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## **The Texas Health Presbyterian Hospital Ebola Crisis: A Perfect Storm of Human Errors, Systems Failures, and Lack of Mindfulness**

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**December 2015**

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This paper utilizes an organizational mindfulness perspective to analyze the series of events that led to the misdiagnosis of the first Ebola case in the U.S. in 2014 and to the transmission of the virus to two nurses at Texas Health Presbyterian Hospital in Dallas. We use an interdisciplinary approach that bridges the supply chain and management fields, drawing from the literature in patient safety and medical errors, and organizational culture and mindfulness. Our approach is two-part: we provide descriptive (what happened) representations of *mindlessness* in the “Ebola crisis chain” and then, offer normative (what should have happened) recommendations for *mindfulness* in responses to health care emergencies. We conclude by discussing cultural aspects of mindfulness in hospitals with a description of how a mindful culture would look, and how it would benefit the health care supply chain.

**Keywords:** health care supply chain, medical errors and patient safety, hospital quality and performance, global public health, resilience, organizational culture, high-reliability organizations, mindfulness.

### **Introduction**

The 2014 Ebola epidemic in West Africa is the largest and most horrific Ebola outbreak in recorded history. As of November 4, 2015, there have been 28,607 confirmed, probable, and suspected cases and 11,314 reported deaths. The fatality rate in Guinea is 67 percent, 29 percent in Sierra Leone, and 45 percent in Liberia; the fatality rate for health care workers across these three countries is 58 percent (WHO 2015). The first case – and first death – of Ebola on U.S. soil was that of Thomas Eric Duncan, a Liberian national who arrived in Dallas on September 20<sup>th</sup>, 2014 on a flight from Monrovia, Liberia. Mr. Duncan’s death generated panic in the U.S. when it was reported that he had been misdiagnosed and sent home after his first arrival at Texas Health Presbyterian Hospital (THPH) in Dallas, Texas, and that two nurses had contracted the virus. A widespread reaction of the U.S. media was to ask: How could this be happening here?

The purpose of this paper is to analyze the events surrounding the misdiagnosis of the first Ebola case in the U.S. from the perspective of organizational mindfulness. In recent years, research on mindfulness has grown rapidly across several disciplines (Levinthal and Rerup 2006). This concept has been applied to the individual (e.g., Langer 1989) and organizational (e.g., Sandelands and Stablein 1987) levels, and particularly to high-reliability organizations (HROs) (e.g., Weick et al. 1999). Acting mindfully means that HROs “organize themselves in such a way that they are better able to notice the unexpected in the making and halt its development. If they have difficulty halting the development of the unexpected, they focus on containing it. And if some of the

unexpected breaks through the containment, they focus on resilience and swift restoration of system functioning” (Weick and Sutcliffe 2001: 3).

The notion of mindfulness, although related to the concept of resilience, is much more extensive in its reach, as captured by Dane’s (2011: 1000) definition of mindfulness as “a state of consciousness in which attention is focused on present-moment phenomena occurring both externally and internally.” The term resilience is widely used in the supply chain literature (Boone et al. 2013), where supply chain resilience consists of the ability to return to normal performance levels following a supply chain disruption (Sheffi 2005), and can be created by building in redundancy or flexibility (Christopher and Peck 2004; Sheffi and Rice 2005). Mindfulness is, to our knowledge, a concept still absent from supply chain discussions, but we propose it is particularly relevant in the health care context because it denotes a state of active awareness (Langer 1989) that is critical in a life-or-death environment.

