

Trauma Patient Transitions:  
An Exploratory Study of Organizational Variables and Provider Behavior

By

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## DEDICATION

This dissertation is dedicated to health care providers who aspire for just patient care but struggle in an imperfect system.

“The time is always right to do what is right.”<sup>1</sup>  
*-Dr. Martin Luther King Jr.*

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# Chapter I

## Introduction

### Statement of Problem

Health care providers and healthcare organizations collectively aim to meet the needs of patients. They often rely on care coordination processes to meet these needs. Many studies have described the importance of structural and process elements (e.g., checklists, provider continuity, promoting communication-friendly environments) <sup>2-4</sup> in the care transitions that influence patient care and outcomes, but only a few have begun to describe the impact of provider behavior on the transition process. <sup>5,6</sup> Transition processes focus on the resources and human actions required to ensure that patient information and care accountability is passed to the receiving provider when the patient is moving from one level of care to another. This dissertation will focus on trauma patient transitions from the intensive care unit (ICU) to other units providing a less intensive level of care. These include step-downs or units or other wards within the same institution. Trauma patient transitions are the focus of this investigation because they represent a heterogeneous patient population with new and variable medical therapy plans. Trauma patient transitions demonstrate process variability and may therefore highlight opportunities for future study.

Despite years of transition initiatives focused on improving transitions, patient transitions, and provider handoffs remain vulnerable time periods for patients. <sup>7</sup> Uncovering what conditions are necessary for an ICU transition to be highly reliable is a desirable outcome. High reliability is a concept associated with organizations that operate in complex environments, such as healthcare. High reliability organizations (HROs) are organizations where any error can be catastrophic, and significant efforts are made to safeguard against such errors. Healthcare

organizations work to achieve high reliability to avoid preventable errors in patient care. Transition processes must demonstrate effective standardization and persistent mindfulness on opportunities for process improvement to be highly reliable. Many healthcare organizations strive toward high reliability, but the complexities of human factors, clinical differences, treatment idiosyncrasies, and behavior-dependent processes compounded by variably resourced environments make translation into health care challenging.<sup>8</sup> Evidence-based interventions to improve patients' outcomes after ICU transitions can only be hypothesized after the salient variables involved are well described. Robust characterization of patient ICU transition variables that encompass the structure, process, environmental variables, and provider behavior variables will be a step forward in transition science.

### **Purpose of the Study**

The purpose of this cross-sectional exploratory study is to describe the resource and process variables associated with trauma patient transitions from ICU to a lower level of care. The variables described will include environmental resource descriptions where transitions take place and provider behavior descriptions when transfers take place. To characterize the environmental processes, resource variables, and provider behaviors, it focuses on three specific aims. The three specific aims are to:

1. Describe the processes and resources based on the Administratively Mediated Variable (AMV) model that trauma centers utilize to transition patients from critical care to non-intensive care units.
2. Describe and compare patient transfer associated AMV model processes and resources between hospitals that score high versus low on a high reliability measurement scale.

3. Explore the relationships of provider attitudes, subjective norms, and perceived control on provider behavioral intentions toward patient transition processes from critical care to non-intensive care units, based on the Theory of Planned Behavior (TPB).

The data collection process incorporates data from a national database and those generated by two surveys distributed to 1) administrators and 2) providers who work in trauma critical care units. Data were analyzed using SPSS software version 27. Three journal articles are planned for dissemination after the successful completion of this dissertation.

### **Aim Synergy**

The three aims described work together to characterize important elements of individual patient transitions. Each aim could stand on its own because they draw from different theoretical mechanisms, however, they work together in the broader context of a socio-ecologic model. The three aims synergistically describe the influential variables in the social environment of patient transitions.

Social ecology was founded in the late 1960s and early 1970s when theorists began to explain how an individuals' behaviors is affected by multiple contextual layers within their environment. The theory was first hypothesized in childhood human development, with additional circular depiction development added to scope the relational layer of each category.<sup>9,10</sup> Since then, the concentric layered ring depiction has been used to hypothesize social-environmental factor influences. It has been applied in many disciplines, particularly when complex human behavior is the variable of the study.

Most health promotion studies describe the importance of addressing social environmental factors when designing successful interventions.<sup>11</sup> The factors included when

addressing health interventions include: individual, interpersonal, organizational, community, and public policy. <sup>12</sup> These social environmental factors are well represented in many socio-ecologic health promotion models. Both the Centers for Disease Control (CDC), and the Agency for Health Care Research and Quality (AHRQ) have utilized socio-ecological models to describe patient health promotion interventions. It is hypothesized that each layer contains influential variables that influence the individuals' health promotion activity. Figure 1 illustrates a socio-ecologic model utilizing the important social environment layers. It has been used recently to describe a colorectal screening health promotion intervention applied by the CDC. <sup>11</sup>



Figure 1. CDC Socio-Ecologic Model <sup>11</sup>

The model links all three aims in this proposal. Achievement of aim one will add to a description of the salient factors and resources involved in the “organizational” layer of the environment. Completion of aim two will describe a combination of the “interpersonal” and “organizational” layers. Aim three describes the patient transfer environment at the “individual” employee level. Together the aims will address three of five socio-ecologic layers.

A novel aspect of utilizing this model is how it will be applied. The health promotion model depicted in Figure 1 and described by the CDC focuses on the patient, but it can also be applied to the behavior of the health care provider. Changing the behavior focus from patient to the provider as the individual under examination will replace "providers" in the center of the socio-ecologic model. The social dependence on behavioral outcomes will be examined by the Theory of Planned Behavior, eliciting how providers perceive the subjective norms, attitudes, and perceived environmental control they have during trauma patient transitions. In addition to the "interpersonal" depicted categories, "patients" should be added within the interpersonal layer, because the provider-patient relationship is important in the providers' social environment.

Improving the social environment of provider health care delivery during trauma ICU transitions may ultimately improve patient outcomes. To describe the complexity of the healthcare environment, key variables in this study will be extracted from three frameworks. They include the administratively mediated variable (AMV) model, the principles of high reliability organizations (HRO), and the Theory of Planned Behavior (TPB). The variables in the AMV model will characterize the organizational environment from the socio-ecologic model and include the resource input dedicated to transfers.

As part of aim one, capital inputs and organizational facets from the AMV model will be characterized. Describing the organizational resources associated with trauma patient transfers will characterize the "organizational" level of influence within the socio-ecologic model.

The HRO rating of an organization, addressing the organizational socio-ecologic layer will be measured as part of aim two. Organizations that choose to place processes that focus on continuous quality improvement will drive quality innovations, which in turn may impact the labor quality as defined by the AMV model.

In aim three, outcomes are described by characterizing the “individual” and “interpersonal” layers of the socio-ecologic model. Health care provider behavior will be examined in the context of the social network environment by which they conduct transition work. Individual behaviors will be analyzed by the TPB and link to the AMV model through labor quality, employee behavior, and employee attitudes. Capturing the complexity of the environment where transitions are enacted is a key element in this study and will move patient transition literature forward. Through this multilayered approach, more impactful interventions can be developed.

### **Identifying Gaps**

Many gaps can be addressed to advance the scientific knowledge associated with transition tools based on a literature review from PubMed, MEDLINE, CINAHL, PsycINFO, and Google Scholar. Transition tools are often described as checklists. They include resource and process expectations completed by providers when transitioning patients from one unit to another. Four areas warrant research to build a platform for progress in transition tool literature. They include: 1) describing the scope and utilization of transition tools in the American healthcare system; 2) associating influential components that transcend population needs; 3) developing standardized process metrics that reflect influential components; and 4) organizing within a framework that allows for flexibility, risk adjustment, with opportunity for future hypothesis testing.

The national standard for coordinated patient-centered transition interventions does not exist. Framing how quality recommendations have progressed since mandated in 2012 will gauge how organizations prioritize coordinated transitions and will also characterize new salient variables. For example, how many organizations utilize transition tools or bundles to facilitate

high-quality transitions, and are their employees utilizing them? Do organizations currently track or monitor transfer-associated quality? What types of resources are in place to facilitate transfers? Are both structural and human resources allocated or prioritized for transitions? The first step at answering these questions will be to describe the scope of human and organizational resources at work in the AMV model (described in section two), in combination with a granular description of employees' behaviors associated with transition duties.

Current transition tools reflect the interdependent and contextual nature of health care delivery. I expect resource variability to increase as patient complexity increases over time. A single all-encompassing tool that will identify every salient element on every patient, every time, will be difficult to design. The Agency for Healthcare Research and Quality (AHRQ) has developed and recommends a handoff process named I-PASS (Illness, Patient Summary, Action list, Situation awareness, and contingency planning, Synthesis by the receiver) in 2012. Despite its attempt to be all-encompassing, many hospitals continue to design and publish population-specific handoff instruments.<sup>6,13-16</sup> The need for transition tool flexibility is demonstrated in the continued publication of new process elements hypothesized to accommodate either patient population nuances or resource considerations.<sup>6,14-17</sup> Despite these contextual considerations, common process indicators can be identified. The process indicators likely impact transition tool performance and compliance, unifying process expectations. Developing this platform can standardize salient and influential components that transcend specific patient populations, and create an opportunity for organizational accountability and patient safety.

Developing a standardized process metric reflecting influential components within a trauma ICU patient transition tool will require many studies to establish.<sup>18</sup> This descriptive study contributes to the development of transition science by examining administrative resources,

employee attitudes, and behavior toward transitions, and characterize the HRO principles reflected by their organizational leadership.

## **Research Questions**

Transition science will benefit from rigorous framework application. Its variable nature mandates a framework that allows for flexibility, risk adjustment, and room for future hypothesis testing. This descriptive study begins to answer several relevant questions but is premature in leaping toward a hypothesis regarding trauma patient transitions. This section describes questions answered by examining each of the three proposed aims.

Aim one describes the processes based on the Administratively Mediated Variable (AMV) model that trauma centers utilize to transition patients from critical care to non-intensive care units. The first associated question includes:

1. What processes and resources (labor and non-labor) are expected of ICU providers when transferring a patient from critical care to a non-intensive care unit in US trauma center hospital settings?

Aim two describes and compares patient transfer associated AMV model processes between hospitals that score high versus low on a high reliability measurement scale. The second salient question answers the following:

2. What process and resource (labor and non-labor) transition variables are associated with high reliability health care environments?

The third aim of this study explores the relationships of provider attitudes, subjective norms, and perceived control on provider behavioral intentions toward patient transition processes from critical care to non-intensive care units, based on the Theory of Planned Behavior (TPB). By studying aim three, study questions three and four include:

3. Within the confines of a feasibility design, are any provider attitudes and attributes related to provider behavioral intent when tasked with completing transition duties?
4. Within the confines of a feasibility design, are provider attitudes and attributes associated with a provider's perceived control of their transition process duties?

### **Significance of the Issue and the Need for Study**

#### Significance to national priorities

The general public, patients, and their families expect safe care when they enter any American hospital. They have been polled about their experience during transitions in a variety of formats and expressed their views and perceptions via several methods.<sup>15,19</sup> Unfortunately, poor performance continues to be highlighted by popular consumer publications. According to Becker's Hospital Review, in 2016 two of the top ten patient safety issues have components (medication errors and diagnostic errors) associated with patient transitions. Outcomes negatively impacted by poor transitions include mortality, morbidity, readmissions as well as diagnostic, medical, and medication errors.<sup>16,20-23</sup>

Transitions have an impact on every patient who survived their initial hospital unit admission. This fact has made seamless health care transitions a long-time goal of taxpayers and hospital systems. Despite years of incentive programming and monetary penalties, hospital systems continue to report patient safety events associated with patient transitions and contribute to the cost of national healthcare debt.<sup>2</sup>

In-hospital metrics have had limited characterization and represent a gap in estimating potential gains if transitions are improved. Adverse events attributed to transitions are difficult to administratively quantify. For example, a case-control study examined adverse event costs in 52 medical intensive care units, estimating an annual cost of \$853,000 per unit in preventable

errors.<sup>24</sup> Other studies have estimated transition error cost by attributing hospital readmission costs to inefficient transition care.<sup>25</sup> “In 2011, approximately 3.3 million adult 30-day all-cause readmissions took place in the U.S., with an associated \$41.3 billion in hospital costs.”<sup>26</sup> These estimates demonstrate how expensive poorly-coordinated transitions cost the American public.

Many studies link transition errors to poor outcomes, high costs, and poorly matched resource allocations.<sup>7,27,28</sup> These studies recommend smarter transition practices through organized handoff processes, often called bundles. Cost savings have been demonstrated in transfer bundles for pharmacy-based interventions in high-risk Medicaid patients.<sup>29</sup> Cost savings have also been demonstrated in colorectal and spinal surgery patients by bundling care practices.<sup>14,30</sup> Although cost savings are not the focus of this study, it is an important associated product of improving transitional care that benefits the US healthcare system.

The trauma population directly benefits from this study. Trauma patients are vulnerable to systems-based problems and human errors during transitions. As trauma patients grow in complexity, and hospitals move more at-risk patients expeditiously through the system, safety practices are critical to identify.<sup>31</sup> Describing important trauma patient transition variables will help focus efficiency, promote safety, and improve patient outcomes.

#### Significance to healthcare

Healthcare regulatory bodies have also increased the pressure to improve transition communication. Since 2006, the Joint Commission issued National Patient Safety Goal 2E, advocating for a standardized approach to handoffs and transitions.<sup>32</sup> Recommended communication interventions focus on promoting interactive communication, timely and accurate information transfer, and limiting interruptions and iterative feedback. Despite regulatory body recommendations, few gains in transition outcomes have been described.

In response to the national patient safety goals, organizations then began to focus on patient population service line resources and refining transition tools. Many institutions developed local transition tools and checklists to improve components of patient transitions and provider handoffs.<sup>33</sup> National recommendations by AHRQ also aimed to organize bundled handoff communication instruments in an ICU transition tool called I-PASS.<sup>13</sup> Despite years of recommendations, transition tool standardization has stagnated in its development and its compliance is unknown. Developing a novel evaluative framework focusing on clinical outcomes and highlighting salient transition metrics will improve patient transition care.

Applying a framework to transition concepts will begin to characterize structural components. A framework such as the Administratively Mediated Variable (AMV) depicted in Figure 2, will characterize transition tools and bundles with salient health-care organizational structure. Most importantly, the AMV model is flexible and can embed behavior models for more precise transition descriptions. For example, the culture and safety in an organization may be associated with transition tool interpersonal communication, compliance, and fidelity.<sup>34</sup>

Handoff and transition practices have led to and are likely influenced by both structural and interpersonal communication components. Advancing science in healthcare will entail building on these two interdependent areas by analyzing them together. Only by organizing, refining, and analyzing transition components will significant improvement be made in the delivery of health care.

Significance to direct clinical care

Patient safety nursing checklists have also been developed in the last 20 years.<sup>35</sup> Many of the checklists focus on procedural safety and communication-based handover techniques outlined by The Joint Commission in 2006.<sup>32</sup> Despite numerous studies, nursing studies fall

short in describing key elements required for a successful transition, particularly across patient populations.<sup>36</sup> Other non-nursing, but multidisciplinary studies have involved nursing components during full enactment of a transition tool.<sup>6,37-42</sup> Examples include nurse participation during MD handoff,<sup>6</sup> nursing opportunities to formally identify patients who are at high risk of ICU readmissions,<sup>16</sup> and revising the RN-to-RN sign-out to mirror medical problem lists during specific transition types.<sup>41</sup> Nurse practitioners have also played a pivotal role in developing many of the population-focused transition programs.<sup>43-47</sup> In many hospitals, nurse practitioners are the provider enacting a transition tool. It's safe to conclude that patient transition tools influence every level of healthcare provider educational preparation and licensure.

Describing transitions with evidenced-based frameworks that reflect the practice environment will be an important scientific step toward understanding where to focus next steps. This dissertation merges important organizational and behavioral models in complex environments to apply a clinically focused model to advance transition science.

## Chapter II

### Literature Review and Theoretical Framework

#### Theoretical Frameworks

Four organizing frameworks have been considered in characterizing intensive care to non-intensive care transitions. These frameworks work within the socio-ecologic model described in Chapter One. They include the Administratively Mediated Variable (AMV) model, High Reliability Organization (HRO) principles, the Capability, Opportunity, Motivation, and Behavioral (COM-B) system, and the Theory of Planned Behavior (TPB). This section describes the four models used to describe the important concepts thought to influence trauma patient transitions.

The administratively mediated variable model

The AMV model describes the salient capital resources and human resources that interact in a health care organization to produce patient outcomes. The model relates organizational factors, human resources, and patient characteristics in the health care setting. The broad model is a step toward health care organizational-level predictive modeling. The AMV model is illustrated in Figure 2.

The AMV model characterizes organizational and patient outcomes with success.<sup>48,49</sup> The model is flexible and portrays many possible variables to examine. The forward arrow movement toward “outcomes” infers that directional associations should be considered. It also characterizes sub-variables that synergistically impact others, such as employee attitudes and employee behavior. Every AMV can apply nursing metrics associated with patient transitions, for example, nursing resource allocation during patient transitions (e.g., employment status, competency, FTE allocation). Each variable can also examine the safety of nursing practices

during transitions. Similar studies characterize nursing allocation and competency, establishing safe work environments for patients.<sup>50,51</sup> Further characterization of provider roles will build important future interventions.

Developing study designs and interventions that consider influential variables depicted by the model is helpful in risk adjustment development. The AMV model aids in predicting healthcare organization influential constructs. The strength of this model is how openly it can be applied, but its weakness is how other constructs must be superimposed when specific microsystems (e.g., employee behavior) are not explanatory enough for hypothesis generation (e.g., applying the TPB: will be described later in this chapter). Additionally, sub-concepts such as employee behavior may require multiple explanatory mechanisms for complete characterization. For example, health care organizations have begun to describe employee behavior change through enacting high reliability concepts. In the AMV model, it is hypothesized that high reliability interventions may impact employee behavior at the organizational level but will also be characterized at the individual level using the TPB.

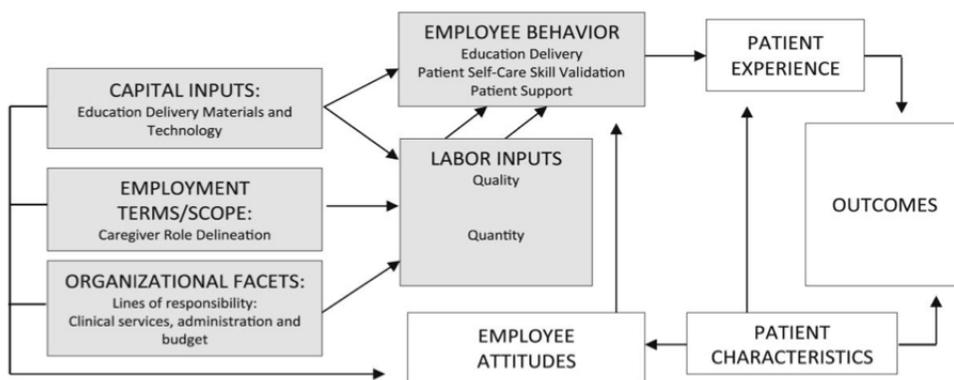


Figure 2. The Administratively Mediated Variable Model from Kleinpell<sup>52</sup> and originally described by Minnick, Roberts, Young, Kleinpell, and Marcantonio<sup>53</sup>

## High reliability organization principles

When the five principles of HROs are enacted by organizations, they promote healthy work environments. Defined in Table 1, the HRO principles work synergistically to increase the quality of employee collective awareness in an organization, enhancing the capacity to reduce failures and eliminate patient harm.<sup>34,54</sup> The HRO principles have been applied in a variety of models, targeting different aspects of the AMV variables.<sup>54</sup> “They improve efficiencies and quality of information sharing, they increase accountability, they empower a greater sense of community, and jointly enable a culture of collaboration and collegiality, ultimately resulting in an increased quality of collective awareness.”<sup>54</sup> When HRO principles are organizationally deployed, they bridge individual employee behavior with overall organizational culture. To date, most literature describes HRO principles with small sample sizes and requires a uniform measurement tool to predict other organizational facet processes.<sup>55</sup> The principles can be applied as a measure of organizational culture, indicating employee behavior success, but can also serve as a risk adjustment factor for individual employee behavior. This dissertation measures organizational level HRO concepts at trauma centers and also characterizes employee behaviors associated with the transition process for trauma patients.

### *HRO principle development*

Most health care organizations are working toward high reliability status. They must demonstrate policies and procedures that facilitate HRO principles at every level of the organization. When evaluating an organization, local intervention participants and influential organization leaders should be evaluated. The Joint Commission is an influential national accrediting body and is working toward HRO principle application in US healthcare organizations.

The Joint Commission is an independent, nonprofit organization that accredits and certifies all health care organizations in the United States.<sup>56</sup> The Center for Transforming Healthcare is a task force within the Joint Commission that aims “to transform health care into a high reliability industry by developing highly effective, durable solutions to healthcare’s most critical safety and quality problems.”<sup>57</sup> The High Reliability Model involves three domains: leadership commitment, adoption of safety culture, and robust process improvement.<sup>34</sup> This proposal focuses on critical care provider behavioral intention assimilation. Evidence suggests that there is a relationship between provider behavioral dimensions and the level of staff perception of the hospital’s safety culture. This was directly assessed in an analysis of AHRQ’s Hospital Survey on Patient Safety Culture (HSOPSC), linking perception, attitude, and behavior with patient safety.<sup>58</sup> To attribute where organizations rank on high reliability concepts, one validated question per HRO domain (five total) will aim to characterize high reliability based on validated safety culture questions. These scores were analyzed for their impact and appropriateness. The developed analysis accounts for important risk adjustments for the antecedents of behavioral intentions.

