for a pregnancy;" and "Once when I broke my wrist, the doctor compared the fracture to a healthy tree branch that bent but did not break."

4.8.2.7 War/Battle

About five percent of participants described analogies associated with war, fighting, or a battle (*n*=12; 4.94%), including the body attacking itself or something else attacking the body. Analogies representing this theme include: "I have ulcerative colitis and my doctor described how

it is an autoimmune issue and that it is like my own body getting confused and attacking itself;" and "Yes, when I had Hodgkin's lymphoma, my oncologist described it like an army slowly colonizing different parts of my body with malignancy. It helped me understand my treatment options, and it put my mind at ease somewhat."

4.8.2.8 Medical/Body/Medicine

The final theme consists of analogies comparing one health issue to another health issue, body part, medication, or treatment (n=8; 3.29%). For instance, "I once felt like I was dizzy constantly and the doctor did explain how an inner ear infection works and how it can make you feel as though you have vertigo;" and "The closest thing would be the doctor making a fist with one hand and cupping the other hand over the fist to describe my shoulder joint hitting the rotator cuff."

4.9 Research Question 6

Research question 6 asks in which medical situations participants perceive analogies are most useful. First participants were asked whether they think use of analogies by healthcare providers to explain complex medical information is helpful (N=1,079). A majority of participants answered "Yes" (n=778; 72.1%), indicating they find analogies to be helpful, followed by "Maybe" (n=254; 23.5%), and "No" (n=47; 4.4%), indicating they did not find analogies to be helpful.

Participants may have different preferences for analogies based on their level of health literacy. To compare whether individuals with different levels of health literacy think analogies are more or less helpful, a binary logistic regression was conducted. Perceptions of analogies as helpful were split into Yes (n=778) and No/Maybe (n=308) in order to conduct a binary logistic regression. The logistic regression was statistically significant: $\chi^2(1) = 4.68$, $p = .031$. However,

health literacy explained only .6% (Nagelkerke R^2 = .006) of the variance in perceptions of the usefulness of analogies, indicating a very small association. Those with higher health literacy were somewhat more likely to think analogies were helpful than those with lower health literacy (see Table 21).

Table 21. RQ6: Binary Logistic Regression Results for Health Literacy and Helpfulness of Analogies

	B	*SE*	*Wald*	*p*	*exp(B)*	95% CI
Health Literacy	.129	.059	4.71	.030	1.14	[1.01, 1.28]
Constant	.228	.338	.455	.500	1.26	

4.9.1 Open-Ended Data Analysis

For participants who provided a relevant answer to the question about in which medical situations analogies are most useful (N=927), their responses were analyzed, and eight themes emerged from the data (see Table 22).

Table 22. RQ6: Under Which Medical Conditions or Situations Analogies Are Useful (N=927)

Themes	Kappa (% Agreement)	*n* (%)	Examples
Hard to Understand Health Issue	.80 (90.13)	438 (47.25)	"Puts descriptions into an understandable perspective." "To help explain if the patient does not get the diagnosis." "When describing a medical condition that is complicated and uses a lot of medical terminology."
Any/All Situations	.93 (97.21)	267 (28.80)	"All of them." "I think it would be useful in many of them." "Pretty much every situation. Analogies are almost always helpful."
Specific Situation	.74 (91.99)	215 (23.19)	"In order to get people to understand the size or shape of something..." "Maybe diabetes or high blood pressure." "To propel the patient into wanting to comply with doctor's suggestions."
Uncommon/ Unfamiliar Health Issues	.78 (96.64)	84 (9.06)	"I think any situation the patient is unfamiliar with it would be helpful for the doctor to use an analogy." "When it is an uncommon situation." "When the condition is less well known."
Hard to Visualize Health Issues	.91 (98.88)	59 (6.36)	"Any internal medical condition." "If it's really hard to visualize on its own." "When explaining something abstract, an analogy is useful."
Talking to a Specific Type of Patient	(97.02)	58 (6.26)	"I think when explaining to children you need to have an analogy to make things click sometimes." "Maybe when you're speaking to a child or someone with a language barrier..." "Those with a lack of medical background, or younger patients..."
Serious Health Issue	.83 (98.14)	44 (4.75)	"If the patient is critical." "Serious extreme issues I think." "When discussing a terminal illness or condition."
Not Serious/Common Health Issue	(98.88)	13 (1.40)	"Any that are not serious, life-threatening conditions." "Under normal treatments." "When the situation is non-life threatening. If I'm having a heart attack, I don't want to hear about what's happening in my body..."

Note. Only percent agreement is reported for "Talking to a Specific Type of Patient" and "Not Serious/Common Health Issue" because those themes occurred so infrequently.

4.9.1.1 Hard to Understand Health Issue

Almost half of participants mentioned that they think an analogy is useful for a health issue that is complex/complicated, hard to understand or confusing, contains jargon/technical terminology, or is technical (*n*=438; 47.25%). For example, "I think an analogy is most helpful when the procedure or medical terms are hard to understand;" and "To help people understand complex health issues." This category was also coded for participants who said analogies are helpful because they make information more understandable or in any situation in which a patient cannot understand the health issue. An example illustrating this part of the theme is "I think if a patient is really struggling to understand what is happening to them it could be useful."

4.9.1.2 Any/All Situations

The second most frequently occurring theme was for participants mentioning analogies are useful in any, all, most, or almost all medical situations (*n*=267; 28.80%). Sample responses illustrating this category are: "Every single one;" "I think analogy is helpful with all situations and conditions;" and "Most of the time."

4.9.1.3 Specific Situation

Other participants said that analogies are useful in a specific situation or for a specific purpose (*n*=215; 23.19%), such as making information more relatable to a patient or for explaining a specific health issue or body part. Example responses from this theme are: "Heart disease, kidney disease, broken bones;" "Mostly would work best if they knew something about the patient, like their line of work or hobbies, so they could use something relative to them;" and "To explain how they are going to repair something or explanation before a surgery."

4.9.1.4 Uncommon/Unfamiliar Health Issues

For some respondents, they indicated that analogies would be useful for describing health issues that are uncommon, unusual, rare, new, or are unfamiliar to the patient (*n*=84; 9.06%). For example, “Anything that is not very common knowledge;” “If I had an unusual diagnosis and wanted to learn more;” and “When describing a new condition you may have that you are unfamiliar with.”

4.9.1.5 Hard to Visualize Health Issues

Use of analogies for health issues that are difficult to visualize due to being internal or not physically seen comprised the next theme (*n*=59; 6.36%). Sample comments include, “Any medical condition that is not visible;” “It can be very helpful to visualize things;” “Under just about any situation dealing with things which are difficult to visualize, such as internal organs.”

4.9.1.6 Talking to a Specific Type of Patient

Some respondents said that analogies are useful when talking to certain groups of patients such as children, individuals with less education, those with a language barrier, or people without a medical background (*n*=58; 6.26%). Responses representing this theme are: “For dealing with children;” “It might be helpful when dealing with the uneducated or unintelligent;” and “This analogy would be most helpful to someone whose understanding of the English language is limited...”

4.9.1.7 Serious Health Issue

About 5% of participants (*n*=44; 4.75%) indicated they think analogies are useful to describe health issues that are serious, life-threatening, scary, critical, or terminal. For example,

"During extreme health conditions;" "Perhaps a serious or life-threatening condition;" and "Under serious conditions and patients who are in critical care."

4.9.1.8 Not Serious/Common Health Issue

The least frequently occurring theme is essentially the opposite of both the "serious health issue" and "uncommon/unfamiliar" themes (n=13; 1.40%), such that participants felt analogies were most useful for situations that were not serious or terminal, or were more common, basic, or routine health conditions. For instance, "It does also help with more common afflictions;" "Less serious diagnosis" and "Non emergency situations. In an emergency I don't think I would be able to focus on an analogy but more on getting better quick."

CHAPTER 5. DISCUSSION AND CONCLUSION

5.1 Influence of Physician Analogies on Participant Understanding

When analyzing the influence of physician use of analogies on participant understanding-related variables (objective understanding, perceived understanding, and clarity), the analyses suggested that health literacy should be used as a covariate since it was significantly and positively associated with this group of dependent variables. This decision to include health literacy as a covariate aligns with previous research suggesting that health literacy has an influence on individuals' levels of recall, with those patients with low health literacy recalling significantly less information than those with adequate health literacy (McCarthy et al., 2012). Some studies even suggest that use of analogies may help patients with low health literacy understand information (Coleman et al., 2017; Talley, 2016), or that analogies differently impact how individuals with varying levels of health literacy understand health-related information (Galesic & Garcia-Retamero, 2013; Krieger et al., 2017). However, in the present study, participants with higher health literacy had only somewhat greater perceptions that analogies were helpful than those with low health literacy.

Physician use of analogies, when including health literacy as a covariate, did not enhance participant perceptions of the clarity of the physician's message, nor objective understanding or perceived understanding in the experiment. These results are somewhat similar to previous research. For instance, some literature suggests that use of analogies in an intervention may result in increased understanding of health information after the intervention (Gazzinelli et al., 2010; Naik et al., 2011). However, other literature indicates a nonsignificant influence of analogies on understanding (Gasteiger et al., 2020; Raimi et al., 2017). It is somewhat surprising that use of analogies did not influence any of the understanding-related variables. Perhaps the analogies were

not noticed or appreciated by the participants, or the message may have been easy to understand without the analogies.

5.1.1 Analogies and Health Condition

When analyzing the influence of analogies and health condition on the understanding-related dependent variables, there was a main effect for health condition for one of the dependent variables. There was no main effect for clarity or perceived understanding based on health condition. Interestingly, objective understanding of the message was significantly greater in the pneumothorax conditions compared to the hypertension conditions. This result is somewhat surprising, given that intuitively one might think that understanding would be higher when someone is more familiar with a health condition than less familiar. For example, U.S. students who were given a familiar context to describe global warming had significantly greater understanding of global warming compared to those given an unfamiliar context (Song & Bruning, 2016). In addition, though not the same dependent variable, a meta-analysis indicates that use of metaphorical language is more persuasive than literal language in situations of high familiarity with the target being described compared to low familiarity (Van Stee, 2018). However, among 20 Japanese college students reading a passage from a Japanese novel in English, for students who knew the source of the passage, they remembered significantly less information than students who did not know the source of the passage (Stott, 2004). Stott (2004) pondered whether participants paid more attention to the message when they did not know the source since they were supposedly less familiar with it, or maybe their own prior knowledge of the source was confused with the information from the message, resulting in worse performance. A similar phenomenon may have occurred among participants in the dissertation when they were assigned to the pneumothorax condition such that they may have paid more attention to the message since they were less familiar

with it, or maybe with the hypertension message they answered the questions based on their own knowledge as opposed to information from the physician's message. The fact that the objective understanding score was higher for the pneumothorax health conditions could be indicative of an occurrence similar to the Dunning-Kruger effect (Dunning, 2011; Kruger & Dunning, 1999). In this case, participants may have assumed they have more knowledge about hypertension than they actually had based on the information provided in the physician's message since they were familiar with it, and assumed they had less knowledge about pneumothorax since they were unfamiliar with it.

There were no significant interaction effects between use of analogies or not and health condition for the understanding-related dependent variables. This finding is unexpected because logically, those who have less knowledge about something could need additional clear communication strategies such as analogies to help them understand compared to those who have more knowledge. Some literature supports this prediction, with authors explaining that children who know less about chemistry or who have lower cognitive ability may benefit from analogies more than those with more knowledge about chemistry or higher cognitive ability (Orgill & Bodner, 2005; Sarantopoulos & Tsaparlis, 2004). It is possible that the analogies used in the dissertation scripts did not resonate with the participants.

5.1.2 Diagnosis Versus Treatment Analogies

There was no significant difference between use of diagnosis or treatment analogies on the understanding-related variables. As there was no previous research directly comparing the use of analogies to explain diagnosis or treatment, there was no particular expectation for the results, but some research is tangentially related. When communicating with children about chronic pain, certain analogies can be helpful for explaining diagnosis, while other analogies, such as a teeter

totter or an onion, can be used to describe treatment for chronic pain (Coakley & Schechter, 2013). Metaphors are also used by some pulmonary physicians to describe diagnoses or treatments (Arroliga et al., 2002), while Salis and Ervas (2020) explain that metaphors can help patients understand their diagnoses. Findings from a meta-analysis of the influence of metaphors on persuasion suggest that use of metaphors in the introduction of a message were perceived as significantly more persuasive than use of metaphors at the end of a message (Sopory & Dillard, 2002), suggesting that there may have been some effect in favor of diagnosis metaphors over treatment metaphors based on their placement. However, a more recent meta-analysis covering the same topics did not find a significant effect for metaphors placed at the beginning versus the end of a message (Van Stee, 2018). Perhaps it is the quality of the analogies or the specific concept being described that matter more to their effectiveness at enhancing understanding-related variables as opposed to analogies being used to describe diagnosis or not.

As a post hoc analysis, the number of analogies were analyzed as an independent variable to see if they differently impacted the understanding-related variables. As the number of analogies increased, so did the perceptions of clarity, but there were no significant effects on objective or perceived understanding. Though a meta-analysis indicated that use of one metaphor was more persuasive than use of more metaphors in a message, the effect was not significant (Sopory & Dillard, 2002). Healthcare providers could consider using more analogies when describing health issues in order for patients to perceive that the messages about their health are clearer.

5.1.3 Written Versus Spoken Use of Analogies

Among participants who were assigned to analogy conditions, they better understood the information when reading the vignette as opposed to watching the video message. However, there were no significant effects for perceived understanding or clarity of the message. In a set of studies,

when participants were assigned to a condition with verbal information only or written information only compared to verbal and written information together, in both cases the verbal plus written condition was superior in terms of increasing knowledge or recall of information (Muthusamy et al., 2012; Webber et al., 2001). Some research suggests that written information may be beneficial for sharing metaphorical information, such as Gallagher et al.'s (2013) study finding that chronic pain patients who were given a booklet of metaphors versus a booklet of information about pain treatment without metaphors had greater understanding of pain biology. Yet, regarding the persuasiveness of messages using metaphors based on the format of the message, visual messages were more persuasive than written messages (Van Stee, 2018). Being able to read the information might have allowed participants to take their time since they could control the pacing as opposed to watching the video. In addition, some participants may have preferred this format based on their learning style if reading is a better format for learning than listening.

5.2 Mentioning Analogies When Recalling the Health Condition

Only a small percentage of participants (approximately 6-7%) mentioned an analogy when they were asked to imagine they were explaining the health condition to another person. However, those who were assigned to an analogy condition were more likely to use an analogy than those not assigned to an analogy condition, suggesting that some of them noticed the analogies. While it is possible that most participants did not find it necessary to mention the analogies, it is also possible that many of them did not notice or remember the analogies. In order to investigate this issue further, the manipulation check items asking participants to select any object that they recall being mentioned separately for the hypertension and pneumothorax video messages were analyzed to determine whether the participants assigned to analogy conditions remembered the objects mentioned in the analogies. For each analogy within each condition, recall ranged from 15.6-52.6%

(see Table 23) in each condition, meaning that (except for "balloon" with Condition 6) less than half of participants in each condition noticed each individual analogy. Further, 11.3-27.5% of the participants in each analogy condition indicated that none of the objects listed were mentioned in the message. Therefore, in a majority of cases, it appears that participants did not recognize or remember the analogies, which could explain why so many did not use analogies in their explanations. People may not pay adequate attention to messages from their healthcare providers, and so having the providers provide a written summary of medical visits might be useful for patients.

