Virtual Reality Training Simulation - A Patient's Point of View: Teaching Providers Teamwork and Empathetic Communication Skills via Immersive Perspective Taking, Interaction and Narrative Transport

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Introduction

Humans live a narrative experience. Much like a storyline filled with characters, our real life interactions direct our narratives and allow us to form the relationships that propel our stories forward. But as we form these relationships, we don't simply create our own stories; we impact the experience and storyline for others. Being able to understand the experiences of other people and how our interactions may impact their own stories grants us the power to help facilitate more positive relationships. For some individuals, like medical providers, this ability may even mean the difference between life or death. Medical providers must be able to identify a patient's state of mind, considering factors such as trauma and stress, and respond in ways that promote health and stability. In order to improve the efficacy of care, providers must establish a positive relationship with their patients. Empathetic communication is key to such a relationship.

The provider-patient relationship is at the core of healthcare. Built on expertise and empathetic communication, this relationship is an important diagnostic and therapeutic tool that enables the complete care necessary for quality outcomes. When providers employ empathetic communication, they build patient trust, serve as better patient advocates, positively affect psychosocial outcomes (e.g., quality of life, anxiety, depression) and measurable outcome parameters (e.g., symptom reduction, lowering of blood pressure and blood glucose levels), improve patient understanding & compliance, reduce readmission, increase satisfaction, and decrease the risk of malpractice claims. These outcomes impact a University Hospital's operational excellence, the resources it receives, and ultimately, the population it serves. Internal alignment among a hospital's providers and personnel is essential to maintaining an operational excellence that best serves the public.

However, today's advancing medical technologies and increased provider responsibilities means providers have less time to connect with patients. This trend is reflected in medical education: While clinical skills training improves alongside technological breakthroughs, training in the communications skills necessary for relationship-building has lagged. Within the

UNC School of Medicine curriculum, focus group interviews with UNC providers, instructors and patients identified a lack of integrated communications training and a need for more emphasis on empathetic communication with trauma patients. Currently, trauma resuscitation medical simulations at UNC require the time and resources of personnel to lead a simulation that is focused on clinical skills development and typically uses a plastic mannequin. In this training scenario, the patient isn't spoken to nor emphasized as an individual, and no evaluations are in place to measure how patient care learning objectives are actually being met. The result of current training methods is emphasis on clinical skills, with little or no guidance on how to communicate with a patient during trauma resuscitation.

Trauma resuscitation is a scary and confusing experience for patients. They don't choose when, where and by whom they receive treatment; instead, they are rushed into an unfamiliar room where an ad hoc team of healthcare professionals must quickly work together to assess and deliver rapid protocol-driven care. For both the team and the patient, trauma is an emergency -- but for the patient, the factor that can intimately shape the perceived quality of that experience can also be the most variable: communication. Reflecting the current training model mentioned, an AHRQ study on patient engagement found that while patients often assess quality care based on their interpersonal interactions with providers, providers predominantly perceive quality care in terms of clinical skills. The study notes that even if the clinical care delivered is the same, patients judge providers who are "responsive, empathetic, and attuned" as being of higher quality than less responsive and less empathetic providers. The bottom-line is that empathetic communication impacts patient experiences, hospital reputation, funding, and the ability to deliver quality care to future patients.

Considering the impact empathetic communication has on the quality of care offered to the local NC population, and the disconnect between provider and patient perspectives, training providers to understand the patient perspective and be prepared to engage in quality interactions is critical. In this time-limited climate, medical schools and hospitals must optimize the

relationship potential of empathetic communication, while also considering the time and resources that training requires.

Virtual reality offers a strategic solution, allowing medical students and providers to experience a patient's Point-Of-View, develop empathy via perspective taking and understand the impact of communication on patient care via experiential learning and modeling -- all while requiring less time and resources than traditional live training methods. Leveraging 360 video and interactive narrative, the virtual reality training experience created for UNC School of Medicine training and presented in this paper simulates the patient POV during a trauma resuscitation to improve physicians' empathetic communication skills. UNC School of Medicine's motto is "empathy and expertise," and this virtual reality training approach seeks to strengthen that commitment.

While virtual reality is considered a novel approach to education, the use of multimedia to teach and tell stories is not new. Throughout history, our storytelling mediums or "communications channels" have had transformative effects: oral traditions allowed humans to pass knowledge from generation to generation, and the written text extended such knowledge to distant peoples separated by space and time. Still photography gave people the ability to visualize concepts, and the advent of the radio brought instant access to world events into one's living room, again lessening the distance between people. Finally, motion picture brought the world to life: granting access to the experiences that combine auditory and visual simulation. Now, virtual reality promises to be the next chapter of human storytelling potential.

Each of these technological developments in communications have brought humanity closer to simulating sensations shared by our real-life "narrative experience," stimulating multiple senses that may provide for more contextualized memory making. As these communication technologies continue to advance, so too will the power of the narratives they share. However, with these developments, the media landscape has grown to include an array of competing messages, and many publics have become "passive" in their consumption of stories. This passivity contributes to the phenomena of "selective empathy," in which publics are less

engaged with the information they consume. This passive approach to learning can mean that information takes the form of "background noise", processed at a surface, peripheral level, and easily fades from salience. Interactive narratives, enabled by virtual reality technologies, however, are poised to transform the way we interact with stories, and thus process, learn and behave.

Studies suggest that immersive, interactive experiences have the potential to reach audiences on a deeper level than prior communications technologies (Fraustino 2018; Murray 2018; Suarez 2013; Van Loon 2018; Yoo 2018). In virtual reality, users engage with a story in an experiential way, interacting with their environment to uncover meaning. The role of choice for narrative development suggests that a certain degree of mindfulness must accompany users' consumption of the stories. Unlike the passive consumption of stories, more mindful engagement with a message may increase the likelihood of cognitive elaboration and thus influence on attitudes and future behaviors. Stimulating this type of cognitive processing may be especially useful for communications efforts that seek to motivate empathy and behavioral change from audiences. Thus, immersive 360° technology is positioned to become a key tool through which educational institutions across the globe may overcome the pervasion of selective empathy in current culture and help communicators bring audience members closer to new ideas and perspectives.

This paper will first seek to develop the pedagogical framework for message design in virtual reality, noting its potential for promoting education and empathy. I discuss relevant communications theory and practice; namely, cognitive elaboration, narrative transport, spatial presence, perspective taking and interactivity; and describe how virtual reality can uniquely combine these tools to effectively connect with and *move* audiences. After establishing this pedagogical foundation, this paper presents a virtual reality project that employs the tools discussed, with the goal of providing education that elicits empathy and improves providers' empathetic communication with trauma patients.

Literature Review

HOW HUMANS THINK

It is important for any communications effort to consider how humans think. Research among fields of psychology, neuroscience, anthropology, sociology and communications indicates that humans conceptualize the world through the cognitive process of categorization; it is this cognitive process that forms the "basis for the construction of knowledge" (Cohen & Lefebvre 2005: 2). Categorization is a "joint process of abstraction and generalization," in which categories are formed in the mind and objects/subjects are placed into these categories, lending to quicker assumptions about shared qualities for future encounters (Jaffe and Nebenzahl 2006). Thus, by categorizing, humans draw conclusions and guess at how a situation is likely to unfold. In their book, *Essences and Surfaces: Analogy at the Heat and Fire of Thinking*, Hofstadter and Sander assert that analogy, as the vehicle for categorization, is the core of cognition. They go on to explain that categories allow us to bypass the need for direct observation. "If we didn't constantly extrapolate our knowledge into new situations, if we refrained from making inferences, then we would be conceptually blind, we would be unable to think or act, doomed to permanent uncertainty and eternal groping in the dark. In short, in order to perceive the world around us, we depend just as much on categorization and analogy as we do on our eyes and ears" (Hofstadter & Sander, 2013: 21). Our concepts about life and the world around us evolve "instant by instant," and no thought can be formed that isn't informed by the past.

It therefore becomes apparent that communication is more than a unidirectional message; the impact of a message is mediated by its interaction with existing categories or "mental models" of reality within the mind of the receiver. As the receiver interprets a message, each component's nuance is mediated by the mind's unique experienced reality and filtered through linguistic and cultural familiarities. Every message is translated by these filters into something of value, and the more seamless this process is, the greater the understanding of the original

message becomes. If a mass communications effort is to truly reach the global scale, it must be easy to understand and connect with audience members on a deeply human level.

The question, then, is what do we all share in the human experience? I assert that it is experience itself. Experience allows for the unfolding of existential narrative, as the mind simulates one's presence and decision-making in interactions. By giving audience members the opportunity to "experience" a narrative, we can reach them on a deeper human level, and perhaps more effectively motivate cognitive elaboration and behavioral change.

EXPERIENCED REALITY IS SIMULATED

Every interaction we participate in becomes a simulation that we experience within the mind, as the mind simultaneously works to categorize, define and forge our mental map connections. Hofstadter and Sanders discuss how a prototype of reality is "a generic mental entity found in long term memory [which] summarizes all one's life experiences with the given category, or else the notion of the complete set of exemplars of a given category that one has encountered over one's lifetime" (2013: 57). These prototypes are thus the "stored mental simulators of experiences one has undergone, which in response to a fresh stimulus, reactivates certain regions of the brain that were once stimulated by the closest experiences to the current stimulus" (2013: 57). Hofstadter and Sander assert that these simulated realities are what the brain relies on to explore existing categories of concepts, based on one's experienced reality thus far, but also to continue to categorize new concepts during our experiences. This process is what allows us to make sense of stimuli, and based on our simulations, we comprehend, encode new memories, retrieve old memories, update our reference points and interact. Our mental simulation is therefore what enables us to "experience" our communications with others.

The idea of communication as an experience is illustrated by Shepherd, who asserts that "experiences can be good or bad, colorful or dull, rewarding or punishing, memorable or forgettable… but they cannot be right or wrong, accurate or inaccurate, or true or false" (2005: 23). In his explication, Shepherd points out that the experience of communication is not a

straightforward process and is not limited to the original goal or intention of a communications message. Instead, the communication includes the interaction of a message within both the speaker and receiver's existing mental models. While intentionality is indeed an important part of communication, the effects of communication are not a direct transfer of ideas, nor a unilateral exertion of intent. Shepherd emphasizes the importance of considering each interacting identity within the communications experience. Our pre-existing mental models weigh heavily on how we process new messages as we continue to explore our models.

Paivio's (1986) influential dual-code hypothesis further suggests that events are represented in two very different ways: an analogue code of the sensory, physical features experienced, and a symbolic code that tags verbal description to the event. This can be understood as the dimensional difference between the mind's possession of an image of a cat under a table, and its verbalized sense making, "the cat is under the table."