This paper contributes to our knowledge of health care supply chains in multiple ways. First, studying the 2014 Texas Health Presbyterian crisis sheds light on strategic and operational aspects of the health care supply chain. We provide descriptive representations of *mindlessness* in the “Ebola crisis chain,” which includes players such as THPH, the U.S. Centers for Disease Control (CDC), the World Health Organization (WHO), and first-responder agencies (EMS, fire, law enforcement, dispatch). Furthermore, we offer normative recommendations for *mindfulness* in responses to health care emergencies. Second, we use an interdisciplinary approach that bridges the supply chain and management fields, drawing from the literature in patient safety and medical errors, and organizational culture and mindfulness. This interdisciplinary approach enables us to envision the events leading up to the tragic episodes in Dallas as occurring within a complex supply chain of facilities, equipment, information, and people. Finally, we also contribute to the mindfulness field by describing how a mindful culture would look and how it would benefit the health care supply chain. Our paper’s managerial implications also provide hospital administrators with a new perspective that examines hospitals as complex systems with different levels of mindfulness.

## **Events Leading to the U.S. Ebola Crisis**

### **The 2014 Ebola Outbreak**

According to epidemiological investigation, the Ebola virus detected in Guinea in 2014 is a new strain (Baize et al. 2014), suggesting a single point of introduction into humans from an animal reservoir (Schieffelin et al. 2014). The suspected index patient is a two-year-old child who died in Guinea on December 6, 2013 (Baize et al. 2014). Transmission of the unidentified disease spiraled into an outbreak in Guinea by February 2014 (Gire et al. 2014). In March 2014, hospitals in Guinea notified its Ministry of Health and Doctors Without Borders of a “mysterious disease characterized by fever, severe diarrhea, vomiting, and an apparent high fatality rate” (Baize et al. 2014: 1418). The fatality rate of initial cases was 86 percent. Blood samples from these cases were sent to biosafety level 4 (BSL4) labs in France and Germany for analysis, ultimately resulting in the identification of *Zaire ebolavirus* as the causative agent. It is suspected that fruit bats are reservoirs of the virus (Bausch et al. 2007; Leroy et al. 2005). Within a few months, Ebola spread rapidly throughout Guinea to neighboring Liberia and Sierra Leone (Gire et al. 2014). WHO was notified on March 23, 2014 (Aylward et al. 2014), and on August 8, WHO declared the Ebola epidemic to

be an international public health emergency (WHO 2014).

Ebola was first identified in Sub-Saharan Africa in 1976 as the cause of hemorrhagic fever outbreaks in Sudan and the Democratic Republic of the Congo (DRC) (Peters and LeDuc 1999). The virus appeared in the U.S. in 1989 when Ebola-infected nonhuman primates were imported from the Philippines to a primate facility in Reston, Virginia. Epidemics in this facility, as well as others, were reported intermittently until 1992, then again in 1996. The actual source of the virus was never detected (Peters and LeDuc 1999). From 1994 to 1996 an Ebola epidemic emerged in Central Africa; the virus was identified in Cote d'Ivoire, DRC, and Gabon (Peters and LeDuc 1999). There was an additional outbreak in Central Africa during 2000-2001 in Uganda (Aylward et al. 2014). These previous outbreaks were contained, largely because they occurred in remote, rural areas (Aylward et al. 2014; Gostin et al. 2014b).

The 2014 Ebola outbreak is the worst in recorded history--larger than all past outbreaks combined (Frieden et al. 2014). The WHO Ebola Response Team published an article in the *New England Journal of Medicine* on October 16, 2014 detailing the results of analysis of Ebola cases as of September 14 (Aylward et al. 2014). The authors state that "because Ebola virus is spread mainly through contact with the body fluids of symptomatic patients, transmission can be stopped by a combination of early diagnosis, contact tracing, patient isolation and care, infection control, and safe burial" (Aylward et al. 2014: 1482). When diagnosed in early stages, before the onset of severe diarrhea and vomiting, aggressive supportive treatment with IV fluids to combat the severe dehydration, enhanced by antibiotics, can improve survival (Fowler et al. 2014). However, given the failure to identify Ebola in the early months of the 2014 transmission, coupled with the lack of health care infrastructure and resources in West Africa, most of those infected were not in a position to receive supportive treatment. In fact, many died before receiving health care services or even a diagnosis (Aylward et al. 2014).