Table 23. Post Hoc Analysis of Participants' Recall of Analogy Objects- Video Message (N=934)

	Hypertension- Diagnosis		Hypertension- Treatment		
	Pipe	Hose	Faucet	Belt	None
Condition 2 (*N*=152)	41 (27.0%)	73 (48.0%)	-	-	21 (13.8%)
Condition 3 (*N*=182)	-	-	63 (34.6%)	32 (17.6%)	50 (27.5%)
Condition 4 (*N*=167)	55 (32.9%)	67 (40.1%)	80 (47.9%)	26 (15.6%)	23 (13.8%)

	Pneumothorax- Diagnosis		Pneumothorax- Treatment		
	Oil	Balloon	Pump	Tire	None
Condition 6 (*N*=151)	26 (17.2%)	69 (45.7%)	-	-	37 (24.5%)
Condition 7 (*N*=149)	-	-	40 (26.8%)	48 (32.2%)	29 (19.5%)
Condition 8 (*N*=133)	23 (17.3%)	70 (52.6%)	51 (38.3%)	42 (31.6%)	15 (11.3%)

Note. Even though faucet was not one of the objects mentioned for Condition 2, 42.1% (*N*=64) of participants indicated they remembered a faucet being mentioned in the message about hypertension.
Note. Even though pipe and hose were not one of the objects mentioned for Condition 3, 13.2% (*N*=24) of participants indicated they remembered a pipe being mentioned, and 10.4% (*N*=19) indicated they remembered hose being mentioned in the message about hypertension.
Note. Even though pump was not one of the objects mentioned for Condition 6, 17.9% (*N*=27) participants indicated they remembered a pump being mentioned in the message about pneumothorax.
Note. Even though balloon was not one of the objects mentioned for Condition 7, 20.1% (*N*=30) participants indicated they remembered balloon being mentioned in the message about pneumothorax.

Though analogies were not frequently mentioned in their explanations, among participants who did use analogies, certain analogies were preferred to others. This finding is somewhat contradicted by a study in which participants who completed a workshop on pain neuroscience reported that they found metaphors to be similarly helpful as opposed to preferring certain metaphors over others (Louw et al., 2019b). However, in another study in which medical students were taught how to position patients before being intubated, use of a finishing a race analogy was significantly better than use of sniffing the air analogy in terms of influencing their ability in how to correctly position a manikin for intubation (Brindley et al., 2010). In this dissertation, in general, participants preferred the spigot/hose analogy more than the others for hypertension, and both the vacuum and tire/patch analogies for spontaneous pneumothorax. One possible reason that other analogies were not mentioned as often, as well as why participants had trouble recalling some of these analogies, may be because the first three hypertension analogies (pipe, hose, and faucet/drain) were too similar to one another. All three relate to plumbing and water, so participants may have mentioned the hose, but assumed that it could have been used to describe more than one element of the message or may not have noticed the other two similar analogies, or realized that they were separate. A second reason that fewer analogies were mentioned for hypertension is perhaps the fact that the participants were familiar with hypertension. They may have figured that there was no need to use analogies to help explain it since they already understood the health issue, and may have perceived that the audience they were speaking to also adequately understood hypertension.

One of the analogies that was not commonly mentioned in participants' recalled explanations was the balloon analogy for pneumothorax to describe the lung. It is possible that participants thought this analogy was too elementary or unnecessary. What is fascinating though, is that when participants were later asked to recall analogies that they remember actual providers

using, many of them recalled a balloon analogy. Specifically, 26 responses mentioned a balloon as all or part of the analogy, or used it as a verb (e.g., “ballooning”), which comprised 10.76% of all analogies that were recalled by participants. Because some of these participants remembered balloon analogies being used by their providers, one might think that they themselves would remember and use a balloon analogy when describing pneumothorax, but that was generally not the case.

5.3 Influence of Physician Analogies on Participant Perceptions of Physician

Physician use of analogies did not significantly influence perceptions of the physician in areas of liking or similarity, or satisfaction or affective communication. Similarly, few participants mentioned analogies as a reason for liking or disliking the physician in their open-ended responses. The lack of liking for analogies is somewhat surprising given previous literature suggesting that use of analogies compared to not using them results in greater perceptions of the usefulness of advice (Donnelly & Dumas, 1997), enhanced perceptions of doctor communication (Casarett et al., 2010), or greater liking for therapy interactions (Tay, 2020b). Perhaps participants do not have a strong like or dislike for clinician use of analogies. For instance, in an intervention in which therapists were trained to pay attention to use of metaphors in their role plays, the more of a gap there was between the therapist and client in their desire to come up with metaphors, the lower the perception of their bond was by the client (Mathieson et al., 2017). Another reason participants may not have liked the analogies or the physician for using them could be because analogies were used to explain a health issue as opposed to using analogies for more of a relationship building function, as analogies can be used for different purposes, such as educating patients or for therapeutic uses (Frieden & Dolev, 2005).

The lack of liking for analogies is also surprising given other findings from this dissertation; specifically, the finding in which almost three-fourths of participants (72.1%) indicated that they think use of analogies is beneficial for healthcare providers when explaining complex information to patients. Apparently other factors mattered more regarding liking of the physician or message in this case. One potential reason for the overall lack of analogies being mentioned as something participants liked about the physicians could be the delivery of the physician actor or the format of the messaging. When responding to the open-ended question about what participants liked or disliked about the physician, many of them mentioned elements of delivery with the video message, such as the physician seeming robotic, speaking in a calm/relaxed manner, or that it seemed as though he was reading from a script. With the vignette, some participants also mentioned that they liked or disliked the fact that they could read it as opposed to the format being a video. Thus, the format may be one factor that stood out to participants more than analogies regarding their preferences.

Regarding the categories mentioned for liking or disliking the physician and the chi-square results, hardly any of the conditions varied based on use of analogies or not and/or health condition. These results generally support the results from the experimental part of the study, finding no significance regarding liking of the physician based on the use of analogies or not. For significant effects, participants watching the video assigned to the no analogy conditions liked that the physician was more caring than those assigned to analogy conditions for pneumothorax, but not for hypertension. Based on the predictions regarding liking and analogies, one would think that the analogy conditions would be perceived as more caring, but the effect was small. Another significant difference between categories was the finding that participants were more likely to perceive the physician as unclear in the no analogy vignette conditions versus the analogy

conditions for the unfamiliar health condition. This finding makes more sense, because it is almost a reverse way of saying that the use of analogies was perceived as clearer than no analogies, which aligns with the prediction from the first hypothesis. However, it is still a small effect, and the fact that it was only found for the vignette indicates that context matters.

5.4 Analogies as Memorable Messages and Analogy Categories

For research question 5, about one-quarter of participants recalled an analogy that a healthcare provider used to describe a health condition, suggesting that for some people, analogies may serve as memorable messages (Knapp et al., 1981). Clinician use of analogies would align well with the concept of memorable messages since these analogies are short, provided by a person with expertise and power, are relevant to the patient, and are given when a patient is in need (Knapp et al., 1981; Stohl, 1986). Analogies and figurative language more broadly could be added to the types of memorable messages that researchers ask participants to recall in future studies. Provider analogies are potentially important memorable messages since they likely help patients to remember and understand information about their health. This study is unique in that though memorable messages given by healthcare providers have been analyzed previously (Willer, 2014), memorable messages have not been analyzed specifically as analogies providers have used.

Regarding the categories of analogies, machine metaphors were most commonly mentioned, followed by act/feeling/experience, random object, structure, food, nature, war/battle, and medical/body. Categories discovered in this dissertation somewhat align with healthcare provider use of analogies in previous literature, such as battle, sports, puzzle, agriculture, and machine (Casarett et al., 2010; Periyakoil, 2019; Skelton et al., 2002), or bodily sensations, environment, and color (Spall et al., 2001). However, some of the metaphor categories were novel, such as random object, structure, or food. The act/feeling/experience category somewhat aligns

with the "bodily sensations" idea, and may be especially helpful for patients since it is concrete, as long as people have experienced it before, since analogies should be grounded in experiences from everyday life (Niebert et al., 2012). For instance, "Only when a metaphor is linked to its experiential basis can that metaphor increase our understanding" (Beck, 2016, p. 77).

Some of these metaphor categories may be more useful to patients than others. For instance, machine metaphors, while commonly used in medicine in the U.S., may be negatively perceived by patients because they focus on the body as individual parts as opposed to thinking of the patient as one entire being (Plotnikoff, 2004). Relatedly, some Norwegian clinicians discussing medically unexplained symptoms with teenagers used metaphors to describe the symptoms, but tried to avoid using the body as machine metaphor (Østbye et al., 2018). Considering that the machine category was most frequently recalled, perhaps healthcare providers should consider other analogies instead. Another metaphor category that has been widely criticized is the war metaphor (Harrington, 2012) since it puts illnesses (especially cancer) in a win or lose frame, which can result in patients feeling discouraged (Altilio, 2011). Yet, the war metaphor was not as commonly mentioned by participants as other categories in this dissertation. The fact that the medical category was least commonly mentioned is encouraging, because metaphors are more useful when they come from completely different domains compared to the concept they are describing (Halpern et al., 1990; Tourangeau & Sternberg, 1981). While other studies have examined typologies of analogy categories, this study is unique because participants were asked to recall analogies providers used as opposed to having providers recall analogies they use or having researchers observe analogies providers use.

5.5 In Which Medical Situations Analogies are Most Useful

Most participants indicated that they thought analogies are helpful for healthcare providers to use when discussing health issues. This finding seems contradictory to the findings from the experimental part of the dissertation in which there was little to no significance regarding liking for the healthcare provider based on their use of analogies or not. Even more surprising, when asked in which medical situations analogies would be useful, about 29% of participants said they are useful nearly all of the time in these types of situations. Otherwise, participants most frequently indicated that clinician use of analogies is beneficial when discussing health conditions that are hard to understand or in a specific situation, followed by unfamiliar health issues, hard to visualize health issues, when talking to a certain type of patient, for a serious health issue, or for a non-serious health issue. This suggests that participants find analogies to be useful for explaining complex information because it may help patients with understanding the information. Some of the categories mentioned align with previous research, and some do not. For instance, hematology clinicians in Ireland who used analogies to describe a plasma cell disorder decided whether to use analogies based on the age, intellectual ability, and educational background of their patients (McShane et al., 2018). One medical doctor says that she uses analogies to assist with patient comprehension when patients appear confused or are skeptical, in order to explain novel concepts to them (Harpham, 2010). Among clinicians in England working in the context of death and grief, they used metaphors to avoid discussing things, enhance focus on a topic, help patients comprehend information, or to facilitate a relationship with patients (Spall et al., 2001). Clinicians could consider using analogies when talking with their patients since most of the participants indicated that analogies seemed appropriate in a medical context.

5.6 Analogies as PCC

Based on the findings from the dissertation, it is possible that analogies may be a form of PCC. Though there were no significant findings for liking or positive perceptions of the physician, at the same time, a majority of participants thought that analogies would be useful for clinicians to discuss health issues. The most common situation mentioned was for participants perceiving that analogies would be useful to describe hard to understand health concepts, or useful when a patient did not seem to understand particular health information. One component of PCC is shared understanding (Epstein et al., 2005), and PCC can allow for shared decision making (Smith, 2016). Functions of PCC include uncertainty management, giving and receiving information, and facilitating positive relationships (McCormack et al., 2011). Analogies may enhance messages when providers are sharing information with their patients, and potentially facilitate a positive relationship with them, especially if patients find use of analogies to be appropriate in medical situations. Part of PCC also involves describing concepts without jargon and in a clear manner, and because analogies enhance perceptions of clarity when more analogies are used, they might also align with PCC (Epstein & Street, 2007). Medical students from one medical school were taught to use analogies when talking to patients to describe complicated health issues in a straightforward manner, and this intervention was part of an effort to create a patient-centered atmosphere (Kanthan & Mills, 2005). Finally, among some oncologists explaining a tumor gene expression test, some of them indicated that they used analogies to describe the testing process in a patient-centered manner (Roberts et al., 2016).

5.7 Why so Few Significant Results and so Many Small Effects

The overall lack of significant findings regarding use of analogies is somewhat unexpected given that many participants indicated they find analogies to be useful. However, some literature

suggests similar contradictory findings, with nonsignificant results regarding understanding, but also participant appreciation for analogies. For instance, for medical students who completed an intervention on history taking, there was no significant difference in knowledge between those who completed a 3D metaphor game versus receiving a PDF without metaphors containing similar information, but the group assigned to the game had greater satisfaction, perceiving that the metaphor game was fun and interactive (Alyami et al., 2019). Next, in an experiment describing climate change among U.S. adults, using analogies did not increase understanding of climate change or had a very small effect, but participants generally perceived that the analogies were useful (Raimi et al., 2017). However, some of the means from the experiment trended in the hypothesized direction, suggesting that analogies are helpful, such as the means for clarity and perceived understanding.

There are several potential reasons for the general lack of significant findings and small effects regarding physician use of analogies. One reason is that analogies may not have been prominent enough in the dissertation scripts. Even though the scripts were only a few paragraphs in length, the analogies may have gotten lost in the other information discussed regarding the health issues. As mentioned previously, it is possible that respondents did not notice the analogies since a majority did not remember many of the objects mentioned in the analogies, or that other factors mattered more, such as the delivery of the actor physician. It is also possible that participants may not have recognized that the analogies were actually analogies. For example, in a survey of allied health instructors, many of them could not accurately identify metaphors that were used in sentences compared to sentences without metaphors (Gess et al., 2020).

Another reason for the lack of significant results is that the analogies may not have been expanded upon enough. Some research has discussed the use of brief versus extended analogies,

whether in terms of amount of time spent talking about the analogy (Casarett et al., 2010), or the number of related or sub-analogies discussed in the context of a message (Sopory & Dillard, 2002). Casarett et al. (2010) describes brief analogies as those that occur within the course of a few seconds, and extended analogies as those that are discussed for more than a minute. According to this definition, all of the analogies used in the dissertation would be considered brief analogies. Sopory and Dillard (2002) indicated in their meta-analysis that though extended metaphors were more persuasive than brief metaphors, the difference between the two was not significant. Perhaps different results would be found for extended analogies. However, the overall message would have to be extended because the entire message lasted between 1-2 minutes with the current scripts.

Regarding the script, it is conceivable that the explanations for each health condition were easy to understand even without the analogies. Though jargon was mentioned, it was defined in all conditions, regardless of whether analogies were used. The physician was already using clear communication strategies such as using simple language, defining technical terminology, and limiting the number of main points covered in the message. The fact that the message was already clear may have resulted in a ceiling effect, in which analogies might not have added much, if any, additional clarity to the explanation. In addition, because there were no significant differences in participants indicating that they liked the physician because of perceptions of clarity for research question 4, this suggests that participants generally found the messages to be relatively equally easy to understand, whether analogies were used or not.

The analogies used in the dissertation may also not have resonated with particular participants, or they may not have understood their relevance to what was being described. Analogies are often not comprehended as they are intended, resulting in misunderstanding (Niebert et al., 2012). Additionally, doctors and patients tend to use different categories of metaphors

(Skelton et al., 2002), suggesting that perhaps patients may not be on the same page in terms of correctly interpreting all of their healthcare providers' metaphors. Additionally, metaphors may be more effective when targeted to particular groups of individuals, such as members of certain cultural groups (Lakoff & Johnson, 1980; Lin et al., 2016; Magaña, 2019). Not knowing about the participants' characteristics beyond being U.S. adults, it was difficult to know how to target the analogies to participants for this dissertation. Some researchers even indicate that it would be better for analogies to be tailored to individual participants (Reisfield & Wilson, 2004) based on characteristics such as their levels of health literacy (Krieger et al., 2017). Thus, use of one set of analogies may not be effective for providers to use with all their patients. Lastly, the lack of significant findings could be due to other limitations associated with the dissertation.