Research has shown that the more dimensions one uses to encode can strengthen the encoding process. The strength of these dimensions can be stimulated through not simply drawing one's attention to something, but inciting them to process it at a more abstract, schematic, and conceptual level. For example, when Craik and Tulving (1975) asked participants to decide whether a word fit meaningfully in either a simple, medium, or complex sentence, the most complex sentences were remembered best. Brown and Craik assert that these results suggest "the complex sentences activate larger, richer cognitive structures than did the simpler sentences" (Brown & Craik 2005: 94). Such insights are useful for not merely understanding memory, but also understanding techniques for more effective long-term education and persuasion.

Communications that more elaborately engage one's mental models in simulation, i.e. through the activation of abstract, conceptual thinking, paired with narrative logic, have the potential to heighten the degree to which encoding and retrieving information takes place. Simultaneously, these high level communications mediate/ expand the simulating prototypes through which the encoding and retrieving process take place. The implications of this are

extraordinary: each communications activity mediates future thought patterns, and the degree of involvement by an audience through various stimulus plays a role in the strength of that mediation. Further, I assert that virtual reality provides literal experiences, relying less on abstract interpretation of communication and more on direct experience of scenarios encountered. This experience-focused simulation design presents a new opportunity to enhance learning that may more readily transfer to real-world scenarios.

LEARNING THEORY

Insights into mental simulation have informed theories on learning, which have implications for more effective message and instructional design. Among learning theory, conditioning, constructivism, experiential learning, situated knowledge and learning transfer.

Conditioning refers to the behaviorists' view of learning as a reaction to positive and negative stimuli. It includes three levels: 1) classical conditioning, in which behavior becomes a reflex response to stimulus, 2) operant conditioning, in which stimuli result from behavior as reinforcement or punishment, and 3) social learning theory, in which behavior is informed by the observation of modeling. Recalling that individuals possess existing experienced realities which inform the prototypes or mental simulators that process new information, the behaviorist view of learning through conditioning has been criticised for leaving out considerations of the unique mediation on learning by the learner.

Considering the importance of learners' active involvement in the construction of knowledge, constructivism (Piaget) and experiential learning (Kolb) emerged as learning theories. Kolb states that "learning is the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping experience and transforming it" (Kolb D 1984: 41). As such, the importance of our "experience" of new information is paramount. Building on this understanding, the idea of situated knowledge recognizes that knowledge formation occurs contextually, as each learning experience is framed by particular conditions. "Knowledge is situated, being in part a product of the activity, context,

and culture in which it is developed and used." (Brown JS, 1989: 32) Thus, the issue of learning transfer arises, which questions the extent to which knowledge generated from one situation or learning environment is transferred to other situations. Learning transfer has been discussed particularly in academic instruction, and "one of the major criticisms of instruction today is the low rate of far-transfer generated by presentational instruction" (Dede, 2014). This criticism echoes the issue of passive message consumption, highlighting a missed opportunity for more active learning. Addressing this issue may require emphasis on creating learning environments that facilitate more cognitive elaboration by learners, to allow for a deeper understanding of issues and thus transfer of understanding to a variety of contexts.

COGNITIVE PROCESSING MODELS

Levels of cognitive processing in how people process persuasive messages have been discussed in communications research, with two primary dual-processing models emerging: The elaboration likelihood model (ELM; Petty & Cacioppo, 1986) and the heuristic systematic model (HSM; Chaiken, 1980). In both models, two routes of processing are highlighted to explain how people receive and process persuasive messages. In ELM, these routes are termed central and peripheral cognitive processing. In HSM, they are termed systematic and heuristic cognitive processing.

The peripheral and heuristic routes both describe a "surface level" processing, similar to the passive consumption discussed in this introduction. HSM asserts that heuristic processing occurs because individuals tend toward minimizing their use of cognitive resources, thus affecting the reception and processing of messages. Mental shortcuts are used to evaluate messages at a more superficial level. In HSM, this means audience members often rely on availability, accessibility and applicability of cues. Availability determines how easily a heuristic structure can be stored in memory, accessibility determines how easily that heuristic is retrieved from memory, and applicability refers to how relevant the heuristic stored in one's memory is to current stimulus and thus judgmental tasks. Example of shortcuts that aids heuristic processing is the perceived credibility of a source, how agreeable the information is with existing

mental models, and whether the message is endorsed by others, thus allowing the individual to store the information without fully processing it's content.

Conversely, central and systematic processing both require more cognitive resources. In the ELM model, central processing is said to occur when an audience has the motivation and ability to think more elaborately about a message, which may occur when a topic is seen as personally relevant or due to an individual's "need for cognition." The need for cognition refers to one's need to structure relevant situations in a meaningful, integrated way and their need to "understand and make reasonable the experiential world" (Cohen et al. 1955: 291). The HSM model asserts that in systematic processing, source reliability and the content of the message are both important, and individuals rely heavily on in-depth analysis of the information presented in order to make a judgment. This active process involved in comprehension and evaluation means that the recipient engages with the material to a greater extent, and is thus more likely to develop a deeper understanding of the message. The suggested benefits of activating central or systematic processing are that attitudinal changes last longer and are more predictive of behavior. This means that if opinion changes are successful, the resulting judgements/attitudes are more likely to persist over time, resist counter-persuasion and have a greater guiding influence on future judgments and behaviors.

Communications efforts that rely on central or systematic cognitive processing do tend to increase the likelihood of scrutiny by audience members. These messages also require greater energy, time and mental effort from the audience, which can, depending on the communications channel, result in losing audience members. Thus, many persuasive communications efforts rely on the peripheral and heuristic processes. These processes are especially stimulated in narrative texts, as narrative is said to lessen audience members' counter-arguing tendencies through its use of "narrative transport." However, my research indicates that both levels of processing can be used simultaneously. This simultaneous processing can serve to both transport audiences into a narrative for ease of message delivery, while giving them the tools to consider a message more deeply. Therefore, effecting a greater potential for long-term attitudinal change that becomes more predictive of future behaviors. Further, by augmenting the central/systematic cognitive

processing with the allure of peripheral/heuristic approachability through the use of narrative, the energy, time and mental investment required for central/systematic processing becomes more enjoyable and is thus more readily devoted by audience members.

NARRATIVE TRANSPORT

Schank and Berman (2002) propose that we understand situations by storing and retrieving stories from memory. They suggest that "we construct and tell stories, in part, to teach ourselves what we know and what we think" (Schank & Berman 2002: 294). In this vein, our experiences are remembered as stories, filling out our own personal narratives and therefore informing the narratives we enact. Furthermore, the stories we encounter are to some degree "experienced", and if accepted, are similarly stored in our narrative. The more involved one is with the "experience" of the story, the greater the likelihood of accepting that story into one's narrative experience becomes - thus, the greater its impact.

Walter Fisher stated, "there is no genre, including technical communication, that is not an episode in the story of life" (Fisher 1985: 347). Fisher's narrative paradigm views narrative as humans' fundamental mode of understanding the world around us. He defines narrative as "a theory of symbolic actions (words and/or deeds) that have sequence and meaning for those who live, create, and interpret them" (Fisher 1985: 58). The paradigm includes two principles for effective narrative: coherence and fidelity. Coherence refers to the extent to which a story makes sense based on internal consistency. Fidelity refers to the credibility or reliability of the story, based on the audience's prior understanding. Together, these principles influence whether a story adequately creates a perception of reality that audience members can accept or be "transported" into.

Research suggests that people cognitively process stories differently than they do non-narrative messages: when an individual experiences "narrative transport", disbelief is suspended and the tendency to "counter-argue" is reduced, thus, leaving the individual more open to persuasive messages contained in the narrative (Green & Brock 2000, Slater & Rouner

2002). Due to this phenomenon, current research in advertising, health communication, and entertainment education incorporate theoretical and methodological elements of narrative persuasion (e.g., Durkin & Wakefield, 2008; Escalas, 2007; Moyer-Gusé, 2008). Narrative transport has been used in health communications ranging from anti-smoking to STD testing, in order to persuade audience members toward behavioral changes they may have otherwise been defensive about when confronted directly. In addition, research on entertainment-education initiatives to promote positive health behaviors has shown that people exposed to narrative materials were more likely to change their behavior than a control group (Hinyard & Kreuter 2007).

Bilandzic, H., & Busselle, R. (2012) view audiences as processing information in either a paradigmatic or narrative mode, similar to the ELM and HSM models discussed earlier. "In the paradigmatic mode, audience members are thought to gather information, weigh facts, and evaluate arguments; while in the narrative mode, they are assumed to focus on understanding causally and chronologically related events played out by sentient characters" (Bilandzic, H., & Busselle, R. 2012). This view, however, suggests that humans engage in either one information processing mode or the other; but I assert that more mindful consumption of stories -- engaging deeper cognitive elaboration for real-world transfer -- is possible. Bordwell describes a story as "the imaginary construct we create progressively and retroactively … the developing result of picking up narrative cues, applying schemata, and framing and testing hypotheses" (Bordwell 1985: 49). Engaging this active construction of understanding -- through the combination of a stimulating narrative and interactive investigation -- may help cultivate in humans a more mindful approach to message consumption at large, thus impacting attitudes and behaviors.

SIMULATION OF SPATIAL PRESENCE

Virtual Reality simulation offers a communicative channel that speaks to something we all naturally learn from on a daily basis: spatially present experience. Baumgartner et al define presence as "a sense of being physically situated within a spatial environment portrayed by a medium" (Baumgartner et al 2006: 1). Schubert et al comment that spatial presence is the "sense

of being there," occurring "when part or all of a person's perception fails to accurately acknowledge the role of technology that makes it appear that she or he is in a physical location and environment different from her or his actual location and environment in the physical world" (Schubert et al 2001: 266). In a virtual reality experience, audience members enter a self-contained immersive digital world that depends upon depth, direction, and movement for storytelling. Individuals' are motivated to explore the story via these facets in part by their sense of presence in the story. Slater and Wilbur's article *A Framework for Immersive Virtual Environments (FIVE): Speculations on the Role of Presence in Virtual Environment*s, defines presence as "a state of consciousness that may be concomitant with immersion, and is related to a sense of being in a place" (Slater & Wilbur 1997: 1). They go on to state that "participants who are highly present should experience the VE (Virtual Environment) as the more engaging reality than the surrounding physical world and consider the environment specified by the displays as places visited rather than as images seen" (Slater & Wilbur 1997: 1). By establishing a sense of "place" through which people can experience a message, information is given a contextual space to unfold within the mind. This allows for a more vivid memory of the message, thus availability of retrieval cues and impact on the individual.