As of this writing, there is no commercially-available vaccine for *Zaire ebolavirus*, although several candidate vaccines have been undergoing clinical trials (Regules et al. 2015). Several health care workers, including the two nurses infected in Dallas, have been treated with an experimental antibody, previously used only on nonhuman primates (Gostin et al. 2014b). The nature of the population and lack of health care infrastructure in Guinea, Sierra Leone, and Liberia have precluded the timely containment of Ebola. These three countries are inherently interconnected with a lot of cross-border traffic, creating increased opportunities for the virus to spread (Aylward et al. 2014). Furthermore, the cultural customs regarding bereavement and burial rites impact the transmission from the deceased to the living; 60 percent of the cases in Guinea have been associated with traditional burials (Chan 2014). Finally, the extreme poverty level in West Africa has exacerbated the disease progression (Chan 2014). There is a reliance on bush meat for food, increasing the likelihood of human contact with an animal reservoir (Frieden et al. 2014). The lack of health care infrastructure has contributed directly to the magnitude of this outbreak; shortages in staffing, facilities, and systems hinder the containment of the virus once it has been identified (Boozary et al. 2014; Briand et al. 2014). In fact, Boozary et al. (2014: E1) state that the scarcity of health care workers in western Africa poses a serious challenge, and that, "even before the outbreak, Liberia's 4.3 million people were served by just 51 physicians – fewer than many clinical units in a typical major U.S. teaching hospital."

According to Aylward et al. (2014), the Ebola virus has a 21-day incubation period. With a 1-week average length of hospital stay, the number of available beds is grossly inadequate. Gostin et al. (2014b) state that hospitals have become "amplification points" for the spread of the virus due to a severe lack of isolation units, personal protective equipment (PPE), and trained staff. This

leads to a vicious cycle of too many patients overwhelming facilities, which in turn leads to even more cases (Frieden et al. 2014). The lack of other critical resources in the supply chain (e.g., IV fluids, guidelines/protocols) has compromised the safety of the health care workers operating under these conditions (Boozary et al. 2014). As of November 4, 2015, 881 health care workers have been infected with Ebola; 58 percent have died (WHO 2015).

### **The Dallas Ebola Case**

On September 30, 2014, the CDC announced that a patient was diagnosed with Ebola in the U.S. The patient, Thomas Eric Duncan, was a Liberian national who arrived in Dallas on September 20<sup>th</sup> on a flight from Monrovia, Liberia through Brussels. He had unknowingly contracted Ebola from a pregnant neighbor in Monrovia on September 15<sup>th</sup>, whom he carried when she fainted in a taxi they shared. It is believed that when he boarded the flight four days later, he was asymptomatic and, therefore, not likely contagious (Gostin et al. 2014a).

Duncan began to feel ill on September 24<sup>th</sup> and went to THPH's emergency room (ER) in Dallas on the 25<sup>th</sup>. He was treated for fever and abdominal pain, diagnosed with a low-grade virus, and released with a prescription for a course of antibiotics and told to take Tylenol. On September 28<sup>th</sup> he returned to this hospital, this time in an ambulance, with symptoms now including diarrhea and vomiting. He was placed in isolation in critical condition, diagnosed with Ebola on September 30<sup>th</sup>, and died October 8<sup>th</sup>. Two nurses who treated Duncan were diagnosed with Ebola on October 12<sup>th</sup> and 15<sup>th</sup>, respectively. They were transferred to biocontainment units in hospitals in Bethesda, Maryland and Atlanta, Georgia (*The Guardian*, October 10, 2014). Both nurses recovered from the virus. *The Guardian* reported on October 10, 2014 that:

It is still not clear why the hospital did not test Duncan for Ebola on his first visit, based on his travel history and symptoms. The hospital initially said Duncan had not told them of his travel history, and then later said he had, but the nurse had not shared that information with the entire medical team. The following day, the hospital changed its story again, attributing the error to a “flaw” in its online health records system, but then corrected its statement and said their (sic) was “no flaw” and Duncan’s travel history had been available to the entire medical team.