5.8 Limitations

There are several limitations from this dissertation that must be mentioned. First, the reliabilities for the immediacy and health literacy measures were lower than ideal. Another limitation is the fact that the main study sample was mostly female and White, as opposed to having a more diverse sample, which potentially limits the generalizability of the findings. Due to using MTurk for data collection, a lot of data had to be deleted due to being poor quality. Though precautions were put into place to try to avoid obtaining bad data, there were still many responses from duplicate IP addresses or geographical coordinates, participants failing attention check items, or bogus responses to the open-ended questions, resulting in a lot of data having to be removed.

Though the experiment was set up in a clean manner, there were limitations associated with the experiment. The use of an imagined scenario limited the external validity and realistic nature of the study. Though the videos were accurate to the script because the words were read from the script, the delivery of the message did not necessarily appear natural. Yet, the stimulus script

information was delivered in a particular way in order to provide standardization across conditions, such as making sure nonverbal behavior was consistent across conditions. Additionally, the actor was instructed to avoid gesturing with his hands or arms because that could influence perceptions of participants. By the same token, analogue patients were used rather than actual patients, which decreases the realistic nature of the study. However, in order for the dissertation to be feasible given the budget and timeline, U.S. adults from MTurk were recruited as participants.

As mentioned before, it is possible that the manipulation of the analogies was not strong enough, and perhaps the analogies could have been made more prominent by reducing other information or expanding more upon each analogy that was used. In addition, the hose, pipe, and faucet analogies used for hypertension were probably too similar for participants to be able to adequately distinguish them from one another. Finally, the study design involved all participants watching the video first and then reading the vignette second, as opposed to having half of them see the video first and the other half see the vignette first. This is a limitation because the significant result from the second research question, with objective understanding being higher for the vignette than the video, could be due to the fact that the participants knew they would be quizzed the second time around. Thus, they may have paid more attention to the message in the vignette compared to watching the video due to a testing/order effect as opposed to the message format.

5.9 Future Research

The limitations of the dissertation lead to ideas for future studies to continue this trajectory of research. If given more resources and time, a similar experiment could be conducted using actual healthcare providers and patients, in which patients are actually being diagnosed with a health issue and the interaction is face to face. In this case, a longitudinal study could be conducted analyzing the dependent variables over time, and analyzing additional outcomes such as self-

efficacy, adherence, and/or health-related outcomes. It might be best to conduct this type of study within a particular medical specialty clinic, in which the specialists are making the same kinds of diagnoses, as opposed to a primary care clinic, in which the diagnoses would vary a lot from patient to patient. A more novel idea for future research would be to have an easy-to-understand message versus a more complicated message that contains more jargon along with the use of analogies to explain the jargon, since the explanations in the dissertation were generally easy to understand.

Because some participants indicated that they thought healthcare provider use of analogies is helpful but others did not, a future study could use a within subjects design. The same participants would be assigned to a physician message with analogies, and a message without analogies, and one could see if individuals' preferences for analogies differently impact their perceptions. Analyzing the combination of physician messages in addition to varying the nonverbal behavior of the physician such as their nonverbal immediacy would also be interesting, in order to see if there is an interaction between use of analogies and nonverbal behavior on participants' understanding of health information. Given that the study design in this dissertation was not fully crossed in terms of viewing order of the video and vignette, another experiment could be conducted with 16 conditions, in which half of the participants view the video first, while the other half view the vignette first. This would allow for ensuring that there was no order effect if there were any significant effects for the format of the message on the outcome variables.

Other studies could be conducted by varying the types of analogies that are used. One idea is to analyze the influence of visual analogies on outcome variables. As one of the categories that arose regarding in which medical situations analogies would be useful was for visualizing health issues, testing visual analogies would be appropriate. For instance, thirteen out of sixteen Scottish podiatrists who were surveyed indicated that they felt using visual metaphors is helpful to teach

patients with foot issues about diabetes (Bullen et al., 2018). A visual analogy involves "relating an observation to a recognizable image" (Jasani & Saks, 2013, p. e1329). While this definition indicates that visual analogies can be concrete analogies that are delivered verbally, use of actual images or pictures as analogies would also be interesting to examine as stimulus material. For example, researchers have used a dial, gauge, or speedometer as visual analogy to show progress on particular health issues, which enhanced participants' recall of information (Martin et al., 2012; Reading Turchioe et al., 2019). In a review of studies using pictures in health communication, the use of pictures with verbal or written information enhanced understanding when the pictures revealed connections between concepts or spatial associations more than text or words alone, and also influenced adherence and behavior change (Houts et al., 2006). Another interesting take on visual analogies would be to analyze the potential effectiveness of demonstrations of concepts, in which analogies are acted out to see if they help increase understanding. For instance, one participant, when recalling an analogy from a provider, stated: "The closest thing would be the doctor making a fist with one hand and cupping the other hand over the fist to describe my shoulder joint hitting the rotator cuff." As another example, one strategy for teaching nursing students about what it feels like for a patient to breathe who has an obstruction, is to have them breathe through a straw (Aldridge, 2018).

A different type of clear communication strategy that could be studied in a future experiment is based on the concept of non-examples. One participant, in responding to research question 6 about in which medical situations analogies are useful, indicated that metaphors are only helpful up to a point. They stated, "Problem with metaphors is that they fail at some point—that's why they're metaphors and not the thing itself—so it's important the patient understand the dissimilarities too." This point is especially an issue if there are situations in which the analogy

fits some of the qualities of the concept being described, but also does not fit in important other areas. For example, clinicians in the UK used the flip of a coin analogy to explain clinical trial randomization, but this analogy is not completely correct because other characteristics such as age are considered, so it is not exactly a 50/50 chance (Jepson et al., 2018). The idea of using analogies as a way to discuss how a concept is both similar to and different from the analogy itself is reminiscent of the concept of non-examples.

Non-examples "...resemble the concept by sharing some aspects of the criteria but fall short of having all of the criteria..." which can "...help audience members clearly understand the difference" (Morgan et al., 2020, p. 229). Non-examples involve explaining how two concepts are *different* from one another in addition to explaining how they are similar. For example, if a clinician were explaining stitches to someone who had never heard of stitches, they could compare stitches to sewing. They could say that stitches are like sewing because they both involve a needle and thread and connecting two things together, which is an analogy. A non-example would take this one step further by also explaining how the two are different. The clinician could say that giving stitches is different from sewing because with sewing, two separate pieces of fabric are connected with one another, but with stitches there is a cut or skin that is split open, and that skin is being stitched back together. As another illustration, imagine a healthcare provider is explaining an arteriovenous malformation (AVM), which is basically a bunch of blood vessels tangled in the brain (Mayo Clinic, 2019, "Brain AVM"). The provider could compare the AVM to rubber bands being tangled up in a ball, and then say that the AVM is different from a tangled ball of rubber bands because the blood vessels have blood inside of them, and the AVM can result in a stroke if a blood vessel ruptures; but with rubber bands, there is nothing inside of them, so if they got a hole in them or snapped, that would not result in a leak. One workplace safety training used both

examples and non-examples, and the training was effective at enhancing trainees' performance (Taylor et al., 2016). Elementary aged children who were taught decimals using correct and incorrect examples versus only correct examples had increased learning as well as fewer misconceptions about decimals (Durkin & Rittle-Johnson, 2012). Therefore, comparing regular analogies to analogies that are elaborated upon in the form of non-examples, by also explaining how they are different from a medical concept, may result in enhanced patient understanding.

In addition to examining non-example types of analogies, extended analogies could be examined. This would involve a clinician discussing an analogy for more than a few seconds at a time, and perhaps returning to the analogy throughout the duration of their message or elaborating upon it by going more in-depth about how it aligns with the health concept being described. Testing out the effectiveness of analogies by targeting them to particular cultural groups or samples, or even taking it a step further and tailoring analogies to individual participants in future research could be fruitful to determine if analogies have a positive influence on understanding of health information or perceptions of healthcare providers. If testing out targeted or tailored analogies, it would be appropriate to use different research methods, such as interviews or focus groups, in order to pilot test the analogies and obtain more in-depth knowledge.

5.10 Conclusions and Implications

This dissertation sought to experimentally investigate the influence of physician use of analogies on participants' objective understanding, perceived understanding, clarity, and perceptions of the physician. Additionally, the study examined nuances such as analogies used to explain different health conditions, used to explain diagnosis and/or treatment, and written versus spoken use of analogies. Finally, when recalling the physician messages, data were analyzed to determine if participants mentioned analogies, whether they mentioned liking or disliking the

physician's use of analogies or what they liked and disliked and whether it differed by analogy condition, which analogies they remember providers using, and in which medical situations analogies are helpful. Participants assigned to analogy conditions did not perceive the physician's message as having more clarity, and there were no significant differences regarding perceived understanding, objective understanding, liking, satisfaction, similarity, or affective communication. There was also no interaction effect between the health issue and usefulness of analogies to enhance understanding-related variables. No overall significant effect was found for the understanding-related variables for diagnosis versus treatment analogies. Explanations containing analogies in a written context tended to be better at enhancing objective understanding than in a video format. While there were few significant effects, and few participants recalled analogies in their explanations of the health issues, most of the participants still indicated that they felt analogies were beneficial for healthcare providers to use in interactions with patients, and some of them recalled actual provider analogies that were used to explain health issues. Participants also believed analogies could be used in most medical situations, or when participants are confused or are unfamiliar with a health issue, or when a health issue is complex.

There are several implications for healthcare providers that arise from the results of this dissertation. First, even though many of the results were not statistically significant, healthcare providers should consider using analogies when discussing health issues with their patients. This may help patients perceive the health information as clearer, and patients may appreciate the fact that analogies are being used to explain the information. Analogies can be utilized in both face to face or written formats, though written format seems to be slightly more beneficial to enhance objective understanding, and use of analogies may be perceived as less unclear when using them in a written format compared to not using analogies. Therefore, clinicians can provide written

synopses of the information they provided using analogies to patients at the end of a medical visit, whether hard copy or via email or a secure patient portal. Some patients may remember when healthcare providers use analogies to explain health concepts, so it is important for healthcare providers to be cognizant of the analogies that they are using. Providers may want to avoid using particular categories of analogies such as war (Altilio, 2011; Harrington, 2012), machine (Østbye et al., 2018; Plotnikoff, 2004), and medical (Halpern et al., 1990; Tourangeau & Sternberg, 1981) analogies, and use other categories of analogies. Categories of analogies from this study that could be used include act/feeling/experience, random object, structure, food, and nature. Because about 29% of participants indicated that analogies could be used in any medical situation, healthcare providers may want to consider using them. However, participants also mentioned more specific situations in which to use analogies, such as when patients are confused, or a health issue is new to them or difficult to understand. Given previous research, healthcare providers may want to consider targeting or tailoring analogies based on the culture (Lakoff & Johnson, 1980) or health literacy level (Krieger et al., 2017) of their patients if this information is known.

While analogies did not seem to be effective based on the experimental results from the discussion, most patients seem to appreciate them. By using analogies in a conscientious manner, clinicians may be able to have a positive impact on their interactions with patients, and analogies may be a form of PCC. Providers can consider using analogies especially if patients are being diagnosed with a new health issue or are confused about their health condition. If patients perceive that the information provided by their physicians is clearer, then maybe this sense of clarity could influence other important variables such as self-efficacy or adherence to treatment. Perhaps it would be worthwhile to train healthcare providers and medical students in appropriate use of analogies. As more research is conducted examining the potential influence of analogies on patient

outcomes based on particular nuances of their utilization, these findings could be added to update healthcare provider communication best practices literature.

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APPENDIX A. SCRIPTS

Dissertation Stimulus Script- Hypertension

Instructions for actor:

As you deliver the script, vary your vocal intonation as you would in a normal conversation, and pretend as though you are making and maintaining eye contact with the patient by looking directly into the camera while you speak. Utilize facial expressions appropriate to the content, i.e., pleasant, comforting, serious, etc. Maintain a relaxed body position, such that you have your arms open, and shoulders wide, with a slight forward lean. Please make sure the nonverbal behaviors you deliver appear natural and not over rehearsed, unrealistic, or as though you are reading a script. The only difference between the scripts/conditions is in their use of analogies (denoted in red, bold, italics) and the type of health condition.

Instructions for participants: Imagine that you have been experiencing headaches and shortness of breath for the last couple of days, and you decide to visit a doctor to figure out what is going on. At your appointment, the nurse begins by measuring your height and weight, taking your temperature, and measuring your blood pressure using a blood pressure cuff.

After the nurse leaves, the doctor comes in. Please watch the following video and imagine this is the beginning of your interaction with the doctor.

Condition 1 (No analogies):

Hello; well, I looked at your blood pressure reading, and you have hypertension, or high blood pressure.

So in your body you have arteries, which are a type of blood vessel, and the arteries have walls surrounding them. Normally blood flows easily through the arteries. You are experiencing a strong force of blood pushing against the walls of your arteries. This is due to the amount of blood being pumped by your heart, as well as how narrow your arteries are, causing high blood pressure.

Hypertension, when not controlled, *can* lead to complications such as a heart attack or stroke.

In your case, there are a couple of treatment options that I'll suggest. The first is give you a medication called a diuretic. A diuretic is a pill that helps your blood vessels to relax and allows your body to get rid of salt and water. Then, this will decrease the volume of your blood, and lower your blood pressure. If that treatment does not work, we'll try an angiotensin-converting enzyme or ACE inhibitor medication. This medication releases tension in the blood vessels by blocking a chemical that makes your blood vessels narrow, so that the blood vessels will widen.

Condition 2 (2 analogies—diagnosis):

Hello; well, I looked at your blood pressure reading, and you have hypertension, or high blood pressure.

So in your body you have arteries, which are a type of blood vessel, and the arteries have walls surrounding them. Normally blood flows easily through the arteries, ***like the way water flows through a pipe***. You are experiencing a strong force of blood pushing against the walls of your arteries, ***like having the spigot of a garden hose opened fully but the nozzle opened only slightly***. This is due to the amount of blood being pumped by your heart, as well as how narrow your arteries are, causing high blood pressure.

Hypertension, when not controlled, *can* lead to complications such as a heart attack or stroke.

In your case, there are a couple of treatment options that I'll suggest. The first is give you a medication called a diuretic. A diuretic is a pill that helps your blood vessels to relax and allows your body to get rid of salt and water. Then, this will decrease the volume of your blood, and lower your blood pressure. If that treatment does not work, we'll try an angiotensin-converting enzyme or ACE inhibitor medication. This medication releases tension in the blood vessels by blocking a chemical that makes your blood vessels narrow, so that the blood vessels will widen.

Condition 3 (2 analogies—treatment):

Hello; well, I looked at your blood pressure reading, and you have hypertension, or high blood pressure.

So in your body you have arteries, which are a type of blood vessel, and the arteries have walls surrounding them. Normally blood flows easily through the arteries. You are experiencing a strong force of blood pushing against the walls of your arteries. This is due to the amount of blood being pumped by your heart, as well as how narrow your arteries are, causing high blood pressure.

Hypertension, when not controlled, *can* lead to complications such as a heart attack or stroke.

In your case, there are a couple of treatment options that I'll suggest. The first is give you a medication called a diuretic. A diuretic is a pill that helps your blood vessels to relax and allows your body to get rid of salt and water, ***similar to how a faucet flushes water down a drain***. Then, this will decrease the volume of your blood, and lower your blood pressure. If that treatment does not work, we'll try an angiotensin-converting enzyme or ACE inhibitor medication. This medication releases tension in the blood vessels by blocking a chemical that makes your blood vessels narrow, so that the blood vessels will widen, ***similar to the way loosening up a belt makes it less tight***.

Condition 4 (4 analogies—diagnosis and treatment):

Hello; well, I looked at your blood pressure reading, and you have hypertension, or high blood pressure.