HRO scorecards can rate an organization on the culture of safety, collaboration, and collegiality.<sup>59</sup> Comparing HRO scores can highlight where collective awareness and patient safety may exist, but also signal which organizations leave individual employees to develop their own sense of situational awareness. Capturing the variability in the environment culture is integral for a meaningful interpretation of employee attitudes, attributes, and behavior within an organization.

## The COM-B system

The first two approaches in this section characterize organizations. They describe factors that influence employees in a health care organization. The last two models focus on individuals. The models emphasize attitudes and attributes of employee behavior. The culmination of organizational influences with employee attitudes and attributes results in the displayed employee behavior.

The central tenet of the COM-B model is that capability, opportunity, and motivation interact to produce a behavior. The TPB characterizes the behavior relationships at work in the employee's psychological and reflective self. To validate conceptual overlap, the TPB core domains can be linked to the COM-B model through the Theoretical Domains Framework (TDF). This framework was developed for implementation researchers to identify influences on health professional behavior.<sup>60</sup> The TDF is a comprehensive ecological framework that does not hypothesize direct relationships but identifies domains where salient relationships likely exist. Context and theoretical development are needed to test the comprehensive domains. The ecological nature expands outward to the possible environment and personal agency influences that drive behavioral change.

The COM-B system describes the basic human experiential and organic interpretation of influences that result in displayed behavior. "In this 'behavior system,' capability, opportunity, and motivation interact to generate behavior that in turn influences these components (the 'COM-B' system)."<sup>61(p4)</sup> The model definitions can be found in Table 2, and a depiction of the model is displayed in Figure 3.

## The COM-B Model

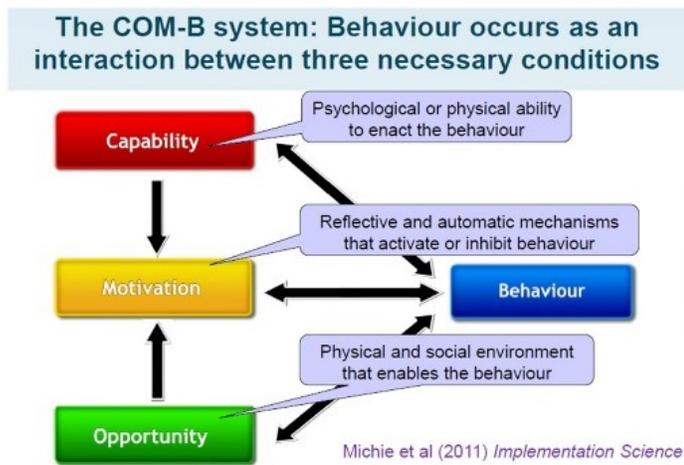


Figure 3. The COM-B Model from Michie, Stralen, West <sup>61</sup>

Capability is characterized by the psychological or physical ability an employee possesses. For health care providers, capability is influenced by state scope of practice laws, organizational privileging, and local organizational facet procedures. Motivation is a reflexive and automatic mechanism, reflecting an individuals' experience and perceptions. Organizational culture norms, collective mindfulness, and situational awareness impact how individuals signal motivation. Opportunity is the physical and social environment that would allow for a behavior. In health care, opportunity often assumes capability due to role credentialing and licensing, but allows for more influential components such as perceived control and social norms to encourage or discourage enactment.

The global inclusiveness of the COM-B model also provides a detailed understanding of psychological capability and reflective motivational processes. <sup>60</sup> The psychological reflective processes in the TDF also overlap with the processes hypothesized in the TPB. Where *behavioral regulation* overlap with the TPB through *attitude*; *beliefs about capabilities* overlap with the TPB through *perceived control*; *beliefs about consequences* overlap with the TPB

through *subjective norms*, and; *intentions* overlaps with the TPB through *behavioral intention*. These domains are all identified in Figure 4. It is important to note that the TDF is intended for prospective behavior change implementation inquiries.

This study describes a cross-sectional view of employee perception and intended behavior, and draws on the hypothesized relationships described in the TPB. The TDF model will play a role in the post-hoc analysis if the relationships proposed in the TPB are not explanatory. The comprehensive list of variables in the TDF domains will provide many alternatives to consider.

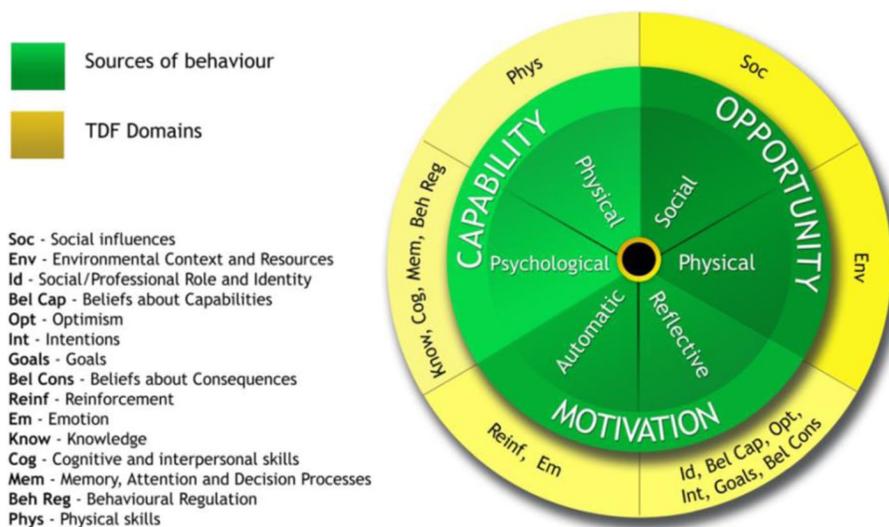


Figure 4. The Theoretical Domains Framework taken from Atkins et. Al (2017) <sup>60</sup>

The COM-B system has been used as the backbone of many studies, particularly in implementation science. <sup>61</sup> It affords a high utility and can be applied in many environments to characterize influential factors on behavior. The COM-B system is particularly important in this phenomenon to bridge the implementation science designs of transition tools and establish the pre-requisite assumptions made in the Theory of Planned Behavior.

## The theory of planned behavior

The TPB has described behavioral changes in many contexts and interventions and has demonstrated reliability over time.<sup>62</sup> It is the most widely tested and applied theory among the models described in this proposal. The theory's concept definitions can be found in Table 2. The TPB is best applied on anticipated or planned behaviors; the process and planned activities of work that are expected of employees. Whereas, the COM-B system attempts to explain all human behavior, including behavior that is reactive and emotional. The deliberate behaviors at work are characterized by perceived control, attitude, and subjective norms. The TPB has been utilized in many health-protective behavior studies, such as physical activity and smoking cessation. More recently, the TPB has been applied in health care employees' adherence in keeping patient information private,<sup>62,63</sup> but has yet to be applied to provider opinions of patient transition work.

Limitations in the TPB model include how attitudes and subjective norms do not directly influence behavior. A growing body of evidence describes the importance of social context as an integral driver of health behavior. Several studies have hypothesized that social context may be a greater influence than health belief models such as the TPB.<sup>64</sup> The aggregate evidence associated with this premise describes direct patient health beliefs regarding their own health (e.g., attaining mammograms, medication adherence, and healthcare access). The behavior under examination is less likely to be influenced by the social determinants of health described in Burke (2009) since work-role expectations of providers are different from personal health beliefs. Potential underlying biases and social contextual variables may exist within the provider workforce under examination but are likely to be different from the socio-ecologic models also described by Burke (2009). This study informs social context research. It characterizes the

context-associated biases held by health care providers, which both health belief models and social context theorists can build. For example, social ecologists may generate hypotheses regarding the etiology of inequity in health care providers' attitudes and attributes demonstrated from this study.

The TPB characterizes what variables go into the behavioral intention of a provider. This assimilation reflects the deliberative nature of the intended behavior under study. I hypothesize that each of the three inputs will act indirectly to influence the enactment of a transition tool, but only behavioral intent and perceived control act directly on enactment. Progressing through the enactment of behavior, the TPB model presupposes that transition tools will improve mortality, morbidity, readmissions, and/or increase organizational efficiency. The model is depicted in Figure 5.

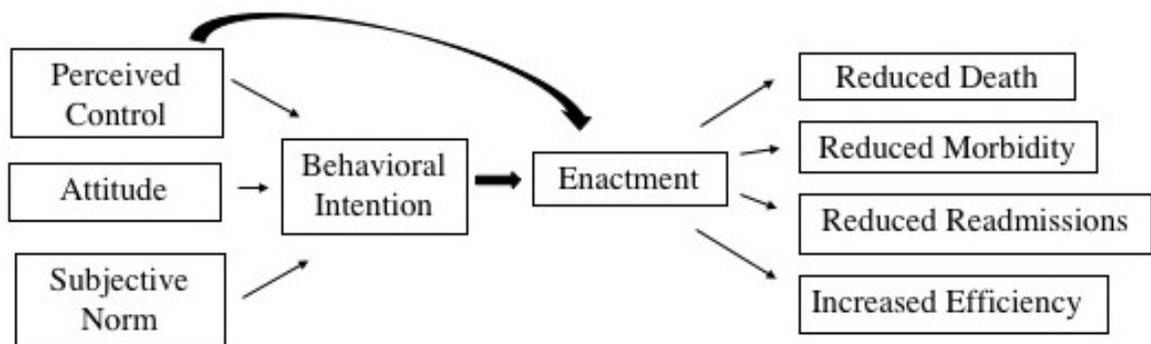


Figure 5. The Theory of Planned Behavior and transition tool outcomes.

Outcome measurement will depend on the aim of individual transition tools and will require appropriate risk adjustment. For organizations that have implemented systematic transition bundles, interpreting outcomes require characterizing the micro-environments and risk

adjustment for AMV associations to be interpreted. Risk adjustment should control employee attributes on the transition tool implementation process. Lastly, piloting the measurement instruments for reliability and validity will be important for the integration of the four models, particularly where presuppositions are made across the models.

## **Linking the Relevant Literature**

### Transitions-of-care and model concept evolution

Health-care providers have traditionally held paternalistic views toward patient care plans. This hierarchy holds them as monopolizing the role of the healer.<sup>65</sup> While components of this remain true today, the last twenty years have shifted toward patient-centered practices to increase adherence to protocols and treatment plans. Partnering with patients has demonstrated improved outcomes and significant gains in adherence to treatment regimes.<sup>65</sup> Despite this paradigm shift, the provider work that goes into transitioning a medically complicated patient is crucial to safely transition patients in acute care settings.

The acute care patient transition tool literature generally describes population-specific care plans that offer varying partnerships with patients. They are largely made up of checklists or bundles developed at individual hospitals and are specific to their workflow. Workflow specification is important for local intervention success, but limits generalization and tool validation across settings.<sup>17</sup> A common link between many of the studies, however is the importance of high-fidelity communication.<sup>66</sup> Despite this common theme, attributing what provider behavior or what communication traits are required to promote a high-fidelity information transfer during transition tool enactment is limited.

The adapted TPB model paired with transition tool outcomes will characterize categories within the AMV model. The adapted model examines how employee behavior and employee

attitudes affect the fidelity of an organizational facet and links the hypothesized outcomes. Only by integrating the organizational models (AMV and HRO) and behavior models (COM-B and TPB) will clinically meaningful characterizations be discovered. Synergistically, the described models will produce practice-level recommendations that impact organizations, providers, and patients.

#### Transition bundle outcome impact

The practice level recommendations will inform best practices, often in the form of studying transition bundle enactment. Many studies have evaluated the efficacy of transition bundles.<sup>13</sup> Transition bundles have yet to be described by provider mediators within the TPB. To date, the outcomes evaluated include mortality, morbidity, readmission rates, and a broad category labeled increased efficiency. They are depicted in Figure 5. An important but slightly differentiated subset of the increased efficiency category is transition bundle compliance. Studies that describe the compliance of a transition tool are the closest evidence that can associate behavioral intention, a critical element in the TPB.<sup>66</sup> This study characterizes the input driving provider behavioral intent during patient transition practices.

The transition bundle outcome literature demonstrates favorable, but variable effect sizes that are demonstrated in Table 3. The impact of transition bundles on patient mortality ( $r = 0.07$  to  $0.25$ ), morbidity ( $r = 0.15$  to  $0.39$ ), and readmissions ( $r = 0.04$  to  $0.29$ ) is found to be small to moderate.<sup>16,20,23,28,39,46,47,67-70</sup> The evidence describing increased efficiency attributes time saving ( $r = 0.15$  to  $0.99$ ), perception of transitions ( $r = 0.04$  to  $0.71$ ), triage transfer accuracy ( $r = 0.08$  to  $0.11$ ), ranging from small to large effect sizes. The variability in this category is unsurprising given the broad construct and the inconsistent rigor of the evidence, often relying on poorly controlled quality improvement studies.<sup>6,15,19,21-23,68,71-85</sup> Many of the contextual variables

described in the organizational and behavioral models are also left unaccounted, where this study will begin to fill these gaps.

When applying the TPB to provider work activities, I anticipated larger and more consistent effect sizes when compared to the general public health promotional studies. The planned nature of work-related activities should by design have capability built-in, and demonstrate a higher degree of motivation because of work-role accountability. Table 3 also describes the effect sizes found in a variety of analogous fields (personal protective behaviors and exercise intention), where the TPB concepts were applied. Moderate to large effects sizes were demonstrated in perceived control ( $r = 0.57$  to  $0.25$ ), and moderate effect sizes found in attitude ( $0.23$  to  $0.36$ ) and subjective norms ( $0.30$  to  $0.32$ ).<sup>62,86</sup> Only enactment of personal protective behaviors ranged from small to moderate ( $0.18$  to  $0.40$ ).<sup>75,87-91</sup> In addition to characterizing the TPB behavior variables characterized in these effect sizes, this dissertation describes the trauma patient transition environment, allowing for more adept interpretations and future applications.

#### Summative evidence and dissertation direction

The state of transition bundle evidence is multifaceted and complex. Factors that drive the variability in transition bundles are a complicated network of relationships described in the AMV model. The complexity of the phenomenon is also reflected by the number of outcome measurements described in Table 3. Despite network (AMV) complexity, none of the studies portrayed negative effects or worse outcomes when a transition tool was deployed. A summative conclusion leads me to believe that by understanding the conditional input of a transition tool, a more accurate characterization of the contextual variables will be defined. Two areas yet to be described include: 1) the perceived control elements reported by providers when performing

common processes to transition patients from the ICU to the non-intensive unit, and 2) the attitudes and attributes of providers including the subjective norms front-line providers report when performing these processes.

This dissertation presupposes the complexity of the administratively mediated variable model and aims to build the evidence associated with transition processes with the Theory of Planned Behavior. Figure 5 demonstrates the TPB tenets with the outcomes described in the transition tool evidence. The TPB allows for a rich behavioral description of influential environmental and provider behavior components that impact trauma patients as they transition out of a critical care environment.

### **Definition of Terms**

Defining the terms and operational constructs is important for sound proposal construction. The AMV model definitions will be utilized from Moore,<sup>49</sup> the COM-B model definitions are taken from Michie et al.,<sup>61,92</sup> high reliability organization definitions are from Vogus and Hilligoss,<sup>93</sup> and the tenets of the TPB are from Ajzen.<sup>94</sup> These definitions can also be found in Table 1 and Table 2. The research aims described in Chapter One drives the research questions in this dissertation. To ensure study specificity, a list of definitions from the aims is provided below.

- **Processes:** A set of interrelated or interacting healthcare activities that transforms an input into outputs. In transition science, it focuses on the resources and human actions required to ensure that patient information is passed to the receiving care team during a patient transition.
- **Trauma centers:** Are hospitals equipped to staff and provide care for patients suffering from major traumatic injuries such as falls, motor vehicle collisions, or gunshot wounds

and are *designated* by the state government. In the United States, hospitals are designated as ACS *verifies* trauma centers when they meet specific criteria established by the American College of Surgeons (ACS). It requires the trauma center to pass a site review by a verification review committee. <sup>95</sup>

- **Providers:** A health care provider is a person who *provides* a health care service to patients. They are licensed professionals who are authorized to practice by the law of that state or country and must practice within the scope of his or her practice as defined under such law.
- **Transition:** The action of a patient moving from one level of care to another; associated with a change in health care resource allocation and/or a change in provider team.
- **Patients:** Adults who are admitted to an acute care unit.
- **Critical care:** Intensive care units that specialize in the treatment of severe and life-threatening illnesses and injuries, which require constant care, close monitoring and support from specialized technology, equipment, and medications designed to return normal physiologic bodily functions.
- **Non-intensive care units:** Adult care units with a reduction in monitoring and an increased patient to RN ratios; patients on these units do not require the specialized treatment, equipment, and staff ratios of the critical care units.
- **Patient transfer associated AMV model processes:** The operationalized transition processes include general workflow processes for transitioning patients, presence of a transition tool, a process for patient and family transition preparation, standardized transition data transfer, and the unit preferred communication mode for transition information.

- **Hospitals:** Are institutions where the sick or injured are provided medical or surgical care. All hospitals in this investigation will also be trauma centers, described above.
- **High reliability measurement scale:** One five-point Likert item scale for each of the five high reliability organization principles (see Table 2 for each principle) characterizing the strength of each principle within each trauma center.
- **Attitudes:** A behavioral evaluation of an object, concept, or behavior along a dimension of favor or disfavor, good or bad, like or dislike. <sup>96</sup>
- **Subjective norms:** This is the perceived social pressure to engage or not to engage in a behavior. <sup>96</sup>
- **Transition processes:** A set of interrelated or interacting health care activities that cluster interventions to safely move patients from one level of care to another, synergistically promoting patient-specific situational awareness.
- **Perceived control:** People's perceptions of their ability to perform a given behavior. In this model, *process variables* influence people's behavior. <sup>96</sup>
- **Behavioral intension:** The provider's subjective probability that he or she will perform a behavior. <sup>96</sup>

## **Chapter III**

### Methodology

#### **Introduction**

To clearly describe the research approach, Chapter Three is divided into two sections. Each section is organized by the study aims, because different designs, methods, and instruments were required. The first section describes the design and methodology for aims one and two, and the second section describes aim three. Despite the various methodologies and sampling plans, the overall mixed method design explored a single setting, the trauma intensive care unit. It enabled description and exploration of the resources, processes and provider behaviors (attitude, subjective norms, perceived control, and behavioral intent) associated with patient transitions from the trauma intensive care units (ICU). The patient transition of interest is limited to patients who transferred from the trauma ICU to other non-intensive care units within the same hospital.

#### **Aims One & Two**

Aim one: to describe the processes and resources based on the Administratively Mediated Variable (AMV) model that trauma centers utilize to transition patients from critical care to non-intensive care units. Aim two: to describe and compare patient transfer associated AMV model processes between hospitals that score high versus low on a high reliability measurement scale. The important elements of each aim were mapped by survey and dataset question (Table 4) and the reader is referred to this in each section.

#### **Design**

Aims one and two were achieved via a descriptive cross-sectional design.

### *Design rationale*

A great deal is known about individual hospital site transition instruments. The literature draws from patient safety and human factors literature.<sup>6,7,16,65,97-100</sup> Transition variable descriptors are scientifically advanced, thus, have progressed past the need for a qualitative design. Advancing transition science should include framework organization, national practice pattern characterization, and variable impact assessment. The purpose of this design is to be descriptive and hypothesis generating.

The descriptive design will not allow for causal inference but is appropriately matched to the proposed aims and the current state of scientific evidence. Analysis techniques were chosen to fit the design and added study credibility. The analysis plan was descriptive and exploratory, attempting to discover what processes and resources exist.

### Methods

To carry out the descriptive cross-sectional design, a multi-method approach utilized an administrative survey and an existing national hospital dataset. The survey was distributed to an administrator at all level one and two trauma centers in the United States. A large national hospital database extraction from the American Hospital Association (AHA) paired data regarding the trauma centers with those that return a survey. Extracting these data elements also reduced the burden of questions in the administrator survey.

#### *Administrator survey: content and instrument development*

The administrator survey captured process and resource variables salient to trauma patients as they transition from the ICU to non-intensive care units. The survey contained three types of questions: 1) organizational structure, 2) transfer processes, and 3) high reliability. Two frameworks guided these questions. The first is the Minnick and Roberts Outcome Production

Model.<sup>101</sup> It organized Administratively Mediated Variables thought to influence patient outcomes. The administrator survey aimed to categorize trauma centers' process and resource variables through: organizational facets, employment scope, and labor input associated with ICU transitions. The second guiding framework was the principles of high reliability organizations.<sup>93</sup> Five questions focused on high reliability concepts, characterizing trauma unit work environments. Definitions for these categories can be found in Table 1.

Questions about the organizational structure were taken from a validated administrative survey developed by Minnick et al. (2007).<sup>102</sup> Survey questions directly or indirectly addressed the salient unit-level AMVs thought to impact the clinical environment where trauma patients transition. The original survey examined unit-specific variables associated with restraint practices, therapy disruption, and falls in ICUs and non-ICUs. In a few questions, word changes were made to reflect transition practices, as the matter of subject.

Questions that focused on transition processes were developed by the candidate. The responses for these questions were based on the most salient and recurrent concepts mentioned in an elicitation study conducted by the candidate. The elicitation is described in the section that describes methods for aim three. Transition variable questions categorized the transition processes and resources. The administrative survey and written correspondence associated (recruitment postcard, cover letter, and survey) are available in Appendix A.

The high reliability questions were derived from the five conceptual tenets of high reliability organizations (HROs) that translated from safety culture validated survey questions.<sup>54</sup> The five concepts include: preoccupation with failure, sensitivity to operations, reluctance to simplify operations, commitment to resilience, and deference to expertise; definitions can be found in Table 1. High reliability concepts linked associations of employee behavior and

explored its use as a possible risk adjustment variable for employee behavioral outcomes. It also rated the five domains of high reliability from the perspective of an administrator through the validated culture of safety questions. Four of the questions were from the Stanford PCSI safety culture survey and one was from the SAQ questionnaire.<sup>103,104</sup> These questions described the organization level presence of each of the five HRO domain concepts. Additionally, each question was chosen because it was rated as reliable for administrator completion.<sup>103,104</sup> The questions focused on the presence of safety programming; they did not characterize the quality of this programming. These questions maintained the Likert 5-point scale by which they were developed and tested.