The misdiagnosis and delay in the proper diagnosis “triggered a cascade of public health missteps” (Gostin et al. 2014a). When Duncan was transported by ambulance, the EMS personnel were not wearing PPE. In fact, the ambulance remained in service for another 48 hours before it went through decontamination (Gostin et al. 2014a). Additionally, according to nurses at THPH, Duncan was not isolated immediately, but was left in an open area in the ER for a period of time, possibly exposing up to seven other patients to Ebola. The nurses further stated that his laboratory samples were transported via the hospital’s pneumatic tube system and personnel went in and out of the isolation units without proper PPE (Brown 2014).

Nurses at THPH responded to the finger-pointing by issuing a statement through their labor union on October 14, 2014 stating that the hospital failed to follow proper procedures and did not provide adequate training and PPE (Brown 2014). The CEO of Texas Health Resources, the parent company of THPH, published a one-page letter to the community with an apology in the *Dallas Morning News* on October 19, 2014. The letter states:

When we initially treated Mr. Duncan, we examined him thoroughly and performed numerous tests, but the fact that Mr. Duncan had traveled to Africa was not communicated effectively among the care team, though it was in his medical chart. On that visit to the Emergency Department, we did not correctly diagnose his symptoms as those of Ebola. For this, we are deeply sorry (Berdan 2014).

A *Dallas Morning News* article on October 24, 2014 discussed Presbyterian Hospital's lessons learned from the mistake, and resulting changes to procedures. The hospital changed how information regarding travel to West Africa is flagged and displayed in the patients' electronic medical records and improved triage, isolation procedures, and other processes (Jacobson 2014).

## **Theoretical Background**

### **Hospitals and High-Reliability Organizations**

In their review of the organizational factors linked to medical errors and patient safety, Hoff et al. (2004) concluded that three system-focused theories have been used in the past to look at hospitals as complex adaptive systems: normal accident theory, high-reliability theory, and the human factors approach. Hoff et al. (2004: 22) summarize these three theories:

... normal accident theory alludes to the structural factors that shape the probability for error within an organizational system. High reliability theory identifies the important role played by the cultural features of an organization in promoting "error-free performance" while structural dynamics play a secondary role. Developing a "culture of reliability," placing high organizational value on safety training and education, and getting workers to buy into the importance of routine and redundancy are intertwined with the development of shared norms and values that emphasize safety. Finally, the human factors approach, pioneered in studying industries such as aviation, emphasizes group-level interactions and the use of multidisciplinary teams as key to minimizing error in a given production process. Common to all these approaches are organizational variables that deal with the use of information and feedback around error.

Each of these theories manages different organizational factors in an effort to reduce error. Normal accident theory focuses on control over personnel, close proximity of upper echelons to operating systems, centralization, use of "buffers" between steps in processes, and feedback (Hoff et al. 2004; Perrow 1994). Human factors theory differs from normal accident theory in some of its recommendations, focusing on factors such as decreased complexity, feedback, redundancies, team cooperation, rapid response capability, communication, information systems, and decentralized decision making (Helmreich et al. 1999; Hoff et al. 2004). Finally, high reliability theory is the one with the most emphasis on designing complex processes for reliable performance by managing factors such as organizational culture, system redundancies, training and education, decentralized decision making, feedback, and routines (Hoff et al. 2004; LaPorte 1988; Roberts 1990; Rochlin 1993; Weick et al. 1999).

In analyzing the Dallas Ebola crisis, we build on the foundations of high-reliability theory, given our interest not only in human and structural factors, but also cultural ones, in achieving

reliable performance. We also position the concept of mindfulness as a natural extension of the HRO conversation. HROs usually refer to organizations such as nuclear power-generation plants (e.g., Marcus 1995; Bourrier 1996), naval aircraft carriers (e.g., Rochlin et al. 1987), air traffic control systems (e.g., LaPorte 1988; Weick and Roberts 1993), and fire-fighting crews (Weick 1993). HROs operate “under very trying conditions” (LaPorte and Rochlin 1994: 221), that is, in environments with high potential for error and where the scale of consequences precludes learning through experimentation (Rochlin 1993).