A study on brain activity during a virtual reality experience by Baumgartner et al found strong activation of the cingulate gyrus, which is an integral part of the limbic system, involved with emotion formation and processing, learning, memory and spatial attention. These functions make the cingulate gyrus highly influential in linking motivational outcomes to behavior (Hayden 2010). Baumgartner et al hypothesize that the processing centers that were strongly activated in this study stimulated the emotional centers via various routes, including the aforementioned posterior cingulate. They note that "these emotional centers (limbic system) might have generated various emotional reactions (including fear, joy, or interest), leading to an increased spatial presence experience" (Baumgartner et al 2006:40). Their research thus further links the experience of virtual reality from a neurological standpoint, to the activation of regions involved in spatial attention, emotion and memory formation.

In an experiment by Fraustino, Julia et al., *Effects of 360° video on attitudes toward disaster communication: Mediating and moderating roles of spatial presence and prior disaster media involvement*, researchers investigated the effects of media modality (traditional unidirectional video content vs. 360° omnidirectional video content) on attitudes toward disaster communication content. The results showed that the 360° video medium "enhanced attitudes toward the helpful impact of the content," and that mediation analyses revealed "(1) a sense of spatial presence underlies these effects, and (2) the mediating effects of spatial presence are attenuated by involvement with similar disaster media coverage (indirect experience)" (2018: 131). People who lacked prior involvement with the natural disaster experience exhibited stronger attitudes toward the subject "via a sense of spatial presence evoked by the 360° video" (Fraustino et al 2018: 339). The research adds new perspective to a growing body of literature examining the role of spatial presence in media (e.g., Sheridan, 1992; Steuer, 1992, Steuer, 1994; Sukoco & Wu, 2011), particularly immersive visual media (e.g., Nowak & Biocca, 2003). The report goes on to assert that "attitudes are related to behaviors in many settings, so it is possible that immersive video technology may hold a key to reaching, transporting, and influencing potential donors who might otherwise find the content not as salient" (Fraustino et al 2018: 339).

Yoo, Seung-Chul et al's study, *Nonprofit fundraising with virtual reality*, similarly compared reactions to VR vs traditional video content, showing "that VR generated superior media effects—vividness, interactivity, and social presence—than those generated by a tablet" (Yoo, Seung-Chul et al 2018: 21). The results demonstrated VR led to higher donation intentions, highlighting the critical role that social presence plays in multimedia effects related to fundraising. Their findings indicate that "social presence—the sense of being there with other people, interacting with them, and empathizing with their plight—is the psychological mechanism that closes the social and psychological distance between affluent potential donors and the beneficiaries of nonprofit fundraising" (Yoo, Seung-Chul et al 2018: 21). Lessening that distance is indeed a function of spatial presence, which virtual reality makes possible.

Virtual reality can help lessen the distance between people not only by allowing users to be "present" within an environment, but also by helping them embody the character spatially

exploring the environment. In an experiment by Van Loon et al, participants interacted with a virtual reality perspective taking experience by either taking the perspective of a partner in a virtual reality, "day-in-the-life" simulation, taking the perspective of a different person in a "day-in-the-life" simulation, or simply doing a neutral activity in a virtual environment. Participants' subsequent propensity "to take the perspective of their partner (a facet of empathy)" was successfully increased for those who had assumed the perspective of their partners in the virtual reality simulation (2018: 1). The researchers report that VR perspective-taking "can be used to increase target-specific perspective-taking in individuals (2018: 15). This increase was moderated by the individual's sense of 'presence', or how immersed in the virtual environment they reported feeling (van Loon, 2018).

INTERACTIVE NARRATIVES AND THE AGENCY OF DECISION MAKING

The impact of spatial-presence becomes especially compelling when it is used to frame perspectives that inform decision making. Like reality, when we engage with something, we uncover meaning in it, and our sense of agency to explore our surroundings is an essential part of learning. Janet Murray (2018) discusses agency in her article, *Research into Interactive Digital Narrative: A Kaleidoscopic View*, asserting that the most important term to evaluate the success of any Interactive Digital Narrative (IDN) is "dramatic agency." She first defines agency as:

> An aesthetic pleasure characteristic of digital environments, which results from the well-formed exploitation of the procedural and participatory properties. When the behavior of the computer is coherent and the results of participation are clear and well motivated, the interactor experiences the pleasure of agency, of making something happen in a dynamically responsive world (12).

And then defines dramatic agency as:

> The experience of agency within a procedural and participatory environment that makes use of compelling story elements, such as an adventure game or an interactive narrative. To create dramatic agency the designer must create transparent interaction conventions (like clicking on the image of a garment to put it on the player's avatar) and map them onto actions which suggest rich story possibilities (like donning a magic cloak and suddenly becoming invisible) within clear stories with dramatically focused episodes (12).

Murray does however note a key difference between games and interactive digital narratives: "unlike in a game, an interactor does not have to... find a 'winning' or successful choice... whether or not we can change the events of the story... we can experience narrative anticipation and pleasure in a navigational choice, such as from one point of view to another in a story made up of fixed events" (Murray 2018: 12). These "choice-points" in the Interactive Digital Narrative can be evaluated individually, considering whether the interactor "has been appropriately motivated by the storyworld to anticipate specific consequences to an action" (Murray 2018: 12). While the aim of these choices is not to "win" like in traditional gaming, the choices do need to "be consistent with the moral physics of the story world, so that the consequences… make sense within the fictional universe" (Murray 2018: 12). Thus, designing a compelling, interactive 360° experience relies on the creation of a believable world, which facilitates the procedural storytelling consistent with that world that helps users make decisions as they navigate said world.

Though not shot in 360°, the recent release of Netflix's *Blackmirror: Bandersnatch* episode brought the interactive narrative or "choose your own adventure" genre back to the forefront of storytelling. The show features a game-designer, Stefan, and allows viewers to make choices ranging from the type of cereal he pours in the morning, to whether or not he decides to work from home or at a gaming company. Bandersnatch stirred conversations across social media about the different narrative choices one could make, and many viewers found themselves re-watching the story numerous times to explore the effects of each choice on the narrative. In an LA Times review by Robert Lloyd, he mentions that while at first he had decided to choose all

the left-hand options, he soon enough "began participating more fully, either to try to make the story go faster or to resist the quicker ending, or just to go exploring," and adds that "if you watch it once, you will want to watch it more than once, just to take apart the puzzle" (Lloyd 2018).

But many critics were unimpressed by Bandersnatch. An NPR article by Holmes mentions that "it would have been good to see this technology demonstrated on a stronger story... you don't really learn enough about who he (Stefan) is to care about him" (Holmes 2018). Other critics have mentioned that the choices made in Bandersnatch didn't really feel like choices at all. While Bandersnatch did indeed use "choice-points" to tell its interactive narrative, its delivery differed from that of a virtual reality experience in many ways, including the fact that viewers could not be "spatially present" in the story. This difference is much like that of looking through a window upon a disjointed "outside" reality and actually walking out the door and into the reality itself. Netflix viewers watched the Bandersnatch story unfold through the window of their two-dimensional television screens sitting in their living rooms, with little presence or investment in Stefan's world.

Further, viewers are essentially alienated from Stefan's world by their disconnection with his character. While viewers do make choices that seemingly control his story, they are neither the main character Stefan himself, nor are they present in the story, as far as Stefan is concerned. They merely control Stefan from a removed distance, taking away his agency and free-will rather than entering into dialogue or cooperating with Stefan to navigate his world. This appears to be the antithesis of presence, and utilizes a corrupt idea of agency within a world: as far as anyone within Stefan's world is concerned, there is no agency at all, and this is due to the separation of the decision-maker and the world actually experiencing the consequences. Thus, the importance of utilizing presence and interactivity together, rather than separately, appears to be essential for interactive narratives to inspire compassion and empathy in a virtual world experience, which has perspective-taking implications for the real world.

MESSAGE DESIGN FOR EMPATHY, ATTITUDE AND PROSOCIAL BEHAVIOR

Perspective taking, positive human interaction and altruistic behavior have been linked to the study of human empathy. The term empathy has been discussed in clinical, developmental and social psychology, with various definitions emerging. Hoffman defines empathy as "an affective response more appropriate to someone else's situation than to one's own" (Hoffman 1982: 281). Batson et al define empathy as "other-oriented feelings of concern, compassion, and tenderness experienced as a result of witnessing another person's suffering" (Batson, Fultz & Schoenrode 1987: 181). Social psychologists Eisenberg and Strayer define empathy as "sharing the perceived emotion of another -- feeling with another" (Eisenberg & Strayer 1990: 5). While it is clear that empathy can increase human concern for people and events outside of one's sense of self, methods for developing empathy in mass communications are still unclear.

Indeed, narrative transport may help increase people's experience of "perspective-taking." Shriram et al asserts that "virtual experiences can also impact attitudes, generating prosocial behavior," noting that in an experiment, "those who had embodied the colorblind condition were more likely to volunteer to help than those who had imagined being colorblind, underscoring how virtual embodiment can be a more effective method than mental simulation for perspective taking" (Shriram 2018: 311).

Further, the spatial and social presence enabled by virtual reality can help people feel more connected to a narrative, helping to create further dimensions of an experienced reality that the mind can adopt into its own personal narrative. This sense of presence can aid in the learning process. Winn asserts that virtual environment (VE) "immersion allows students to visually examine their surroundings naturally in a VE...this enables them to better view the information they need to develop conceptions of water movement, which is a dynamic, three-dimensional, somewhat unpredictable, phenomenon... immersion increased presence and that presence predicted learning" (Winn 2002: 6).

Additionally, interactivity can prompt greater cognitive elaboration and the feeling that informed-behavioral decisions matter to the narrative. Murray states that "by moving storytelling from the unisequential genres of print-based novels and conventional films and TV shows to the new digital medium capable of multiform and multisequential genres like procedural scenarios and branching narratives, we open up the possibility of expanding our understanding of the world and our cognitive capacity" (Murray 2018: 12). The use of branching narratives can be a tool to provide immediate feedback on choices made. In the educational setting, this immediate feedback is known as "formative assessment," and can lessen the tendency toward "passive" consumption of material, increasing motivation to engage. As summarized by Black, "formative assessment is...now recognized as one of the most powerful ways to enhance student motivation and achievement. A major outcome...was the change in classroom practices which increased the active engagement of pupils, who were encouraged to take ownership of their learning rather than being the passive recipients of the delivery of curriculum" (Black 1998: 8). This ownership of learning is crucial to more elaborate knowledge construction.

The strategic combination of narrative transport with choice and self/identity involvement through interactivity, made possible in virtual reality simulations, may serve to provide the benefits of both peripheral/heuristic accessibility to a message and the central/systematic cognitive processing necessary for elaboration. In combining these elements, audience members can experience a more mindful, active engagement with messaging content, leading to higher levels of not just empathy, but a sense of empathy empowered by elaboration and understanding, which is necessary to turn awareness into action.