The administrator questionnaire was tested with potential respondents (n = 6), using the Dillman (2014) format to determine survey time requirement, data availability, ease of use, and comprehension.<sup>105</sup> The procedure included question/content construct feedback, and feasibility testing. Feasibility examined both the ease of data availability and data analytic perspectives. Two cognitive interview techniques were utilized; a think-aloud cognitive interview (n = 3) was conducted and a silent survey completion (n = 3) with a retrospective interview. Both techniques illuminated word comprehension but the latter technique (silent survey completion with a retrospective interview), demonstrated whether a respondent can navigate through the questionnaire properly. During the silent survey completion, respondents circled any unfamiliar word, or unclear item while completing the survey. A retrospective interview with the test-respondent helped the candidate identify problem items, phrasing, or survey construction concerns brought up by the test-respondents. The answers were reviewed and verbally confirmed with the respondent for comprehension. A detailed item analysis with these expert reviewers informed the decisions to drop or modify complex questions. The resultant survey balanced

theoretical salience, rigor, and feasibility that encouraged a robust response rate and successful completion of the administrator survey. The resultant survey can be found in Appendix A.

*Administrator survey: survey administration*

Post-cards were the first point-of-contact sent to all level one and two trauma center program managers or directors, identified by the American Trauma Society (ATS) database (N = 567). Introductory post-cards have demonstrated an increase in response rates across a variety of populations, with very little extra cost.<sup>105,106</sup> Mailing post-cards and surveys to all level one and two trauma centers was possible within the scope of this dissertation. Including level three and four centers would result in the list growing to several thousand centers, where scope and feasibility would be significant. Post-cards described the topic of study, that a future mailing with a paper survey was to be expected, and that the study will be mentioned by a Society of Trauma Nurses (STN) communication. The announcement described the importance of the study and included an email link to the candidate for inquiries regarding the study itself or for enrollment eligibility. Sending a notification post-card increased the legitimacy of the study and likely improved the overall response rate.<sup>105</sup> Paper materials were sent by standard US Postal Service mail.

The Society of Trauma Nurses agreed to cooperate and publicize this study. Based on a phone conference with an administrative representative at STN, the candidate, and Dr. Ann Minnick on August 26<sup>th</sup>, 2019, an agreement of shared interests and cooperation was discussed. The society's expectations were within the scope of the Vanderbilt University graduate school in terms of data rights, analysis, and dissemination. The letter of understanding submitted to STN is in Appendix C. The STN provided a distribution list to the candidate, a webpage announcement, and communication of support for the study.

Paper surveys were sent out the week after the post-card. They were used to encourage a robust response rate. Paper surveying was the chosen method because a comprehensive trauma center physical address distribution list was available to the candidate, whereas a trauma manager/director email list does not exist. Emailed surveys also suffer from lower response rates when compared to multimodal instrument access point studies.<sup>105</sup> The content of this survey may also require the respondent to pause and return to the survey, making a paper survey easier than an electronic version to return-to.

The first mailing contained a cover letter, the administrator survey, and a self-addressed postage-paid envelope. An option to complete the survey via electronic format was also offered in the cover letter. The electronic link connected the respondent to the encrypted, internal review board (IRB) approved Research Electronic Data Capture (REDCap) site operated by Vanderbilt University. Data from the paper surveys were transcribed into the REDCap software program by the candidate. A second independent data entry person entered ten percent of the data to assure data transfer was accurate. The resulting two databases were compared with less than one percent variations. The data entry errors were reconciled with the paper copy, no systematic issues were uncovered. Surveys completed electronically automatically enter and store in REDCap.

Two follow-up mailings were separated by three-week intervals were sent via the US postal mail to non-responders. After a survey was received by the candidate, the institution was taken off the mailing list for future mailings. An email from STN described the importance of the study and was distributed by STN after the first paper survey mailing. Paper and electronic surveys were identical in content. Both aimed to reduce non-response error by utilizing a variety of question styles, clearly written questions with limited question sensitivity.<sup>105</sup> Paper surveys

were printed on light blue paper with black boldface print to increase response rates and readability of the survey. Detailed descriptions of sampling and recruitment procedures are described in the following sections.

*Strategies to ensure human subjects protection*

A single site IRB approval was obtained through Vanderbilt University. The study was approved as an exempt study due to the voluntary nature of autonomous individuals who are not in a protected class, and because there were no sensitive health information data elements. The letter of IRB approval was available upon request to all contacted sites, and the IRB stamp approval number was affixed to all surveys. All respondent data was kept in REDCap and was identified only with a record ID number and site number. The site number existed separately on an excel spreadsheet housed locally on the candidate's encrypted computer. Individual administrator and provider identifiers were not required in the survey data. After paper surveys were transcribed into REDCap, they were kept behind a locked door in a university office. They will be destroyed after the resultant manuscripts are accepted for publication.

All study data were maintained on the candidate's computer as encrypted files and within REDCap. The data files used to analyze in statistical software only contain a site ID number. Site identification and ID numbers were kept in a separate password-protected and encrypted file. During analysis, the data was available to the candidate's dissertation committee for confirmatory analysis purposes. Files were only shared across encrypted university servers. The cleaned data files will be kept for a time period of six years by the candidate for any follow-up questions that may arise.

### *Administrative survey: validity, reliability, and credibility*

Several efforts were made to uphold the validity of concepts tested, reliability of data, and overall process credibility. Overall, the administrative survey underwent testing as previously described. Salient details regarding the validity, reliability, and credibility of the administrator survey are described below.

The organizational questions were based on a validated survey developed by Minnick et al. (2007).<sup>102</sup> Most of the format and layout of the questions were maintained for reliability testing. Some questions were modified to make the survey easier to complete. In the original version, several questions required direct interview interpretation. To improve the fidelity and response rate of these questions, they were simplified. Some were eliminated or altered for clarity after expert reviewers tested them.

The transfer process questions were novel without previous surveys to draw from. Where appropriate, original questions were written by the candidate based on two areas. The first was from the Minnick et al. (2007) survey, where fall prevention and therapy disruption processes were modified to capture transfer processes. The second was from an elicitation study regarding transition practices by providers conducted by the candidate. Details on the elicitation study are discussed later. Construct validity was maintained for these questions by drawing on the elicitation study content analysis and the survey validation procedures described earlier in this chapter.

The high reliability organization (HRO) questions were abstracted from safety survey questions from two previously validated safety questionnaires described above. Conceptual cross-walking the safety questions to the HRO domains were verified with an expert panel and have been tested in multiple surveys.<sup>103,104</sup> These questions were commonly utilized throughout

the safety literature and enhance the ability to compare to other areas. Validity was obtained through direct question verification and cross-validation that ensured conceptual differences were not a threat.<sup>107</sup>

Overall study credibility was addressed through well described and transparent procedures and included validation procedures of the administrative data and survey. Pilot testing was conducted at Penn Medicine. Penn was excluded from study enrollment due to the candidate's managerial role within the health system to prevent the possibility of data bias.

#### *Administrative dataset*

As a strategy to reduce the administrative survey burden, the annual hospital survey from the American Hospital Association (AHA) was used to characterize hospital AMVs as well as trauma center demographics. "The AHA is a national organization that represents and serves all types of hospitals, health care networks, and their patients and communities."<sup>108</sup> Its representative membership network includes about 5,000 hospitals.<sup>109</sup> The AHA compiles an annual comprehensive census of nearly 6,300 hospitals. The data points captured describe many topics, including demographics, operations, service line, staffing, c-suite information, expenses, physician organization structures, beds, and utilization.<sup>109</sup>

The resource elements selected from this database were hospital-level characteristics that aided in AMV categorization that likely impacted the trauma ICU. The AHA dataset was obtained from Vanderbilt University. The trauma centers that returned the administrative survey had AHA data extracted and merged for analysis. The benefit of utilizing the dataset was the reliability of its composition and the burden reduction in the administrative survey. Individual items were examined by the candidate for validation, based on the size and trends of known organizational variables. Discordant variables were verified through an online hospital search or

by contacting the hospital for verification of information. Three instances of multiple returned surveys by the same institution were resolved through email correspondence to identify the correct survey to analyze. The data were compiled in an SAV file for analysis in SPSS. Verifying data from the database obtained was conducted by the candidate.

## Subjects

### *Administrator survey: sampling*

A national list of all trauma centers was obtained from the American Trauma Society (ATS). The list was organized by trauma centers level (1-4) designation. Only level one and two trauma centers were selected (n = 567), representing the complete population of interest. A list of hospital trauma program managers/directors with direct mailing addresses were obtained from the Society of Trauma Nurses (STN). The candidate compared the datasets, and missing trauma center contacts were identified through web-searching each trauma center website where available. Centers with unidentified program managers/directors were mailed the survey at the address provided from ATS addressed labeled "Trauma Program Manager/Director." Based on the available listing from STN and ATS, the level one and level two trauma center universe was surveyed. Rather than choosing a sampling technique for the administrator survey, the entire target population was accessible through the availability of national organizing bodies. This eliminated any systematic biases associated with sampling.

Survey access to administrators was accomplished through the US Postal Service, and by electronic format. Postal addresses were available for all level one and level two trauma centers in the ATS database, but they lack the identifying name of trauma administrators. STN has greater than 500 identified level one and level two trauma administrators in their database. After the first mailing, the STN emailed a communication to their listed manager/directors reminding

them about the project. The communication included the candidate's contact information for any manager/direct who wanted the electronic survey emailed directly to them. The STN email was communicated by STN between paper survey mailings.

For trauma centers not represented in the STN database, a web-search for the administrative contact was attempted by the candidate to complete the STN contact list. In the case of a missing administrator contact name, the survey was addressed to "Trauma Program Manager/Director."

According to ATS, a total of 567 level one and two trauma centers existed in the United States at the time of survey commencement. To assess likely response rates by examining similar studies, a 2014 national survey of trauma centers was reviewed for its procedures. A response of 391 trauma centers (70% response rate) was described. The study utilized monetary incentives as well as multi-modal survey instruments to increase the respondent response rate. The study investigators utilized a \$30-dollar incentive for either a telephone, electronic or paper survey completion.<sup>110</sup> In another national trauma center survey that lacked monetary incentives, a total of 137 centers were recruited, a 78.7% response rate.<sup>111</sup> It thus appears a monetary incentive may not be necessary to obtain a minimum goal of 140 centers (25% response rate) that was required for descriptors and associations to be analyzed from aim one and two. A greater than 30% response rate was desired. Procedures that encourage higher respondent response were enacted by the candidate and are described below.

#### *Administrator survey: subject recruitment*

Several strategies encouraged trauma center enrollment. Addressing the surveys to reach the current administrator increased the likelihood of respondent response. Multiple survey modes were offered (paper and electronic) with multiple opportunities to respond. An initial post-card

mailing that briefly introduced the study was mailed to the program managers/directors, increasing the legitimacy of the study. Three US Postal Service contact attempts at three-week intervals were made to increase respondent participation.<sup>105</sup>

#### Analysis: administrative survey and dataset assessment

Administrator surveys were checked for duplicates for any single center. Duplicates were compared for response differences and completeness. For hospitals reporting differing responses, the candidate contacted the trauma program director to verify the data. Only one survey per institution was included in the analysis. Ten percent of the paper surveys were re-entered by a third party; discrepancies were found in < 1% of responses. Errors were corrected with the original dataset.

IBM SPSS Statistics software version 27 was used for data analyses.<sup>112</sup> Surveys were evaluated for missing item responses using counts of missing responses within each institution and frequency distributions. Missing data were not imputed or carried forward due to the inability to discern if missing data was random or systematic. Once a data-set of survey responders (institutions) were established, those respondents were linked to their respective records in the AHA database. Characteristics of the institutions included in the analyses were compared to those not included to assess possible sample bias and generalizability of findings. Furthermore, characteristics reported via survey were compared to those respective values in the institution in the AHA database. Large discrepancies were verified with the trauma program director/manager for any institution(s) in question. The candidate then determined which response value best characterized the aim of interest. The verified and precise value was included in the analysis.

The administrator survey also contained an instrument to measure the five domains of high reliability. Each of the five domains were scored on a five-point Likert scale. A five indicated a positive rating of “always,” whereas a one indicated the opposite rating of “never.”

#### *Aim one analysis*

Aim one: to describe the processes and resources based on the administratively mediated variable (AMV) model that trauma centers utilize to transition patients from critical care to non-intensive care units. Frequency distributions were used to describe the distributions of transition processes and resources used by the centers.

#### *Aim two analysis*

Aim two: to describe patient transfer associated AMV model processes and resources reported and compare those responses from hospitals that scored high versus low on a high reliability measurement scale. Summaries of the frequency distributions were reported. A total reliability score was calculated by adding each variable category for a total score range of 5 to 25. Medians (IQR) were used to describe the ordinal and skewed continuous data.

#### **Aim Three**

Aim three is based on the Theory of Planned Behavior (TPB), and explores the relationships of provider attitudes, subjective norms, and perceived control on provider behavioral intentions toward patient transition processes from critical care to non-intensive care units. In addition to achieving aim three, this design described the feasibility of utilizing this instrument and methodology in the trauma ICU provider population. The procedures for aim three may establish whether more sophisticated and expensive designs should be considered in the future.

## Design

Aim three was accomplished through a descriptive cross-sectional design.

### *Design rationale*

This arm of the study sought to explore aspects of provider behavior and relate to process and structural aspects of health care delivery. It was the first study to describe employee behavior characteristics in this environment. A descriptive design was appropriate to explore this phenomenon.

In addition to the appropriateness of the descriptive cross-sectional design, it is within the scope of dissertation study resources. It was relatively quick and easy to conduct. Data capture occurred at one site and at one time for each respondent. This design provided a descriptive analysis for hypothesis generation that will inform future outcomes research. <sup>113</sup>

To build on the findings described in this dissertation, it is important to consider the weaknesses of this design for the future. Longitudinal designs are required for causal inference, and associations made in a cross-sectional design must be interpreted with caution. Appropriate risk-adjustment and population/setting assumptions were considered in the analysis portion, particularly as future recommendations were discussed.

## Methods

### *Provider survey: content and instrument development*

The provider survey was designed to elicit behavioral components thought to influence patient outcomes. The hypothesized framework can be viewed in Figure 5 and is based on Ajzen and Fishbein's Theory of Planned Behavior (TPB). <sup>114</sup> The survey rated provider attitudes, subjective norms, perceived control, and behavioral intentions of trauma patient transfers from critical care to non-intensive care areas. It also captured provider experiences with transition

processes and medical errors. The definitions for the Theory of Planned Behavior concepts are found in Table 2.

The provider survey development was guided by Ajzen's instructions for the TPB questionnaires.<sup>94</sup> In preparation for proper stem and foil construction, an elicitation study was completed by the candidate. After the candidate received IRB approval, qualitative interviews were completed on six individuals. Interview respondents were selected from three hospitals, one to represent the east coast, one in the mid-west, and one on the west coast to ensure concept transferability. One RN and one MD/NP were selected from each hospital for a total of six interviews. The five questions asked during the telephone interview can be found in Appendix A. Content analysis with an audit trail was conducted, demonstrating reduced concepts for application to the survey. They were categorized by attitude, subjective norms, perceived control, and behavioral intent. Transfer process concepts were also reduced for use in the administrator survey described in section one. The steps in Ajzen (2016) were utilized to construct the survey.

The provider survey used a Likert 7-point scale where appropriate, per the recommendation of Ajzen (2016). Each TPB theoretical domain was scored on a seven-point scale. A seven indicated a positive rating anchor, whereas a one indicated a polar opposite anchor. For example, the attitude anchor pairs included: 1) easy and difficult; 2) important and not important, 3) increases safety and decreases safety, 4) professionally satisfying and dissatisfying, and 5) personally satisfying and dissatisfying. Each domain (attitude, subjective norms, environmental control, behavioral intention, and historical behavior) had independently tested anchors. Where appropriate, total scores were calculated by adding each of the five category ratings creating a range of scores (7 to 35). Aggregating the respondent ratings provided

stability in outlier respondents but can demonstrate significant variability, due to the potential range in scores. The survey is available to view in Appendix B.

*Provider survey: survey administration*

A US level one trauma center was chosen to enroll providers for aim three exploration. The site was chosen by the candidate, where a known researcher was available to facilitate access to the target population and serve as a site sponsor/sub-PI. The candidate and site sponsor completed recruitment and study advertisement virtually due to the international pandemic. The site sponsor/sub-PI helped facilitate the local IRB process, presented the study at key meetings, and described the importance of the study. The sponsor also maintained survey availability to the provider teams. Paper and electronic surveys were distributed to every provider who does the work of transitioning patients from the trauma ICU to non-intensive units. Paper surveys were available on the trauma unit and via an electronically linked REDCap email that was sent to the providers weekly for four weeks after study commencement.

Electronic surveys were sent directly to REDCap for safe storage. Data from paper surveys were transcribed into REDCap by the candidate and ten percent were transcribed by a second independent data entry person. The resulting two databases were compared. REDCap maintained data safety behind a password-protected site. Details regarding sampling and recruitment procedures can be found below.

*Strategies to ensure human subjects protection*

The provider survey data protection followed the same procedures as the administrative survey described above. In addition to the procedures described, the candidate also corresponded with the site sponsor for the best approach to IRB attainment for the hospital site. This resulted in a secondary IRB approval at the institution. The letter of IRB approval from Vanderbilt was

provided to the site sponsor and in the local IRB submission. A separate expedited review was approved at Vanderbilt and the enrolled institution.

*Provider survey: validity, reliability, and credibility*

Construct validity in the provider survey was ensured through the elicitation study, content expert review, and face validity testing that was completed with NPs/RNs who do the work of transitioning trauma patients at Penn Medicine. The survey construction technique was based on the TPB. The steps for survey construction have been utilized and described in hundreds of studies, demonstrating validity and reliability.<sup>62,115,116</sup>

Reliability testing on TPB studies has been described extensively.<sup>62,63,94</sup> Instructions for survey construction were followed. The most important elements included: conducting an elicitation study and utilizing a seven-point rating scale. Seven points are described as more reliable than five points, but also prevented respondents from being too neutral in their responses.<sup>63</sup>

A pilot test was run after the study was approved by the IRB. An item analysis was conducted to identify any items that should be looked at more closely. Appropriate descriptive statistics were utilized to assess for systematic biases.

Subjects

*Provider survey: sampling*

This survey was given to providers who do the work of transitioning patients from the ICU to other non-intensive care units at a single trauma center. The sample of providers included registered nurses (RN), nurse practitioners (NP/APRN), physician assistants (PA), and physicians (MD/DO). Ideally, every provider who transitions trauma patients from every hospital

that returned an administrative survey would be enrolled. This robust sampling plan is not feasible for a dissertation project, it exceeds a reasonable budget and timeline.

The proposed provider sampling plan aimed to recruit providers from a trauma center where a local sponsor could partner with the candidate for successful recruitment. The trauma center was identified through contacts of the candidate. A total of 103 surveys were distributed to providers at the trauma center. This sample allowed for exploratory and correlational descriptions where relationships may exist in the proposed model. It served as a pilot study for future work.

Providers from the trauma ICU were identified and enrolled by the site sponsor at the selected trauma center. Paper and electronic surveys were made available and administered directly to respondents and through the site sponsor. Sampling aimed for the nurses to represent a 5:1 compared to other providers, due to the typical care team distribution of 2:1 patients/nurse versus 10:1 patient/provider ratio.<sup>117 118</sup> Provider inclusion was limited to providers (RN, MD, DO, NP/APRN, and PAs) who complete the direct work of transitioning trauma patients from critical care (ICU) to non-critical care units. All other provider roles or indirect patient care providers were excluded.

#### *Provider survey: subject recruitment*

A brief presentation was planned with the site sponsor to recruit providers across multiple days. The presentation included 1) background on theoretical constructs, 2) the need for improving patient transitions, and 3) the gap this study aims to address. It was also represented in an advertisement flyer. The flyer can be found in Appendix B.

Paper survey copies were made available and were made available on the unit for continuous provider access for a period of four weeks. Extra surveys were mailed to the site

sponsor. Surveys completed were collected by the site sponsor. The sponsor returned the completed paper surveys to the candidate after the five-weeks of site enrollment.

After the initial presentation, provider data collection commenced. In addition to paper surveys, the survey was distributed by an electronic link to all the trauma ICU providers. The link was live for a total of five weeks. The email contained the cover letter information and a link to the provider survey. The provider survey and cover letter can be found in Appendix B. Follow-up emails recurred weekly for four weeks, allowing for a week of respondent time after the last email attempt. The emails came directly from REDCap and automatically stopped once the respondent completed the survey, or after the fourth email attempt. The multimodal approach with multiple attempts likely increased the rate of respondent response.

A direct email link to the provider survey was also provided to the site sponsor and unit nurse manager for electronic distribution at their discretion. A 70% response rate was anticipated due to the multi-modal methodology and site sponsor's engagement and credibility with the provider teams.

Analysis: provider survey assessment

All returned surveys were included in the analysis. Ten percent of the paper surveys were re-entered by a third party. IBM SPSS Statistics software version 27 was used for data analyses.

<sup>112</sup> Surveys were evaluated for missing item responses within each domain using counts of missing responses. If at least 3 of the 5 items in a domain had been completed, a score for that domain was prorated to a 5-35 scale from the completed responses.