So in your body you have arteries, which are a type of blood vessel, and the arteries have walls surrounding them. Normally blood flows easily through the arteries, ***like the way water flows through a pipe***. You are experiencing a strong force of blood pushing against the walls of your arteries, ***like having the spigot of a garden hose opened fully but the nozzle opened only slightly***.

This is due to the amount of blood being pumped by your heart, as well as how narrow your arteries are, causing high blood pressure.

Hypertension, when not controlled, *can* lead to complications such as a heart attack or stroke.

In your case, there are a couple of treatment options that I'll suggest. The first is give you a medication called a diuretic. A diuretic is a pill that helps your blood vessels to relax and allows your body to get rid of salt and water, ***similar to how a faucet flushes water down a drain***. Then, this will decrease the volume of your blood, and lower your blood pressure. If that treatment does not work, we'll try an angiotensin-converting enzyme or ACE inhibitor medication. This medication releases tension in the blood vessels by blocking a chemical that makes your blood vessels narrow, so that the blood vessels will widen, ***similar to the way loosening up a belt makes it less tight***.

Dissertation Stimulus Script- Spontaneous Pneumothorax

Instructions for actor:

As you deliver the script, vary your vocal intonation as you would in a normal conversation, and pretend as though you are making and maintaining eye contact with the patient by looking directly into the camera while you speak. Utilize facial expressions appropriate to the content, i.e., pleasant, comforting, serious, etc. Maintain a relaxed body position, such that you have your arms open, and shoulders wide, with a slight forward lean. Please make sure the nonverbal behaviors you deliver appear natural and not over rehearsed, unrealistic, or as though you are reading a script. The health condition is pronounced "new-mow-thor-ax". The only difference between the scripts/conditions is in their use of analogies (denoted in red, bold, italics) and the type of health condition.

Instructions for participants: Imagine that you have been experiencing chest pain and shortness of breath for the last couple of days, and you decide to visit a doctor to figure out what is going on. After describing your symptoms to the doctor, the doctor seems concerned and explains that they are going to order a chest X-ray for you.

After completing the chest X-ray, the doctor asks to meet with you to go over the results. Please watch the following video and imagine this is the beginning of your interaction with the doctor since the X-ray.

Condition 5 (No analogies):

Hello; well, I looked at your chest X-ray, and you have a spontaneous pneumothorax, or a collapsed lung.

So in your chest you have a lining that surrounds your lungs and another one on the inside of your chest wall. Normally there is a small amount of fluid in the tiny space between the lining and chest wall, which allows your lungs to expand and contract without too much friction. Your lung lining has developed a small hole that allowed air to enter the space and it cannot get out. This is putting pressure on the lung causing it to collapse.

Pneumothorax *can* lead to another collapsed lung in the future.

In your case, there are a couple of treatment options that I'll suggest. The first is to place a tube into the space with the extra air in your chest. The tube connects to a valve that removes the extra air in that space. Then, in a few hours, the lung should fill with air, and return to normal. If that treatment does not work, we'll try surgery. The surgery would involve going in and making small incisions to the part of the lung that's causing the leak, and sealing it off. Over time, the lung would regrow over the incisions or re-inflate.

Condition 6 (2 analogies—diagnosis):

Hello; well, I looked at your chest X-ray, and you have a spontaneous pneumothorax, or a collapsed lung.
So in your chest you have a lining that surrounds your lungs and another one on the inside of your chest wall. Normally there is a small amount of fluid in the tiny space between the lining and chest wall, which allows your lungs to expand and contract without too much friction, ***like oil reduces friction between two moving engine parts***. Your lung lining has developed a small hole that allowed air to enter the space and it cannot get out. This is putting pressure on the lung, ***which is normally inflated like a balloon***, causing it to collapse.

Pneumothorax *can* lead to another collapsed lung in the future.

In your case, there are a couple of treatment options that I'll suggest. The first is to place a tube into the space with the extra air in your chest. The tube connects to a valve that removes the extra air in that space. Then, in a few hours, the lung should fill with air, and return to normal. If that treatment does not work, we'll try surgery. The surgery would involve going in and making small incisions to the part of the lung that's causing the leak, and sealing it off. Over time, the lung would regrow over the incisions or re-inflate.

Condition 7 (2 analogies—treatment):

Hello; well, I looked at your chest X-ray, and you have a spontaneous pneumothorax, or a collapsed lung.

So in your chest you have a lining that surrounds your lungs and another one on the inside of your chest wall. Normally there is a small amount of fluid in the tiny space between the lining and chest wall, which allows your lungs to expand and contract without too much friction. Your lung lining has developed a small hole that allowed air to enter the space and it cannot get out. This is putting pressure on the lung causing it to collapse.

Pneumothorax *can* lead to another collapsed lung in the future.

In your case, there are a couple of treatment options that I'll suggest. The first is to place a tube into the space with the extra air in your chest. The tube connects to a valve that removes the extra air in that space, ***similar to a vacuum pump.*** Then, in a few hours, the lung should fill with air, and return to normal. If that treatment does not work, we'll try surgery. The surgery would involve going in and making small incisions to the part of the lung that's causing the leak, and sealing it off, ***similar to how a tire with a hole is sealed with a patch***. Over time, the lung would regrow over the incisions or re-inflate.

Condition 8 (4 analogies—diagnosis and treatment):

Hello; well, I looked at your chest X-ray, and you have a spontaneous pneumothorax, or a collapsed lung.

So in your chest you have a lining that surrounds your lungs and another one on the inside of your chest wall. Normally there is a small amount of fluid in the tiny space between the lining and chest wall, which allows your lungs to expand and contract without too much friction, ***like oil reduces friction between two moving engine parts***. Your lung lining has developed a small hole that

allowed air to enter the space and it cannot get out. This is putting pressure on the lung, ***which is normally inflated like a balloon***, causing it to collapse.

Pneumothorax *can* lead to another collapsed lung in the future.

In your case, there are a couple of treatment options that I'll suggest. The first is to place a tube into the space with the extra air in your chest. The tube connects to a valve that removes the extra air in that space, ***similar to a vacuum pump.*** Then, in a few hours, the lung should fill with air, and return to normal. If that treatment does not work, we'll try surgery. The surgery would involve going in and making small incisions to the part of the lung that's causing the leak, and sealing it off, ***similar to how a tire with a hole is sealed with a patch***. Over time, the lung would regrow over the incisions or re-inflate.

APPENDIX B. OBJECTIVE UNDERSTANDING MEASURE

Knowledge/Objective Understanding Quiz (Hypertension)

1. What is the name of the health condition you are being diagnosed with? (hypertension or high blood pressure) (1 point)
2. Which two factors influence the strong force of blood pushing against the artery walls? (amount of blood pumped by heart and narrowness of arteries) (2 points)
3. What can your health condition lead to in the future? (heart attack and stroke) (2 points)
4. How many treatment option(s) were provided? (2) (1 point)
5. What were the treatment option(s)? (diuretic and ACE inhibitor) (2 points)

Knowledge/Objective Understanding Quiz (Spontaneous Pneumothorax)

1. What is the official name of the health condition you are being diagnosed with? (spontaneous pneumothorax) (1 point)
2. How would you describe the health condition (i.e., what has happened to the lung?) (collapsed) (1 point)
3. What part of the lung/chest area has developed a hole in it? (lung lining) (1 point)
4. What medical issue(s) can your health condition lead to in the future? (another collapsed lung) (1 point)
5. How many treatment option(s) were provided? (2) (1 point)
6. What were the treatment option(s)? (tube in chest and surgery) (2 points)
7. Which treatment option did the doctor recommend starting with (i.e., which one to try first)? (chest tube) (1 point)

APPENDIX C. SURVEY ITEMS

[Qualifying Questions] (demographic questions asked at end of survey for student version)

Demographics

I identify as: male/female/transgender/other (please specify)/prefer not to specify

What is your age? ___ (dropdown menu)

I identify as (select all that apply): Caucasian/African American/Hispanic/Asian/Native American/Pacific Islander/Other (please specify)

What is the highest level of education you have completed? (not for student version)

Never completed high school/high school or GED/2 year college degree/4 year college degree/graduate degree

Qualifying Question

Which of the following health conditions have you heard of? (select all that apply): (not for student version)

Bacterial Groloma/Bileana/Diabetes/Fibromyalgia/Hypertension/Oglioitis/Peripheral Sammopilia/Spontaneous Pneumothorax

Qualifying Question Fail Message

Unfortunately you do not qualify for this study, and you will not receive payment for completing the qualifying questions. We appreciate you taking the time to complete the qualifying questions, and your MTurk rating will not be negatively impacted. **Please return this HIT or let this HIT time out, and do not complete it**.

[Informed Consent—if passed qualifying question] (student version started here)

[captcha item] (not for student version)

Please check that you have a **good internet connection**, and that the **sound is working** on your computer or other device.

[SHOW HYPERTENSION STIMULUS/VIDEO]

Physician Clarity

Please respond to the following items based on your perception of the doctor in the video. 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree

1. The doctor fully discussed the health problem.
2. The doctor offered a thorough explanation.
3. The doctor was very informative.
4. The doctor was clear and easy to understand.

Perceived Understanding

Using a scale of 0-100, with 0 being no understanding and 100 being complete understanding, please indicate the degree to which you feel you understand the diagnosis you have been given.

Using a scale of 0-100, with 0 being no understanding and 100 being complete understanding, please indicate the degree to which you feel you understand the treatment options you have been given.

Using a scale of 0-100, with 0 being no understanding and 100 being complete understanding, please indicate the degree to which you feel you understand the message given by the physician.

Objective Understanding

The following questions ask you to recall content from the video you saw with the doctor. When answering these questions, please only provide information you heard from the video, and do not

search the internet for a response. If you do not remember the answer, it is okay to write "I don't know."

Hypertension Questions:

1. What is the official name of the health condition you are being diagnosed with?
2. Which two factors influence the strong force of blood pushing against the artery walls?
3. What medical issue(s) can your health condition lead to in the future?
4. How many treatment option(s) were provided?
5. What were the treatment option(s)?

Physician Affective Communication

Please respond to the following items based on your perception of the doctor in the video. 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree

1. This doctor was warm and caring toward me.
2. This doctor made me feel comfortable discussing personal issues.
3. This doctor really respected me.
4. I did not feel insulted when talking to this doctor.
5. This doctor seemed interested in me as a person.

Liking for Physician

Please respond to the following items based on your perception of the doctor in the video. 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree

1. This doctor seemed likeable.
2. This doctor seemed nice.
3. This doctor seemed pleasant.
4. This doctor seemed interesting.

Satisfaction

Using the continuum below please indicate how you would feel visiting with the doctor you watched in the video/from the scenario you just read

1. Displeased/pleased
2. Dissatisfied/satisfied

3. Uncomfortable/comfortable

Perceived Similarity

Please respond to the following items based on your perception of the doctor in the video.

1. Doesn't think like me/thinks like me
2. Doesn't behave like me/behaves like me
3. Is different from me/is similar to me
4. Is unlike me/is like me

Recall

Now that you have heard the doctor's message regarding your health condition, please imagine that you must explain what the doctor said to a significant other, close friend, or other family member. Please use the space below to type out how you would explain both the diagnosis **and** treatment information regarding your specific health issue:

Attention Check/Realistic Stimulus

Did you watch the video in its entirety? (attention check)

Yes/No

To what degree did the scenario presented in the video appear realistic?

1 = not realistic at all to 7 = extremely realistic

To what degree did the doctor in the video appear realistic?

1 = not realistic at all to 7 = extremely realistic

Reactions to Doctor

If given the opportunity, do you think you would choose to make a future appointment with the doctor from the video?

Yes/No

How likely is it that you would want to make a future appointment with the doctor from the video?

1 = very unlikely to 7 = very likely

Would you recommend the doctor from the video to others?

Yes/No

What did you like about the doctor in the video clip?

What did you dislike about the doctor in the video clip?

Nonverbal Immediacy (for video conditions only)

Below are a series of descriptions of things some doctors have been observed doing in some medical visits. Please respond to the statements in terms of how well they apply to this doctor. 1 = never, 2 = very rarely, 3 = rarely, 4 = occasionally, 5 = frequently, 6 = very frequently, 7 = always

1. Gestured while talking.
2. Looked at me while talking.
3. Smiled at me while talking.
4. Had a very relaxed body position while talking to me.
5. Used a variety of vocal expressions when talking to me.

Now, please imagine yourself in the next health-related situation...

[SHOW PNEUMOTHORAX STIMULUS/WRITTEN SCENARIO]

Physician Clarity

Please respond to the following items based on your perception of the doctor in the scenario you just read. 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree

1. The doctor fully discussed the health problem.
2. The doctor offered a thorough explanation.

3. The doctor was very informative.
4. The doctor was clear and easy to understand.

Perceived Understanding

Using a scale of 0-100, with 0 being no understanding and 100 being complete understanding, please indicate the degree to which you feel you understand the diagnosis you have been given.

Using a scale of 0-100, with 0 being no understanding and 100 being complete understanding, please indicate the degree to which you feel you understand the treatment options you have been given.

Using a scale of 0-100, with 0 being no understanding and 100 being complete understanding, please indicate the degree to which you feel you understand the message given by the physician.

Objective Understanding

The following questions ask you to recall content from the scenario you read with the doctor. When answering these questions, please only provide information you read from the scenario, and do not search the internet for a response. If you do not remember the answer, it is okay to write "I don't know."

Spontaneous Pneumothorax Questions:

1. What is the official name of the health condition you are being diagnosed with?
2. What has happened to the lung?
3. What part of the lung/chest area has developed a hole in it?
4. What medical issue(s) can your health condition lead to in the future?
5. How many treatment option(s) were provided?
6. What were the treatment option(s)?
7. Which treatment option did the doctor recommend starting with (i.e., which one to try first)?

Physician Affective Communication

Please respond to the following items based on your perception of the doctor in the scenario you read. 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree

1. This doctor was warm and caring toward me.
2. This doctor made me feel comfortable discussing personal issues.
3. This doctor really respected me.
4. I did not feel insulted when talking to this doctor.
5. This doctor seemed interested in me as a person.

Liking for Physician

Please respond to the following items based on your perception of the doctor in the scenario you read. 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree

1. This doctor seemed likeable.
2. This doctor seemed nice.
3. This doctor seemed pleasant.
4. This doctor seemed interesting.

Satisfaction

Using the continuum below please indicate how you would feel visiting with the doctor from the scenario you just read.

1. Displeased/pleased
2. Dissatisfied/satisfied
3. Uncomfortable/comfortable

Perceived Similarity

Please respond to the following items based on your perception of the doctor in the scenario you read.

1. Doesn’t think like me/thinks like me
2. Doesn’t behave like me/behaves like me
3. Is different from me/is similar to me
4. Is unlike me/is like me

Recall

Now that you have read the doctor's message regarding your health condition, please imagine that you must explain what the doctor said to a significant other, close friend, or other family member. Please use the space below to type out how you would explain both the diagnosis **and** treatment information regarding your specific health issue:

Attention Check/Realistic Stimulus

Did you read the scenario in its entirety? (attention check)

Yes/No

To what degree did the scenario that you had to read appear realistic?

1 = not realistic at all to 7 = extremely realistic

To what degree did the doctor in the scenario that you had to read appear realistic?

1 = not realistic at all to 7 = extremely realistic

Reactions to Doctor

If given the opportunity, do you think you would choose to make a future appointment with the doctor from the scenario you read?

Yes/No

How likely is it that you would want to make a future appointment with the doctor from the scenario you read?

1 = very unlikely to 7 = very likely

Would you recommend the doctor from the scenario you read to others?

Yes/No

What did you like about the doctor in the scenario you read?

What did you dislike about the doctor in the scenario you read?