Hospitals aspire to become HROs and prior research has explored how HRO practices can be applied to health care (Frankel et al. 2006; Pronovost et al. 2006; Tamuz and Harrison 2006). For example, Frankel et al. (2006) describe three determinants of high reliability in health care: (1) safety culture (including a just culture, engaged leadership, and team training and effective communication); (2) electronic health records (including electronic medical records, computerized physician order entry, medication administration records, bar coding, smart infusion pumps, etc.); and (3) evidenced-based practice (including the standardization and simplification of care processes, default protocols with MD exceptions only, etc.). Pronovost et al. (2006) also propose a model to improve reliability in health care, including interventions to improve organizational culture, with the following steps: (1) identifying evidence-based interventions that improve the outcome, (2) selecting interventions with the most impact on outcomes and converting to behaviors, (3) developing measures to evaluate reliability, (4) measuring baseline performance, and (5) ensuring patients receive evidence-based interventions.

Despite their aspirations, researchers agree that hospitals still lag HROs in their levels of reliability. In fact, interest in hospitals as HROs dramatically rose after the “*To Err is Human*” report, published by the Institute of Medicine (IOM) in 1999, called for a national effort to make health care safer. Although the report has been widely credited with spawning efforts to study and improve safety in health care, limited objective assessment of its impact in practice is available (Stelfox et al. 2006). Five years after the report, Wachter (2004) argued that improvements could be observed in stronger regulation, information technology, and workforce organization and training, but that accountability and error-reporting systems had not been largely impacted. Ten years after the report, Makary (2012), a physician, provided a picture of undertrained and unsupervised interns and residents making mistakes because they are afraid to ask for help, and doctors with God complexes, addictions, and poor track records practicing freely with the “code of silence” preventing colleagues from speaking up or taking action.

### **Mindfulness Strategies**

A key characteristic of HROs is that they foster “mindfulness” in their organizational members. Mindfulness has been described as the “combination of ongoing scrutiny of existing expectations, continuous refinement, and differentiation of expectations based on newer experiences, willingness and capability to invent new expectations that make sense of unprecedented events, a more nuanced appreciation of context and ways to deal with it, and identification of new dimensions of context that improve foresight and current functioning” (Weick and Sutcliffe 2001: 42).

Mindfulness comprises five components (Weick and Sutcliffe 2001; Weick et al. 1999): (1) preoccupation with failure; (2) reluctance to simplify interpretations, (3) sensitivity to operations; (4) commitment to resilience; and (5) deference to expertise. A constant preoccupation about the possibility of failure, even in the most successful endeavors, is part of a culture that avoids hubris

and arrogance, and is open to individuals asking questions and recognizing mistakes. Reluctance to simplify interpretations involves taking deliberate steps to create more complete and nuanced pictures of activities and processes, and comprises incorporating diverse views and skepticism into debates. Sensitivity to operations highlights attention to input from the front line, the development of situational awareness, and the ability to both concentrate on a specific task while having a sense of the bigger picture. Commitment to resilience emphasizes skills to contain and bounce back from errors, including the ability to keep errors small and to improvise workarounds that keep the system functioning. Deference to expertise involves valuing diversity because it lets the organization notice more and do more with the complexities people spot, and migrating decisions to the person with the most expertise, regardless of rank or status. These five characteristics together generate reliably dependable processes with minimal and manageable errors.

### **Mindful Organizational Culture**

Mindfulness strategies need to be enabled and supported by mindful cultures. Research connecting culture with mindfulness is scarce. In proposing the type of culture that supports mindfulness strategies in hospitals, we start by integrating the fragmented map of culture types available in the literature, and then propose the perspective of an error management culture as a mindfulness culture. Table 1 summarizes various types of cultures and their link to mindfulness.