*Aim three analysis*

Aim three: to explore the relationships of provider attitudes, subjective norms, and perceived control on provider behavioral intentions toward patient transition processes from critical care to non-intensive care units, based on the Theory of Planned Behavior (TPB).

Median and IQRs were generated for each theoretical domain score, as well as the aggregate total domain score. Kruskal-Wallis tests were used to compare the distributions. An alpha of .05 was used for determining statistical significance. Post-hoc tests were conducted in cases of statistical significance. A Mann-Whitney U test required Bonferroni-corrected differences at the  $p < .008$  level to determine statistically significant categorical differences.

## **Chapter IV**

### **Results**

#### **Administrator Survey**

##### Procedure fidelity and data preparation

The survey procedures were conducted as described in Chapter Three. Ten percent of the data was transferred from paper surveys to electronic media and were independently verified for accuracy. Minimal discrepancies (< 1%) were reconciled and validated. Missing data were assumed to be informative and thus no imputation of missing data values was conducted. SPSS version 27 was used for the analysis. <sup>112</sup>

##### Response rate

The American Trauma Society recognized 567 United States level I and II trauma centers in 2020. Surveys were mailed to all of these trauma centers. A total of 152 center administrators returned either a paper survey (N = 109) or completed the Research Entry Data Capture (REDCap) web-survey version (N = 43). The overall response rate was 27% (N = 152).

#### **Aim One**

##### Trauma center characteristics: Table 5

The characteristics of all US level one and two trauma centers and those of the survey respondents were compared (Table 5). The respondents appeared to be representative of the population total characteristics; no significant differences were noted.

**Table 5. Aim 1: Characteristics of Level I and II US Trauma Centers and Survey Responders**

<b>Trauma Center Characteristic</b>	<b>State Designated Level I &amp; II Trauma Centers</b>	<b>Responders</b>
	<b>N = 567</b>	<b>N = 152</b>
<b>Trauma Center Level</b>	<b>% (N)</b>	<b>% (N)</b>
State Designated Level 1	39 (219)	33 (50)
State Designated Level 2	61 (347)	67 (102)
<b>ACS Verified <sup>a</sup></b>	61 (347)	64 (97)
<b>Ownership</b>	<b>N = 558</b>	<b>N = 151</b>
Government, nonfederal	15 (85)	17 (26)
Government, federal	<1 (2)	<1 (1)
Nongovernment, not-for-profit	74 (411)	72 (109)
Investor owned, for profit	11 (60)	10 (15)
<b>Hospital Capacity</b>	<b>Median (IQR)</b>	<b>Median (IQR)</b>
Total licensed beds	<b>N = 510</b>	<b>N = 136</b>
	469.5 (370.5)	452.5 (385)
Trauma ICU beds	<b>N = 378</b>	<b>N = 102</b>
	21 (17)	20 (13)
Total facility inpatient days	<b>N = 558</b>	<b>N = 151</b>
	104,132.5 (98,264)	99,276 (106,804)
<b>Financial Variables</b>	<b>N = 558</b>	<b>N = 151</b>
Medicare certification	98 (555)	99 (150)
<b>Organizational Facets</b>	<b>N = 488</b>	<b>N = 129</b>
ICU intensivist model	95 (464)	92 (119)
Closed intensivist ICU model	22 (123)	16 (24)
<b>Labor Inputs</b>		
Dedicated ICU intensivist FTEs	<b>N = 412</b>	<b>N = 106</b>
	9 (13)	8 (13)
APRN/PA employed by hospital	<b>N = 483</b>	<b>N = 129</b>
	96 (462)	96 (124)
<b>Teaching Status</b>	<b>N = 454</b>	<b>N = 147</b>
Report hospital trainees	68 (307)	29 (42)
COTH member <sup>b</sup>	<b>N = 558</b>	<b>N = 151</b>
	32 (180)	29 (44)
Non-teaching	<b>N = 558</b>	<b>N = 151</b>
	68 (378)	71 (107)
<b>Location by ACS Regions <sup>c</sup></b>	<b>N = 566</b>	<b>N = 152</b>
Region 1	5 (29)	3 (5)
Region 2	8 (44)	9 (13)
Region 3	10 (55)	9 (13)
Region 4	15 (86)	13 (19)
Region 5	25 (143)	30 (45)
Region 6	9 (48)	5 (8)

Region 7	6 (35)	9 (14)
Region 8	7 (38)	9 (14)
Region 9	12 (68)	10 (15)
Region 10	4 (20)	4 (6)

**Notes:** Data obtained from the American Hospital Association (AHA) Annual Survey (2018) and the American Trauma Society (ATS) TIEP report (2020) and the American College of Surgeons (ACS) verification and regional organization (2020).

<sup>a</sup> ACS verified: American College of Surgeons verifies the presence of resources for the optimal care of the injured patient.

<sup>b</sup> COTH = Council of Teaching Hospitals and Health Systems organized by the Association of American Medical Colleges (AAMC)

<sup>c</sup> ACS Regions:

Region 1	RI, CT, MA, ME, NH, VT
Region 2	NJ, NY
Region 3	DE, MD, PA, DC, VA, WV
Region 4	GA, AL, FL, GA, KY, MS, NC, SC, TN
Region 5	IL, IN, MI, MN, OH, WI
Region 6	LA, AR, LA, NM, OK, TX
Region 7	IA, KS, MO, NE
Region 8	CO, MT, ND, SD, UT, WY
Region 9	CA, AZ, HI, NV
Region 10	WA, AK, ID, OR

#### Trauma center patient characteristics: Table 6

The reported racial and ethnic make-up of patients and the percentage of geriatric trauma patients of the respondent centers are listed in Table 6. Most administrators did not answer these items. Trauma centers utilized a variety of patient acuity measures to characterize their populations. Administrators from 54 hospitals reported their acuity measures: APACHE 56 % (n = 30), SOFA 50% (n = 27), TRISS 41% (n = 22), CMI 9% (n = 5), SARS 6% (n = 3), TSI 2% (n = 1), and 11% (n = 6) reported the use of other acuity measures. Some hospitals (50%) reported the use of multiple acuity scores, thus the sum equals >100%.

**Table 6. Aim 1: Demographic Characteristics of Patients in Trauma Center Sample**

<b>Patient Characteristic</b>	<b>Mean% (SD)</b>	<b>Median % (IQR)</b>
<b>Patients &gt;65 years of age (N = 57)</b>	46.6 (18.9)	
<b>Patient racial make-up (N = 40)</b>		
American Indian, Alaskan Native		< 1 (0, 1)
Asian		1 (< 1, 5)
Black, African American		13 (5, 35)
Native Hawaiian or Other Pacific Islander		< 1 (0, < 1)
White		74 (55, 86)
More than one of these		2 (0, 5)
<b>Ethnicity (N = 44)</b>		
Identify as Hispanic or Latino/a		10 (5, 20)

Administratively mediated variables

*Organizational facets: Table 7*

Trauma center organizational facets are characterized by structure and process variables. Fifty-seven percent (n = 77) of respondents indicated that trauma patients were assigned to a designated ICU. Twenty-three percent of trauma ICUs were reported to include step-down beds (n = 17). Within these step-down units, 65% (n = 11) of administrators reported that those beds were dedicated to trauma patients.

To evaluate if patients are ready for a transfer, 40% (n = 30) of respondents reported the use of a policy or guideline, and of those, 5% (n = 3) were computerized. Less than 1% (n = 3) of administrators reported that patients must have a mandatory stay in the step-down unit when transitioning from the trauma ICU to another unit. Only 36% (n = 27) of the survey respondents reported the use of a systematic handoff tool, and 73% (N = 53) reported that transfers happen sometimes, frequently, or always during a nursing shift change.

**Table 7. Aim 1: Organizational Structure and Processes Used in Trauma Patient Transitions**

<b>Organizational Facet</b>	<b>% (N)</b>	<b>Median (N) (IQR)</b>
<b>Structure</b>		
Designated Trauma ICU (N = 152)	57 (77)	
Standardized method for staff nursing budget (N = 69)		
Yes	52 (36)	
No	9 (6)	
Do not know	39 (27)	
Trauma ICU monthly patient budgeted occupancy (# of patients) (N = 43)		15 (10, 19)
Trauma ICU actual monthly patient occupancy (# of patients) (N = 45)		15 (11, 22)
<b>Process</b>		
Standardized handoff tool (N = 75)	36 (27)	
Trauma ICU unique transfer tool (N = 73)	5 (3)	
Transfer during nursing shift change (N = 73)		3
Always = 1	12 (9)	(2, 4)
Frequently = 2	18 (13)	
Sometimes = 3	43 (31)	
Rarely = 4	23 (17)	
Never = 5	4 (3)	

*Employment scope: Table 8*

Trauma physician team models reported by administrators varied significantly: 41% (n = 31) reported that the physician team model was a “closed” model, 13% (n = 10) reported a “simple mixed model,” 18% (n = 14) reported a “semi-mixed model,” 25% (n = 19) reported a “matrix mixed model,” and only 3% (n = 2) reported an “open unit” model.

The following ICU role-types play a role in trauma patient transfers: 47% (n = 36) of administrators reported nurse practitioners, 36% (n = 27) reported physician assistants, 55% (n = 42) reported resident/fellow physicians, 55% (n = 42) reported attending physicians, and 8% (n = 6) reported “others.” The eight percent of “others” answers included “RNs”, “the

multidisciplinary team,” and “none.” In one center, “none” was identified because trauma patients do not transfer for the duration of their admission.

Other roles were reported as essential in the transition process. These roles included nursing leader networks 66% (n = 49), non-clinical bed managers 69% (n = 51), NP/PA 68% (n = 50) and physicians 87% (n = 54).

Most respondents reported that attending physicians may write transfer orders (97%, n = 74), but only 45% (n = 34) reported that the attending role is most responsible for transfer duties. Most transition work responsibilities were conducted by physicians in training (fellow, resident or intern) (55%, n = 41).

Most administrators reported the use of one of two nursing shift change strategies: oncoming shift overlap and staggered shifts. Scheduled RN shift overlap is in Table 8. More than half of respondents (65%, n = 49) reported a 30-minute overlap of nursing shifts. The second strategy was to stagger shifts. Five administrator respondents reported staggering RN shifts by >1 hour; eight respondents reported that RNs were staggered to specifically update the oncoming shift.

**Table 8. Aim 1: Employment Models and Processes Used During Trauma Patient Transitions**

<b>Employment Scope/Terms</b>	<b>% (N)</b>
Physician team model in ICU (N = 76)	
Closed model	41 (31)
Simple mixed model	13 (10)
Semi-closed model	18 (14)
Matrix mixed model	25 (19)
Open unit	3 (2)
May write a transfer order (N = 76)	
First-year resident	30 (23)
Resident	71 (54)
Fellow	54 (41)
Attending	97 (74)
Physician role most responsible for the transfer (N = 75)	

First-year resident	4 (3)
Resident	44 (33)
Fellow	7 (5)
Attending	45 (34)
Dedicated bed management role facilitating resources (N = 75)	93 (70)
RN shift scheduled overlap time (N = 75)	
Not at all	11 (8)
1 – 15 minutes	11 (8)
16 – 29 minutes	13 (10)
30 minutes	65 (49)
31 – 59 minutes	0
60 minutes	0

*Capital input: Table 9*

Capital inputs for transitions included computer hardware and software programing designed to facilitate patient transitions. Electronic medical records were reported to be used during transitions at most trauma centers, and 78% (n = 53) of administrators reported the use of software systems to navigate hospital bed flow. Patient specific physiologic readiness programs were reported at 6% (n = 4) trauma centers.

**Table 9. Aim 1: Capital Inputs Available for Trauma Patient Transitions**

<b>Capital Input</b>	<b>% (N)</b>
Computer-software programs used for transfers (n = 68)	
Electric bed flow programs	78 (53)
Software text platforms	22 (15)
Patient physiologic readiness programs	6 (4)
Decision support software	12 (8)
Identification to receiving team prior to transfer	42 (28)
Other	11 (7)
RN communication hardware (n = 75)	
Phones/2-way mobile communication (n = 75)	80 (60)
Pagers/other communication device (n = 73)	12 (9)
Electronic Medical Record (EMR) use (n = 71)	100 (71)
EMR utilization (n = 73)	
Physician order entry (n = 73)	99 (72)
Admission/transfer functions (n = 73)	100 (73)
In-and-out of hospital records (n = 73)	90 (66)
Primary care office records (n = 73)	64 (47)
Skilled nursing facility records (n = 72)	19 (13)

EMR function for transition work	
Physician order entry (n = 68)	97 (66)
Admission/transfer functions (n = 67)	97 (65)
In-and-out of hospital records (n = 62)	74 (46)
Primary care office records (n = 43)	65 (28)
Skilled nursing facility records (n = 12)	58 (7)

*Labor input. Quantity: Table 10*

Nurse practitioners and physician assistants played a role on the trauma team at most trauma centers. Eighty-seven percent (n = 65) of administrators reported that nurse practitioners played a role on their trauma team. Sixty percent reported (n = 39) the nurse practitioners were employed by the hospital and 40% (n = 26) reported they were employed by independent physician groups. Administrators reported that trauma teams employed (combined hospital and physician groups) a median of four, IQR two to six (n = 52) nurse practitioners.

Seventy-five percent (n = 56) of administrators reported that physician assistants played a role on their trauma team. Sixty-three percent (n = 35) of these physician assistants were employed by the hospital and 37% (n = 21) reported that physician assistants were hired by physician groups. Administrators reported that trauma teams employed (combined hospital and physician groups) a median of six, IQR two to nine (n = 42) of physician assistants.

Registered nurse (RN) to patient ratios were reported by 73 administrators. Daytime RN nurse to patient ratios of 1:1 or 2:1 were reported by 25% (n = 18) of the trauma centers administrators; most (70%, n = 51) reported a ratio of 1:2. Five percent (n = 4) of administrators reported a ratio of one RN to three or more patients in the ICU.

*Labor input. Quality: Table 10*

Labor input quality may be described as educational attainment of the workforce. Administrators (n = 49) reported that a median of 80% IQR (74.5, 93.2) of their RN workforce had a baccalaureate degree or higher. Education regarding patient transitions for unit leaders,

RNs and physicians is described in Table 10. Another measure of labor quality is the utilization of temporary agency or float pool nurses, and is also described in Table 10.

**Table 10. Aim 1: Descriptive Characteristics of Trauma Transfer Labor Input**

<b>Quantity</b>	<b>% (N)</b>	<b>Median (IQR)</b>
Monthly # of assigned residents in trauma ICU (N = 69)		2 (1, 4)
Monthly # of assigned intensivists in trauma ICU (N = 68)		4 (4, 6)
Trauma ICU with Medical Director (N = 75)	100 (75)	
Trauma ICU with multiple Medical Directors (N = 66)	27 (18)	
Nurse Practitioner daytime patient ratios (N = 69)		
1:5 or less	19 (13)	
1:6-8	12 (8)	
1: 9-11	25 (17)	
1:12-21	13 (9)	
>21	3 (2)	
Does not employ NPs	29 (20)	
Physician Assistant daytime patient ratios (N = 67)		
1:5 or less	18 (12)	
1:6-8	16 (11)	
1: 9-11	15 (10)	
1:12-21	11 (7)	
>21	0	
Does not employ PAs	40 (27)	
Intensivist daytime patient ratios (N = 65)		
1:5 or less	6 (4)	
1:6-8	12 (8)	
1: 9-11	20 (13)	
1:12-14	22 (14)	
1:15-18	20 (13)	
1:19-21	6 (4)	
>21	8 (5)	
Does not employ intensivists	6 (4)	
Attending Physician daytime patient ratios (N = 65)		
1:5 or less	9 (6)	
1:6-8	8 (5)	
1: 9-11	22 (14)	
1:12-14	17 (11)	
1:15-18	11 (7)	
1:19-21	5 (3)	
>21	14 (9)	
Defers to intensivist for ICU responsibilities	15 (10)	
<b>Quality</b>		
Temporary nursing agency or float pool use (N = 73)		
0% of shifts	36 (26)	

>0% or ≤ 10% of shifts	36 (26)
>10% or ≤ 20% of shifts	11 (8)
>20% or ≤ 50% of shifts	7 (5)
>50% of shifts	11 (8)
Education associated with transitions in last two years	
Unit leadership (N = 62)	68 (42)
<u>Type of education</u>	
Unit based	37 (23)
Hospital based	40 (25)
Outside agency based	3 (2)
Required (N = 37)	76 (28)
RN (N = 63)	70 (44)
<u>Type of education</u>	
Unit based	46 (29)
Hospital based	46 (29)
Outside agency based	8 (5)
Required (N = 39)	70 (27)
Physician/Intensivist (N =55)	40 (22)
<u>Type of education</u>	
Unit based	18 (10)
Hospital based	24 (13)
Outside agency based	7 (4)
Required (N = 20)	70 (14)
APRN (NP)/PA (N = 54)	35 (19)
<u>Type of education</u>	
Unit based	19 (10)
Hospital based	22 (12)
Outside agency based	7 (4)
Required (N = 18)	67 (12)

*Employee behavior: Table 11*

Almost all (90%) administrators reported that health care providers were expected to deliver education about the unit environment to patients when patients transition out of the ICU. Slightly fewer respondents (85%) reported education to families was also expected.

**Table 11. Aim 1: Descriptive Characteristics of Expected Employee Behavior**

<b>Provider Education</b>	<b>% (N)</b>
To patients (N = 62)	
Education about floor environment	90 (56)
Education about the floor staff expectations	57 (35)
Education about the transfer process	87 (54)
An opportunity to preview the floor	5 (3)

A visit from floor representative	11 (7)
To families (N = 64)	% (N)
Education about floor environment	86 (55)
Education about the floor staff expectations	52 (33)
Education about the transfer process	78 (50)
An opportunity to preview the floor	13 (8)
A visit from floor representative	11 (7)
<b>Provider Handoff Method (N = 75)</b>	<b>% (N)</b>
Tape recordings	0
By phone call communication	60 (45)
Review patient information without face-to-face report	11 (8)
Face-to-face report	7 (5)
Walking rounds with patient included	23 (17)

## Aim Two

High reliability scores: Table 12

As described in Chapter 3, administrators were asked to rate their organization on a 5-point Likert scale for each of the five high reliability domains.

Initially, frequency distributions of the five HRO categories for all centers in the sample were examined. Subsequently, for the hospitals that scored high versus low on a high reliability measurement scale were evaluated. The respondent distribution was too homogenous to create two group comparisons. Descriptive statistics were generated for each of the reliability categories (Table 12).

Greater than 77% of the respondents rated their organization as “frequently” or “always” adhering to all five high reliability categories. No statistically significant findings were found for the scores in any of the five domains ( $p > .05$ ).

**Table 12. Aim 2: Trauma Center High Reliability Construct Ratings**

	<b>Always</b>	<b>Frequently</b>	<b>Sometimes</b>	<b>Rarely</b>	<b>Never</b>	<b>Median</b>
	<b>% (N)</b>	<b>% (N)</b>	<b>% (N)</b>	<b>% (N)</b>	<b>% (N)</b>	<b>(IQR)</b>
<b>Sensitivity to operations</b>	30	53	16	2	0	4
N = 152	(45)	(80)	(24)	(3)		(4, 5)
<b>Preoccupation with failure</b>	45	40	10	5	<1	4
N = 139	(62)	(55)	(14)	(7)	(1)	(4, 5)

<b>Commitment to resilience</b>	31	46	18	5	0	4
N = 152	(47)	(70)	(28)	(7)		(4, 5)
<b>Reluctance to simplify</b>	26	57	14	3	0	4
N = 152	(40)	(87)	(21)	(4)		(4, 5)
<b>Deference to expertise</b>	20	58	20	1	<1	4
N = 152	(31)	(88)	(30)	(2)	(1)	(4, 4)
<b>Total High Reliability Score n = 139</b>						
	<b>Max</b>		<b>Min</b>		<b>Mean</b>	
	<b>(max possible = 25)</b>		<b>(min possible = 5)</b>		<b>(SD)</b>	
Sum of the five HRO categories:	25		12		21 (3)	

\*Note: A score of 5 = Always; this indicates a positive/favorable HRO construct

### Provider Survey

#### Procedure fidelity

The procedures for the survey of providers were conducted as described in Chapter Three. Ten percent of the data transferred from paper survey to electronic format were independently verified. Zero discrepancies were found. Missing data were assumed to be informative and thus no imputation of missing data values was conducted. SPSS version 27 was used for the analysis.<sup>112</sup>

#### Participant characteristics and response rate

All survey participants were recruited from one mid-Atlantic level one trauma center. The overall provider response rate was 70% for eligible ICU providers.

The respondents (n = 72) included 91% self-identified Caucasian people. Three quarters were females, and eight percent identified themselves as Hispanic/Latinx. Most respondents (78%) were under 40 years of age; 35% were 20 to 29 years of age, and 43% were 30 to 39 years. Eight percent of the respondents were greater than 50 years of age. Almost all respondents (97%) hold a baccalaureate or higher degree; 12% and 32% of those respondents reported additional masters and doctoral degree attainment respectively.

Most respondents reported full-time employment status; 43% (30 to 39 hours/week), 14% (40 hours/week), and 31% (greater than 40 hours/week). Fifty percent had been in their current role from 0-to-5 years, 31% in the 6-to-10-year category, 14% in the 11-to-15-year category, 4% in the 16-to-25-year category, and 1% reported greater than 25 years in their role. Sixty percent of the respondents were registered nurses (RN), 21% were resident physicians, 12% attending physicians, and 7% were nurse practitioners (NP).

The respondent sample was not representative of the provider distribution by ICU role-type in the center from which they were solicited ( $p < .001$ ). The ICU role-types were statistically different because they had different representation from baseline proportions; total eligible RNs ( $n = 55$ ; response rate 78%), NPs ( $n = 6$ ; response rate 83%), resident MDs ( $n = 30$ ; response rate 50%), and attending MDs ( $n = 12$ ; response rate 75%). In each sub-group  $> 50\%$  of the eligible providers responded, despite this, the sub-groups met statistical significance from their baseline representation ( $p < .001$ ).