Health Literacy

How often do you have someone help you read hospital materials?

1= always, 2 = very frequently, 3 = frequently, 4 = occasionally, 5 = rarely, 6 = very rarely, 7 = never

How confident are you filling out medical forms by yourself?

1 = not at all confident to 7 = extremely confident

How often do you have problems learning about your medical condition because of difficulty understanding written information?

1= always, 2 = very frequently, 3 = frequently, 4 = occasionally, 5 = rarely, 6 = very rarely, 7 = never

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PCP Questions

Have you visited a primary care provider in the last 12 months?

Yes/No

Do you have a regular primary care provider (PCP)?

Yes/No

Hypertension Questions

Before completing this survey, did you know anything about the health condition hypertension (high blood pressure)?

Yes/No

How much more do you think you learned about hypertension (high blood pressure) compared to the knowledge you had about hypertension before completing this survey? (retrospective pre-test)

1 = did not learn any more to 7 = learned a great deal more

Have you ever been diagnosed with hypertension (high blood pressure)?

Yes/No

Do you know anyone who has been diagnosed with hypertension (high blood pressure)?

Yes/No

How serious do you think hypertension (high blood pressure) is?

1 = not at all serious to 7 = extremely serious

Pneumothorax Questions

Before completing this survey, did you know anything about the health condition spontaneous pneumothorax (collapsed lung)?

Yes/No

How much more do you think you learned about spontaneous pneumothorax (collapsed lung) compared to the knowledge you had about pneumothorax before completing the survey? (retrospective pre-test)

1 = did not learn any more to 7 = learned a great deal more

Have you ever been diagnosed with a spontaneous pneumothorax (collapsed lung)?

Yes/No

Do you know anyone who has been diagnosed with a spontaneous pneumothorax (collapsed lung)?

Yes/No

How serious do you think a spontaneous pneumothorax (collapsed lung) is?

1 = not at all serious to 7 = extremely serious

Manipulation Checks

Which of the following objects, if any, do you remember being mentioned in the doctor's message regarding **hypertension** (high blood pressure) (select all that apply)?

Ball, hat, car, faucet, dog, bird, hose, belt, brush, blanket, pipe, card, none of these, other (please specify)

Which of the following objects, if any, do you remember being mentioned in the doctor's message regarding **spontaneous pneumothorax** (collapsed lung) (select all that apply)?

Balloon, dresser, sky, pump, candle, tire, phone, cat, kite, oil, picture, ring, none of these, other (please specify) (spontaneous pneumothorax)

Attention Check

Do you visit the doctor at least once per year? **Please select both responses ("yes" and "no") as the answer.** (select all that apply/attention check)

Yes/No

Provider Use of Analogies

Can you think of a memorable message from a medical encounter where you remember a healthcare provider using a helpful metaphor or analogy? A memorable message is a verbal message you remember that has had an impact on you. A metaphor or analogy compares something that is unfamiliar with something that is familiar to increase understanding of the unfamiliar concept (e.g., a doctor saying your kidney is like a filter because it takes bad things out of your blood). If you can think of any instances where a provider used a metaphor or analogy to explain a medical concept to you, please describe what the provider said in those instances.

Do you think use of analogies by healthcare providers to explain complex medical information is helpful?

Yes/No/Maybe

Under what medical conditions or situations do you think an analogy is helpful?

Demographics

What is your income? (not for student version)

$0-$9,999

$10,000-$19,999

$20,000-$29,999

$30,000-$39,999

$40,000-$49,999

$50,000-$59,999

$60,000-$69,999

$70,000-$79,999

$80,000-$89,999

$90,000-$99,999

$100,000+

What area(s) are your degree(s) in (if applicable)? _____ (not for student version)

Do you work in health care? (not for student version)

Yes/No

Do you have health insurance?

Yes/No

What is your student classification? (student version only)

first year/second year/third year/fourth year/fifth year +/graduate student/other (please specify)

Are you an international or a domestic student? (student version only)

domestic/international

What is your major in school? (student version only)

What U.S. state do you primarily reside in? _____ (not for student version; dropdown menu)

What is your MTurk id number? (not for student version)

Survey code: Thank you for completing this survey. Below is your randomly generated survey code. Please copy and paste the code into MTurk. (not for student version)

APPENDIX D. CODING SCHEMES

RQ4: What Participants Liked About the Doctor

"What did you like about the doctor in the scenario you read/video you watched?"

For this one you will be coding both the vignette and the video spreadsheets, but will use the same coding scheme for both.

Please read through the comments and code for the presence ("1") or absence ("0") of each characteristic in the comments. Categories are listed below in bold with definitions and examples of each category.

There are approximately 2,100 comments that you will be coding (among both spreadsheets). If you run across a comment that you are unable to place in a pre-determined category, please place it in the "Other" category, indicating it does not fit into any of the predetermined categories.

Note: it is possible for a single comment to fit into multiple categories, so please code those comments into each category in which it applies with a "1". If there is a conjunction, comma, or / separating statements, a response may fall within 1+ category. However, one phrase cannot fall within 2+ categories.

Ignore anything negative that is mentioned. Also ignore anything related to reading the scenario or watching the video (anything related to format being written or video). Also ignore anything related to demographic characteristics or appearance or nonverbal behaviors (ex: talked slowly, hair, age, male, eye contact, etc.) for the video conditions.

1. **Caring (Caring)**

- Definition: A participant mentioning they like the doctor because the doctor came across as caring, nice, friendly, pleasant, down to earth, calm, easygoing, relaxed, not judgmental, approachable, or kind. Also includes if participants say the doctor was not

condescending or did not talk down to them. Note: if they say he *talked* calmly, then do not code it/ignore it.

- *Examples:*
    - *"He or she spoke in a way that was helpful to me, but not condescending."*
    - *"He seemed friendly"*
    - *"He seemed to care about me and my well being"*
    - *"In my head, the voice seemed personal and talked like me"*
    - *"Seems nice"*
    - *"Calm and thoughtful"*
    - *"He seemed down to earth and not a person who sticks up his nose to other people"*
    - *"He wasn't rude or anything."*
    - *"I liked that he talked to me like an equal not like an idiot."*

2. Competent (Competent)

- Definition: A participant mentioning they like the doctor because the doctor seemed competent, professional, smart, informative (informational), an expert, trustworthy/they trust them, or knowledgeable. Also includes participants saying they like the approach to treatment or something that the doctor did. Also includes giving patient multiple options for treatment. Also includes vague comments related to doctor doing a good job such as "good doctor." (do not code as caring). If they say doctor explained diagnosis and treatment code here (not clear). Do not code here if they say "treatment options" unless it's a separate statement/idea. Code here if they just say "explained things." Code if they say "gave facts" unless it's talking about being straight/to the point.
- *Examples*
    - *"He did not just jump to surgery as the first treatment."*
    - *"He offered the diagnosis and the treatment in a professional manner."*
    - *"He took a chest xray and had a follow up to explain and go over options"*
    - *"i like that he gave two options"*
    - *"I liked how informative the doctor was."*
    - *"He diagnosed the problem and accurately described it and the recommended solutions."*
    - *"He is smart."*
    - *"I also like the fact that he wanted to try a diuretic first before automatically putting me on an ACE inhibitor."*

3. Took Their Time (Took Time)

- Definition: A participant mentioning they liked the doctor because the doctor took their time, was not rushed, was patient, was thorough/detailed, was precise, or was elaborate. Also code if they say a lot of information here.
- *Examples:*
    - *"Explained the problem in detail"*
    - *"He explained everything thoroughly."*
    - *"S/he takes the time to explain the condition and treatment options in detail."*

- *"The doctor was very thorough in their explanation of the problem and treatment options."*
- *"He didn't seem like he was in a rush."*
- *"...took his time to explain in detail."*
- *"He took the time to explain the problem and all of the solutions"*
- *"He was thorough in his explanation and did not seem rushed at all."*
- *"HE WAS VERY PATIENT..."*

4. Clear/Easy to Understand (Clear)

- Definition: A participant mentioning they liked the doctor because the doctor provided a clear explanation, the explanation was easy to understand, the doctor used simple terms or avoided jargon/language was easy to understand, used plain language, etc. Include mention of analogies and/or examples here. Also includes vague descriptions of liking the explanation such as "good explanation" or "clear explanation"; code here and not as "competent." If they say the doctor explained something in a relatable manner, code here instead of caring.
- *Examples:*
  - *"Broke down the issue in clear to understand language"*
  - *"Clearly explained the medical issue"*
  - *"Good analogies to my condition and the treatments. Some technical terms, but not too much."*
  - *"It was clear, and it had an understandable real world description. When he told me it was like a punctured tire, I could visualize what he meant."*
  - *"It was pretty easy to understand everything he had to say."*
  - *"Clear explanation and well organized"*
  - *"He explained things in laymans terms and did not use a lot of medical jargon to appear intelligent. Anyone could understand his explanations of the disease and the treatment."*
  - *"He spoke clearly and explained the treatments clearly."*

5. Concise/Honest (Concise/Honest)

- Definition: A participant mentioning they liked the doctor because the doctor was honest, no nonsense, matter of fact, blunt, straightforward, etc. Also includes a participant mentioning they liked the doctor because the doctor was concise, direct, to the point, etc.
- *Examples:*
  - *"...didn't sugarcoat anything."*
  - *"HE IS SPEAKING HONESTLY"*
  - *"direct and to the point"*
  - *"He was straightforward about the treatment options"*
  - *"he wasn't too long winded"*
  - *"Direct with minimal fluff."*
  - *"He seemed very matter of fact..."*
  - *"He spoke matter of factly, and did not waste words."*

Other

- Definition: Anything that does not fit into any of the predetermined categories. Always double-check/ask yourself before coding something here if it really belongs as other or if it fits into a different (existing) category because it is better to fit a response into a category than to code it as other.
    - *"everything"*
    - *"he is a human instead of A.I."*
    - *"Doctor is a god"*

RQ4: What Participants Did NOT Like About the Doctor

"What did you dislike about the doctor in the scenario you read/video you watched?"

For this one you will be coding both the vignette and the video spreadsheets, but will use the same coding scheme for both.

Please read through the comments and code for the presence ("1") or absence ("0") of each characteristic in the comments. Categories are listed below in bold with definitions and examples of each category.

There are approximately 900 comments that you will be coding (among both spreadsheets). If you run across a comment that you are unable to place in a pre-determined category, please place it in the "Other" category, indicating it does not fit into any of the predetermined categories.

Note: it is possible for a single comment to fit into multiple categories, so please code those comments into each category in which it applies with a "1". If there is a conjunction, comma, or / separating statements, a response may fall within 1+ category. However, one phrase cannot fall within 2+ categories.

Ignore anything positive that is mentioned. Also ignore anything related to reading the scenario or watching the video (anything related to format being written or video). Also ignore anything related to appearance, demographics, or nonverbal behaviors (ex: was creepy, lack of eye contact, volume too soft, reading from a script, hair, monotone, age, did not like how he was dressed, don't like male doctors, spoke too slowly, etc.) for the video conditions.

1. **Uncaring (Uncaring)**

- Definition: A participant mentioning they dislike the doctor because the doctor came across as uncaring, cold, robotic, not personable or impersonal, unfriendly, not warm, boring, a doctor not engaging in small talk, etc. Again, do NOT code anything related to nonverbals or the delivery of the message; only focus on content. Also includes mentioning that the doctor seemed dry, too straightforward, blunt, matter of fact, all

business, detached, etc. Also includes the doctor seeming too detached, disinterested, disconnected, etc.

- *Examples:*
    - *"Cold and dry way of communicating."*
    - *"He didn't really show any sign of friendliness or caring"*
    - *"He showed very little emotion. I didn't feel connected."*
    - *"I didnt like how he didnt sugarcoat it he told me straight up."*
    - *"I felt like my doctor was wikipedia"*
    - *"He seemed disconnected to me"*
    - *"A bit robotic, didn't seem to have any warmth or concern."*
    - *"He acted like a robot! There was no acknowledgement of the patient he was speaking to."*

2. **Poor or Missing Information (Poor Info)**

- Definition: A participant mentioning they dislike the doctor because they wanted more information, or did not like/criticized the information from the doctor (or missing information that should have been covered).
- *Examples:*
    - *"Discuss my eating and health habits with me before jumping to medication."*
    - *"He and the first doctor did not discuss side effects from the treatment options. And both doctors did not state why they are starting with the first treatment."*
    - *"He did not discuss the future complications of the problem."*
    - *"Could have provided a little more information about the ACE inhibitors treatment option."*
    - *"I didn't like that it seemed like I only had two options to pick one, with one being very severe (surgery)."*
    - *"he could have given me the numbers of my high blood pressure. He could have talked about the causes of high blood pressure. He could have talked about diet and exercise that might help reduce my hbp numbers."*
    - *"He didn't explain the cause of the spontaneous pneumothorax - obviously it wasn't injury related but is it genetic? Environmental? Just bad luck?"*
    - *"The doctor was quick to want to put me on medications instead of offering other options."*

3. **Unclear/Hard to Understand (Unclear)**

- Definition: A participant mentioning they disliked the doctor because the explanation was difficult to understand or confusing, the doctor used jargon/technical terminology, etc. If participants mention not liking the analogies can code that here. Also includes wanting a visual aid.
- *Examples:*
    - *"explanation a little technical"*
    - *"He did not give any analogies or any attempts to simplify things."*
    - *"he should use visual aids"*
    - *"He used large words and I had a hard time following what he said."*
    - *"I didn't understand the second medication"*

- *"I don't quite follow the belt metaphor"*
- *"He used a lot of big words."*
- *"His explanation wasn't that good. I'm still confused."*
- *"I disliked maybe not being shown a diagram of what was happening since a picture could probably better explain the situation to some people."*

4. No Patient Interaction (Interaction)

- Definition: A participant mentioning they disliked the doctor because they wanted to ask questions or wanted the doctor to ask them questions. Also includes mentioning that the doctor did not introduce their self.
- *Examples:*
  - *"didn't ask me if I had any questions."*
  - *"He did not ask if I had someone withs me or needed someone contacted before having the procedure."*
  - *"he didn't ask any opinion for the patient about the treatment"*
  - *"he didn't check in to ask if I understood the information"*
  - *"I didn't like that the doctor didn't ask questions about what I was experiencing, before giving a diagnosis."*
  - *"he never paused to ask if I understood what he was sharing or if I had any questions (that's important)"*
  - *"There wasn't any checking-in with the patient. Questions like "do you understand?" "are you comfortable with this treatment plan?" "do you have any questions?""*
  - *"He never started with a hello..."*

5. Timing (Timing)

- Definition: A participant mentioning they disliked the doctor because the doctor was either too detailed/thorough/long-winded/took too long, or too concise/did not go into enough detail.
- *Examples:*
  - *He didn't take the time to look for other symptoms, causes, or history before making a rushed diagnosis."*
  - *"He seemed rushed."*
  - *"He might have been a bit too brusque. I could have had questions about the proposed procedures, but he did not appear to have time for them."*
  - *"I thought in some ways the example was too lengthly and became irrelevant."*
  - *"The explanation of hypertension was perhaps too detailed. It is a widely understood condition..."*
  - *"It was too much information to take in at once."*
  - *"Someone who has not worked in a health care setting may have found the information dump overwhelming."*
  - *"The video was kind of short, he could have expounded further."*

6. **Condescending (Condescending)**

- Definition: A participant mentioning they disliked the doctor because the doctor came across as condescending, patronizing, treated the patient like a child, felt like the doctor was talking down to the patient, overexplaining things, etc.
- *Examples:*
    - *"He spoke to me as if I were a child and explained things to me as if I was dumb."*
    - *"He spoke to me like I'm stupid."*
    - *"I felt their explanations of the treatments were patronizing."*
    - *"Seemed a bit condescending"*
    - *"Did not converse with me to see my level of understanding, therefore seemed to speak to the lowest level of understanding."*
    - *"He almost over explained as if i was extremely uninformed on what high blood pressure means, like i was a child."*
    - *"He also seemed just a tad condescending."*
    - *"It seemed that he simplified the information a bit too much. May not need to do that if he is reading the patient"*

Other

- Definition: Anything that does not fit into any of the predetermined categories. Always double-check/ask yourself before coding something here if it really belongs as other or if it fits into a different (existing) category because it is better to fit a response into a category than to code it as other.
    - *"everything"*
    - *"He had pretty bad news for me."*
    - *"i do not know him very well yet."*
    - *"I don't like doctors in general."*
    - *"I disliked that the doctor said it was his own fault."*

RQ5: Participants Remembering Healthcare Provider Use of Analogy to Explain a Health Issue—HEALTH CONDITION

"Can you think of a memorable message from a medical encounter where you remember a healthcare provider using a helpful metaphor or analogy?" (*N*=243)

For this coding scheme we are focusing on the **health issue** that is being targeted/explained with the provider's use of analogy and NOT the analogy itself.