Suarez makes the claim that "simulation's effectiveness comes from the human brain's tendency to reconcile two sets of seemingly incompatible operations: It accepts emotion as cognition, and imagined activity as real; working together, these behaviors foster empathy" (Suarez 2013: 1). His claim seeks to justify the use of simulation in service-learning courses as a way of developing education majors' intercultural competencies. His research helps guide the design of such simulations, noting that:

1) Experience is multisensory, including the kinesthetic sense.

2) The mind prefers to work with objects that are as close to real-life as possible.

3) Emotion and memory interact.

4) Emotion and cognition are virtually inseparable.

Suarez further asserts that in designing a simulation, participants should be provided with "settings that are as authentic as possible," and prior to engagement, participants should be given background information and prompts "to remember and discuss conditions, events, and emotions that are similar to those that they will encounter during the simulation" (Suarez 2013: 11).

In designing an interactive, 360° experience, considering the interplay of each of these learning tools is crucial. Providing background information and prompting/priming users for engagement can be designed into the narrative simulation itself. As users are drawn into the story and experience narrative transport, their sense of spatial presence can help increase identification with the guiding characters and the environment being explored. With the increased sense of identification and possession of a personal stake in the story, when the time comes to make a narrative choice, users can act on their engagement, exerting their sense of agency to guide what happens next. As noted by Freeman et al, through virtual reality "new learning can then take place; and, importantly, that the learning transfers into the real world" (Freeman et al 2016: 65). Through simulating this decision-making experience, users practice learning through action, presenting implications for carry-over into the real world. The virtual reality simulation presented in this paper takes this active approach a step further, by not only requiring activity to move the story forward, but simultaneously demonstrating each action's impact on the patient experience, through the patient's eyes.

Project Methods and Procedures

GOALS

Within the scope of this master's thesis project, the goal of the virtual reality simulation presented here is to demonstrate the capability of creating a virtual reality experience aimed at improving empathetic, patient-centered care, via interactive perspective-taking.

The Simulation itself is guided by three key Learning Objectives:

1. Improve the patient experience via training that informs a patient-centered approach.
2. Improve understanding of teamwork communication & leadership skills in trauma resuscitations.
3. Model the trauma resuscitation process.

OVERVIEW

This simulation features 360 videos and interactive hotspots, to simulate the patient POV during a trauma resuscitation. As users make communications choices on behalf of the trauma team, they experience those choices from the patient perspective, in order to demonstrate positive and negative impacts of communication approaches. Additional interactive elements provide users with the opportunity to learn more about patient communication, TeamSTEPPS guidelines for interprofessional trauma team communication and the trauma resuscitation process. The simulation enables a novel approach to learning via immersive perspective-taking, while optimizing resources via asynchronous learning and embedded interactions.

The learning objectives, script & design of this project have been guided by extensive primary and secondary research and regular in-person meetings with the UNC Trauma Program Management and Clinical Skills lab. An analysis of existing UNC patient satisfaction survey data

and focus group interviews with medical campus educators, trauma survivors and advocates identified key pain points, lessons to emphasize, and opinions on content design and delivery. The literature review detailed earlier supports the effectiveness of virtual reality simulations to improve learning outcomes, by employing the principles of perspective taking, interactivity, immersive & experiential learning, and narrative transport.

AUDIENCE AND ALIGNMENT WITH UNC MISSIONS

As UNC Health and UNC School of Medicine continue to improve quality of care standards, it must prepare students and health care professionals to provide both empathy and expertise to patients. UNC's vision to be the nation's leading public academic health care system necessitates being at the forefront of positive disruptive technologies like virtual reality in education and training. This innovative training approach addresses UNC's mission to provide patient-centered care that improves the wellbeing of North Carolinians. It offers a novel approach in training to enhance empathy via an immersive practice in perspective-taking, which is not possible in traditional training, while modeling patient-centered empathetic communication and interprofessional teamwork. It enhances productivity and adds value to the training curriculum by enabling asynchronous learning and a standardized learning experience with measurable learning objectives and evaluation methods. Once deployed, this model can provide a financially viable disruption to the current training model, enabling immersive training while reducing the time and resources required for in-person simulations.

Guided by bi-weekly communication with UNC's Trauma program and Clinical Skills lab, this simulation is targeted at medical students and the interprofessional teams working together in the UNC School of Medicine's Emergency Department. This includes but is not limited to medical students, nursing students, clerkship, Allied Health technicians, pharmacy, pre-hospital providers, Carolina Air Care, clergy, social workers and law enforcement.

FOCUS GROUP INTERVIEWS

Focus group interviews were conducted to investigate patient and medical student needs as well as learning design considerations. The focus group consisted of UNC providers, medical professors, patients, and patient advocates. A fuller summary of comments is included in the appendix (2) of this paper. Below are a few key comments derived from the focus group interviews:

> "Say something like 'I will be the primary person communicating with you, I will let you know as things develop to the extent that you want to know.' Oftentimes the patient gets treated like a case on the table as opposed to an individual."

> "Use the person's name, talk with them rather than about them."

> "[There should] not [be] too many people communicating- a key person"

> "We have TeamSTEPPS classes, ATLS classes, they don't crossover. We don't do cross training, they don't address two things at once."

> "We need to have programs that, while we're addressing team stepps and ATLS skills, they're also addressing communication. That's what's missing. It's very striated; they don't ever overlap."

> "We've missed that concept [communication]… it's an assumed objective…"

> "The point of view of the patient will help them…"

> "We get details versus information. I don't need big words, I need important words."

"The anxiety of not being able to see anything.. The ceiling tiles..… you need that face to come over and someone to say what it is and communicate with you"

"The trauma simulations don't have [evaluations]. We assume we're meeting our objectives, but right now there's no pre [survey on] what things would you like to learn and there's no post [survey on] what did you learn… [Evaluations are] never related to 'oh you didn't talk to the patient'"

"The more that providers have this sense of meaning and purpose in their work, the better they do, no matter how stressful it is… If people feel more prepared to engage empathically with the patient and that their communication is better, it enhances their sense of meaning and purpose, because even when they can't fix what's going on physically with the patient… if they can relieve to some degree the patient's stress, it makes them feel better. But when people feel that they don't have the tools, it increases the provider's anxiety which then increases the patient's."

"There's definitely a way to still focus on [communication] when they're unconscious, because they're having a conversation about the patient, and so making sure that we're using the patient's name, we're talking about the patient as a person and not a body on a bed."

"The patient can hear when they're unconscious… that needs to be very clear."

"[Say,] 'these are things we're doing for you.' Let them know we're traveling with them.. [Be] very simple in the terms that are used."

"How do I know that it's effective? How does it register in my brain as a good way of doing it? How is it that you highlight that this is the right way to do it?"

"The most important part of the communications case is that it highlights what constitutes the effectiveness. Most providers are not aware of what's effective."

The primary take-aways from these responses were that empathetic communication needs further skill development in medical education. The simulation must clearly demonstrate and indicate effective ways to communicate with the patient. Students need to understand the patient's experience, including how the words used by providers can impact them, whether their eyes are open or not.

INVENTORY OF DIGITAL ASSETS CREATED

- Edited 360 videos (recorded in 5.6k with head-mounted GoPro Max; edited in Adobe Premiere Pro with added special effects, testing in Oculus Quest using Oculus Link and Adobe Premiere Immersive Environment).
- Menu and hotspot imagery (created in Adobe Photoshop and Illustrator).
- Interactive simulation (created in 3D Vista).

DESIGN CHOICES

Script Design Rationale

This simulation reflects the experience of a trauma resuscitation from transport to the hospital, to intubation, from the patient's eyes. In this scenario, the patient, Carter, was a passenger in a motor vehicle crash. The patient is in and out of consciousness, experiencing some confusion, and asking about the driver, Jamie.

The choice to have the patient experience black-outs was not only necessary to demonstrate the patient's experience, but was also necessary for design considerations. Since 360

videos due not entail shifting camera angles, but rather a capture of everything at once, blackouts allowed for scenes recorded at different times to be strung together into one experience. This also enabled editing for cuts if mistakes were made during a scene or if statements needed to be rearranged to accurately reflect a real trauma resuscitation.

Throughout the simulation, there are decision points in which the user must choose to communicate with the patient. If the user chooses the optimal communication path, the simulation continues with an on-screen call-out indicating the communication guideline used. If the user chooses a suboptimal response, the video proceeds by skipping the positive interaction and begins to play a heartbeat sound effect, until further communication from the care team is demonstrated in the video. This sound effect is intended to indicate the increased stress the patient is experiencing.

Design methods for meeting the key learning objectives of this project include:

- Interactive popup questions provide the opportunity for users to consider next steps and engage empathetic communication via dialogue choices.
- On-screen visuals reinforce the terminology and selection of effective patient-centered communication and TeamSTEPPS communication practices. When viewing from a computer, these are also recorded in a review menu (AHRQ 2020).
- Audible heartbeat sound effects indicate changes in stress when the user chooses a suboptimal response.
- Patient thoughts/reactions to chosen dialogues will provide insight into the patient's current level of understanding and experience.
- Hotspots over each member of the interprofessional trauma care team reveals their role / profession upon hover. Upon click, the user can read more about their responsibilities.

Actors

Participants in the recording signed release forms, which have been stored in a secure location. Following discussions with the client, it was determined that the use of real medical

personnel to fulfill acting roles in this simulation would be most effective. The rationale for this is that the simulation would flow more naturally, reflecting the years of experience of the real interprofessional trauma care team. My selection criteria for team members, particularly the Airway and Captain, was that the members have an emotive voice. The rationale for this is that these key players provide the most interaction with the patient, and should be able to model empathetic communication.

The patient actor was a standardized patient, identified in collaboration with UNC School of Medicine's Clinical Skills lab, following my preference for a male of medium age with an emotive voice. I chose a male in order to avoid complications with the exposure scene. Consider the target audience – young professionals and medical students, selecting a patient of medium age was considered to have the furthest reach, allowing users to more easily identify as the patient. Since the user will not actually see the patient's face, they will rely on voice to identify with the patient, thus an emotive, controlled voice was essential to creating a quality experience for users.

SIMULATION ARCHITECTURE

Scene 1: Air Care (patient POV).

The simulation begins as the patient, Carter, wakes up in the helicopter. Carolina Air Care makes a call to the hospital while transporting the patient to the UNC hospital. One interactive question appears during this scene, as the patient, Carter, asks Air Care about the driver, Jamie. The user is given the option to either have Air Care answer Carter about Jamie, or tell Carter it is hard to hear and that they will be at the hospital soon.