### **Aim Three**

#### Theory of planned behavior analysis

Results related to the theory of planned behavior categories (attitude, subjective norms, environmental control, and behavioral intent) as well as historical transfer behavior, and experiences with medical errors are discussed in the following sections. In addition to the reported aggregate respondent analysis for each category, findings were also compared by ICU role-type. The roles compared included registered nurses (RNs), advanced practice registered nurses (APRNs), resident physicians (MD) and attending physicians (MD). Physician assistants were not included because they did not make up the ICU workforce at the enrolled trauma center.

*Attitude. Table 13*

As detailed in chapter three, respondents rated their attitudes on a seven-point scale. A seven indicated a positive attitude, whereas a one indicated a polar opposite attitude anchor. The average attitude toward transitions value for the respondents (N = 72) was 14.5 (out of a possible 35, SD = 5.7). This demonstrated a moderate attitude toward the work associated with transferring a trauma patient from the ICU to another unit.

There were no statistically significant differences in total attitude scores among the role types (p = .199), but differences were observed in specific attitudes toward transfer duties being “easy” (p < .001). RNs found transfer duties “easier” than resident MDs (p < .008); RNs reported a median score of six, IQR (5, 6) and resident MDs reported a median score of four, IQR (4, 5).

**Table 13. Aim 3: Attitude Scores toward Trauma Patient Transfers (N = 72)**

Attitude	Participant Rating							Median (IQR)
	7	6	5	4	3	2	1	
Score Rating*	% (N)							
Easy	21% (15)	33% (24)	26% (19)	13% (9)	7% (5)	0	0	6 (5, 6)
Important	44% (32)	21% (15)	10% (7)	7% (5)	11% (8)	6% (4)	1% (1)	6 (4, 7)
Increases safety	35% (25)	22% (16)	7% (5)	19% (14)	10% (7)	3% (2)	4% (3)	6 (4, 7)
Professionally satisfying	19% (14)	14% (10)	18% (13)	22% (16)	11% (8)	7% (5)	8% (6)	5 (3, 6)
Personally satisfying	22% (16)	14% (10)	17% (12)	18% (13)	17% (12)	7% (5)	6% (4)	5 (3, 6)
<b>Total Attitude Scores N = 72</b>								
			<b>Max</b>			<b>Min</b>		<b>Mean (SD)</b>
Sum of the five Attitude categories			28 (max possible = 35)			5 (min possible = 5)		14.5 (5.7)

\*Note: A score of 7 is associated with a favorable/positive rating of the attitude

*Subjective norm. Table 14*

The overall subjective norm scores have little variation. The total referent median scores ranged from 30 to 36, with a max possible of 49. These were calculated by multiplying the

“belief” and “wish to comply” scores for each referent. This indicated a moderately-strong social norm referent structure. The bed-flow coordinators and hospital administrators were rated the lowest with a median score of 30, IQR (16, 36) and (16, 42) respectively. An aggregate score of social norms was tabulated by adding the total score of each referent category. This created a score range from 36 to 245. The mean score was 160, SD 53. This score represented a moderately-strong social norm structure.

When the subjective norm categories were compared by ICU role-type, two of the five subjective norm referents for wish to comply reached statistical significance at the  $p < .05$  level. The wish to comply with a transition process was statistically significant in the “receiving RN” referent category ( $p = .016$ ). The post-hoc analysis revealed that the RNs “wish to comply” was statistically higher than the resident MDs ( $p < .008$ ). The median score for the RNs “wish to comply” was seven, IQR (6, 7), and the resident MD median score was five, IQR (4, 7).

The second subjective norm category was the belief that hospital administrators have an expectation that employees’ complete transition processes. The referent category of hospital administrators was statistically significant ( $p = .021$ ) but the post-hoc analysis did not reveal differences among the groups ( $p > .008$ ). The total median score toward hospital administrators was six, IQR (4, 7). The highest median score was for the attending MDs, who reported a median of seven, IQR (6, 7), and the lowest was for the APRNs, who reported a median score of three, IQR (3, 6).

The total subjective norm score did not meet statistical significance ( $p = .159$ ). The entire sample median score was 164, IQR (130, 202) with a maximum of 245. The social norm referent total scores for each ICU role-type were found to be a moderate influencer toward trauma patient transition processes.

**Table 14. Aim 3: Subjective Norm scores toward Trauma Patient Transfers**

Subjective Norm Subject		Participant Rating*							Median (IQR)
		7	6	5	4	3	2	1	
Nurse Manager	<b>Belief:</b> (N = 71)	26%	38%	11%	17%	1%	1%	4%	6
	Very Strongly	(19)	(7)	(8)	(12)	(1)	(1)	(3)	(5, 7)
Bed-Flow Coordinator	<b>Comply:</b> (N = 71)	46%	19%	15%	14%	1%	3%	0	6
	To a very great extent	(33)	(14)	(11)	(10)	(1)	(2)		(5, 7)
	<b>Belief:</b> (N = 72)	21%	25%	18%	18%	7%	6%	6%	5
Receiving Provider	Very Strongly	(15)	(18)	(13)	(13)	(5)	(4)	(4)	(4, 6)
	<b>Comply:</b> (N = 72)	33%	31%	11%	13%	4%	4%	4%	6
	To a very great extent	(24)	(22)	(8)	(9)	(3)	(3)	(3)	(4, 7)
Receiving RN	<b>Belief:</b> (N = 72)	40%	35%	13%	6%	4%	3%	0	6
	Very Strongly	(29)	(25)	(9)	(4)	(3)	(2)		(5, 7)
	<b>Comply:</b> (N = 71)	46%	33%	13%	4%	1%	1%	0	6
Hospital Administrators	To a very great extent	(33)	(24)	(9)	(3)	(1)	(1)		(6, 7)
	<b>Belief:</b> (N = 72)	40%	33%	13%	7%	1%	4%	1%	6
	Very Strongly	(29)	(24)	(9)	(5)	(1)	(3)	(1)	(5, 7)
Hospital Administrators	<b>Comply:</b> (N = 71)	46%	22%	15%	8%	1%	6%	0	6
	To a very great extent	(33)	(16)	(11)	(6)	(1)	(4)		(5, 7)
	<b>Belief:</b> (N = 72)	33%	26%	10%	11%	8%	7%	45	6
Hospital Administrators	Very Strongly	(24)	(19)	(7)	(8)	(6)	(5)	(3)	(4, 7)
	<b>Comply:</b> (N = 72)	31%	25%	18%	17%	1%	4%	4%	6
	To a very great extent	(22)	(18)	(13)	(12)	(1)	(3)	(3)	(4, 7)

**Total Subjective Norm Scores**

Product of subjective norm belief and wish to comply

	Max (max possible = 49)	Min (min possible = 1)	Median (IQR)
Nurse Manager (N = 70)	49	4	36 (28, 42)
Bed-Flow Coordinator (N = 72)	49	1	30 (16, 36)
Receiving Provider (N = 72)	49	3	36 (24, 42)
Receiving RN (N = 71)	49	2	36 (28, 49)
Hospital Administrators (N = 72)	49	1	30 (16, 42)

**Sum of Five Subjective Norm Subject Categories N = 69**

Max (max possible = 245)	Min (min possible = 7)	Mean (SD)
245	36	161 (53)

\*Note: A score of 7 is associated with a favorable/positive rating of the subjective norm.

*Environmental control. Table 15 & Table 16*

The respondents' ratings for aspects of environmental control varied. Having a busy patient assignment was the category with the highest median score of seven, IQR (5, 7). ICU ancillary staff completing their duties was the lowest rated variable, median of five, IQR (4, 7).

The aggregate median score for environmental control was 29, IQR (23, 32), with a maximum score of 35 were described in Table 15.

**Table 15. Aim 3: Environmental Control scores associated with Trauma Patient Transfers**

Environmental variables impacting trauma patient transfers	Participant Rating % (N)							Median (IQR)
	7	6	5	4	3	2	1	Disagree
<b>Score Rating*: Agree</b>								
Busy patient assignment (N = 72)	50% (36)	24% (17)	11% (8)	4% (3)	6% (4)	3% (2)	3% (2)	7 (5, 7)
ICU bed availability (N = 72)	39% (28)	22% (16)	15% (11)	6% (4)	3% (2)	11% (8)	4% (3)	6 (5, 7)
Receiving teams' availability (N = 72)	49% (35)	13% (9)	13% (9)	4% (3)	10% (7)	7% (5)	6% (4)	6 (4, 7)
Complicated medical course (N = 72)	39% (28)	25% (18)	22% (16)	6% (4)	3% (2)	3% (2)	3% (2)	6 (5, 7)
ICU ancillary staff complete duties (N = 71)	26% (19)	10% (7)	22% (16)	17% (12)	8% (6)	8% (6)	7% (5)	5 (4, 7)
<b>Total Environmental Control Scores (N = 71)</b>								
	<b>Max</b>			<b>Min</b>			<b>Median</b>	
	<b>(max possible = 35)</b>			<b>(min possible = 5)</b>			<b>(IQR)</b>	
Sum of five environmental control categories	35			5			29 (23, 32)	

\*Note: A score of 7 is associated with a favorable/positive rating of environmental control

Summaries of the environmental control categories were compared by ICU role-type (Table 16). Statistically significant differences by role-types were observed for the total score as well as each of the component scores ( $p < .05$ ). Post-hoc tests revealed that, in general, attending physicians reported less impact of the environmental factors on their transfer duty work than did all other provider types (total score, Bonferroni-corrected  $p < .008$ ). The specific factors that contributed most to the lesser impact on attending physicians compared to RNs were busy patient assignments, ICU bed availability, the receiving teams' availability, and having ancillary staff complete their duties.

The total environmental control score was also statistically significantly by ICU role-type ( $p = .001$ ) with statistically significant post-hoc difference among RNs, APRNs, and resident

MDs compared to attending MDs. The total score median was 29, IQR (23, 32) with a max of 35, which indicated a high degree of impact, whereas, the attending MD total score was 16, IQR (12, 23).

**Table 16. Aim 3: Environmental Control Scores Compared by Roles Associated with Trauma Patient Transfers**

<b>Environmental control</b>	<b>RN (N=43)</b>	<b>APRN (N=5)</b>	<b>Resident MD (N=15)</b>	<b>Attending MD (N=9)</b>	<b>Entire Sample (N=72)</b>
	<b>Median (IQR)</b>				
Busy patient assignment (p = .035)	7 (6, 7) <sup>a</sup>	7 (3, 7)	6 (6, 7)	4 (3, 7) <sup>b</sup>	7 (5, 7)
ICU bed avail (p = .002)	6 (5, 7) <sup>a</sup>	6 (6, 7)	5 (2, 6) <sup>b</sup>	2 (2, 6) <sup>b</sup>	6 (5, 7)
Receiving teams' avail (p = .001)	7 (6, 7) <sup>a</sup>	5 (4, 7) <sup>a</sup>	6 (5, 7) <sup>a</sup>	2 (2, 3) <sup>b</sup>	6 (4, 7)
Complicated medical course (p = .032)	6 (5, 7)	7 (6, 7)	6 (5, 7)	4 (2, 6)	6 (5, 7)
Ancillary staff comp. duties (p = .010)	5 (4, 7) <sup>a</sup>	6 (5, 7) <sup>a</sup>	5 (4, 7)	3 (2, 4) <sup>b</sup>	5 (4, 7)
Total score (p = .001)	30 <sup>a</sup>	29 <sup>a</sup>	30 <sup>a</sup>	16 <sup>b</sup>	29
Sum of 5 categories: (range: 5 – 35)	(25, 33)	(24, 33)	(24, 31)	(12, 23)	(23, 32)

\*Note: A score of 7 is associated with a more influential rating of the environmental control  
Superscripts indicate statistically significant Bonferroni-corrected differences (p < .008)

*Behavioral intention. Table 17*

Behavioral intention was measured on an eleven-point scale (100% to 0%), and captured the respondent's intention to complete important transfer process duties. Every transfer variable measured had a median score of 90% or 100%, and indicated that respondents reported that they intended to complete all of their transfer duties most if not all of the time.

The behavior intention categories were compared by ICU role-types. Despite the homogenous overall scores, a statistically significant difference was found in the “focus on safety” category (p = .013) with post-hoc analyses indicating differences between the RNs and resident MDs (p < .008). The median score for the RNs was 100%, IQR (100, 100) and the resident MDs reported median score was 90%, IQR (90, 100). While statistical significance was found in this category, it is unlikely to be clinically significant since both groups intend to “focus on safety” greater than 90% of the time.

**Table 17. Aim 3: Behavioral Intention Scores Toward Trauma Patient Transfers**

Transfer behavior	Percent rating: intention to complete the behavior											Median (IQR)
	100%	90%	80%	70%	% (N)		40%	30%	20%	10%	0%	
Complete every duty (N = 72)	43% (31)	36% (26)	13% (9)	6% (4)	3% (2)	0	0	0	0	0	0	90% (90%, 100%)
Prepare ahead (N = 72)	36% (26)	33% (24)	14% (10)	4% (3)	4% (3)	4% (3)	0	3% (2)	0	1% (1)	0	90% (80%, 100%)
Report ICU events (N = 71)	63% (45)	22% (16)	7% (5)	1% (1)	3% (2)	1% (1)	0	0	1% (1)	0	0	100% (90%, 100%)
Satisfy bed-flow requests (N = 72)	36% (26)	26% (19)	15% (11)	11% (8)	3% (2)	1% (1)	1% (1)	3% (2)	0	1% (1)	1% (1)	90% (80%, 100%)
Focus on safety (N = 72)	70% (50)	22% (16)	3% (2)	1% (1)	4% (3)	0	0	0	0	0	0	100% (90%, 100%)

*Historical transfer behavior. Table 18*

Respondents were asked to reflect on their transfer behavior over the last month.

Behaviors were evaluated on the seven-point scale discussed in Chapter Three. Most variables were rated favorably in terms of percent of patients for whom the behavior was completed. Two variables: “influenced by time constraints,” and “easy to communicate with the receiving team” had median values of 5, IQR (6, 7) and 5, IQR (5, 6) respectively. As such, communicating with receiving providers and time constraints were reported to have influenced to the providers’ ability to complete their recent transfer duties.

When the historical transfer behavior categories were compared by ICU role-type, a statistically significant difference was found in one behavior type: “reported important plans” (p = .031). A favorable rating was reported for this behavior compared to other categories, but post-hoc analysis did not meet statistically significant difference between ICU role-types. Most

providers reported that they “reported important plans” for 100% of patients, with a median score of seven, IQR (6,7).

Two moderately rated categories may be clinically important to consider despite the categories not meeting statistical significance against other domain categories: their overall median scores were moderate. “Influenced by time constraints” reported a median score of five, IQR (6, 7), and “easy to communicate with receiving team” reported a median score of five, IQR (5, 6).

**Table 18. Aim 3: Scores for Historical Trauma Patient Transfer Employee Behavior**

Transfer behavior	Past month rating on transfer behavior							Median (IQR)
	% (N)							
Score*: 100% of patients	7	6	5	4	3	2	1	
Completed all duties (N = 71)	43% (31)	40% (29)	6% (4)	1% (1)	1% (1)	4% (3)	3% (2)	6 (6, 7)
Reported important plans (N = 72)	60% (43)	21% (15)	6% (4)	1% (1)	3% (2)	8% (6)	1% (1)	7 (6, 7)
Influenced by time constraints (N = 71)	15% (11)	24% (17)	31% (22)	13% (9)	4% (3)	10% (7)	4% (3)	5 (6, 7)
Easy to communicate with receiving team (N = 72)	21% (15)	21% (15)	36% (26)	14% (10)	4% (3)	3% (2)	1% (1)	5 (5, 6)
ICU team functioned well, completing expected roles (N = 72)	33% (24)	40% (29)	17% (12)	3% (2)	3% (2)	3% (2)	1% (1)	6 (5, 7)

\*Note: A score of 7 is associated with a favorable/positive rating of historical transfer behavior

*Transfer handoff variables. Table 19*

Handoff mechanisms, communication expectations and education regarding the work of transferring a patient are important to consider when evaluating employee behaviors toward transfer work. Most respondents 93% (N = 65) reported that verbal communication is expected via a direct phone call, and 60% (n = 43) used a checklist or systems-based tool to facilitate communication.

Respondents were asked to use a seven-point scale to indicate if they had an opportunity to ask questions during handoffs. A seven indicated that there was an opportunity “all the time,” and a one indicated that there was “never” an opportunity. Most (85%; n = 61) of the respondents rated the item a six or seven; the median score was seven, IQR (6, 7).

Most respondents (86%, N = 61) indicated that they have received mentoring or education about the trauma patient transfer process.

**Table 19. Aim 3: Descriptive Characteristics for Transfer Process Handoff Communication**

<b>Handoff Variables</b>	<b>Response</b>	<b>% (N)</b>
Direct verbal communication (N = 72)	Yes	93% (65)
Checklists or systems-based tools (N = 72)	Yes	60% (43)
Mentoring, education or transition education (N = 72)	Yes, at least annually	23% (16)
	Yes, orientation/training	63% (45)
	None	14% (11)
<b>Select all that apply: % total by cases</b>		
Type of handoff communication expected (N = 111)	Direct phone call	93% (67)
	Face-to-face sign-out	42% (30)
	Email document	0
	Text message sign-out	1% (1)
	Via medical records	18% (13)
<b>Opportunity for questions (N = 71)</b>  (7 = all the time; is a favorable rating score)	<b>Scale (1-7)</b>	<b>% (N)</b>
	1	0
	2	0
	3	1% (1)
	4	1% (1)
	5	11% (8)
	6	29% (21)
	7	56% (40)
	<b>Median (IQR)</b>	<b>7 (6, 7)</b>

Characterizing the provider decision environment

To further characterize the context of the theory of planned behavior concepts, providers were asked to rate the impact that medical error experiences have had on the transition work they are expected to complete.

*Provider experiences with medical errors: Table 20 & Table 21*

The respondents were asked about their personal experiences with medical errors. They were asked whether they had ever been the subject of an error due to transfer misinformation, whether a family member or someone close to them has been affected by a transfer error, and if they have ever made an error on a patient due to misinformation after a transfer. Each of the three questions were followed by rating how much their experience impacted their approach to patient care on a seven-point Likert scale. A score of seven indicated that it “impacts my approach,” and a score of one indicated “no impact” in the respondent’s approach to care.

Of the three questions about experience with medical errors, 42% (N = 30) of the respondents reported having made an error after transfer misinformation (Table 20). The respondents who experienced medical errors gave similar ratings to the impact it has had on their approach, with a median of six, IQR (6, 7) for all three types of experiences.

**Table 20. Aim 3: Provider Personal Experiences with Medical Errors and Impact Score**

Experience	Participant rating*							% (N)	Median (IQR)
	7	6	5	4	3	2	1		
Personally experienced medical error related to transfer misinformation (Yes) (N = 72)								22% (16)	
Impacts my approach (N = 16)	37% (6)	19% (3)	13% (2)	13% (2)	6% (1)	6% (1)	6% (1)	6 (4, 7)	
Family or close individual who was subject to a medical error related to transfer misinformation (Yes) (N = 72)								21% (15)	
Impacts my approach (N = 15)	33% (5)	27% (4)	13% (2)	13% (2)	7% (1)	0	7% (1)	6 (4, 7)	
Provider personally made a medical error due to misinformation after a patient transition (Yes) (N = 72)								42% (30)	
Impacts my approach (N = 30)	37% (11)	26% (8)	10% (3)	7% (2)	10% (3)	7% (2)	3% (1)	6 (4, 7)	

\*Note: A score of 7 is associated with personal experience having a high degree of impact on transfer approach.

A Chi squared test to determine differences in the medical error experiences by ICU role type was conducted. A statistically significant difference was found in the respondents who reported that they have made a patient care error because of misinformation after a transfer (N = 32, p = .034). A post-hoc analysis revealed that 73% of resident physicians reported they have made an error due to misinformation after a transfer. The adjusted residual of this statistic was 2.8 and is statistically significant (p < .05) when compared to the proportion of other ICU roles who also reported making an error due to misinformation after a transfer.

**Table 21. Aim 3: Provider Experience with Medical Errors**

<b>Experience</b> (N = 72)	<b>Yes</b> <b>% (N)</b>	<b>Impacts</b> <b>approach to</b> <b>care:</b> Rating- 1 – 7* <b>Median (IQR)</b>	<b>Chi-Square test</b> <b>Experience type by ICU role</b> (RN, APRN, Resident, Attending)
Has been a patient who experienced a medical error associated with a transition	22% (16)	6 (4, 7)	$X^2=1.15^+$ , $p = .764$
Has had a family member or personally close individual experience a medical error associated with a transition	21% (15)	6 (4, 7)	$X^2=2.83^+$ , $p = .418$
Has made an error on a patient due to misinformation after a transfer.	42% (30)	6 (4, 7)	$X^2=8.65^+$ , $p = .034^{\text{p}}$

\*Note: A score of 7 is associated with a significant impact in the provider’s approach to care

+degrees of freedom = 3

<sup>p</sup> Statistically significant at (p < .05)

## Chapter V

### Discussion

The content of this chapter includes: 1) barriers, facilitators, strengths and weaknesses; 2) comparisons of what is known and what was discovered; and 3) recommendations for scientific inquiry regarding trauma patient transitions.

### **Method & Design**

#### Barriers to study execution

The COVID-19 pandemic delayed data collection which was originally scheduled to begin in April of 2020. Distributing the surveys at busy level one and two trauma centers during the height of a pandemic would likely have resulted in poorer response rates. Administration of both surveys was delayed to the fall of 2020 when trauma center strain was relieved between the first and second wave of COVID-19 surges.