**Table 1. Organizational Culture Types**

	<b>Definition</b>	<b>Relationship to Mindfulness</b>
<b>Safety culture</b> (e.g., Rasmussen 1997)	A culture that reflects individual, group, and organizational attitudes, values, and behaviors concerning safety.	-focus on wariness -formal safety practices and responsibilities documented in a safety management system
<b>Informed culture</b> (e.g., Reason 1997)	A culture that requires the free exchange of information.	-focus on wariness -open channels of communication
<b>Fair and just culture</b> (e.g., Frankel et al. 2006)	“Don’t shoot the messenger” A culture in which management and employees openly identify and examine the organization’s weaknesses, and feel safe voicing concerns about their own actions and those of others.	-open channels of honest communication -individuals feel psychological safety at work
<b>Reporting culture</b> (e.g., Reason 1997)	“Don’t be afraid of being shot” A culture with a system of reporting near misses, “close calls,” and other warning events.	-open channels of communication
<b>Flexible culture</b> (e.g., Reason 1997)	“Rules don’t and can’t cover every situation” A culture that adapts to changing demands.	-Individuals understand that rules don’t and can’t cover every situation.

**Table 1. Organizational Culture Types (Continued)**

<b>Learning culture</b> (e.g., Schein 1997)	“Learning is continuous; be a student” A culture conducive to creativity, problem solving, and experimentation.	-active scanning on environment -learning flows from the individual to the group and organizational levels, and back to individuals and group
<b>Error management culture</b> (e.g., Van Dyck et al. 2013)	A culture that focuses on minimizing the negative consequences of errors by early detection and error correction, and on preventing similar errors in the future by analyzing the causes of errors, and learning from errors.	-continuous awareness and proactive processes towards early detection, management, and prevention of errors, and towards learning from errors

Schein (1997) defines the culture of a group as a pattern of shared basic assumptions learned by the group as it solves its problems of external adaptation and internal integration; this pattern of assumptions has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems. Thus, shared values, norms, and perceptions are the raw materials of culture; when held in common, the resulting shared expectations associated with role clusters in a group tend to encourage members to bring certain assumptions to the task of decision making and to operate with similar views of rationality. In some conditions, however, a group may not have the kind of learning experiences that allow it to evolve a culture. This is the case, for example, when there is turnover in the leadership or in group membership, or when the group’s mission, its primary tasks, or its technology, change. Furthermore, when values and beliefs work at cross purposes with other values and beliefs, situations of conflict, confusion, and ambiguity can arise. Turner and Pidgeon (1997: 47) describe other risks associated with culture:

Part of the effectiveness of organizations lies in the way in which they are able to bring together large numbers of people and imbue them for a sufficient time with a sufficient similarity of approach, outlook and priorities to enable them to achieve collective, sustained responses which would be impossible if a group of unorganized individuals were to face the same problem. However, this very property also brings with it the dangers of a collective blindness to important issues, the danger that some vital factors may be left outside the bounds of organizational perceptions.

### Mindful culture as safety culture

Multiple types of cultures have proliferated in literature on HROs and health care organizations. One of the few exceptions of research connecting culture and mindfulness is work by Weick and Sutcliffe (2007), where they proposed that safety/informed cultures are aligned with mindfulness strategies and HROs, and described four sub-cultures within a safety culture: (1) a reporting culture, (2) a fair and just culture, (3) a flexible culture, and (4) a learning culture.