Scene 2: Patient Arrival at the hospital (patient POV)

In this scene, Air Care transports the patient by stretcher to the trauma bay, where they meet the trauma care team. The primary points demonstrated in this scene are to give the trauma team a report on the patient's status before transfer. During this scene, on-screen call-outs

indicate good communication practices, including prompting Air Care for the report, and performing a check back by repeating the report to Air Care. The user then chooses whether or not to warn Carter that he is about to be moved to another bed. Upon move, Carter briefly loses consciousness.

Scene 3: Primary Survey (patient POV)

During the primary survey, the trauma care team must conduct phase one of a trauma resuscitation. All efforts are focused on identifying and treating shock / life threatening injuries ATOMIC (Airway obstruction, Tension pneumothorax, Open chest wound, Massive hemothorax, flall chest, Cardiac tamponade) through an A/B/C/D/Log Roll (Airway, Breathing, Circulation and Disability). The log-roll is performed to enable the team to assess for life-threatening injuries on posterior surfaces. A full set of vitals, manual BP, core temp and x-rays are obtained in this phase. Before performing the log roll, users have the choice to inform Carter that he is about to be rolled onto his side.

Scene 4: Secondary Survey (patient POV)

During the secondary survey, the bedside and airway physicians work in concert to identify potentially non-life threatening injuries (bumps and bruises) through a serial assessment from head-to-toe. As the scene progresses, Carter's condition begins to depreciate, indicated by a blurring vision, reduced feedback and increasing blackouts. Airway and the bedside physician call-out the patient’s condition, advocating for intubation. Upon the trauma Captain’s confirmation, the user has the choice to inform Carter that he will be put to sleep in order to relax and be given a breathing tube. The simulation concludes with intubation.

TIMELINE

This timeline reflects key development points beginning in Quarter 2 (April) of 2019. At the time of this submission, the project completes Quarter 1 of 2020, concluding phase one of the project, which is within the scope of this thesis project. Phase two will begin with Q2 of 2020.

Table 2.0 Activities Timeline	**2019**			**2020**			
	Q2 (Phase 1)	Q3 (Phase 1)	Q4 (Phase 1)	Q1 (Phase1)	Q2	Q3	Q4
Discovery meeting with client							
Summarize client goals for approval							
Develop proposal							
Secondary research							
Needs analysis: patient survey comments analysis							
Needs and design analysis: focus group interviews							
Develop learning objectives							
Feedback on learning objectives: client & focus group							
Approve revised learning objectives							
Identify technologies needed							
Develop script							
Feedback on script: client & focus group							
Approve revised script							
Identify key players (simulation participants)							
Develop shot list & tentative schedules							
Record 360 videos at hospital (2 days)							
Edit videos and audio							
Create interactive simulation							
Publish first draft of simulation							
Feedback on simulation							
Revise and approve simulation for user testing (End of Phase One)							
IRB exemption application							
Finalize plans to incorporate into curriculum							
Secure headsets for deployment							

Develop user survey								
Deploy simulation								
Analyze feedback and revise for study								
Conduct Clinical Teamwork Scale (CTS) pre-test								
Re-deploy simulation								
Analyze pre and post results								
Publish study (End of Phase Two)								

PARTNERS

As the Primary Investigator (PI) of this project, I worked with colleagues at the UNC School of Medicine IT (SOM-IT) Instructional Media Services group to move the project forward. Support from SOM-IT included assistance acquiring necessary gear and scheduling meetings with partners. Partnership with the Trauma Services Program helped ensure the project would meet the needs of workforce development at UNC Health, while partnership with the Clinical Skills Lab helped ensure the project's content meets the learning needs of medical students. Further, partnership with the MD Program helps ensure the project is incorporated into the curriculum.

Table 1.0 Partners	**Organization**	**Role**
Trauma Program	UNC Health	Phase 1: Provide expertise/resources on the trauma resuscitation process, patient experience and TeamStepps protocol to be included in the simulation. Phase 2: conduct CTS test; integrate training into workforce development.
Clinical Skills Lab	UNC School of Medicine	Phase 1: Provide expertise on the trauma resuscitation process.
MD Program	UNC School of Medicine	End of Phase 1, beginning of Phase 2: Integrate training into medical student curriculum.
IPEP	UNC	Phase 2: Identify opportunities for IPE training across departments. Increase visibility of interdepartmental training.

CLIENT / PARTNER FEEDBACK

Alberto S. Bonifacio, RN, BSN, MHA, CEN | UNC Trauma Program Manager:

"I've never seen any educational offering that captures the patient perspective this well. In fact, I've never seen trauma from this perspective at all. I'm totally blown away by how you were able to piece everything together.

The opening scene was engaging and realistic – totally enlightening to see what it looks and feels like (breathing) to be inside of a helicopter and transported to the bay. The breathing and helicopter sounds really helped with immersion. The log roll was so scary – really looked like you'd fall off the stretcher.

As far as education, the pauses are great. I also really loved the "ideal" trauma assessment. The communication with call-outs and check-backs were perfect. The Trauma Captain was "thinking out loud" and summarizing at key moments to enhance the team's situational awareness and shared mental model. The "labels" for the different roles were also awesome."

Luigi Pascarella, MD, FACS| Associate Professor of Surgery | Division of Vascular Surgery | Surgery Clerkship Director | Co-Director, HISC UNC SOM:

"I had the opportunity to collaborate with Ms. Fenison during the creation of a Trauma VR Module. Ms. Fenison is a very dedicated and motivated individual with high ethical standards. She['s] polite, well mannered. Her knowledge regarding her project but mostly regarding educational strategies to deliver a curriculum with specific objectives is outstanding.
We would like to further collaborate with her beyond her thesis in order to develop a set of VR Modules for the UNC Surgery Clerkship. The technology and its delivery to medical education, that she is mastering and championing will be essential in the near future in order to develop novel strategies for Medical Students and Residents Education."

Daryhl L. Johnson II, MD, MPH, FACS | Trauma Medical Director | Associate Professor of Surgery, Division of General and Acute Care Surgery

"This statement is in support of the Master Thesis work to be submitted by Christi Fenison. It provides a perspective of her work and it's future impact. The project originated as an idea to combine the patient perspective and the new paradigm of the patient being a part of the team. The team representing a trauma resuscitation team which is essentially an "adhoc crisis team" that assembles at random times throughout the day when patients present to the hospital after traumatic injury. Another key attribute of the work involved layering team work dynamics within the project. Dynamics that we as health care professionals struggle with due to the inability to train often as successful teams do. So in essence this work was viewed as an opportunity to immerse the health care learner into a virtual environment as tool to help mitigate the barriers posed in healthcare related to team training. The project matured from a concept to a deliverable tool that will continue to be enhanced for effectiveness and used in other areas where virtual learning may be effective. This work is being evaluated for the immediate use with regard to medical student learning and the challenges the Coronavirus Pandemic has caused. After continued validation the work will developed to assist with learning objectives with regard to nursing and doctors in training."

LIMITATIONS/BARRIERS/RISKS

The unpredictable nature of the availability of the trauma bays, and the availability of actors to play the roles in the training was a limitation in terms of scheduling challenges. Since a real trauma case could come into the bay at any moment, the trauma bay is a volatile filming environment. Even if all participants are scheduled to film at specific times, it was known that the time could change during the recording. This did in fact happen when recording; two takes were taken of certain scenes, but as a real trauma came in, we were prevented from recording any additional takes, including a full, seamless recording of the trauma resuscitation process

without mistakes. This limitation meant increased post-production time, in order to splice various shots into one seamless storyline, and apply special effects to avoid the jarring impact of cuts in a 360 video.

Furthermore, due to the incorporation of participants from two different teams, Carolina Air Care and UNC Hospitals, scheduling necessitated at least 2 days of recording. The Carolina Air Care scene was recorded on a Saturday on the hospital helipad and in the trauma bay. The Trauma resuscitation scenes were recorded on Sunday, the following day, in the trauma bay. Due to this schedule, the transfer scene between Air Care and the Trauma team was in reality recorded at separate times. These scenes were combined in post-production using key-framed masks to merge two separate halves of the trauma bay with moving actors at times crossing the center-line, in order to simulate a conversion between teams.

While preparation could not prevent certain scheduling challenges, mitigation of risk included collaboration with the UNC Trauma Services Program and the Clinical Skills Lab to identify key personnel for the roles. Participants received communications and a copy of the script in advance of the planned recording to provide sufficient lead time. In order to reduce this scheduling limitation and post-production time commitment in the future, a 220 degree green screen will be acquired. This will allow for an easier creation of additional scenes in phase 2 that avoid reliance on the availability of the trauma bays, and future simulations. This approach will require taking a background snapshot of the Trauma Bay or appropriate location, and then scheduling shoots that aren't contingent on the real location's availability. This approach allows for recording as many takes as necessary during a scheduled time, without worrying about environmental factors.

A potential barrier to scaling beyond the pilot project is resource constraints. Once this initial version of the training is incorporated into the School of Medicine curriculum and gains notoriety, considerable interest from other departments is anticipated. The plan to mitigate the strains of increased demand is to allocate sufficient additional resources up front in anticipation of demand. Successful integration of VR training into the UNC School of Medicine curriculum

depends on accessibility; funding will be sought to secure a VR green screen for recording,VR headsets for student use and to establish a VR program at UNC School of Medicine. Securing these resources will help reduce post-production time and streamline deployment.

Next Steps: Phase Two

Within the scope of this thesis project is Phase One: simulation creation. In Phase ATwo, the simulation will be tested for user experience and incorporated in UNC SOM curriculum for third year medical students. The first class of students will evaluate user experience elements, providing feedback on design effectiveness. After revision, subsequent classes will complete a pre and post evaluation for analysis and discussion forum prompts. This analysis will seek to further investigate the effectiveness of using interactive 360 videos from a patient point of view, to meet communications learning objectives. The degree to which the participant interacts with the environment will be tracked and used to evaluate the effectiveness of engagement, as well as how interaction patterns influence changes between pre and post evaluations.

MODES OF EVALUATION

A baseline evaluation: This is a two part survey.

The first part assesses participant knowledge, attitude and confidence regarding patient communication before beginning the simulation. In addition to multiple choice and likert scale questions, there will be an open essay section describing a patient communication scenario and asking the participant to describe how they would respond to the patient.

The second part is a self-rated empathy test. This self-evaluation provides an opportunity for personal reflection on approaches and habits prior to the simulation's practice in perspective taking. The Jefferson Scale of Physician Empathy (JSPE) is a validated, 20-item scale that is designed to measure empathy in physicians and other practicing health care professionals

(HP-version), medical students (S-version) and other health care professional students (HPS-version). It has been translated into 56 languages and has been used in more than 85 countries.