#### *Preparation of survey materials*

Production of the study materials involved facing several barriers. The Vanderbilt Print Center, the only approved printing site identified by the Clinical and Translational Science Award (CTSA) funding mechanism, closed permanently in May 2020 without notice to the author. Fortunately, the Vanderbilt School of Nursing was able to accept a Student Achievement Research Award (SARA) funding application and subsequently supported the production of survey materials.

After changing strategy to a private printing vendor, the printer's local locations were closed indefinitely due to unsafe local conditions. The materials were ordered once the printer reopened in late June 2020. Ultimately, the printer did not complete the work. The candidate then

processed the materials with a personal printer. Materials were ready in the first week of September 2020.

*Administration of administrator survey: aims one & two*

In September 2020, news coverage reported significant delays in the United States Postal Service (USPS) mail system. Despite these reports, no apparent delays were noted during each of the three mailings.

*Survey content clarification*

After the first mailing of the administrative surveys, an interpretation question was posed by several respondents who contacted the candidate. The requests were to clarify the definition of a “designated trauma ICU.” After addressing their questions and adjusting their responses with a clarified definition, administration continued without other content concerns. In future ICU studies, simply stating the definition of the ICU population inclusion and exclusion criteria in close proximity to the question is recommended.

*Administration of provider survey: Aim three*

Permission to survey the provider population of interest required three months more than anticipated. The candidate was not an employee of the health system of interest, and the site was not the same site as the primary IRB. It took five months for the site IRB to grant approval and for the PI to have access to the population on interest.

This site required a student research agreement and, a proctored clinical exam regarding hospital policies and Joint Commission standards. Several clarifications between the Vanderbilt IRB and the local IRB were required and had to be facilitated by the candidate. Data collection began in October 2020.

Facilitators of success

The first facilitator of success was how quickly the Vanderbilt School of Nursing was able to respond to the changing environment. The school was able to provide funding when it became unclear if the required printing or postage options would qualify for reimbursement under CTSA. CTSA should only be considered as a funding mechanism for future Vanderbilt researchers after printer service policies are revised.

The second facilitator for both the administrator and the provider survey's administration was strong active support of sources credible to the population of interest. The administrator survey had the cooperation of the Society of Trauma Nurses (STN). STN sent communication about the survey to their membership, and the STN website contained a description of the study as well as the candidate's contact information.

It was important to have an engaged provider site sponsor to help navigate the administrative requirements during the five-month preparation runway. The provider survey site sponsor (sub-PI) coordinated the paper survey administration and was able to forward questions to the PI in a timely manner. He was a credible clinician within the department of trauma, and he was able to convey the importance of participation to all role types. His commitment, enthusiasm, and institutional credibility likely contributed to the robust response rate for the provider survey. It is recommended to future researchers that an engaged and credible site sponsor be enlisted.

### **Limitations and Strengths**

Strengths and weaknesses of the study are described by aim.

Aims one & two

*Strengths*

The survey design and recruitment plan resulted in respondents from institutions that were representative of all US level one and two trauma centers. The representativeness of the institutions signaled that there was not a systematic reason that administrators did not respond, reducing the likelihood of a nonresponse error.<sup>105,119</sup>

A second strength was rigor in survey construction. These techniques included an IRB approved elicitation study conducted by the candidate in the spring of 2019. The elicitation study was designed to describe the salient aspects of the processes and work of trauma patient transitions. These perspectives were from the potential respondent population.<sup>120</sup> The survey then underwent an expert panel review. A final step was testing for item comprehension, subject burden, and format.

### *Limitations*

The fill-in response questions in this survey were the most frequent question-type left blank (37%). Adapting this question type to respondents who complete the survey without direct researcher contact (through interviews or observations) may improve responses to these items.

Although steps were taken to ensure a robust response rate, a moderate 27% response rate was obtained. In 2014 a similar national survey of US level one and two trauma centers offered a \$30 dollar incentive for survey completion, and resulted in a 74% response rate.<sup>110</sup> It is unclear if repeating the methods described in this study would have resulted in a similar response rate. This is because 1) national response rates for paper surveys have continued to decline, and 2) it is unknown how many trauma center administrators are allowed to accept a monetary reward given changing institutional policies. An incentive that could be considered is asking the respondent on the survey if they can be entered into a lottery. Additionally, this amount of funding was not feasible within the scope of this dissertation. The demands of the pandemic on

administrators may have influenced the response rate. This influence cannot be estimated at this time.

Aim three

### *Strengths*

The response rate was 70%. Prescriptive survey construction techniques were followed during development and the reliability of the TPB instrument was established. An IRB approved elicitation study was completed to identify the important categories and their anchors. Afterward, the instrument underwent an expert panel review, and field testing to assess the internal validity of the survey.

### *Limitations*

The results from aim three cannot be generalized to other institutions because it was a single site feasibility study. Additionally, the respondent make-up represented statistically significant differences from the unit they were derived. A higher proportion of MD and NP providers responded compared to registered nurses, who make up most of the health care workers in the trauma ICU. This statistical difference should not be construed as a coverage error because every role-type had a >50% response rate. Future multicenter studies should consider recruitment efforts specifically targeted by profession.

## **Knowledge Comparisons & Implications for Future Research**

Discussions regarding what was discovered, how discoveries align with what is known, and what future research will advance improvements in transitions research are contained in this chapter.

Aims one & two

*What is known compared with study results: directions for future researchers*

*Organizational facets: structure*

Only 57% (n = 77) of level one and two trauma centers have a designated ICU for trauma patients, this has not been reported in the literature. The 43% of centers that don't place trauma patients within an identified unit may have different outcomes. Question for future research: How, if at all, does assigning trauma ICU patients to a dedicated unit influence patient transition and continuity outcomes?

*Organizational facets: process*

Safety literature suggests that systematic handoff tools improve process reliability and safety.<sup>13</sup> Many organized handoff tools cannot be generalized due to the complexity of local environments and patient populations.<sup>121</sup> More than a third (36%; n = 27) of trauma center administrators reported the use of a standardized handoff tool. Five percent (n = 3) reported the use of a unique trauma transfer handoff tool. This is despite the fact that the Joint Commission and the Agency for Healthcare Research Quality and the Accreditation Council for Graduate Medical Education have recommended the use of handoff tools (I-PASS).<sup>122</sup> Question for future researchers: why isn't I-PASS being used? Future work should characterize barriers and facilitators to their use. Human factors literature lags in helping understanding provider roles and process compliance in the use of this type of tool.<sup>35</sup>

*Shift change.* Many patient transitions were reported to occur during a shift change. The respondents reported that 73% (n = 53) of transfers happened sometimes, frequently, or always during a shift change. What makes this new finding a concern is that most trauma center administrators reported that providers also did not utilize an organized handoff tool. Question for future research: when patient transfers occur at shift change, what if any additional processes are used to promote patient safety?

### *Employment scope*

*Provider type.* Respondents reported that 47% of trauma centers utilized nurse practitioners, 36% used physician assistants, 55% used resident/fellow physicians, and 55% used attending physicians as key personnel to transfer trauma patients. This study was not designed to detail the transition tasks assigned to each role-type, but scope of practice literature has demonstrated role-changes over the last 20 years for inpatient NP/PAs<sup>52,123</sup> With the evolution of these roles, it is unsurprising that variability was found in the provider types who have key roles in patient transfers. Question for future research: What, if any, provider-type attributes improve transfer outcomes, such as: handoff too compliance, transfer process fidelity?

*Employment models.* The respondents also reported a variety of physician team role types: 41% closed model, 13% simple mixed model, 18% semi-closed model, 25% matrix mixed model, and 3% open unit. This reported variability is new knowledge. Research has previously focused on the multidisciplinary team approach to critical care and its importance, but little is known on how these models ascribe accountabilities. The addition of a critical care physician/NP/PA team in a “closed” model has demonstrated improved outcomes compared to the “open unit” structure.<sup>124,125</sup> Outcomes from these studies included ICU processes and overall mortality. Patient transitions and overall patient hospital progression were not included.<sup>126</sup> Questions for future research: what, if any, trauma ICU care-team model-type optimizes trauma patient transition outcomes? Which variables from effective models can be applied to less effective model types?

*Shift change.* Respondents reported that all registered nurses’ shifts are scheduled to overlap for less than 30 minutes. The prevalence of the 30-minute shift change is not a new phenomenon, but in the context of transition science, it may be significant to consider. In

addition to the short-shift-change, 73% (n = 53) of transfers happened sometimes, frequently, or always during a shift change. When combined, with the fact that 64% of trauma centers did not use a systematic transfer tool, rigorous simultaneous examination of outcomes associated with all three variables is merited. Question for future research: what process variables are fundamental to improve patient transitions that occur during nurse shift change?

### *Capital input*

*EMR.* Software technology plays a role in the care of every hospitalized patient in the US. The utilization of software technology for trauma patient transitions is only in the design and development stages.<sup>127</sup> In other health care domains, such as the development of the electronic medical record (EMR), the evidence for improved patient outcomes and technology is more advanced.<sup>35</sup> An example of an EMR adaptation that focused on handoffs was recently described in the neonatal population.<sup>128</sup> This instrument method could easily be applied with content from other populations, such as trauma patients.

Trauma centers are relatively homogenous in the use of EMR (100%) and communication hardware (92%). This is not new knowledge and is unsurprising because the EMR has developed over many years and has demonstrated improved patient outcomes.<sup>129</sup> A few respondents reported the use of patient physiologic readiness programs (6%), or software decision support (12%) programs. The use of these programs is relatively recent and has not been explored in transition science. Characterizing where these information technology programs are in terms of their development and use is important to determine their value.<sup>129</sup> Question for future research: to optimize their use, what EMR and software developments are associated with improved patient outcomes?

*Labor input. Quantity*

*Nurse practitioners & physician assistants.* The respondents reported that 87% of centers had a provider mix that included nurse practitioners (n = 65); 75% had physician assistants (n = 56). Only 47% reported that nurse practitioners (n = 36) were assigned to complete patient transfer activities; (n = 36) 36% of the centers assigned physician assistants (n = 27). The difference between employment provider mix vs transfer accountability is new discovery. Nurse practitioners and physician assistants have demonstrated improved patient outcomes for many years.<sup>52,123</sup> It is important to discover what preparatory and competency differences influence clinical practice patterns and role development. Questions for future research: what are the differences in the roles of nurse practitioners and physician assistants at trauma centers? How if at all, are differences associated with transition outcomes?

*Physicians.* Most respondents reported that attending physicians cared for more than nine patients on each shift; this was a higher patient load than reported for other role-types. It was also reported that every designated trauma ICU has a medical director. These demographic statistics are not new, but they are novel in the context of transition science, because attending MDs were identified as key patient transition stakeholders. Attending MDs likely have differing tasks/duties compared to other providers given their increased patient to attending ratio and role accountability differences. Question for future research: what attending MD responsibilities within the context of delegated team accountabilities are associated with patient transition outcomes?

*Labor input. Quality*

*Transition education.* A majority of trauma centers required transition education for every ICU provider role. They included: unit leaders (80%), RNs (100%), physicians (49%) and

NP/PAs (48%). The gap between transition education by role-type is a new discovery. Future research should examine if there are differences in patient and process outcomes associated with transition education. Question for future research: does transition education increase the use and quality of use of handoff tools for physicians and NP/PAs?

*Temporary agency and float pool nurses.* Temporary agency or float pool nurses were used as an RN staffing strategy at the respondent trauma centers, with 83% of respondents reporting their use on < 20% of shifts. This is a new discovery about labor quality at trauma centers. Although temporary agency or float pool nurses are able to provide quality and competent nursing care, the nature of their possibly inconsistent role or unit specific process knowledge may translate into poor patient transition outcomes. Conversely, this may be a positive strategy and may contribute to better patient transition outcomes due to filling critical labor shortages. Questions for future research: what variables associated with temporary agency and float pool nurse strategies influences patient transition outcomes? What is the employment scope of agency nurses and float pool nurses employed in trauma center ICUs? What is the average length of temporary agency nurse contracts in trauma ICUs? What education or training do float pool and agency nurses receive regarding patient transitions?

#### *Employee behavior*

*Patient education.* The respondents reported that 90% of the trauma centers expected providers to give patients education about the floor environment. This is a new discovery. Investigating further into the type and quality of this education will be an important next step. Questions for future research: what, if any, patient focused education material and delivery method improves trauma patient transition outcomes from the ICU? How does timing play a role in when patient education is delivered to ICU patients?

*Family education.* The respondents reported that 86% of trauma centers expected providers to give families' education about the environment to which the patient is being sent. This is a new discovery. Exploring the type and quality of this education will be an important next step. Questions for future research: what family-oriented education material and delivery method improves the experience of the patient and family as they transition from the ICU? How does timing play a role in when patient education is delivered?

*Handoff communication.* Respondents reported that all provider handoffs included conversations between the sending and receiving units' staff members. Sixty percent reported conversations were usually accomplished by phone, 17% face-to-face, and 23% during a walk-round with the patient. All handoff processes were reported to happen in real time, and none of the centers reported handoffs as pre-recorded. Neither of these findings have been reported previously. Patient safety literature encourages handoffs to have clear boundaries, face-to-face contact and they should be as distraction free as possible.<sup>130</sup> Questions for future research: what type of handoff communication methods promote systematic handoff tool utilization? What variables promote face-to-face provider handoff models? What variables promote the inclusion of patients during the provider handoff process?

#### *High reliability*

Many health care organizations strive to keep patients safe and aim for high reliability. The Joint Commission has developed a tool by which to measure organizations, the Oro 2.0.<sup>131</sup> It is a proprietary and lengthy instrument that requires contribution from several leaders at each institution and takes about a month to complete. Developing a low subject burden instrument designed to indicate high reliability would be a useful translational science instrument, particularly in comparing complex processes.

The trauma center respondents reported strong high reliability ratings with little variation across all the centers. The five questions associated with HRO concepts were likely too sensitive and not specific enough to detect differences in trauma center ratings. Another potential influence on the responses may have been the self-report bias of the administrators. Social desirability and lack of exposure to day-to-day realities in the unit are two other facts that may have influenced responses. The same instrument could be distributed to providers, and examine for differences in the resultant distributions. Next steps may involve measuring high reliability with a more rigorous but low subject burden instrument across a variety of personnel categories. It may also be important to consider an observational design. Observing the prevalence of high reliability behaviors in providers and administrators would also confirm or dispute self-report bias.

#### Aim three

For the first time in a trauma setting, a Theory of Planned Behavior type survey instrument was used to measure providers' attitudes, subjective norms, environmental controls, and behavioral intent. The survey results must be interpreted cautiously because only one trauma center was represented.

*What is known compared with study results: directions for future researchers*

#### *Attitude*

The overall attitude scores demonstrated some variation in attitude responses. This discovery demonstrated that provider attitudes toward transitions can be the subject of examination in future study. Successful interventions to change some attitudes have been reported in smoking cessation.<sup>132</sup> Question for future research: what are providers' attitudes regarding transition work duties across many trauma centers?

### *Subjective norm*

The subjective norm belief-and-comply system was rated by providers who do the work of transitioning patients. The provider responses demonstrated some variation. Research in HIV prevention have demonstrated that subjective norm interventions can alter behavior.<sup>133</sup> This discovery warrants further inquiry on this behavioral antecedent in a larger sample. Question for the future: do subjective norm referent ratings vary across a representative sample of trauma centers?

### *Environmental control*

Environmental control demonstrated variability across every category ( $p < .05$ ). This was a new discovery and may be important avenue for intervention if confirmed in a multi-site nationally representative study. Questions for the future: what transition work environment variables enhance or retard providers doing the work of patient transitions? Do environmental control variables vary in a nationally representative sample?

### *Behavioral intention*

Most providers reported strong behavioral intention scores across every category. This finding demonstrated little variation and may have been affected by social desirability. The TPB behavioral intention domain may be less applicable to professionals' work-related constructs than its application in self-improvement constructs like smoking cessation, where behavior intention was the best predictor.<sup>132</sup> Other health professions' work-related studies using the TPB found that social desirability may limit the value of the respondent's behavioral intention.<sup>134,135</sup> Future research in this domain must develop a future measure that overcomes social desirability bias. If social desirability can be overcome, a question for future research: what are provider behavior intention ratings of transfer duty completion in a multi-site representative sample?

### *Historical transfer behavior*

This domain demonstrated little variability in respondent answers. Scores were homogeneously high and similar to behavioral intention. Self-report bias should be considered as possibly overestimating provider behavior.<sup>135</sup> To accurately characterize historical transfer behavior, a direct observation study arm should be considered. Questions for future research: what are providers' self-report scores of transfer duties in a multi-site representative sample study? Do provider self-report scores of transfer duties correlate with direct observation scores of the transfer duty?

### *Transfer handoff variables*

Transfer handoff variables were relatively homogenous. Most respondents reported some type of education delivery about transitions, and verbal communication was the predominate mode of handoff communication. Sixty percent of the respondents reported the utilization of a systematic handoff tool, and most respondents highly rated that they had the opportunity to ask questions during handoffs. Questions for future research: in a multi-site representative design, do providers have the ability to ask questions during a handoff? In a multi-site representative design, how important do providers' rate the ability to ask questions? Is the ability to ask questions during handoffs related to behavior outcomes?

### *Characterizing the provider decision environment*

*Provider experiences with medical errors.* Forty-two percent of providers reported that they have made an error because of transfer related misinformation. Providers who made such errors reported that the experience influenced their approach to care; the median score was six, IQR (4, 7) with a maximum score of seven. This discovery merits further inquiry. The impact that medical errors have on providers has been studied in the past, but is not well developed.<sup>136</sup>

Questions for future research: what is the post-transition error rate across a representative sample of trauma centers? What type of patient errors have providers experienced after a patient handoff? What individual safeguards do providers take to prevent patient errors after a handoff that result in a medical error?

## Implications

Aims one & two

### *Future research implications*

Suggested study recommendations to researchers are organized in Table 22.

**Table 22. Aims 1 & 2: Administrator Study Recommendations**

<b>Instrumentation</b>	<ul style="list-style-type: none"> <li>• As brief as possible and easy for the reader</li> <li>• New terminology is clearly defined</li> <li>• Reduce open-ended questions</li> <li>• Expert panel assessment and pilot with population of interest</li> </ul>
<b>Method &amp; Design</b>	<ul style="list-style-type: none"> <li>• Post-card encouragement &amp; electronic availability</li> <li>• National organization cooperation</li> <li>• Paper and electronic version availability</li> <li>• Lottery incentive</li> </ul>

### *Summaries of suggested research questions: aims one & two*

The suggested research questions for aims one and two are organized in Table 23.

**Table 23. Aims 1 & 2: Suggested Research Questions**

<b>Organizational facets</b>	
Structure	<ul style="list-style-type: none"> <li>• How, if at all, does assigning trauma ICU patients to a dedicated unit influence patient transition and continuity outcomes?</li> </ul>
<b>Organizational facets</b>	
Process	<ul style="list-style-type: none"> <li>• Why isn't I-PASS being used?</li> </ul>
Shift change	<ul style="list-style-type: none"> <li>• When patient transfers occur at shift change, what if any additional processes are used to promote patient safety?</li> </ul>
<b>Employment scope</b>	
Provider type	<ul style="list-style-type: none"> <li>• What, if any, provider-type attributes improve transfer outcomes, such as: handoff too compliance, transfer process fidelity?</li> </ul>
Employment models	

Shift change	<ul style="list-style-type: none"> <li>• What, if any, trauma ICU care-team model-type optimizes trauma patient transition outcomes?</li> <li>• Which variables from effective models can be applied to less effective model types?</li> <li>• What process variables are fundamental to improve patient transitions that occur during nurse shift change?</li> </ul>
<b>Capital input</b> EMR	<ul style="list-style-type: none"> <li>• To optimize their use, what EMR and software developments are associated with improved patient outcomes?</li> </ul>
<b>Labor input: Quantity</b> Nurse practitioners and physician assistants	<ul style="list-style-type: none"> <li>• What are the differences in the roles of nurse practitioners and physician assistants at trauma centers?</li> <li>• How if at all, are differences associated with transition outcomes?</li> </ul>
Physicians	<ul style="list-style-type: none"> <li>• What attending MD responsibilities within the context of delegated team accountabilities are associated with patient transition outcomes?</li> </ul>
<b>Labor input: Quality</b> Transition education	<ul style="list-style-type: none"> <li>• Does transition education increase the use and quality of use of handoff tools for physicians and NP/PAs?</li> </ul>
Temporary agency and float pool nurses	<ul style="list-style-type: none"> <li>• What variables associated with temporary agency and float pool nurse strategies influences patient transition outcomes?</li> <li>• What is the employment scope of agency nurses and float pool nurses employed in trauma center ICUs?</li> <li>• What is the average length of temporary agency nurse contracts in trauma ICUs?</li> <li>• What education or training do float pool and agency nurses receive regarding patient transitions?</li> </ul>
<b>Employee behavior</b> Patient education	<ul style="list-style-type: none"> <li>• What, if any, patient focused education material and delivery method improves trauma patient transition outcomes from the ICU?</li> <li>• How does timing play a role in when patient education is delivered to ICU patients?</li> </ul>
Family education	<ul style="list-style-type: none"> <li>• What family-oriented education material and delivery method improves the experience of the patient and family as they transition from the ICU?</li> <li>• How does timing play a role in when patient education is delivered?</li> </ul>
Handoff communication	<ul style="list-style-type: none"> <li>• What type of handoff communication methods promote systematic handoff tool utilization?</li> <li>• What variables promote face-to-face provider handoff models?</li> </ul>

	<ul style="list-style-type: none"> <li>• What variables promote the inclusion of patients during the provider handoff process?</li> </ul>
<b>High reliability</b>	<ul style="list-style-type: none"> <li>• What process and resource (labor and non-labor) transition variables are associated with high reliability health care environments?</li> </ul>

*Practice implications*

*Handoff tool enactment*

The Joint Commission suggests that all hospitals implement an organized transition handoff.<sup>13</sup> Additionally, in 2010, the Accreditation Council for Graduate Medical Education (ACGME) required residents to receive formal handoff training.<sup>13</sup> Respondents reported that only 36% utilized a standardized handoff tool and only 40% offered education about transitions in the last two years. This disparity in implementation should be a call to action for trauma programs. National organizations, hospital administrators and trauma program managers should ensure transition handoff tool education is provided to the providers who do the work of transitioning patients, and ameliorate handoff tool enactment for all trauma patient transitions.