Please read through the comments and code for the presence ("1") or absence ("0") of each characteristic in the comments. Categories are listed below in bold with definitions and examples of each category.

There are approximately 250 comments that you will be coding. If you run across a comment that you are unable to place in a pre-determined category, please place it in the "Other" category, indicating it does not fit into any of the predetermined categories.

Note: **only code 1 health issue for each analogy mentioned (not multiple).**

If there is a conjunction, comma, or / separating statements, a response may fall within 1+ category. However, one phrase cannot fall within 2+ categories.

Feel free to Google/look up any health conditions or body parts that you are unfamiliar with, or look up which body systems particular organs fit in with if you are unsure.

1. **Cardiovascular System**

- Definition: A participant mentioning a health issue related to the heart, veins, blood vessels, arteries, blood, etc.
- *Examples:*
    - *"Heart is like a pump"*
    - *"I can remember one time a doctor commenting on my resting pulse of 60 being "like clockwork."*
    - *"A doctor described veins like highways for blood"*

2. **Musculoskeletal System**

- Definition: A participant mentioning a health issue related to muscles, tendons, bones, joints, etc. Note: if they are referring to the spine, code it under Nervous System instead.
- *Examples*
    - *"My arthritis was like a piece of sand in a pack of ball bearings."*
    - *"Bones get rusted when not used properly and not kept lubricated."*
    - *"Tendons are like ropes that hold the joints and muscles together"*
    - *"One time a provider explained to me that my torn ACL was like a rubberband that snapped under pressure."*

3. **Mental Health**

- Definition: A participant mentioning a health issue related to mental health, such as anxiety, depression, bipolar disorder, dementia, etc.
- *Examples:*
    - *"That a person who has dementia, their brain is like swiss cheese."*
    - *"anxiety is a "fight or flight" reaction, as though we feel there is a tiger around ready to get us, but there is no tiger."*
    - *"Anxiety is like a bad day you can't forget about but eventually the hard times and days do pass."*

4. **Dental/Eyes/Skin**

- Definition: A participant mentioning a health issue related to teeth, eyes, or skin. Could include mentioning that a dentist, optometrist, or dermatologist was the healthcare provider sharing the analogy.
- *Examples:*
    - *"My dentist told me about my tooth being connected to nerves that are like "wires".*
    - *"A doctor once told me that my retinal detachment is like having a rip in the wallpaper lining my eye."*
    - *"skin is red as a beet"*

5. **Reproductive System**

- Definition: A participant mentioning a health issue related to the reproductive organs or giving birth.
- *Examples:*
    - *"When I was in labor, the doctor asked if the pressure I felt on my tailbone was as if I had to go to the bathroom."*
    - *"The cervix being 'tied up with a drawstring like a sack' during a cerclage."*

6. **Respiratory System**

- Definition: A participant mentioning a health issue related to breathing such as asthma or anything related to the lungs.

- *Examples:*
    - *"The doctor described my nose/mouth as a complete system, with air running through the whole area (this was an allergist)."*
    - *"A pulmonologist once told me the cells in my lungs behaved like little balloons filling up and going down."*
    - *"Asthma is like drowning without water."*

7. Digestive System

- Definition: A participant mentioning a health issue or organ related to digestion or excretion. Ex: stomach, intestines, colon, esophagus, constipation, liver, pancreas, gallbladder, etc.
- *Examples:*
    - *"Liver is the poison control center of the body."*
    - *"Not eating healthy is like putting water in your gas tank and expecting your car to run."*
    - *"When I had my gall bladder removed the doctor described the gall bladder as being your body's grease trap similar to like the grease trap under a sink."*

8. Urinary System

- Definition: a participant mentioning a health issue or organ related to urination such as kidneys or bladder.
- *Examples:*
    - *"Having a kidney stone is like giving birth."*
    - *"Your kidneys are like a filter."*
    - *"Your bladder is like a water balloon and is sometimes difficult to fully empty."*

9. Nervous System

- Definition: A participant mentioning a health issue or organ related to the nervous system (brain, nerves, spinal cord). Notes: here I would think of the brain as more circuitry/functioning as opposed to specific to mental health issues. Also code any spinal issues here rather than under Musculoskeletal System. Also code ear stuff here.
- *Examples:*
    - *"the brain is about the size of two fists placed together"*
    - *"brain is like a computer"*
    - "*Bulging discs are like jelly donuts that are squished and the jelly is smashing a nerve."*

10. Endocrine System

- Definition: A participant mentioning a health issue related to the endocrine system or hormones, or an organ from the endocrine system such as thyroid.
- *Examples:*
    - *"explained that the parathyroid is the regulator for how much calcium goes into your blood"*

- *"My PCP told me I had hypothyroidism and said it was like my thyroid was sleepy and needed a stimulant."*
- *"The thyroid is like a mood regulator in that it can make you feel depressed if there are issues with it."*

Other/Miscellaneous

- Definition: Anything that does not fit into any of the predetermined categories. Always double-check/ask yourself before coding something here if it really belongs as other or if it fits into a different (existing) category because it is better to fit a response into a category than to code it as other.
- *Examples:*
  - *"marijuana acts as a pain medicine"*

RQ5: Participants Remembering Healthcare Provider Use of Analogy to Explain a Health Issue—ANALOGIES

"Can you think of a memorable message from a medical encounter where you remember a healthcare provider using a helpful metaphor or analogy?"

For this coding scheme we are focusing on the **analogy** that is being used and NOT the health issue being explained with the analogy.

Please read through the comments and code for the presence ("1") or absence ("0") of each characteristic in the comments. Categories are listed below in bold with definitions and examples of each category.

There are approximately 250 comments that you will be coding. If you run across a comment that you are unable to place in a pre-determined category, please place it in the "Other" category, indicating it does not fit into any of the predetermined categories.

Note: only code 1 theme/category for each analogy mentioned (not multiple).

If there is a conjunction, comma, or / separating statements, a response may fall within 1+ category. However, one phrase cannot fall within 2+ categories.

1. **Another medical issue/body part/medicine**

- Definition: A participant mentioning an analogy that compares one health issue to another health issue/condition or a body part or medication/treatment.
- *Examples:*
    - *"A doctor said that the brain is about the size of two fists placed together."*
    - *"A doctor once described to me the heart as a muscle which needs to be built with exercise over time."*
    - *"My doctor says my kidney is like painkiller because it does bad things from my blood."*

2. **Nature/Animal**

- Definition: A participant mentioning an analogy that compares a health issue to some aspect of nature (such as trees) or an animal, insect, etc.

- *Examples*
    - *"The doctor saying how skin is like the Earth's layers."*
    - *"Your tailbone has snapped like a twig hanging from a branch."*

3. Food

- Definition: A participant mentioning an analogy that compares a health issue to some type of food or drink.
- *Examples:*
    - *"There's the same amount of calories in a bottle of red wine as there is in a Big Mac."*
    - *"I had a Dr once describe hypertension as blood being too thick, like syrup."*
    - *"I was with a family member and the Dr. compared a tumor to be about the size of a mango."*

4. **Mechanical/Machine**

- Definition: A participant mentioning an analogy referencing something mechanical, part of a system, or something electrical. Also includes referencing things that could be part of a machine (Ex: filter, grease trap, valve, pump, clock). Also includes references to computers and plumbing.
- *Examples:*
    - *"My eye doctor had explained the eye to me in terms of a clock, with the retina being like the inner workings."*
    - *"describing the esophagal sphincter as a valve, that is letting food in, but then closing to prevent bile/acid from coming back up"*
    - *"brain is like a computer"*

5. Random Object

- Definition: A participant mentioning an analogy that is an object, but the object does not fit into one of the other categories. (Ex: glass, balloon, rope, drum, glue, bandaid, rubber band, football, etc.)
- *Examples:*
    - *"That the brain of a child is like a sponge, they absorb everything even when they don't seem like they are."*
    - *"My doctor described my husband's aerotic aneurysm as a balloon ready to pop."*
    - *"I had a dermatologist once tell me that my skin was like a giant Saran wrap for my whole body."*

6. War/Battle

- Definition: A participant mentioning an analogy associated with war, fighting, or a battle. Could reference the body attacking itself or something attacking the body.
- *Examples:*
    - *"That my antibodies are attacking my thyroid, so it's causing the thyroid to release hormones and not work correctly"*

- *"A brain aneurysm is like an invisible ticking time bomb."*
- *"I have had doctor's describe vaccines by talking about how vaccines "teach" the body to recognize an invader."*

7. An Act/Feeling/Experience

- Definition: A participant mentioning an analogy that consists of an act/experience/event that occurs, or a feeling/emotion. Also include personification/a body part doing humanlike things. Note: if there are multiple parts and/or multiple things happening or that could be coded into different categories it is probably an act and should be coded here. (Ex: hailstorm ruining car, jumping out of airplane/pulling parachute, filling car w/ water instead of gas, etc.) To distinguish act from other similar categories, ask yourself if it is happening now/present tense (code as act) or if it happened in the past and it's really just an object, machine, nature/animal, etc. (code elsewhere).
- *Examples:*
  - *"having a kidney stone is like giving birth"*
  - *"The Dr was telling me about my hip and he said it's going to be like walking on an uneven ground all the time."*
  - *"Migraines are like when you get lost on a road and don't know where you are."*

8. Structure

- Definition: a participant mentioning an analogy related to a structure, shape, infrastructure or architecture. Ex: wall, bridge, house, slit, bulge, pocket, etc.
- *Examples:*
  - *"Your vessels are like walls and if they are too close, that can cause high blood pressure."*
  - *"A doctor described veins like highways for blood"*
  - *"My dentist told me that the roof of my tooth was gone but the basement was good"*

RQ6: When Participants Think Analogies are Helpful

"Under what medical conditions or situations do you think an analogy is helpful?"

Please read through the comments and code for the presence ("1") or absence ("0") of each characteristic in the comments. Categories are listed below in bold with definitions and examples of each category.

There are approximately 900-950 comments that you will be coding. If you run across a comment that you are unable to place in a pre-determined category, please place it in the "Other" category, indicating it does not fit into any of the predetermined categories.

Note: it is possible for a single comment to fit into multiple categories, so please code those comments into each category in which it applies with a "1". If there is a conjunction ("or," "because," "and," etc.), comma, or / separating statements, a response may fall within 1+ category. However, one phrase cannot fall within 2+ categories.

Ignore any parts of the comments that relate to not being sure about analogies or not liking analogies. Just focus on the parts that are answering the question.

Note: remember to read these slowly and double-check them to break them down into each individual part/unit/phrase and make sure you've coded it in each category in which it fits.

1. **Any (Any/All)**

- Definition: A participant mentioning an analogy or metaphor is useful in any, all, almost all, or most medical situations. Note: only code here if the participant ONLY says any/all/most, and not if they are adding a clarification or exception to it and it's actually more specific than it initially sounds.
- *Examples:*
    - *"All of them"*
    - *"I think analogy is helpful with all situations and conditions as it can really help someone to understand and put them at ease if they know something relatable."*
    - *"I think it would useful in many of them."*
    - *"Most of the time; it helps people make connections to their real life stuff, and also is less scary to think about then whatever is messed up in your body."*

- *"Pretty much every situation. Analogies are almost always helpful."*

2. **Hard to Understand Health Issue (Understand)**

- Definition: A participant mentioning an analogy or metaphor is useful for a health issue that is complex, is hard to understand or confusing, contains jargon/technical terminology, or is complicated/technical. Code here if a participant says analogies help because they make information more understandable. Note: Code here when a patient cannot understand a health issue; do not code that as "Patient."
- *Examples*
  - *"I think an analogy is most helpful when the procedure or medical terms are hard to understand."*
  - *"I think if a patient is really struggling to understand what is happening to them it could be useful."*
  - *"probably most especially if the material is difficult to understand."*
  - *"Puts descriptions into an understandable perspective."*
  - *"To help explain if the patient does not get the diagnosis"*
  - *"to help people understand complex health issues"*
  - *"When describing a medical condition that is complicated and uses a lot of medical terminology."*

3. Uncommon or Unfamiliar Health Issue (Uncommon/Unfamiliar)

- Definition: A participant mentioning an analogy or metaphor is useful for a health issue that is uncommon, unusual, unfamiliar, rare, new, or not well known. Note: if they say that a *patient* is unfamiliar with the health issue or terminology, code it here and not as "Patient."
- *Examples:*
  - *"I think any situation the patient is unfamiliar with it would be helpful for the doctor to use an analogy."*
  - *"When describing a new condition you may have that you are unfamiliar with."*
  - *"When explaining something that is not a typical medical condition."*
  - "*When it is an uncommon situation"*
  - *"When the condition is less well known"*

4. **Serious Health Issue (Serious)**

- Definition: A participant mentioning an analogy or metaphor is useful for explaining a health issue that is serious, life-threatening, scary, or terminal. If they mention a specific serious health issue (ex: cancer) do NOT code it here; code it as "specific situation." This category is just for generic mentioning of a serious situation.
- *Examples:*
  - *"If the patient is critical."*
  - *"Serious extreme issues I think."*
  - *"Under serious conditions and patients who are in critical care. It gives them more of a quick understanding of whats going on and needs to be done."*
  - *"when discussing a terminal illness or condition"*

5. **Specific Situation (Situation)**

- Definition: A participant mentioning an analogy or metaphor is useful in a specific situation/for a specific purpose (ex: putting a patient at ease or relaxing them) or for explaining a specific health issue or body part. Code here when they list/mention any specific health issues. Ex: heart issues, how an organ works, surgery, long term conditions, asthma, cancer, etc.
- *Examples:*
    - *"In order to get people to understand the size of shape of something, as well as the function of a body part."*
    - *"Maybe diabetes high blood pressure."*
    - *"Tendonosis, herniated discs and arthritis"*
    - *"To explain how they are going to repair something or explanation before a surgery."*
    - *"to propel the patient into wanting to comply with doctor's suggestions"*

6. **Talking to Specific Patient Group (Group)**

- Definition: A participant mentioning an analogy or metaphor being useful when talking to certain types/groups of patients, such as children, those who are uneducated, those with a language barrier, or just lay people in general (those with nonmedical background). Note: if they say something like "when patients don't understand," code that as "Hard to Understand." Similarly, if they say something like "when patients are unfamiliar" code it as "Uncommon/Unfamiliar" instead of here.
- *Examples:*
    - *"I think it would be helpful for some people who don't have scientific minds, I suppose."*
    - *"I think when explaining to children, you need to have an analogy to make things click sometimes."*
    - *"It might be helpful when dealing with the uneducated or unintelligent."*
    - *"Maybe when you're speaking to a child or someone with a language barrier, when any information gained is useful, then you should use an analogy."*
    - *"These with a lack of medical background, or younger patients, or anyone really."*

7. **Hard to Visualize Health Issues (Visualize)**

- Definition: A participant mentioning an analogy or metaphor is useful for explaining health issues that are difficult to visualize, cannot be physically seen, are internal, hard to conceptualize, etc. Also code responses talking about how analogies help to visualize things here.
- *Examples:*
    - *"If it's really hard to visualize on its own."*
    - *"it can be very helpful to visualize things"*
    - *"Under just about any situation dealing with things which are difficult to visualize, such as internal organs"*
    - *"when explaining something abstract, an analogy is useful."*
    - *"Any internal medical condition"*

8. Not Serious/Common (NOT Serious/Common)

- Definition: a participant mentioning an analogy or metaphor is helpful for situations that are not serious, are not terminal, are common, etc. Also includes participants mentioning analogies are helpful for more common/basic/routine visits or health conditions. Think of this as the opposite to both the "Serious" and "Uncommon" categories.
- *Examples:*
    - *"Under normal treatments."*
    - *"When the situation is non-life threatening. If I'm having a heart attack, I don't want to hear about what's happening to my body. I want to know whether or not I'm going to be okay and that the doctor is going to care about me."*
    - *"Any that are not serious, life-threatening conditions."*

APPENDIX E. INFORMED CONSENT

Informed Consent for Pilot Study

Please take time to review this information carefully. This is a research study. Your participation in this study is voluntary which means that you may choose not to participate at any time without penalty or loss of benefits to which you are otherwise entitled. You may ask questions to the researchers about the study whenever you would like. If you decide to take part in the study, you will be asked to give your consent, be sure you understand what you will do and any possible risks or benefits.