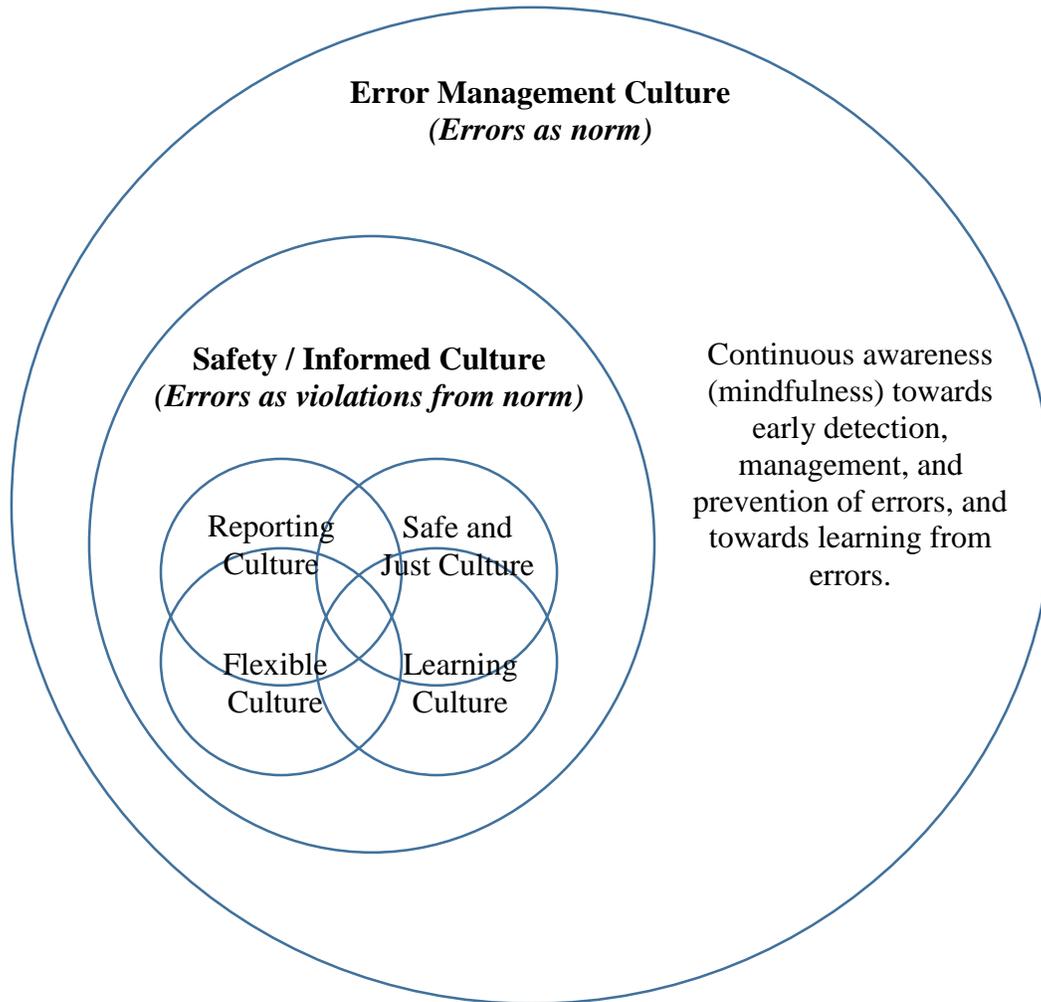
First, safety cultures are dependent upon information gathered from errors and mistakes. Thus, the reporting of knowledge gained from rare incidences, near misses, mistakes, and other situations needs to be encouraged. This means that individuals must feel comfortable and safe discussing

their own errors so that others can learn from them. Second, safety cultures are dependent upon individuals and groups examining their own weaknesses. Organizations with a just and fair culture are willing to expose areas of weakness as they are to display areas of excellence. In health care, when a safe and just culture is implemented, every individual in the organization – patient, nurse, physician, staff member – feels safe voicing concerns, knows how to do so, and is able to do so easily (Frankel et al. 2006). Third, safety cultures need to adapt to changing demands. In a flexible culture the organizational hierarchy is flat and there is deference to expertise in a particular area regardless of rank or position. Information tends to flow more freely. Employees are empowered to make decisions that aid in quality and safe patient care. Finally, safety cultures need to actively scan the internal and external environments in order to proactively shape responses. A learning culture supports the organization's capacity to adapt or to respond quickly and in new ways, while working to remove barriers to learning. This culture is receptive to individual learning efforts and puts in place systems, structures, and rewards that encourage sharing and using the newly learned information.