Aim three

*Future research implications*

Suggested study recommendations to researchers are organized in Table 24.

**Table 24. Aim 3: Provider Study Recommendations**

<b>Instrumentation</b>	<ul style="list-style-type: none"> <li>• As brief as possible and easy for the reader</li> <li>• Use of TPB survey construction methods with an elicitation study</li> <li>• Representation of every provider role in elicitation study</li> <li>• Consider adding patient/family as a normative referent</li> <li>• Expert panel assessment and pilot with population of interest</li> </ul>
<b>Method &amp; Design</b>	<ul style="list-style-type: none"> <li>• Add observational design to assess socially desirable categories</li> <li>• Site sponsor/sub-PI who is a credible provider</li> <li>• Plan for extended time period for access to population (est. five months) (i.e., institutional permissions &amp; IRB)</li> <li>• Paper and electronic version availability</li> </ul>

*Summaries of suggested research questions: aim three*

The suggested research questions for aim three are organized in Table 25.

**Table 25. Aim 3: Suggested Research Questions**

<b>In a nationally representative sample of level 1 &amp; 2 US trauma centers:</b>	
	<ul style="list-style-type: none"> <li>Do provider scores in attitude, subjective norm, environmental control, and behavior intention demonstrate variability?</li> </ul>
<b>Attitude</b>	<ul style="list-style-type: none"> <li>What are providers' attitudes regarding transition work duties across many trauma centers?</li> </ul>
<b>Subjective norm</b>	<ul style="list-style-type: none"> <li>Do subjective norm referent ratings vary across a representative sample of trauma centers?</li> </ul>
<b>Environmental control</b>	<ul style="list-style-type: none"> <li>What transition work environment variables enhance or retard providers doing the work of patient transitions?</li> </ul>
<b>Behavioral intention</b>	<ul style="list-style-type: none"> <li>What are provider behavior intention ratings of transfer duty completion in a multi-site representative sample?</li> </ul>
<b>Historical transfer behavior</b>	<ul style="list-style-type: none"> <li>What are providers' self-report scores of transfer duties in a multi-site representative sample study?</li> <li>Do provider self-report scores of transfer duties correlate with direct observation scores of the transfer duty?</li> </ul>
<b>Transfer handoff variables</b>	<ul style="list-style-type: none"> <li>In a multi-site representative design, do providers have the ability to ask questions during a handoff?</li> <li>Is the ability to ask questions during handoffs related to behavior outcomes?</li> </ul>
<b>Provider experiences with medical errors</b>	<ul style="list-style-type: none"> <li>What is the post-transition error rate?</li> <li>What type of patient errors have providers experienced after a patient handoff?</li> <li>What individual safeguards do providers take to prevent patient errors after a handoff that result in a medical error?</li> </ul>

*Next research questions for my future and why?*

My long-term goal is to design implementation studies that improve the provider workplace environment and patient outcomes. My initial steps will take into consideration the feasibility of resource acquisition for a new researcher. I hope to discover if provider attitudes and/or environmental control are related to effective transfer processes and patient outcomes. If they are, the next steps would include pilot studies to determine if there are interventions that improve provider attitudes.

As my ability to procure significant funding develops, I then hope to contribute to the high reliability literature by discovering what transfer variables ascribe to a high reliability patient transfer. This will require many studies to establish but will be guided with the results from aims one and two. For example, respondents reported significant variability in trauma ICU team models. Examining the various model-types for relationships with transition outcomes would be an important next step.

#### *Practice implications*

Aim three was designed as a feasibility study, thus, results do not allow for recommendations. It should be used as a successful example for methodology development in future transition science studies.

Table 1. Key Definitions and Terms Associated with Organizational Concepts

<b>Administratively Mediated Variables</b>	
Organizational facets	<ul style="list-style-type: none"> <li>• Work environment, work traits, and work guides or organizational structures and procedures.<sup>49</sup></li> <li>• Structures include traits within an organization that affect worker autonomy (e.g., Magnet facility); and procedures including guidelines that influence the work environment (e.g., policies, standards of care).<sup>49</sup></li> <li>• Care delivery processes also include those that influence providers' ability to exercise their expertise and direct standardization of work.<sup>48,49,137</sup></li> </ul>
Employee behavior	<ul style="list-style-type: none"> <li>• Actions taken by employees for patients to increase quality of care, increase patient satisfaction, and improve outcomes<sup>49</sup>.</li> </ul>
Labor inputs	<ul style="list-style-type: none"> <li>• Measures that reflect the quantity of providers or the quality (characteristics) of providers within a setting.<sup>49</sup></li> <li>• Quantity includes factors such as number of RN FTEs, or physicians devoted to the care of a patient population; and quality includes factors such as nurse certification, education, and level of experience.<sup>49</sup></li> <li>• Within the framework, a second assumption is the labor inputs mediate the effects of capital inputs, employment terms, and organizational factors, and influence employee behavior.<sup>48,49,137</sup></li> </ul>
Capital inputs	<ul style="list-style-type: none"> <li>• Tangible items that entail significant financial investments by organizations (e.g. transplant databases, electronic medical records, equipment).<sup>49</sup></li> </ul>
Employment terms/scope	<ul style="list-style-type: none"> <li>• A contractual agreement of employment.</li> <li>• Defined by time and workload requirements.<sup>48</sup></li> </ul>
Employee attitudes	<ul style="list-style-type: none"> <li>• Reflect the internal disposition of employees.<sup>49</sup></li> </ul>
Patient experience	<ul style="list-style-type: none"> <li>• The objective and subjective life and health care experience of patients.<sup>49</sup></li> </ul>

Patient characteristics	<ul style="list-style-type: none"> <li>• Represent baseline status at the outset of treatment and/or the status before onset of the problem that requires treatment.</li> <li>• Within any study, investigators must consider patient-related elements considered to be most relevant to the outcome(s). <sup>49,53</sup></li> </ul>
<b>High reliability organizations</b>	
Preoccupation with failure	<ul style="list-style-type: none"> <li>• Principle 1</li> <li>• Practicing with a chronic, proactive wariness of the unexpected. <sup>93</sup></li> </ul>
Reluctance to simplify interpretations	<ul style="list-style-type: none"> <li>• Principle 2</li> <li>• Taking deliberate steps to question assumptions and create a more complete and nuanced picture of operations. <sup>93</sup></li> </ul>
Sensitivity to operations	<ul style="list-style-type: none"> <li>• Principle 3</li> <li>• Ongoing interaction about expertise and current operations. <sup>93</sup></li> </ul>
Commitment to resilience	<ul style="list-style-type: none"> <li>• Principle 4</li> <li>• Developing and refining capabilities to quickly detect, contain and learn from errors and unexpected events. <sup>93</sup></li> </ul>
Deference to expertise	<ul style="list-style-type: none"> <li>• Principle 5</li> <li>• Ensuring that decision-making authority migrates to the person or people with the most expertise when needed. <sup>93</sup></li> </ul>
Situational awareness	<ul style="list-style-type: none"> <li>• A comprehensive and coherent representation of the current system state that is continuously updated based on repetitive assessment. <sup>35</sup></li> </ul>
Collective mindfulness	<ul style="list-style-type: none"> <li>• Any organization where all workers look for, and report, small problems or unsafe conditions before they pose substantial risk to the organization and when they are easy to fix. <sup>34</sup></li> </ul>

Table 2. Key Definitions and Terms Associated with Provider Behavior

<b>Behavior concepts</b>	
Capability	<ul style="list-style-type: none"> <li>An individual's psychological and physical capacity to engage in the activity concerned. It includes having the necessary knowledge and skills. <sup>61</sup></li> </ul>
Motivation	<ul style="list-style-type: none"> <li>Brain processes that energize and direct behavior, not just goals and conscious decision-making. It includes habitual processes, emotional responding, as well as analytical decision-making. <sup>61</sup></li> </ul>
Opportunity	<ul style="list-style-type: none"> <li>All the factors that lie outside the individual that make the behavior possible or prompt it. <sup>61</sup></li> </ul>
<b>Theory of Planned Behavior</b>	
Attitude	<ul style="list-style-type: none"> <li>Refers to the degree to which a person has a favorable or unfavorable evaluation of the behavior of interest. It entails a consideration of the outcomes of performing the behavior. <sup>96</sup></li> </ul>
Subjective norms	<ul style="list-style-type: none"> <li>Refers to the belief about whether most people approve or disapprove of the behavior. It relates to a person's beliefs about whether peers and people of importance to the person think he or she should engage in the behavior. <sup>96</sup></li> </ul>
Perceived control	<ul style="list-style-type: none"> <li>Refers to a person's perception of the ease or difficulty of performing the behavior of interest. Perceived behavioral control varies across situations and actions, which results in a person having varying perceptions of behavioral control depending on the situation. <sup>96,114</sup></li> </ul>
Behavioral intention	<ul style="list-style-type: none"> <li>Refers to the motivational factors that influence a given behavior where the stronger the intention to perform the behavior, the more likely the behavior will be performed. <sup>96,114</sup></li> </ul>
Enactment	<ul style="list-style-type: none"> <li>An individual's observable response in a given situation with respect to a given target. <sup>114</sup></li> </ul>

Table 3. Patient Transition Evidence Strength

Model Concept	Effect sizes	Strength
<b>State of transition bundle evidence by outcome</b>		
Mortality	$r = (0.07 \text{ to } 0.25)$	Small to moderate
Morbidity	$r = (0.15 \text{ to } 0.39)$	Small to moderate
Readmissions	$r = (0.04 \text{ to } 0.29)$	Small to moderate
Increased efficiency -Saving time	$r = (0.15 \text{ to } 0.99)$	Small to large
Increased efficiency -Perception of transitions	$r = (0.04 \text{ to } 0.71)$	Small to large
Increased efficiency -Transfer triage accuracy	$r = (0.08 \text{ to } 0.11)$	Small
Compliance	$r = (0.18 \text{ to } 0.40)$	Small to moderate
<b>Theory of Planned Behavior evidence strength from other areas</b>		
<u>Perceived control</u> -2 meta-analysis of personal protective behaviors	$r = (0.57 \text{ to } 0.25)$	Moderate to large
<u>Attitude</u> -1 meta-analysis of personal protective behaviors & 1 meta-analysis of exercise intention	$r = (0.23 \text{ to } 0.26)$	Moderate
<u>Subjective norm</u> -2 meta-analysis of personal protective behaviors	$r = (0.30 \text{ to } 0.32)$	Moderate
<u>Enactment</u> -2 meta-analysis of personal protective behaviors	$r = (0.18 \text{ to } 0.40)$	Small to moderate

Table 4. Aims Definitions and Assessment Record

<b>Aim 1</b>		
Noun	Operationalization	Assessment Question
Processes	Workflow processes Transition tool Patient and Family Prep Data transfer Communication mode	A2, A25, P10 A23ab, P10d A24 A5a P10a, P10b, P10c
AMV model	Communication Technology Trauma provider employed and patient ratio Provider training level Unit resources and allocations  Types and providers and schedules in trauma ICU  Unit FTE allocations Unit role longevity Staff education Patient and Family Experience	A1, A5bc  A17ab, D5 A9 A4, A5bc, A35, A36, A34, A6ab,  A12, A13, A14, A15ab, A16b, A16c, A16d, A26, A21, A18 A19 A20, P10f  A4
Trauma centers	ACS Verified Payor mix Type of patients Organizational structure Hospital resource utilization Hospital personnel resources Family visitation	A32 D7 A37, A38, A39 D1, D2, D3, D4 D6, D8, D11 D9, D10, D12
Transition patients	Nurse liaison/coordinator role Patient readiness assessment Patient statistics	A7, P10e A22, P10g A33
Critical care	Closed unit model	A8
Non-intensive, non-stepdown units	Nurse ratio changes Transition destination	A11 A3
<b>Aim 2</b>		
Noun	Operationalization	Assessment Question
Patient transfer	See “Transition patients” in aim 1	
AMV model	See “AMV model” in aim 1	
Processes	See “Processes” in aim 1	
Hospitals	See “Trauma center” in aim 1	
High reliability measurement scale	Sensitivity to operations Preoccupation with failure	A27 A28

	Reluctance to simplify Commitment to resiliency Deference to expertise	A29 A30 A31
<b>Aim 3</b>		
Noun	Operationalization	Assessment Question
Theory of Planned Behavior	Enacted below in: subjective norms, perceived control, provider behavioral intentions.	
Provider attitudes	Attitude matrix	P2
Subjective norms	Nurse manager	P3
	Bed flow/admin coordinator	P4
	Receiving provider	P5
	Hospital administrators	P6
Perceived control	Patient assignment acuity	P7a
	ICU bed resource	P7b
	Receiving team permission	P7c
	Patient acuity	P7d
	ICU ancillary staff	P7e
Provider behavioral intentions	Complete every transfer	P8a
	Prepare ahead	P8b
	Report every ICU event	P8c
	Satisfy bed-flow coordinator request	P8d
	Focus on patient safety	P8e
Patient transition processes	See "Processes" in aim 1	
Critical care	See "Critical care" in aim 1	
Non-intensive, non-stepdown units.	See "Non-intensive, non-stepdown units" in aim 1	

A = Administrator Survey; P = Provider Survey; D = AHA Database

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APPENDIX A\*

\*Note: Spacing and margins were adjusted for production.

**Trauma Patient Transitions: Administrator Survey**

**INSTRUCTIONS:**

- The transition you should think about when completing this survey is when a trauma patient transitions from the ICU to non-ICU care areas within your hospital.
- Use the postage-paid envelope provided to return the completed survey.
- **Any** information you can provide will be important.
- Email [Jason.A.Saucier@Vanderbilt.edu](mailto:Jason.A.Saucier@Vanderbilt.edu) to request another paper survey if needed.
- You may use our electronic format via: <https://redcap.link/42uj6s0i>.
- Please indicate your survey number in the electronic format: Your Survey # \_\_\_\_\_

**Definitions of Terms**

Registered Nurse (RN): a graduate trained nurse who is licensed by state authority after qualifying for registration.

APRN—Nurse Practitioner (NP): a registered nurse with advanced clinical training at the masters or doctoral level who is licensed by state authority after qualifying or registration.

Physician Assistant (PA): a licensed professional who practices medicine under the supervision of a licensed physician.

Physician (MD/DO): a doctoral prepared medical professional licensed to practice medicine under the laws of the state.

Intensivist: Is a physician who specializes in the care of critically ill patients

ICU: Adult intensive care units are critical care units resourced and dedicated to treated life-threatening conditions, often with specialty equipment and lower nurse to patient ratios.

Non-intensive, non-stepdown unit: Adult care units with a reduction in monitoring and increased patient to RN ratio; patients on these units do not require the specialized treatment, equipment, and staff ratios of the critical care units.

Senior management: Pertains to hospital administrators directly above the unit leadership team and are likely not part of the day-to-day operations of the unit.

FTE: Full-Time Equivalent; One (1) full time person equal 1 FTE. Two (2) part-time persons equal 1 FTE regardless of the number of hours employed.

1. Does your hospital have a designated trauma ICU? (Check one)

Yes  \*No

\*If no, please skip to **# 34**

2. Is your trauma center verified? (Check ALL that apply)

Yes, by state designation

Yes, by ACS

No

Do not know

3. Does the trauma unit include ICU and step-down beds? \*Yes  No

\*If yes, approximately what percentage of these beds are dedicated to ICU patients? \_\_\_\_\_%

4. When patients are ready to transfer out of the trauma ICU, do 100% of these patients transition to a stepdown unit? (Check one)

Yes, every ICU patient must go to a stepdown after the ICU

No, at least some trauma patients may go to other types of units in the hospital (e.g., floor/ward)

***Tell us about the transition processes in the Trauma ICU...***

5. Does the trauma ICU have a guideline describing the patient characteristics that qualify for transition readiness? (Check ALL that apply)

- Yes, by policy/guideline  Yes, computerized  None

6. Do the providers at your institution utilize a standardize hand-off as patients transition from the trauma ICU? (An example is the I-PASS handoff tool) (Check one)

- \*Yes  No

6a. \*If Yes, please describe it by name: \_\_\_\_\_

7. How are patients and families prepared for their new floor prior to the transition?

(Check ALL that apply)

	Patients		Families	
Education about the floor environment.....	Yes <input type="checkbox"/>	No. <input type="checkbox"/>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Education about the floor staff expectations.....	Yes <input type="checkbox"/>	No. <input type="checkbox"/>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Education about the transfer process.....	Yes <input type="checkbox"/>	No. <input type="checkbox"/>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
An opportunity to pre-view the floor before transfer.....	Yes <input type="checkbox"/>	No. <input type="checkbox"/>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
A visit from a floor representative.....	Yes <input type="checkbox"/>	No. <input type="checkbox"/>	Yes <input type="checkbox"/>	No <input type="checkbox"/>

8. Patient transfer handoffs are conveyed between nurses primarily by (Check one)

- Tape recordings
- By phone call communication
- A review of patient information such as the care plan without face-to-face report
- Face-to-face report in nurses' station or other location such as break room
- Walking rounds/report at which they stop in the patient's room or bedside

9. How often do patient transitions occur during a nursing shift change? (Check one)

- Always
- Frequently
- Sometimes
- Rarely
- Never

***Tell us about the resources that support Trauma ICU transition work...***

10. What types of **computer software programs** are utilized during Trauma ICU transitions?

(Check ALL that apply)

- Electronic bed flow programs
- Software text platforms
- Patient physiological readiness programs
- Decision support software
- Identification of the receiving team prior to transfer
- Other: \_\_\_\_\_

11. Do all unit RNs use:

	Yes	No
Phones/2-way mobile communications.....	<input type="checkbox"/>	<input type="checkbox"/>
Vibrating pager/other communication device.....	<input type="checkbox"/>	<input type="checkbox"/>

12. Does your institution use an electronic medical record (EMR)?

\*Yes.  No

\*If yes, indicate which of the following EMR functions are available to staff:

	*Yes	No	*If yes, is it used for transition work?	
			Yes	No
Physician order entry.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Admission/transfer functions.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In-and-out of hospital records.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Primary care office records.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Skilled nursing facility records.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12b. Does the trauma ICU have a transfer form(s) unique to their unit?

Yes  No

12c. If yes, describe: \_\_\_\_\_

13. Do you have a standardized method on which your nurse staffing budget is based?

Yes  No  Do not know

13a. If yes, describe the system: \_\_\_\_\_

14. What is the trauma ICU **budgeted** occupancy for last month? (# \_\_\_\_\_ patients)

15. What was the **actual** trauma ICU occupancy for last month? (# \_\_\_\_\_ patients)

16. Which of the following acuity measures is (are) used to characterize patients? (Check ALL the apply)

- APACHE.....
- TSI.....
- TRISS.....
- SARS.....
- CML.....
- SOFA.....
- Other.....  (Specify: \_\_\_\_\_)

17. Approximately what percentage of your population is greater than 65 years of age?

\_\_\_\_\_ % > 65 years of age

18. Approximately, what percent of the trauma ICU patient population identifies as:

- % \_\_\_\_\_ American Indian, Alaskan Native
- \_\_\_\_\_ Asian
- \_\_\_\_\_ Black, African-American
- \_\_\_\_\_ Native Hawaiian or Other Pacific Islander
- \_\_\_\_\_ White
- \_\_\_\_\_ More than one of these

**Total 100%**

19. Approximately what percent of the trauma unit's population is Hispanic/Latino/Latina?

\_\_\_\_\_ % Hispanic or Latino

***Tell us about the provider role and human resources in the Trauma ICU...***

20. Which statement best describes the physician model on the trauma ICU? (Check one)
- Only intensivists manage patients (**closed model**)
  - Some patients are managed by intensivist(s) and some are managed by attending physicians (**simple mixed model**)
  - Patients are managed jointly by an intensivist and the attending physician with defined roles (**semi-closed model**)
  - Some patients are managed by an intensivist, some are managed by attending physicians, and some are jointly managed by both intensivists and attending physicians (**matrix mixed model**)
  - There are no intensivists, attending physicians manage their own patients (**open unit**)
21. In your trauma ICU, what physician role can write a transfer order? (Check **ALL** that apply)
- First-year resident
  - Resident
  - Fellow
  - Attending
22. In your trauma ICU, what *physician* level is **most** responsible for providing elements of the transition process during a patient transfer? (Check one)
- First-year resident
  - Resident
  - Fellow
  - Attending
23. Who is **primarily** tasked with the ICU provider-to-provider hand off? (Check **ALL** that apply)
- APRN- Nurse Practitioner
  - Physician Assistant
  - Attending Physician
  - Resident/Fellow MD/DO
  - Other: please specify \_\_\_\_\_
24. Approximately how many residents were assigned to the trauma ICU last month? (# \_\_\_\_)
25. In a **one-month period**, approximately how many intensivists care for patients on this unit? (# \_\_\_\_)
26. Does this unit have a physician director? \*Yes  No   
\*If Yes, more than one? Yes  No

27. Do the following kinds of providers practice in the Trauma ICU?

(Please check one, if yes, specify approximate #)

\*Yes (if \*yes, estimate #)

No

Nurse practitioners employed by hospital.....	<input type="checkbox"/>	(# _____)	<input type="checkbox"/>
Nurse practitioners employed by physician group.....	<input type="checkbox"/>	(# _____)	<input type="checkbox"/>
Physician assistants employed by hospital.....	<input type="checkbox"/>	(# _____)	<input type="checkbox"/>
Physician assistants employed by physician group.....	<input type="checkbox"/>	(# _____)	<input type="checkbox"/>

28. What is the approximate typical provider-to-patient ratio during the **day-time**?

(Check one per provider-type where *Provider : # of Patients*)

1:1 or 2:1   1:2   1:3   1:4   1:5   1:6   >6

**Provider Type**

RNs.....