What is the purpose of this survey?

This survey is concerned with physician communication when talking with patients. The research project will take place over the course of approximately one month. To participate in this study, you must be at least 18 years old. We would like to enroll 3,000 people in this study.

What will I do if I choose to participate in this survey?

If you agree to participate in this survey, you will be asked to imagine you are a patient being diagnosed with a health condition, and will watch an online video of a physician delivering a message about the health condition. Then you will be asked to complete an online survey via Qualtrics.

How long will I be in the study?

This study will take about 15 minutes to complete.

What are the possible risks or discomforts?

The risks of participating are not greater than those ordinarily encountered in daily life. Breach of confidentiality is always a risk with data, but we will take precautions to minimize this risk as described in the confidentiality section. There are no anticipated costs to participate in this research.

Are there any potential benefits?

If you decide to take this survey, you will be contributing to a body of research and may learn about a particular health condition.

Will I receive payment or other incentive?

You will receive course credit or extra credit for completing the survey. If you choose not to participate in this research, you will have another opportunity to receive course credit or extra credit that will be worth the same amount of points you would have received for completing this study that will be assigned by your instructor.

Will information about me and my participation be kept confidential?

All data collected will be anonymous. Be assured that your name will not be associated in any way with the research findings and your information will be kept confidential.

What are my rights if I take part in this study?

Your participation in this study is voluntary. You may choose not to participate or, if you agree to participate, you can withdraw your participation at any time without penalty or loss of benefits to which you are otherwise entitled.

Who can I contact if I have questions about the study?

If you have any questions, comments, or concerns about this research project, please contact the researchers: Dr. Evan K. Perrault, at perrault@purdue.edu or (765) 496-6429, or Grace M. Hildenbrand (first point of contact), at ghildenb@purdue.edu or (765) 494-6550.

If you have questions about your rights while taking part in the study or have concerns about the treatment of research participants, please call the Human Research Protection Program at (765) 494-5942, email (irb@purdue.edu) or write to:

Human Research Protection Program – Purdue University
Ernest C. Young Hall, Room 1032
115 S. Grant St.,
West Lafayette, IN 47907-2114

Documentation of Information Provision

By clicking on to the next screen, you indicate you are at least 18 years old, and that you voluntarily agree to participate in this research and have your answers included in the data set.

Informed Consent for Main Study

Please take time to review this information carefully. This is a research study. Your participation in this study is voluntary which means that you may choose not to participate at any time without penalty or loss of benefits to which you are otherwise entitled. You may ask questions to the researchers about the study whenever you would like. If you decide to take part in the study, you will be asked to give your consent, be sure you understand what you will do and any possible risks or benefits.

This study contains 5 unpaid qualifying questions. If you do not qualify you will return the HIT and it will not have a negative impact on your MTurk rating.

What is the purpose of this survey?

This survey is concerned with physician communication when talking with patients. The research project will take place over the course of approximately one month. To participate in this study, you must be at least 18 years old. We would like to enroll 3,000 people in this study.

What will I do if I choose to participate in this survey?

If you qualify for this study and agree to participate in this study, you will be asked to imagine you are a patient being diagnosed with a health condition, and will watch an online video of a physician delivering a message about the health condition. Then you will be asked to complete an online survey via Qualtrics.

How long will I be in the study?

This study will take about 15 minutes to complete.

What are the possible risks or discomforts?

The risks of participating are not greater than those ordinarily encountered in daily life. Breach of confidentiality is always a risk with data, but we will take precautions to minimize this risk as described in the confidentiality section. There are no anticipated costs to participate in this research.

Are there any potential benefits?

If you decide to take this survey, you will be contributing to a body of research and may learn about a particular health condition.

Will I receive payment or other incentive?

If you qualify for the study, and fully read and answer each question, you will be paid $1.00 for completing the survey. However, this survey has a number of questions embedded in it as validity checks to ensure that you are not a robot and are in fact fully reading and answering each question. A unique combination of answers to those questions may result in your survey being rejected.

Will information about me and my participation be kept confidential?

All data collected will be anonymous. Be assured that your name will not be associated in any way with the research findings and your information will be kept confidential.

What are my rights if I take part in this study?

Your participation in this study is voluntary. You may choose not to participate or, if you agree to participate, you can withdraw your participation at any time without penalty or loss of benefits to which you are otherwise entitled.

Who can I contact if I have questions about the study?

If you have any questions, comments, or concerns about this research project, please contact the researchers: Dr. Evan K. Perrault, at perrault@purdue.edu or (765) 496-6429, or Grace M. Hildenbrand (first point of contact), at ghildenb@purdue.edu or (765) 494-6550.

If you have questions about your rights while taking part in the study or have concerns about the treatment of research participants, please call the Human Research Protection Program at (765) 494-5942, email (irb@purdue.edu) or write to:

Human Research Protection Program – Purdue University
Ernest C. Young Hall, Room 1032
115 S. Grant St.,
West Lafayette, IN 47907-2114

Documentation of Information Provision

By clicking on to the next screen, you indicate you are at least 18 years old, and that you voluntarily agree to participate in this research and have your answers included in the data set.

APPENDIX F. DISSERTATION TIMELINE

January 2020	Defended Prospectus
February 2020	Submitted Study to IRB
March 2020	Filmed Video Clips
April 2020	Conducted Pilot Study
August 2020	Analyzed Pilot Data/Made Modifications
September 2020	Collected Main Study Data/Cleaned Data/Created Coding Schemes
October 2020	Coded Open-Ended Data
December 2020	Analyzed Data/Drafted Rest of Dissertation
February 2021	Dissertation Edits Based on Advisor Feedback
April 2021	Defended Dissertation
May 2021	Dissertation Edits Based on Committee Feedback
May 2021	Deposit Dissertation

VITA

Grace M. Hildenbrand

EDUCATION

Ph.D. in Health Communication

Purdue University, West Lafayette, IN: August 2021

Advisor: Dr. Evan K. Perrault (Brian Lamb School of Communication)

Committee: Dr. Maria K. Venetis (Brian Lamb School of Communication/Rutgers University)

Dr. Bart Collins (Brian Lamb School of Communication)

Dr. Philip E. Keller (Indiana University School of Medicine)

M.A. in Communication Studies

Certificate in Corporate Communication and Training

Texas State University, San Marcos, TX: May 2014

GPA: 4.0

Comprehensive Exam Committee: Dr. Melinda Villagran (Dept. of Communication)

Dr. Marian Houser (Dept. of Communication)

B.A. in Corporate Communication

Minor in Leadership Studies

Washburn University, Topeka, KS: May 2012

GPA: 4.0, Summa cum laude

ACADEMIC EXPERIENCE

Instructor of Record:

Organizational Communication, Summer 2021, Purdue

Health Communication, Fall 2019-Spring 2020, Purdue

Science Writing & Presentation, Summer 2019-Summer 2020, Purdue

Fundamentals of Presentational Speaking, Fall 2017-Spring 2018, Purdue

Public Speaking, Fall 2015-Spring 2017, Washburn

Fundamentals of Human Communication, Fall 2013-Spring 2014, Texas State

Teaching Assistant:

Quantitative Methods for Communication Research, Fall 2018-Spring 2019, Purdue

Fundamentals of Human Communication, Fall 2012-Summer 2013, Texas State

Communication Consultant:

Purdue University Human Resources, Fall 2017-Spring 2021

- Wrote application for Indiana AchieveWell 5 Star Certification, and the certification was granted in Summer 2019.
- Wrote case studies about happenings related to health benefits and collected and analyzed benefits handbooks from Power 5 schools.
- Collected and analyzed survey data from faculty and staff regarding benefits communication and created annual report for Human Resources on employee survey results related to benefits communication.

PUBLICATIONS

Hildenbrand, G. M. (2021). Explaining jargon using clear communication strategies. *Communication Teacher.* https://doi.org/10.1080/17404622.2021.1906924

Hildenbrand, G. M. & Benedict, B. C. (2021). Examining variation in emotional distress among individuals with a cancer diagnosis. *Western Journal of Nursing Research*. https://doi.org/10.1177/0193945921994118

McCullock, S. P., **Hildenbrand, G. M.**, Schmitz, K. J., & Perrault, E. K. (2021). The state of health communication: A content analysis of articles published in *Journal of Health Communication* and *Health Communication* (2010-2019). *Journal of Health Communication*, *26*(1), 28-38. https://doi.org/10.1080/10810730.2021.1879320

Perrault, E. K., Barton, J. A., **Hildenbrand, G. M.**, McCullock, S. P., Lee, D., & Adu Gyamfi, P. (2021). When doctors swear, do patients care? An experiment examining physicians cursing in the presence of patients. *Health Communication*. https://doi.org/10.1080/10410236.2020.1865610

Perrault, E. K., McCullock, S. P., Lee, D., **Hildenbrand, G. M.**, & Mikkelsen, D. G. (2021). College student gratitude: A silver lining to a largely non-significant yearlong bathroom stall messaging campaign. *Journal of American College Health*. https://doi.org/10.1080/07448481.2021.1910516

Hildenbrand, G. M., Perrault, E. K., & Keller, P. E. (2020). Evaluating a health literacy communication training for medical students: Speaking in plain language. *Journal of Health Communication*, *25*(8), 624-631. https://doi.org/10.1080/10810730.2020.1827098

Hildenbrand, G. M. & Houser, M. L. (2020). An investigation of college student learner orientation impact on perceptions of instructor behavior alteration techniques/messages. *Educational Research Quarterly*. *43*(3), 3-23.

Hildenbrand, G. M., Perrault, E. K., & Devine, T. M. (2020). You may call me professor: Professor form of address in email communication and college student reactions to not knowing what to call their professors. *Journal of Communication Pedagogy*, *3*, 82-99. https://doi.org/ 10.31446/JCP.2020.08

Perrault, E. K., & **Hildenbrand, G. M.** (2020). The buffering effect of healthcare provider video biographies when viewed in combination with negative reviews: "You can't fake nice." *Journal of Medical Internet Research*. *22*(4), e16635. https://doi.org/10.2196/16635

Perrault, E. K., **Hildenbrand, G. M.**, Loew, T. F., & Evans, W. G. (2020). Evaluation of a university's smart partying social norms campaign including emoji-style messaging. *Journal of Communication in Healthcare*, *13*(1), 35-45. https://doi.org/10.1080/17538068.2020.1753471

Perrault, E. K., **Hildenbrand, G. M.**, McCullock, S. P., Schmitz, K. J., & Lambert, N. J. (2020). Online information seeking behaviors of breast cancer patients before and after diagnosis: From website discovery to improving website information. *Cancer Treatment and Research Communications*, *23.* https://doi.org/10.1016/j.ctarc.2020.100176

Perrault, E. K., **Hildenbrand, G. M.**, & Rnoh, R. H. (2020). Employees' refusals to participate in an employer-sponsored wellness program: Barriers and benefits to engagement. *Compensation & Benefits Review*, *52*(1), 8-18. https://doi.org/10.1177/0886368719899209

Inderstrodt, J., Perrault, E. K., Hintz, E. A., & **Hildenbrand, G. M.** (2019). Addressing health disparities in America: An analysis of community health improvement plans across the United States. *Nursing Research*, *68*(5), 405-412. https://doi.org/10.1097/NNR.0000000000000364

Perrault, E. K., & **Hildenbrand, G. M.** (2019). Breaking down benefits: Employee understanding of benefits, and readability levels of university benefits handbooks. *Compensation & Benefits Review*, *51*(1), 13-26. https://doi.org/10.1177/0886368719863532

Perrault, E. K., & **Hildenbrand, G. M.** (2019). Development of a Benefits Ambassadors programme to leverage coworker relationships to increase employee knowledge. *Knowledge Management Research & Practice*, *17*(3), 306-315. https://doi.org/10.1080/14778238.2019.1609342

Perrault, E. K., **Hildenbrand, G. M.**, McCullock, S. P., Schmitz, K. J., & Dolick, K. N. (2019). Hashtag health: College health on social media and students' motivations to follow, interact, and share their social media content. *Health Promotion Practice*, *20*(5), 721-729. https://doi.org/10.1177/1524839919853820

Perrault, E. K., **Hildenbrand, G. M.**, & Nyaga, R. G. (2019). Epigeneti-what? Approaches on translating research for primary breast cancer prevention. *Frontiers in Oncology*, *9*, 1-6. https://doi.org/10.3389/fonc.2019.00267

Perrault, E. K., Schmitz, K. J., **Hildenbrand, G. M.**, & McCullock, S. P. (2019). Preventive/office visit patient knowledge, and their insurance information gathering perceptions. *The American Journal of Managed Care*, *25*(12), 588-593.

Perrault, E. K., & **Hildenbrand, G. M.** (2018). Primary care confusion—Public knowledge of NP and PA duties and their information gathering behaviors. *Journal of General Internal Medicine*, *33*(11), 1857-1858. https://doi.org/10.1007/s11606-018-4580-x

Manuscripts Under Review & In Revision

Hildenbrand, G. M. (under review). The influence of physician immediacy on patient liking for physician, motivation, and recall. *Communication Quarterly*.

Hildenbrand, G. M., Perrault, E. K., & Rnoh, R. H. (revise & resubmit). Patients' perceptions of healthcare providers' dismissive communication. *Health Promotion Practice*.

Nyaga, R., **Hildenbrand, G. M.**, Mattson, M., Collins, W. B., & Lumala, M. (revise & resubmit). Does perceived privacy influence patient satisfaction among college students? A comparative study of students at a Kenyan university and those at a large American midwestern university. *International Journal of Communication*.

Manuscripts in Progress

Hildenbrand, G. M. Healthcare provider analogies as memorable messages.

Hildenbrand, G. M., & Perrault, E. K. Adapting and evaluating a nonverbal immediacy training for first-year medical students.

Hildenbrand, G. M., Perrault, E. K., & Switzer, M. Smiling versus resting b**ch face: Patients' expectancies and evaluations of male and female physicians' facial expressions.