Discussion Forum:

Participants will be asked to post their understanding of patient centered care in the discussion forum prior to the simulation. After the simulation, each participant will be asked to make two postings, including a) reflections and thoughts on how their understanding of patient centered care has changed, and b) a discussion of their experience and take-away from at least one of the interactions in the simulation.

There will be timed decision points during the simulation, however, these will be used for role modeling / demonstrating choice outcomes, and not for evaluation. The degree to which the participant interacts with the environment, however, will be tracked and used internally to evaluate the effectiveness of the simulation's engagements as well as how interactions may influence changes between pre and post evaluations.

Post evaluation:

After the simulation, participants will complete a post evaluation covering the same topics as the pre-evaluation, including knowledge, attitude, confidence, and learning methods regarding patient care, and the self-rated empathy test. This self-evaluation will again provide an opportunity for personal reflection in response to participants' exposure to perspective-taking.

Evaluating Simulation Effectiveness:

The pre and post evaluations will be compared to determine if there is a change in knowledge, attitudes, and confidence regarding patient communication, as well as a change in self-reported empathy. Patient communication scenarios provided in the open-essay section of the pre and post evaluations will be randomized to reduce bias, and responses will be evaluated

for signs of empathy / compassionate engagement. These evaluations will be compared pre and post simulation.

Conclusion

Creating interactive 360 experiences requires in depth planning. This project began with a discovery meeting in April of 2019. After this, months of research, focus group interviews and discussions with the client guided the creation of key learning objectives and a working script. These elements were essential to have in place before recording the simulation, to ensure the simulation would meet training needs. This planning process has also worked to help ensure buy-in from key players within UNC medical campus. While the primary goals for phase one of this project are reflected in the learning objectives, the overarching goal is to establish a new model for VR curriculum at the UNC School of Medicine, that improves empathetic, patient-centered care, via the successful creation and deployment of this proof of concept (POC) simulation. To achieve this goal, buy-in from key players is essential, and the planning that informed this project not only sought to create a quality simulation, but also helped to establish this buy-in for future scalability. This project began with the mission to improve work-force development at the UNC Hospital; by involving various members of the UNC community in the creation process, the project has been identified for additional inclusion in UNC medical student education.

Virtual reality transforms education. The positive disruption discussed here allows users to make communication choices on behalf of a care team and experience those choices as the patient. By allowing providers and medical students the unique ability to see through the patient's eyes using interactive 360 video, we can revolutionize training for empathetic communication skills. Training for these skills can help ensure internal alignment with UNC Health's goal of providing "empathy and expertise", and this simulation seeks to improve the patient-centered care approaches that shape the patient experience.

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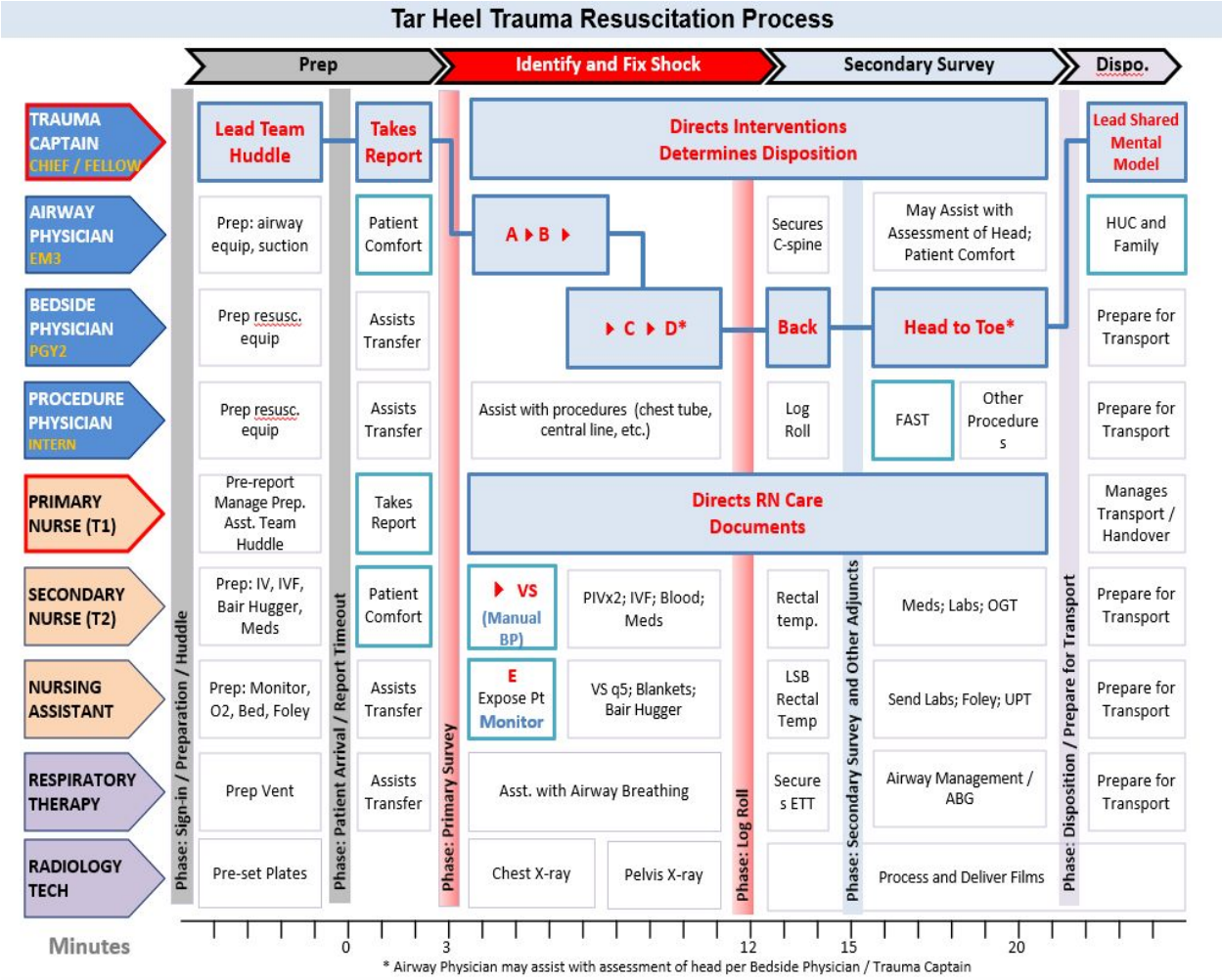
Appendix

1. TRAUMA RESUSCITATION PROCESS DIAGRAM



2. FOCUS GROUP INTERVIEWS

Focus group interviews were conducted to investigate patient and medical student needs as well as learning design considerations. The focus group consisted of UNC providers, medical professors, patients, and patient advocates. The following comments were taken from the focus group interviews:

> "Say something like 'I will be the primary person communicating with you, I will let you know as things develop to the extent that you want to know.' Oftentimes the patient gets treated like a case on the table as opposed to an individual."

> "Oftentimes, how empathy is expressed are simple statements, like 'I know this must be very anxiety producing for you.. I can see you are really distressed, let me try to decrease that stress by telling you…' and use the person's name, talk with them rather than about them."

> There should "not [be] too many people communicating- a key person"

> "We have TeamSTEPPS classes, ATLS classes, they don't crossover… we don't do cross training, they don't address two things at once."

> "We need to have programs that, while we're addressing team stepps and atls skills, they're also addressing communication… that's what's missing.. It's very striated, they don't ever overlap."

> (Referring to an assignment requiring both clinical skills and communication) "[The students] couldn't walk and chew gum at the same time."

"We've missed that concept [communication]… it's an assumed objective…"

"The point of view of the patient will help them…"

"Having your patient say 'I'm scared' will be something good to say to them."

"[Say,] We just want to make sure there's nothing else going on here…"

"We get details vs information. I don't need big words, I need important words."

"The anxiety of not being able to see anything.. The ceiling tiles..… you need that face to come over and someone to say what it is and communicate with you"

"Attendings forget their communication skills…"

Regarding Evaluations:

"The trauma simulations don't have [evaluations]. We assume we're meeting our objectives, but right now there's no pre [survey on] what things would you like to learn and there's no post [survey on] what did you learn."

"[Evaluations are] never related to 'oh you didn't talk to the patient'"

Regarding follow up question about students struggling:

"They have a hard time with things like not talking about themselves.. They have a hard time bringing up topics that are anxiety producing for them, like bad news."

"What I worry about is… from time to time, when I'm going through, you see a family member coming in… overwhelmed… all these thoughts, worried about your loved one… making sure that someone is engaging with the family member. Hey, I see they are working on your loved one. So can I take you over here where it's a little quieter, there's a place to sit, and we'll be sure to communicate with you the moment that there is any news. Just having that warmer engagement with the family member is important."

"The more that providers have this sense of meaning and purpose in their work, the better they do, no matter how stressful it is… If people feel more prepared to engage empathically with the patient and that their communication is better, it enhances their sense of meaning and purpose, because even when they can't fix what's going on physically with the patient… if they can relieve to some degree the patient's stress, it makes them feel better. But when people feel that they don't have the tools, it increases the provider's anxiety which then increases the patient's."

"[Students should] watch a provider talk to the mother on the phone"

"There's definitely a way to still focus on [communication] when they're unconscious, because they're having a conversation about the patient, and so making sure that we're using the patient's name, we're talking about the patient as a person and not a body on a bed."

"The patient can hear when they're unconscious. People say inappropriate stuff when the patient is unconscious in a trauma room, and that needs to be very clear."

"It's better to say I'm sure you're stressed"

"[Say,] these are things we're doing for you.. Let them know we're traveling with them.. [Be] very simple in the terms that are used."

"How do I know that it's effective.. How does it register in my brain as a good way of doing it.. How is it that you highlight that this is the right way to do it?"

"The most important part of the communications case is that it highlights what constitutes the effectiveness. Most providers are not aware of what's effective."

3. SCRIPT

SCENARIO:

- Patient was a passenger, riding with family/partner.
- Single Vehicle crash, In and Out of Consciousness / Head Trauma, taken by Aircare.
- Driver did not lose consciousness, taken by EMS.
    - Communication with patient about driver status - potential for greater emotional/anxiety effect.

SCRIPT DESIGN NOTE:

- Decision Points in this script:
    - Choices / clickable areas are written in Blue
    - Optimal path outcomes are highlighted in Green.

- Suboptimal outcomes are highlighted in red.

###

SCENE 1: Aircare

VISUAL: Blackscreen

AUDIO: Helicopter sound effects (sfx)

Air Care (Voiceover):

(Difficult to hear)

"Inbound with a 30 year old male, unrestrained passenger in a motor vehicle collision in Chatham County. Right forearm open with controlled bleeding and deformity, blunt trauma with bruising and swelling to forehead, 5 cm laceration to right forehead. We have him fully immobilized, here are his vitals- initial SPO2 80% now 96% with mask at 15 liters per minute.