	<u>1:5 or less</u>	<u>1:6-8</u>	<u>1:9-11</u>	<u>1:12-14</u>	<u>1:15-1</u>	<u>1:19-21</u>	<u>&gt;21</u>	<u>N/A</u>
APRN- Nurse Practitioner.....	<input type="checkbox"/>							
Physician Assistant.....	<input type="checkbox"/>							
Intensivist (MD/DO).....	<input type="checkbox"/>							
Attending Physician.....	<input type="checkbox"/>							

29. In the last month, approximately how often did the unit use temporary nursing agency or float pool nurses? (Check one)

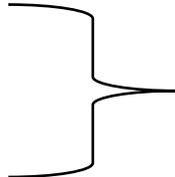
- 0% of shifts
- > 0% and equal or less than 10% of shifts
- > 10% and equal or less than 20% of shifts
- > 20% and equal or less than 50% of shifts
- > 50% of shifts

30. In the trauma ICU, nursing shifts are scheduled to overlap.... (Check one)

not at all

If not at all, check here if some staff overlap at least some shifts to update incoming nurses: \_\_\_\_\_

- 1 - 15 minutes
- 16 - 29 minutes
- 30 minutes
- 31 - 59 minutes
- 60 minutes



Besides the overlap, are some RNs assigned to overlap shifts by > 1 hour (e.g. an RN who works 1300-1700 when most RNs change shift at 1500)  Yes  No

31. Approximately what percent of trauma ICU RNs have a bachelors or higher nursing degree?: % \_\_\_\_\_

31a. In the last *two years*, have there been educational initiatives associated with *transitions*?

(Check ALL that apply)

Required? Personnel	Type						Outside Agency	
	Yes	No	Unit based	Hospital based	Provided	Yes	No	
Unit leadership.....	<input type="checkbox"/>							
Staff RN.....	<input type="checkbox"/>							
Physician/Intensivist.....	<input type="checkbox"/>							
APRN (NP)/PA.....	<input type="checkbox"/>							

32. At your institution, what *people* have an essential role in the transfer process of trauma patients?

(Select ALL that apply)

- Network of nursing leaders
- Non-clinical bed management roles
- Nurse Practitioner/Physician Assistant roles
- Physicians

33. Is there a role in your institution dedicated to facilitating overall bed management resources?

(e.g., nurse liaisons, clinical resource coordinators, etc.) (Check one)

- Yes  No

**Tell us about your organization...**

34. Senior management has a good idea of the kinds of mistakes that occur in this facility.

**Check one**

- Always  Frequently  Sometimes  Rarely  Never

35. The trauma ICU follows a specific process to review performance against defined metrics.

**Check one**

- Always  Frequently  Sometimes  Rarely  Never

36. The culture of this organization makes it easy to learn from errors.

**Check one**

- Always  Frequently  Sometimes  Rarely  Never

37. Good communication flow exists up the chain of command regarding patient safety issues.

**Check one**

---

Always	Frequently	Sometimes	Rarely	Never
<input type="checkbox"/>				

38. Patient safety decisions are made at the proper level by the most qualified people.

**Check one**

---

Always	Frequently	Sometimes	Rarely	Never
<input type="checkbox"/>				

**This is the end of the survey, thank you for your time.**

Please use the postage-paid envelope provided to return the completed survey:

Jason Saucier  
1229 Chestnut St.  
Philadelphia, PA 19107  
FRNT 1 PMB #461

*or* fill out the electronic version: <https://redcap.link/42uj6s0i>

## Recruitment Post Card

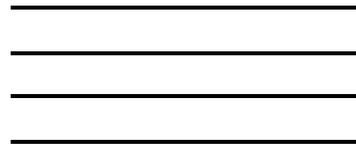
Dear Trauma Program Director or Manager,

In about a week, you will receive a 25-minute survey about patient transition resources in trauma critical care units. This survey will provide the first step in describing what elements are most important to provide safer trauma-patient transitions from critical care.

You may also receive communication from the *Society of Trauma Nurses* regarding the importance of this study. As an advanced practice nurse on a Trauma unit, I hope this information will help providers deliver better care.

Sincerely,

Jason A. Saucier PhD(c), MSN, CRNP  
Doctoral Candidate  
Vanderbilt University School of Nursing



## Administrative Cover Letter

Dear Trauma Center Administrator,

You are invited to complete the attached 25-minute survey designed to characterize the resources associated with trauma patient transitions. This topic is important because it will inform transition resource characterization at level 1 and level 2 trauma centers. Your participation is crucial to describe the current state of trauma patient transition work.

As a board-certified acute care nurse practitioner with 13 years of experience, I am completing a health services PhD program at the Vanderbilt School of Nursing. My research skills and findings from this study will improve the health care environment for patients and providers.

Your information will be kept secure in a HIPPA compliant software program named REDCap. The study poses minimal risk to you. I plan to publish the results within 18 months of completing the study. All results will be presented in aggregate to preclude identification of institutions or individuals.

Participating in this survey is voluntary. Deciding not to participate or choosing to only partially complete the survey will not result in any penalty. During or after the study, you may contact me at [Jason.A.Saucier@Vanderbilt.edu](mailto:Jason.A.Saucier@Vanderbilt.edu) or my advisor, Dr. Ann Minnick PhD, [Ann.Minnick@Vanderbilt.edu](mailto:Ann.Minnick@Vanderbilt.edu) if you have any questions or concerns. You may also complete this survey electronically; it can be found via the following link <https://redcap.link/42uj6s0i>.

Thank you for your time and consideration.

Best regards,

Jason Saucier MSN, CRNP, PhD-c  
Vanderbilt University School of Nursing  
461 21<sup>st</sup> Ave S.  
Nashville, TN 37240  
[Jason.A.Saucier@Vanderbilt.edu](mailto:Jason.A.Saucier@Vanderbilt.edu)

## APPENDIX B

### Elicitation Study

#### Salient beliefs regarding ICU transitions

Thank you for agreeing to participate in this interview. The questions I am asking you to answer refer to the duties you have when a patient is ready to leave your ICU. In many institutions there are a list of duties that are expected, like a transition bundle or processes that include order clean-up, sign-out communications, high risk patient identification, or a specified patient and family notification. To set your frame of reference, think about the last time you had an ICU patient who is now ready to leave the unit to move to the floor/ward. The transfer I am asking you to describe are only the transfers that happen from the ICU to ward (not discharge home, operating room transfer, or alternate facility transfer).

1. When transferring a patient from the ICU to the floor, what are the benefits of completing the tasks you are expected to safely transfer him?
2. What are the disadvantages of completing all the tasks you are expected to complete in order to transfer a patient to the floor/ward?
3. When it comes to transferring patients out of the ICU, there may be people who influence your tasks. In your past and present, think about who these people might be.
  - a. Please list the individuals or groups (no names) who would approve or think you should complete all of the transfer tasks.
  - b. Please list the individuals or groups (no names) who would enable or think it's ok *NOT* to complete all of the transfer tasks.
4. You have likely witnessed others in your role doing the work of transferring a patient out of the ICU, think about those you may have witnessed in your past and present.
  - a. Please list any transfer process duties that you believe are frequently left incomplete by others when transferring a patient.
  - b. Please list the transfer process duties that you believe others complete on most or all patient transfers.
5. Please describe what influences your ability to perform your transfer duties:
  - a. What makes it easier?
  - b. What makes it harder?

**Provider Survey**  
**Opinions about Patient Transitions Survey**

As you complete the survey below, please reflect on the work you do to transition a trauma patient from the ICU to the floor/ward (after their crucial care needs have resolved) within your institution.

Most questions in this survey use a 7-point rating scale. In this section, please **circle** the number that best describes your patient transition opinion.

For example, in question #1 if you find the work described in the prompt statement satisfying circle: 1-‘personally satisfying’, and if your opinion is that the work described is dissatisfying, circle: 7-‘dissatisfying’.

1. What is your hospital/institution name? (please write out)  
*(This is question is very important to analyze your answers correctly)*
  
2. 

---

The work I do to transfer a patient from the ICU to the floor/ward (non-ICU, non-stepdown type units) is...  
easy : \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : difficult  
important : \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : not important  
increases safety : \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : decreases safety  
professionally satisfying : \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : dissatisfying  
personally satisfying : \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : dissatisfying
  
3. How strongly does the nurse manager believe you should complete all of your transfer process duties?  
not strongly at all : \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : very strongly  
  
How much do you wish to comply with the nurse manager?  
very little : \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : to a very great extent
  
4. How strongly does the bed-flow nurse/administrative coordinator believe you should complete all of your transfer process duties?  
not strongly at all : \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : very strongly  
  
How much do you wish to comply with the bed-flow nurse/administrative coordinator?  
very little : \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : to a very great extent
  
5. How strongly does the receiving provider believe you should complete all of your transfer process duties?  
not strongly at all : \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : very strongly  
  
How much do you wish to comply with the receiving provider?  
very little : \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : to a very great extent

6. How strongly do high-level hospital administrators believe you should complete all of your transfer process duties?  
not strongly at all : \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : very strongly

How much do you wish to comply with high-level hospital administrators?  
very little : \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : to a very great extent

7. When transferring a patient from the ICU to the floor/ward (non-ICU, non-stepdown type units), my ability to complete expected duties are...
- a. impacted by how busy my patient assignment is  
agree: \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : disagree
  - b. impacted by ICU bed resource availability  
agree: \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : disagree
  - c. impacted by the receiving team's availability and permission  
agree: \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : disagree
  - d. impacted by how complicated my patients' medical course is  
agree: \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : disagree
  - e. impacted by how well the ICU ancillary staff members complete their duties  
agree: \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : disagree
8. When doing the work of transferring a patient from the ICU to the floor/ward (non-ICU, non-stepdown type units), I intend to...
- a. complete every expected duty:  
\_0%\_ : \_10%\_ : \_20%\_ : \_30%\_ : \_40%\_ : \_50%\_ : \_60%\_ : \_70%\_ : \_80%\_ : \_90%\_ : \_100%\_ : of the time
  - b. prepare ahead:  
\_0%\_ : \_10%\_ : \_20%\_ : \_30%\_ : \_40%\_ : \_50%\_ : \_60%\_ : \_70%\_ : \_80%\_ : \_90%\_ : \_100%\_ : of the time
  - c. report every ICU event to the receiving provider:  
\_0%\_ : \_10%\_ : \_20%\_ : \_30%\_ : \_40%\_ : \_50%\_ : \_60%\_ : \_70%\_ : \_80%\_ : \_90%\_ : \_100%\_ : of the time
  - d. satisfy the requests of bed-flow coordinators/nurses in charge:  
\_0%\_ : \_10%\_ : \_20%\_ : \_30%\_ : \_40%\_ : \_50%\_ : \_60%\_ : \_70%\_ : \_80%\_ : \_90%\_ : \_100%\_ : of the time
  - e. focus on patient safety during transitions:  
\_0%\_ : \_10%\_ : \_20%\_ : \_30%\_ : \_40%\_ : \_50%\_ : \_60%\_ : \_70%\_ : \_80%\_ : \_90%\_ : \_100%\_ : of the time
9. In the recent transfers I have been a part of...
- a. I completed all my expected transfer tasks  
all the time: \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : never
  - b. I reported forward to the receiving team all the important plans for my patient  
all the time: \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : never

- c. I was influenced by time constraints  
all the time:   1   :   2   :   3   :   4   :   5   :   6   :   7   : never
- d. I found it easy to communicate with the receiving team about the transfer  
all the time:   1   :   2   :   3   :   4   :   5   :   6   :   7   : never
- e. I recall that the ICU team functioned well, all ICU staff members (MD/NP/PA & RN and ancillary staff) completed their expected role in transitioning the patient.  
all the time:   1   :   2   :   3   :   4   :   5   :   6   :   7   : never

As you answer the following questions, please answer what best describes your ICU:

10. For the following questions, your patient is transitioning from the ICU/critical care to the floor/ward (non-intensive, non-stepdown unit):

- a. In my organization, when a patient's health condition improves and no longer requires ICU level care, please select the type of communication handoff that is expected between providers. (Select **ALL** that apply)
  - Provider-to-provider direct verbal sign-out phone call
  - Face-to-face sign-out is expected
  - Email document
  - Text messaging sign-out
  - Communication through medical records only.
- b. Do you have a provider-to-provider direct verbal sign-out expectation?  
(Select one)
  - Yes
  - No
- c. Is there an opportunity for questions to be asked?  
all the time:   1   :   2   :   3   :   4   :   5   :   6   :   7   : never
- d. All providers in my role are expected to utilize an organized communication strategy such as a checklist, or systems-based reporting tool during a sign-out?  
(Select one)
  - Yes
  - No
- e. At your institution, when patients transition from the ICU to the floor/ward, how frequently are discharge coordinators required to coordinate resources?  
all the time:   1   :   2   :   3   :   4   :   5   :   6   :   7   : never
- f. I have received mentoring, education, or communication regarding the transition process in my institution.  
all the time:   1   :   2   :   3   :   4   :   5   :   6   :   7   : never

- g. Patients identified to transition from critical care are always medically ready for this transition.  
all the time: 1\_ : 2\_ : 3\_ : 4\_ : 5\_ : 6\_ : 7\_ : never

As you answer the following questions, please describe yourself:

11. What is your role in the ICU? (Select one)

- Registered Nurse
- APRN- Nurse Practitioner
- Physician Assistant
- Resident Physician
- Attending Physician
- Other

12. What gender do you identify with? (Select one)

- Male
- Female
- Other

13. What is your racial make-up? (Select one)

- African American or Black
- American Indian or Alaskan Native
- Asian
- Caucasian or White
- Pacific Islander or Native Hawaiian

14. Do you identify as Latino or Hispanic? (Select one)

- Yes
- No
- Unsure

15. What is your current age? (Select one)

- 20 to 30 years
- 30 to 40 years
- 40 to 50 years
- 50 to 60 years
- > 60 years

16. Highest degree held? (Select one)

- Associates degree
- Bachelors degree
- Masters degree
- Doctorate degree

17. What is your current employment status? (Select one)

- Less than 20 hours per week
- 20 to 30 hours per week
- 30 to 40 hours per week
- 40 hours per week
- Greater than 40 hours per week

18. How many years have you worked in your role? (Select one)

- 0 to 5 years
- 5 to 10 years
- 10 to 15 years
- 15 to 25 years
- Greater than 20 years

19. Have you ever personally been the subject of a medical error related to provider misinformation? (Select one)

- Yes\*
- No

\*If **Yes**, please rate how this has impacted your diligence to patient transition care.  
no impact : \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : impacts my diligence on every transition

20. Have you or a person close to you been subject to a medical error related to provider misinformation?

- Yes\*
- No

\*If **Yes**, please rate how this has impacted your diligence to patient transition care.  
no impact : \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : impacts my diligence on every transition

21. In your role, have you ever made a patient medical decision in error due to misinformation?

- Yes\*
- No

If **Yes**, please rate how this has impacted your diligence to patient transition care.  
no impact : \_1\_ : \_2\_ : \_3\_ : \_4\_ : \_5\_ : \_6\_ : \_7\_ : impacts my diligence on every transition

**Thank you for your time**  
**Your opinions are important to improve patient transitions**

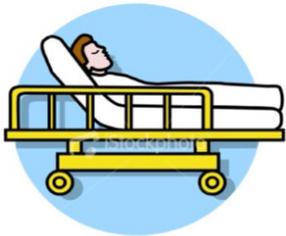
## Advertisement Flyer

A research study at Vanderbilt University School of Nursing wants to learn more about what elements impact [trauma patient transitions](#)

### Opinions about Patient Transitions Survey

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#### Why is this study important?



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- Patient transitions are a vulnerable time for patients.
- Poor transitions impact mortality, morbidity, readmissions, and clinical decision making.
- Are transition practices standardized across hospitals?
- How does provider behavior impact the transition process?
- How can we strive for a highly reliable transfer?

#### This study is a good fit for you if:

- You are a health care provider who does the work of transitioning trauma patients out of the ICU, including: **RNs, PAs, Advanced Practice Nurses, and Physicians**. Research is voluntary. Your participation is highly desired.

#### If you decide to participate in this study, you will have:

- One 15-minute paper survey to complete, available with [insert local site contact]
- Alternatively, a direct electronic survey is available at: [insert link]
- Personal information confidentiality. NO identifying personal information is collected.

#### Where will this research take place?

- Will take place on your ICU, analysis will take place through Vanderbilt University.

*The importance of this study is described on the [Society of Trauma Nurses](#) website.*

The researcher for this study is Jason A. Saucier CRNP, a PhD candidate at Vanderbilt University, 461 21<sup>st</sup> Ave S, Nashville, TN 37240. [Jason.A.Saucier@Vanderbilt.edu](mailto:Jason.A.Saucier@Vanderbilt.edu). IRB#[insert]

## Provider Cover Letter

Dear Physicians, APPs, and RN staff,

I invite you to complete a 15-minute survey that is designed to characterize the provider social environment associated with trauma patient transitions. This study will inform future transition interventions and may help you consider transitions at your unit.

As a board-certified acute care nurse practitioner with 13 years of experience, I hope to complete a health services PhD program at the Vanderbilt School of Nursing. My research skills will aim to improve the health care environment for providers through research.

Your information will be kept secure in a HIPPA compliant software program named REDCap. The study poses minimal risk to you; there are no links to your identity. I plan to publish the results within 18 months of completing the study. I will notify your local leadership and they will inform your unit on how to access the related publication. Your opinions and participation are crucial to characterize the important factors at work during patient transitions.

Participating in this survey is voluntary. Deciding not to participate or choosing to only partially complete the survey will not result in any penalty. During or after the study, you may contact me at [Jason.A.Saucier@Vanderbilt.edu](mailto:Jason.A.Saucier@Vanderbilt.edu) or my advisor, Dr. Ann Minnick PhD, [Ann.Minnick@Vanderbilt.edu](mailto:Ann.Minnick@Vanderbilt.edu) if you have any questions or concerns. You may also complete this survey electronically; it can be found via the following link: <https://redcap.link/ubgxhq38>.

Thank you for your time and consideration.  
Best regards,

Jason Saucier MSN, CRNP, PhD-c  
Vanderbilt University School of Nursing  
461 21<sup>st</sup> Ave S.  
Nashville, TN 37240  
[Jason.A.Saucier@Vanderbilt.edu](mailto:Jason.A.Saucier@Vanderbilt.edu)

## APPENDIX C

### Letter of Understanding



September 2, 2019

Stephanie Czuhajewski, MPH, CAE  
Society of Trauma Nurses  
446 East High Street, Suite 10  
Lexington, Kentucky 40507

Dear Ms. Czuhajewski:

Once again, thank you for talking with Jason and me about his dissertation work last week. As promised, we are sending you a letter of understanding about what we believe were the major points of the meeting. Let us know if there are any changes needed. To simplify things, I have divided the letter by project stages.

1. You will provide us with a listing of the intensive care trauma nurse managers in October after Jason defends his proposal early in the month. He will let you know the happy news! This list is approximately 520 managers and includes their addresses. We understand this represents close to but not every trauma unit in the US. Jason will take other measures (AHA database, calling etc.) for those not listed or if there is incomplete information. Based on past experience with mailing lists, we know this is always in flux!
2. Jason will complete his IRB application in October and then work on reproducing cover letters and surveys and assembling envelopes, etc. This is not paid for nor is the responsibility of the STN in anyway. Jason is applying for funding for this from a variety of VU resources.
3. We will work together in November and December to craft an announcement your organization will make via its usual member communication channels about the survey and its importance to understanding patient transitions from trauma ICU to other hospital units. The survey cover letter will in no way indicate an endorsement by the Society.
4. Jason is aiming to mail the survey in the second half of January or early February. You will send out reminders about completing the survey then using your usual communication channels with members. He will send two follow-up surveys to non-responders at approximately two and a half week intervals. You indicated you will send reminders to members then.
5. It is Jason's responsibility to conduct all data reduction, analyses and reporting.
6. Jason will submit an abstract for presentation at your national meeting upon completion of the project. He understands this is a competitive process and that his acceptance is not guaranteed. We anticipate the date for submission is dependent on the conference submission deadline dates.
7. Jason intends to write several papers based on the results. He intends to submit at least one to your organization's journal. He understands that acceptance is not guaranteed. He must go through the normal peer review process. We anticipate this submission will be in the second half of 2020.

We are both so grateful for your assistance. It is always wonderful to see nursing societies helping nursing research. I noticed you are not that far away from us in Nashville. Perhaps you will be able to

VANDERBILT UNIVERSITY	<a href="http://www.mc.vanderbilt.edu/nursing">www.mc.vanderbilt.edu/nursing</a>
461 21st Avenue South	tel 615.322.4400
Nashville, Tennessee 37240-1119	fax 615.343.7711

come to hear Jason's final defense sometime next summer if you are in our area! We always video our student defenses and these can be seen, usually a month after the live defense on our web site. This could be an alternative arrangement for you!

We look forward to hearing from you regarding anything we may have misunderstood or omitted.

Best wishes,

  
Ann Minnick, PhD, RN, FAAN  
Julia Eleanor Chenault Professor of Nursing

  
Jason A. Saucier, RN, PhD (c)