Hildenbrand, G. M., & Shields, C. Clinician and patient use of metaphorical language in opioid-related medical encounters.

Hildenbrand, G. M., & Switzer, M. A content analysis of healthcare provider verbal and nonverbal immediacy behaviors.

SCHOLARLY POSTERS & PRESENTATIONS

Paper Presentations

Hildenbrand, G. M. (2020, November). *The influence of physician immediacy on patient liking for physician, motivation, and recall* [Paper presentation]. National Communication Association Conference, Indianapolis, IN.

Hildenbrand, G. M., & Perrault, E. K. (2020, November). *Evaluating a health literacy communication training for medical students: Speaking in plain language* [Paper presentation]. National Communication Association Conference, Indianapolis, IN.

***Top paper panel for the training and development division**

Benedict, B. C., & **Hildenbrand, G. M.** (2020, April). *Variation in depression and use of social media and information and communication technologies among individuals with a cancer diagnosis* [Paper presentation]. Central States Communication Association Conference, Rosemont, IL. (conference was cancelled due to COVID-19)

***Top paper panel for the health communication division**

Hildenbrand, G. M., & Perrault, E. K. (2019, November). *You can call me professor: Professor form of address in email communication* [Paper presentation]. National Communication Association Conference, Baltimore, MD.

Nyaga, R., **Hildenbrand, G. M.**, Mattson, M., Collins, W. B., & Lumala, M. (2019, November). *Does perceived privacy influence patient satisfaction among college students? A comparative study of students at a Kenyan university and those at a large American midwestern university* [Paper presentation]. National Communication Association Conference, Baltimore, MD.

Perrault, E. K., & **Hildenbrand, G. M.** (2019, November). *Breaking down benefits: Employee understanding of benefits, and readability levels of university benefits handbooks* [Paper presentation]. National Communication Association Conference, Baltimore, MD.

Perrault, E. K., & **Hildenbrand, G. M.** (2019, November). *The buffering effect of healthcare provider video biographies when viewed in combination with negative reviews: "You can't fake nice"* [Paper presentation]. National Communication Association Conference, Baltimore, MD.

Perrault, E. K., **Hildenbrand, G. M.**, McCullock, S. P., Schmitz, K. J., & Dolick, K. N. (2019, November). *Hashtag health: College health on social media and students' motivations to follow, interact, and share their social media content* [Paper presentation]. National Communication Association Conference, Baltimore, MD.

Schmitz, K. J., **Hildenbrand, G. M.**, & McCullock, S. P. (2019, November). *Preventive/office visit patient knowledge, and their insurance information gathering perceptions* [Paper presentation]. National Communication Association Conference, Baltimore, MD.

Perrault, E. K., **Hildenbrand, G. M.**, Loew, T. F., & Evans, W. G. (2019, May). *Emojis and social norms: An evaluation of a university's smart partying campaign* [Paper presentation]. International Communication Association Conference, Washington, D.C.

Hildenbrand, G. M. (2018, November). *Speaking in "plain language:" Training for medical students in communicating with patients who have limited health literacy* [Paper presentation]. National Communication Association Convention, Salt Lake City, UT.

***Top paper panel for the student section**

Perrault, E. K., & **Hildenbrand, G. M.** (2018, November). *"This is not a sexy or exciting topic"—Development of a benefits ambassadors program to leverage coworker relationships to increase employee awareness* [Paper presentation]. National Communication Association Convention, Salt Lake City, UT.

Hildenbrand, G., & Houser, M. L. (2017, November). *Impacts of student learner orientation on perceptions of instructor behavior alteration techniques* [Paper presentation]. National Communication Association Convention, Dallas, TX.

Hildenbrand, G. (2013, March). *Angela Davis and the prison metaphor* [Paper presentation]. New Voices, New Perspectives Student Research Conference, Denton, TX.

Poster & Panel Presentations

Hildenbrand, G. M., & Perrault, E. K. (2021, April). *Adapting and evaluating a nonverbal immediacy training for first-year medical students in the age of COVID-19* [Poster presentation]. Accepted at D.C. Health Communication Conference, virtual.

Perrault, E. K., Barton, J. B., **Hildenbrand, G. M.**, McCullock, S. P., Lee, D., & Adu Gyamfi, P. (2020, November). *When doctors swear, do patients care? An experiment examining physicians cursing in the presence of patients* [Poster presentation]. National Communication Association Conference, Indianapolis, IN.

McCullock, S. P., **Hildenbrand, G. M.**, Schmitz, K. J., & Perrault, E. K. (2020, May). *A content analysis of articles published in Journal of Health Communication* and *Health Communication (2010-2019)* [Poster presentation]. International Communication Association Conference, Gold Coast, Australia. (conference was virtual due to COVID-19)

Hildenbrand, G. M., Perrault, E. K., & Rnoh, H. R. (2020, April). *Employees' refusals to participate in an employer-sponsored wellness program: Barriers and benefits to engagement* [Poster presentation]. Kentucky Conference on Health Communication, Lexington, KY. (conference was virtual due to COVID-19)

Perrault, E. K., Dolick, K. N., **Hildenbrand, G. M.**, McCullock, S. P., & Schmitz, K. J. (2019, April). *Social media fail: Active but unpopular accounts of student health centers nationwide: A content analysis*. [Poster presentation]. 2019 D.C. Health Communication Conference in Fairfax, VA.

Waldbuesser, C. E., **Hildenbrand, G. M.**, Bryant, L. E., Ward Sr., M., & Romo, S. (2018, November). *Expanding the view of instructional communication: Alternative educational contexts* [Panel presentation]. National Communication Association Convention, Salt Lake City, UT.

Perrault, E. K., & **Hildenbrand, G.** (2018, April). *Benefits ambassadors: Leveraging coworker relationships to encourage participation in university workplace wellness initiatives* [Poster presentation]. Kentucky Conference on Health Communication, Lexington, KY.

Hildenbrand, G. (2017, June). *Examining tensions between the biomedical and psychosocial models in physician communication training* [Poster presentation]. Communication, Medicine, and Ethics (COMET) Conference, Indianapolis, IN.

Under Review

Hildenbrand, G. M. (2021, November). *Healthcare provider analogies as memorable messages* [under review]. Submitted to National Communication Association Convention, Seattle, WA.

Hildenbrand, G. M., Perrault, E. K., & Switzer, M. (2021, November). *Smiling versus resting b**ch face: Patients' expectancies and evaluations of male and female physicians' facial expressions* [under review]. Submitted to National Communication Association Convention, Seattle, WA.

GRANT FUNDING

College of Liberal Arts Purdue Research Foundation XR (Research) Grant—Purdue University (2020-2021) – "Physicians' Use of Analogies to Enhance Patient Understanding."
Submitted a proposal to the Brian Lamb School of Communication Graduate Advisory Committee who nominated the request to move forward to the College of Liberal Arts Purdue Research Foundation Grant Selection Committee to fund the project.
Outcome: Funded $25,000, August 2020

Lamb School Doctoral Grant –Purdue University (2020) – "Physician Facial Expressions on Patient Perceptions of Physician."
Submitted a $6,000 funding proposal to the Brian Lamb School of Communication Graduate Advisory Committee to fund the project.
Outcome: Funded $6,000, February 2020

Lamb School Doctoral Grant –Purdue University (2019) – "The Influence of Physician Immediacy on Patient Recall."
Submitted a $1,000 funding proposal to the Brian Lamb School of Communication
Graduate Advisory Committee to fund the project.
Outcome: Funded $1,000, March 2019

INVITED PRESENTATIONS

Guest Speaker for First Year Foundations of Clinical Practice 1 Medical Student Course – Indiana University School of Medicine – West Lafayette Campus

- Presented 1 hour training I designed on using nonverbal immediacy when communicating with patients in August 2019 and August 2020
- Presented 1 hour training I designed with advisor on communicating with patients who have low health literacy in August 2018

Trainer for Organizational Change Training Session - Central Texas Medical Center

- Created and delivered training with two peers for top leadership in March 2014

Trainer for Use of Supportive Communication in the Workplace Training - Texas State University

- Prepared and delivered with two peers for managers at Texas State University in October 2013

RECOGNITION AND AWARDS

Alan H. Monroe Graduate Scholar Award, 2020, Brian Lamb School of Communication, Purdue University

Brian Lamb School of Communication Service Award, 2020, Purdue University

Charles J. Stewart Doctoral Fellowship Award, 2020, Brian Lamb School of Communication, Purdue University

Top Paper Panel Awards

- Health Communication Division, 2020, Central States Communication Association

- Training & Development Division, 2020, National Communication Association
- Student Section, 2018, National Communication Association

Nominated for Bruce Kendall Award for Excellence in Teaching, 2019, Brian Lamb School of Communication, Purdue University

Chi Omega Favorite Professor Tea, 2013, Texas State University

First Year Outstanding Graduate Student Award, 2013, Communication Studies Department, Texas State University

Star Among Stars Award, 2012, Stormont-Vail Health*Care*

Sibberson Award, 2012, highest academic award at Washburn University

Communication Capstone Award, 2012, Communication Studies Department, Washburn University

Who's Who Among College Students, 2012, Washburn University

Communication Studies Outstanding Student Award, 2012, Washburn University

SERVICE ACTIVITIES

Departmental:

- Faculty Committee Liaison, Communication Graduate Student Association, Fall 2019-Spring 2020, Purdue University
- Volunteer, College of Liberal Arts STEM event, Fall 2019, Purdue University
- Graduate student representative on two search committees: Clinical PR Assistant Professor and PR/Health Tenure Track Assistant Professor, Fall 2019, Purdue University
- Buddy to incoming students, Brian Lamb School of Communication Welcome Weekend, Spring 2018-Spring 2020, Purdue University
- Mentor, Teaching Mentor Program, Fall 2018-Spring 2020, Purdue University

- Rater, Assessment for Fundamentals of Presentational Speaking Course, Fall 2018, Purdue University
- Vice President of Administration, Communication Graduate Student Association, Fall 2018-Spring 2019, Purdue University
- Assisted with 4 Boiler Gold Rush (Freshman Orientation) Events, Fall 2018, Purdue University
- Served on Logistics Committee, Communication Graduate Student Association Conference, 2018, Purdue University
- Judge, Nall Speak-Off Bi-Annual Public Speaking Competition, Fall 2015-Spring 2017, Washburn University

University:

- Judge, Purdue Undergraduate Research Conference, Spring 2021, Purdue University
- Member, Digital Media Task Force, Fall 2014-Summer 2017, Washburn University
- Facilitator, University Communication Student Learning Outcome Assessment, Spring 2016, Washburn University
- Rater, University Communication Student Learning Outcome Assessment, Fall 2015-Spring 2016, Washburn University
- Facilitator, Student Leadership Council Retreat, Fall 2015, Washburn University
- Scorer, Leadership 100 Course Presentations, Fall 2015, Washburn University
- Scorer, Quest Quiz Bowl Competition, Fall 2015, Washburn University
- Judge, Leadership Challenge Event, Spring 2015-Spring 2016, Washburn University
- Trainer, Use of Facebook in an Academic Setting, Spring 2015, Washburn University
- Facilitator, Public Speaking Workshop on Organization for faculty and staff, Spring 2014, Texas State University

Discipline:

- Reviewer for the Student Section of the *National Communication Association* Conference, April 2021
- Reviewer for the Instructional Development Division of the *National Communication Association* Conference, April 2021
- Reviewer for *Journal of Multidisciplinary Healthcare*, December 2020-present

- Reviewer for the Health Communication Division of the *International Communication Association* Conference, November 2020
- Reviewer for *Health Communication*, May 2020-September 2020
- Reviewer for the Health Communication Division of the *National Communication Association* Conference, April 2020; April 2021
- Reviewer for *Patient Education and Counseling*, January-March 2020
- Reviewer for *The American Journal of Managed Care*, January 2020-present
- Elite Reviewer for *Health Promotion Practice*, February 2019-present
- Reviewer for *Communication Teacher*, 2015-2016

CONTINUED EDUCATION AND PROFESSIONAL DEVELOPMENT

Research/Grants:

- NIH 101 Workshop, September 2018, Purdue University
- Qualtrics and Amazon Mechanical Turk Workshop, March 2018, Purdue University
- Academic Writing Workshop, October 2017, Purdue University
- Engaging Qualitatively with Healthcare Discourse Data Masterclass, June 2017, COMET Conference in Indianapolis, IN

Teaching:

- Foundations in College Teaching Certificate, October 2018, Purdue University
- Fundamentals of Public Speaking Teaching Training, Fall 2017, Purdue University
- Student Learning Outcome Course Success Group Participant, 2016, Washburn University
- Adjunct Faculty Institute, August 2016, Washburn University Center for Teaching Excellence and Learning
- Teaching and Learning Academy (teaching training), Fall 2012-Spring 2013, Texas State University

Diversity/Inclusion:

- Safe Zone Training, November 2020, LGBTQ Center at Purdue University
- Question Persuade Refer (QPR) Training for suicide prevention, October 2020, Purdue University

- Ally Training, January 2014, Office of Student Diversity and Inclusion at Texas State University

Industry:

- Women in Leadership Institute, March 2021, Purdue University
- EduWeb Digital Summit Marketing Conference, August 2016, Denver, CO
- Lean Six Sigma White Belt, October 2015, Center for Organizational Excellence at Washburn University
- Leadership Washburn Professional Development Program, September 2015-April 2016, Washburn University

Social Media:

- Scholars & Social Media Workshop, March 2019, Purdue University
- Social Media Training, February 2015, Digital Media Task Force at Washburn University

Other:

- Preconference-Current and Future Directions in Your Career and the Discipline, November 2020, Health Communication Division, National Communication Association
- Failing Forward Workshop, March 2019, Purdue University
- Time Management Training, January 2014, Texas State University

INDUSTRY EXPERIENCE

Communications Coordinator/Dean's Assistant, Topeka, KS November 2014-August 2017
College of Arts and Sciences, Washburn University

- Managed Facebook account and posted updates, and managed and updated the College's website and assisted with updating 19 department websites.
- Designed and created print materials including brochures, flyers, and the College's newsletters.

Support Analyst, Kansas City, KS August 2014-November 2014
Cerner Corporation

- Built new elements of medical software for clients and analyzed issues with the software.

Corporate Trainer, San Marcos, TX August 2013-April 2014

Texas State University

- Conducted training session along with two peers on use of supportive messages in the workplace for Texas State University Professional Development Program on Management.
- Created task analysis, needs assessment, and training proposal for Central Texas Medical Center for a five-hour training on organizational change and presented it in March 2014.

Nonprofit Consultant, Austin, TX June-July 2013

Texas Association of Nonprofit Organizations

- Compiled and designed their first Principles and Practices for Nonprofit Excellence document, and provided suggestions for making the document interactive using technology and social media.

Marketing Intern, Topeka, KS February-August 2012; May-July 2013

Stormont-Vail HealthCare

- Designed and created flyers, brochures, and press releases for community events.
- Designed and created informational booklet for new cancer patients and a community cookbook, and wrote newsletter articles regarding healthy eating and hospital volunteering.

Research Intern, Topeka, KS February-May 2012

The Women's Fund

- Conducted focus groups made up of members of community organizations.
- Researched needs of women and children in areas such as education, healthcare, and income, and compiled research report with results and presented research at The Women's Fund Annual Meeting.

Special Events Intern, Topeka, KS August-November 2011

March of Dimes

- Coordinated collection of donations, and designed mailers, slideshows, program booklet, and signs for Signature Chef's Auction, a 200-person event.

Marketing Intern, Lawrence, KS June-August 2011

Crystal Swearingen, Realtor- McGrew Real Estate

- Updated social media accounts with housing updates, articles, and quotes, wrote scripts for YouTube videos regarding real estate tips, and designed postcards to send to expired listings.