BP 165/99 HR 125 . Pt has 18G in LAC. 2 Bilateral 16 gauge IVs with normal saline infusing at KVO. GCS 10 (3-3-4). Approximate 30 minute extrication."

VISUAL: Fade in from black, inside Helicopter. Oxygen mask, Aircare on radio in and out of focus.

AUDIO: breathing and heartbeat increasing.

Radio from Hospital (Voiceover):

“Thank you, room 2 on arrival”

VISUAL: Blink in and out, Slow fade to black,

AUDIO: Helicopter sound fades, breathing and heartbeat become louder.

VISUAL 2: Vignette effect & blurry 3 second flashback inside car, rainy.

AUDIO 2: car engine + radio music

VISUAL 3: Vignette/ transform video back to helicopter, Aircare looking at user.

AUDIO 3: helicopter sfx

Carter (Patient) Voiceover:

(Difficulty voicing/ muffled)

“Wha-?”

Air Care :

(Difficult to hear over helicopter- good eye contact)

“I’m sorry it’s loud in here, you were just in a car accident and we are on the way to the hospital. My name is Ana and I’m a nurse. I am giving you oxygen right now”

AUDIO: breathing sfx quickens and becomes louder.

VISUAL: Vignette/blur effect, aircare in focus

Carter (Patient) thoughts voiceover:

(thoughts- trying to remember)

Ana? What happened.. Where is Jamie?

Carter (Patient) Voiceover:

(emotional)

Jamie--"

INTERACTIVE, Timed Option on-Screen:

| Provide Reassurance? |

On-Screen Subtext:

Point your controller and pull the trigger to select Ana's response.

Note: First interactive Option highlights on selection or on timeout, in case the user is disoriented/unfamiliar with VR in the beginning.

Air Care:

"Jamie was driving, right?

AUDIO: heartbeat quickens.

She is awake and is in good hands, the ambulance is bringing her to the hospital too so the doctors can check over both of you."

AUDIO: heartbeat softens.

VISUAL: Blink in and out, Fade to black.

AUDIO 2: 4 sec helicopter sfx continue

###

POV Transition:

(Optional Transition Effect) God View: fade in from black, view from above patient inside helicopter, scene shrinks with peripheral view black, circular blurred edge video in center of screen, continues to zoom out until black screen. Helicopter, heartbeat and breathing sfx fade out. (For visual, see Creed VR "Knockout" Effect concept example).

Fade to black

VISUAL: black screen as background or masked/ faded shot of helicopter flying from outside in background. No sfx.

On-Screen Text:

"The Trauma Team is preparing for your arrival."

INTERACTIVE Timed Options On-Screen:

| View Simulation Tutorial |

| Shift perspective to Trauma Team Huddle now |

VISUAL: time indication bar shrinking to center under buttons.

Note: If no selection made, auto select Tutorial

VISUAL: Highlight button, filter/ fade screen.

Tutorial Option:

VISUAL: black background, animated image of headset controller, trigger highlighted.

On-Screen Subtext:

When an opportunity appears, point and pull the trigger to select your experience

Simulation Preview Voiceover:

"You have just been in a car accident, and are on the way to the hospital where the Trauma team will work together, and with you, to help you recover. During this experience, select the on-screen options to choose the path your care team takes, as you experience trauma care from a patient's point of view. *(pause)*

In just a moment, we'll see what the trauma team is doing to prepare for your arrival."

VISUAL: Fade to black

###

SCENE 2: ED Phase 1A (Team Huddle/Brief)

VISUAL: Fade into Hospital where team is preparing, Secondary Nurse POV

VISUAL ON-Screen Graphics during scene:

- *Checklist to populate as key case info is delivered: BP, Pulse, O2 Sat etc..*
- *Timeline of Trauma Resuscitation Phases, **Team Huddle** highlighted.*
- *INTERACTIVE Clickable team members during scene for role & summary popups.*
- *INTERACTIVE On-Screen graphics as ✔TeamSTEPPS are demonstrated, clickable for definitions*

Charge Nurse:

"We have a 30 year old male in a motor vehicle crash. Initial GCS 12 (3-4-5) with blunt head trauma. Initial SPO2 80% now 96% with mask at 15 liters per minute. BP 90/50 HR

125 . We're bolusing with 2 Liters of NS. He is backboarded, collared, 2 Bilateral 16 gauge IVs. ETA 15 minutes."

Captain:

"Okay, Patient is minimally responsive, they have oxygen going, 2 IV?"

Charge Nurse:

"Yes, 2 IVs."

VISUAL On-Screen graphic: ✔TeamSTEPPS: Checkback

Captain:

"Okay everyone, we have a head trauma coming. Let's conduct our pre-trauma huddle. I'm Finley, Trauma Captain."

(Team members introduce self and roles, highlight members as mentioned)

I'm Sam, Airway.

Logan, Bedside Physician.

Adrian, Procedure Physician (intern).

Parker, Primary Nurse.

Charlie, Secondary Nurse.

Erin, Nursing Assistant.

Rory, Respiratory.

Avery, Radiology.

Mary, ED Pharmacist.

VISUAL On-Screen graphic: ✔TeamSTEPPS: Introductions

Finley (Captain):

"It sounds like this guy is seriously injured, report says he was a passenger in a car crash, blunt head trauma, airway problem and he is in shock.

VISUAL On-Screen graphic: ✔TeamSTEPPS: Situational Awareness

Okay- typical trauma process. Primary assessment, roll, then secondary.

VISUAL On-screen graphic: ✔TeamSTEPPS: Shared Mental Model

My biggest concern is his GCS. Sam and Rory, are you good with the airway in case we need to intubate? Mary and Charlie can we have RSI meds ready just in case?"

Mary (ED Pharmacist):

“What meds do you want?”

Sam (Airway):

“Let’s do Etomidate, Vecuronium and Succs. Sounds like typical doses, but we’ll confirm once we see the patient”

Finley (Captain):

“Sounds good to me”

Mary (ED Pharmacist):

“Got it. I’ll get them out of the Pyxis.”

INTERACTIVE TeamStepps graphics are clickable for definition

Finley (Captain):

“Thank you. Charlie, he has two IV’s, when he arrives, verify the second IV. Are we good with blood in the fridge?”

Charlie (Secondary Nurse):

“Will do. And yes, we’ve got six units in the fridge. The rapid transfuser is right here in case we need it.”

Finley (Captain):

“Great. Parker, did we miss anything?”

Parker (Primary Nurse):

“Erin, can we make sure to keep him warm?”

Erin (Nursing Assistant):

“Will do. I’ll get blankets on him as soon as possible and we’ve got the Bahr hugger ready.”

VISUAL: on screen graphic: ✔TeamSTEPPS: Check Back

Finley (Captain):

“Great. Okay everyone, ETA 10 minutes”

Note: Include other role & responsibility call-outs?

Airway Physician (EMS): Prep: airway equip, suction > Patient Comfort

Bedside Physician (PGY2): Prep Resuscitation equip >Assists Transfer

Procedure Physician (intern): Prep Resuscitation equip > Assists Transfer

Primary Nurse (T1): Pre-report Manage Prep. Assist Team Huddle > Takes Report

Respiratory Therapy: Prep Vent > Assists Transfer

Radiology Tech: Pre-set Plates > __

VISUAL On-Screen graphic: ✔TeamSTEPPS: Team Brief

VISUAL: Fade to black

###

SCENE 3: ED Patient Arrival: Phase 1B Prep/Transfer

Patient POV

VISUAL: Black.

AUDIO: Helicopter sfx, Hear rolling, elevator ding.

Air Care (Voiceover):

“We are at the hospital now, we’re taking the elevator down to meet the care team.”

VISUAL: fade in from black to inside elevator, blink effect. Aircare is looking at user, ready to listen, reassures with nonverbal communication.

VISUAL 2: Fade to black

AUDIO: elevator door opening, background noise of trauma bay, getting louder

Finley (Captain)(Voiceover from distance):

“Trauma is here.”

AUDIO: Silence

VISUAL: fade in from black, in trauma bay surrounded by team.

Finley (Captain):

“Aircare, what do we have?”

Air Care:

“This is Carter, he is 30 years old, he was an unrestrained passenger in a motor vehicle crash. The driver lost control of the car, over-corrected and crashed into a tree. Highway speeds. Significant damage to the front passenger side of car. 30 minute extrication. He is in and out of consciousness and is confused. Initial GCS 10 (3-3-4). He has a 5 cm laceration to the head, the bleeding is controlled, and has an open fracture to his left arm and bruising to the right chest. Initial SPO2 80% now 96% on 15L of oxygen. His BP now 98/65 after two liters of normal saline. Heart rate 106 . He’s got 2 bilateral 16 gauge IVs. The driver is coming by ground.”

Finley (Captain):

“Thank you, so he’s gotten a total of two liters of saline?

Air Care:

“Yes, a total of two liters.”

VISUAL On-Screen graphic: ✔TeamSTEPPS: Check Back

Finley (Captain):

Got it. Are we ready to move?”

INTERACTIVE Timed Option On-Screen:

| Inform Carter? |

If Option Selected:

Sam (Airway, visually highlighted) to user:

(Making eye contact with user)

“We’re going to lift you up onto our bed here okay?”

Sam (Airway):

“Is everyone ready? On three...1..2..3..”

Scene note: team performs move.

VISUAL: Ceiling, Vignette

//If Not Selected:

//AUDIO: surprised Gasp sfx on lift

//VISUAL: red vignette (stress indication)

VISUAL: Fade to Black

###

SCENE 4: ED Phase 2 (Primary Survey: Identify and fix shock)

VISUAL: Black, Timeline of phases with current phase highlighted, ***ABCD***

INTERACTIVE timeline / phases clickable for definition, (option to pause simulation during info popup)

Sam (Airway) to User:

“Can you hear me?...

VISUAL: Fade in from black. Secondary Nurse or Airway in focus.

Can you tell me your name?”

Carter (Patient) Voiceover:

“Where’s Jamie?”

Sam (Airway) to User:

“Jamie will be here very soon, My name is Sam and I’ll be checking in on both of you. We need to help you right now and then we can let you see each other. Can you tell me your name?”

Carter (Patient) Voiceover:

“Carter…

Sam (Airway) to User:

“Thank you Carter, listen, I and the team are going to check you over real good. It may get a little loud, but we’ll keep you as comfortable as possible. Hang in there okay?”

Note: Airway check performed, (jaw)

VISUAL: Ceiling, tops of team heads

AUDIO: Team communication in background:

Finley (Captain):

“Sam, how’s his airway?”

Sam (Airway):

“Airway clear”

VISUAL on screen graphic: ✔TeamSTEPPS: ***Call Out, Closed Loop Communication***

Parker (Primary Nurse):

“Got it.”

Carter (Voiceover):

“Why is this happening?”

Sam (Airway):

“Carter, I understand you’re feeling confused, you were just in a car accident. It was raining and we think you all lost control before hitting a street lamp. The helicopter brought you here to the UNC Chapel Hill Hospital where we are now, and Jamie is on her way too by ambulance.

We have to check you over now so we can help you, okay?”

*VISUAL on screen graphic: ✔Empathetic Communication: **Acknowledgment.***

Carter (Patient) thoughts voiceover:

It was so Rainy... There was a dog.

Optional VISUAL: image darkens, 2 sec faded visual overlay of inside car, next to Jamie, rain outside and dog crossing street.

Note: Breathing check performed (look, listen, feel chest) for contusions, lacerations, broken ribs.

Finley (Captain):

“Breathing?”

Sam (Airway):

“Breath sounds decreased on the right, crepitus on the right chest. ”

Scene Note: Circulation check performed- (pulse, rate, rhythm, volume, skin color, scan body for life threatening bleeds. Cervical collar)

Finley (Captain):

“Let’s get initial vitals, check circulation.”

Parker (Primary Nurse):

“Manual BP is 90/40. Heart rate 115. O2 Sat 90%.”

Logan (Bedside Physician):

“Femoral pulses are strong, radial pulses are thready.”

Charlie (Secondary Nurse):

“2 Bilateral 16 gauge are patent”

*VISUAL on screen graphic: ✔TeamSTEPPS: **Call-Out***

Finley (Captain):

“Any obvious bleeding?”

Logan (Bedside Physician):

“Bleeding on the right arm, controlled.”

Finley (Captain):

“Thank you.”

Parker (Primary Nurse):

“Got it.”

Charlie (Secondary Nurse):

“2 Bilateral 16 gauge normal saline switched to warm saline. Do you want blood?”

*VISUAL on screen graphic: ✔TeamSTEPPS: **Call-Out; Patient Comfort***

Finley (Captain):

“Let’s hold off on the blood. But please recheck his blood pressure every 5 minutes. Okay let’s expose.”

*VISUAL: On Screen timeline highlight: **Exposure***

INTERACTIVE Timed Option On-Screen:

| Inform Carter? |

If Option Selected:

Sam (Airway):

“Carter, this might feel a little cold but we need to remove your blanket for a moment, and then we’ll get you covered back up.”

VISUAL: Ceiling, tops of team heads, blanket lifted up

//If Option Not Selected:

//Heartbeat increases, visual deep blue vignette/ blur for stress/confusion & cold indication

//Carter (Patient) thoughts voiceover:

(stressed) **Why did they take my blanket?.. I don’t have any clothes on!**

Note: Disability check, Pearl AVPU Scale

Finley (Captain):

“Disability?”

Carter (Patient):

“.. It hurts.. Where is Jamie?”

Sam (Airway):

“Carter is verbally responsive but confused, localizing pain.”

Avery (Radiology):

“XRAY!”

Audio: xray beep sfx

Logan (Bedside Physician):

“FAST Negative”

Parker (Primary Nurse):

“Sorry was that negative?

Logan (Bedside Physician):

“Correct, negative.”

Parker (Primary Nurse):

“Got it”

VISUAL On-Screen graphic: ✔TeamSTEPPS: Checkback

INTERACTIVE Timed Options On-Screen:

| Acknowledge, Inform & Explain |

| Inform |

If Option | ***Acknowledge Pain, Inform & Explain*** | *Selected:*

Sam (Airway):

"I'm sorry you're in pain Carter, and I know you're worried about Jamie, she is here at the hospital, she is alert and talking, and she knows where you are and that we are taking care of both of you.

You were knocked out and do have a broken arm, we're giving you some medicine to help, but we need to see if you have any other injuries so we can help, okay?"

Carter (Patient) thoughts voiceover:

(breathy/exhaling) **"She's okay. Okay. My arm, that's why I couldn't move.. I hope nothing else is wrong. I want to see Jamie."**

*//If Option | **Inform** | Selected:*

//Sam (Airway):

“We’re giving you some pain medicine and they are taking care of Jamie right now.”

//Carter (Patient) thoughts voiceover:

Is Jamie okay? I need to see Jamie.. I can’t move.. Something is wrong.

//(Heart rate & breathing increase. Vignette/ watery blur on screen)

VISUAL: Fade to Black

###

SCENE 5: ED Phase 3 (Secondary Survey)

*VISUAL: Black. Timeline On Screen: **Log Roll***

INTERACTIVE: Timed Option On-Screen:

| Inform Carter? |

If Option | Inform Carter? | Selected:

Sam (Airway):

"Carter, we need to roll you onto your side so we can check your back now."

Scene Note: team performs roll.

VISUAL: fade in from black, waist level. Vignette

//If Option Not Selected:

*//AUDIO **"Ouch"** from patient.*

//VISUAL: fade in from black, waist level, Red Vignette (pain indication)

Finley (Captain):

"Examining the spine, no step-off or deformities. Rectal tone deferred."

INTERACTIVE: Timed Options On-Screen:

| Acknowledge Pain, Inform & Explain |

| Inform |

If Option | Acknowledge Pain, Inform & Explain | Selected

Sam (Airway):

"I'm sorry that was uncomfortable, we didn't see any serious injuries to your back, but we are going to do some x rays and check over you again, then we'll get you a blanket, okay?"

Carter (Patient) thoughts voiceover:

Okay, this really hurts, but it sounds like they know what they're doing.

//If Option | Inform | Selected:

//Sam (Airway):

“It’s okay, we’re giving you some more pain medicine.”

//Carter (Patient) thoughts voiceover:

What did they see, is something else wrong?

//(Heart rate increase)

Visual:(xray)

Visual: Fade to black, can still hear.

//If NO Options are Selected:

//Carter (Patient) thoughts voiceover:

“Why aren’t they talking to me?

Something must be wrong… Do they know I’m awake?

//Heart rate sfx increase.

Jamie, _____”

Note: (“I’m sorry?” Imply something unresolved, exacerbating/exacerbated by stress)

//Breathing sfx increase.

Visual: black

Finley (Captain):

“Okay let’s reassess what we’ve done so far, we’ve done our ABCD’s, airway is secured, we’ve assessed his breathing is good, he’s got diminished breath sounds on the right side.”

VISUAL on screen graphic: ✔TeamSTEPPS: **Huddle, Situation Awareness, Shared Mental Model**

AUDIO: Increase breathing sound

Carter (Patient) Voiceover:

(moan/ indication of pain)

Sam (Airway):

“Breathing is labored and GCS deteriorating, No eye opening, no longer verbally responding, withdrawing from pain. I feel we should intubate.”

*VISUAL on screen graphic: ✔TeamSTEPPS: **Situation Monitoring, Call-Out, Patient Advocacy***

Finley (Captain):

“Labored breathing and deteriorating GCS, thank you. Yes, let’s intubate.

Then, Charlie, would you mind putting in an OG tube, and Erin let’s get a temp foley in, then we’ll reassess with our head to toe secondary survey.”

Charlie:

“Putting OG tube in”

Erin:

“Getting temp foley”

INTERACTIVE: Timed Options On-Screen:

| Try to talk to Carter |

| Intubate & Move to Secondary Survey |

If Option | Talk to Carter | Selected

Finley (Captain):

(Whispering in ear)

"Hi Carter, my name is Finley, I'm the trauma surgeon. We found a few fractures that we're going to take care of for you. We are worried about your breathing, so we are going to intubate you now so you can sleep, which will help control your pain and help your breathing."

Carter (Patient) thoughts voiceover:

They are going to help me. Thank you, thank you. Jamie, I can't wait to see Jamie.

Heart rate sfx normalizes

//If Option | Move on to Secondary Survey | Selected:

//Carter (Patient) thoughts voiceover:

My pelvis, ribs? I'm so cold, am I going to be okay? ...

Please help me. (Optional emotional: Jamie, I love you)

//(Heart rate increase) - optional: when patient heart & breathing increase- end scene with needing to intubate.

Closing:

Breathing picks up, the patient is told they will be put on a breathing tube, and goes to sleep.

###

(Optional- beginning may be overheard by patient with eyes closed.

Below is a sample of a full secondary survey:)

Finley (Captain):

"His right pupil is 5mm, minimally reactive, left pupil is 6 mm and reactive. He has obvious head trauma here with a **5 cm** laceration, soft tissue injury on the right temporal frontal region of the forehead. His nares are patent without any blood. Mid face is stable. Mandible has no crepitus. No cephalohematoma in the back, mild cephalohematoma in the front. Right tympanic membrane has some hemotympanum. The left tympanic membrane is intact and clear. I'm going to move down to the neck, { ROLE } hold c-spine so I can look at his anterior neck. I'm releasing the anterior portion of the collar. There are no anterior hematomas, no carotid bruit. (reaches behind neck) No gross cervical spine step offs. I'm going to put the collar back on. His chest has a large amount of ecchymosis to the lower anterior right chest, a mild amount of crepitus there. No subcutaneous emphysema. His lungs are clear but decreased breath sounds on the right. Abdomen is soft, non distended, no masses palpated. Pelvis is wrapped in a sling and felt unstable. Flanks have no ecchymosis. He has an obvious open fracture deformity to the right forearm. No gross deformities on lower extremities. Moving on to vascular. He has less than 2 second capillary refill on his bilateral toes. 1+ dorsalis pedis pulses in both feet. 1 to 2+ radial pulses in both arms. I don't see any other gross abnormalities. His urine is clear. Avery, We're going to need x-rays of his right hip and femur, right wrist, forearm, and elbow. Already have chest, already have pelvis. I'm going to cover him up to prevent hypothermia."

###

Optional SCENE 6: ED Phase 4 (Disposition and Transport)

Goal: *Demonstrate post-resuscitation huddle and transport.*

Before the patient is transported, the trauma captain will lead a post-resuscitation huddle (shared mental model) to align the team's efforts, ensure all injuries are identified, the team is prepared for transport.

(3 minutes)

Summary of Roles

Captain: Lead Shared Mental Model

Airway Physician (EMS): HUC and Family

Bedside Physician (PGY2): Prepare for Transport

Procedure Physician (intern): Prepare for Transport

Primary Nurse (T1): Manages Transport / Handover

Secondary Nurse (T2): Prepare for Transport

Nursing Assistant: Prepare for Transport

Respiratory Therapy: Prepare for Transport

Radiology Tech: __