#### Mindful culture as error management culture

In Figure 1, we propose that an error management culture encompasses the cultures described above, and is best aligned with the development of mindfulness. Error management is a strategy that focuses on minimizing the negative consequences of errors by early detection and error correction (Van Dyck et al. 2013). Errors are defined as “unintended deviations from plans, goals, or adequate feedback processing as well as an incorrect action that result from lack of knowledge” (Van Dyck et al. 2005: 1229). Causes of errors include fatigue, workload, fear, cognitive overload, poor interpersonal communications, imperfect information processing, and flawed decision making (Helmreich 2000; McKay and Efferson 2010; Johnson et al. 2013). People in organizations with an error management culture anticipate that errors are likely to occur on occasion, and therefore, focus on containing potential damage resulting from errors (Frese 1995) instead of blaming and punishing the occurrence of errors (Van Dyck et al. 2005). An error management culture also focuses on preventing similar errors in the future by analyzing the causes of and learning from errors (Van Dyck et al. 2013). Individuals are encouraged to learn from errors and communicate about errors, use errors as learning opportunities, and increase exploration and experimentation after an error occurred (Heimbeck et al. 2003). Error management has been highlighted as a crucial aspect in understanding quality in multiple fields (e.g., Hoffmann and Roche 2010).

Figure 1. Relationships among Organizational Cultures



The key difference between a safety/informed culture and an error management culture is that safety cultures focus on errors as violations from the norm. In a safety culture there is a tendency to focus on error prevention, rather than error management. This focus on compliance and minimization of violations places individuals and the organization in a reactive frame of mind rather than in a proactive state. Mindfulness implies a proactive state, which is a key characteristic of an error management culture. An error management culture goes beyond a reporting culture and a just and fair culture in the way it manages errors, and goes beyond a flexible culture and a learning culture in the way it moves forward from errors. In an error management culture, people expect errors to happen because errors can never be prevented completely (which supports preoccupation with failure), people consider errors to be random (which supports reluctance to simplify), people build tools for quick error detection (which supports sensitivity to operations), people motivate and develop skills, routines, and communication processes to deal with errors (which supports commitment to resilience), and people believe that there is never just one answer to the error problem because one cannot predict all possible errors (which supports deference to expertise).

Next, we apply the perspectives of mindfulness and error management culture to the way in which THPH managed and should have managed the Ebola crisis.

## **Mindlessness at THPH: The Descriptive Model**

Table 2 shows examples, not of mindfulness, but of mindlessness at THPH.

**Table 2. Mindlessness at Texas Health Presbyterian Hospital: Descriptive Representations**

<b>Mindfulness Strategy</b>	<b>Examples of Mindlessness</b>
Preoccupation with failure	<ul style="list-style-type: none"> <li>• Dallas Presbyterian admits that it had been ready to <i>treat</i> Ebola, but not ready to <i>diagnose</i> Ebola.</li> <li>• Sense of urgency and gravity lacking:               <ul style="list-style-type: none"> <li>○ Low acceptance that an Ebola crisis was a real possibility in the U.S.</li> <li>○ Low preparation for the possibility of close calls and near misses in diagnosis given that Ebola symptoms could also be associated with indigestion, intoxication, or food poisoning.</li> </ul> </li> <li>• Culture of arrogance and complacency at the country level and hospital level: U.S. doctors and volunteers were going to Africa to treat, so they were the “world experts” in Ebola.</li> </ul>
Reluctance to simplify	<ul style="list-style-type: none"> <li>• Blind spots:               <ul style="list-style-type: none"> <li>○ System failed because travel history was recorded, but did not raise a red flag. The miss was basically a simple question that the physician didn’t ask: Had Mr. Duncan traveled? The only reference to Africa came in a brief nurse’s note.</li> <li>○ CDC guidelines for protective equipment were not up-to-date.</li> </ul> </li> </ul>
Sensitivity to operations	<ul style="list-style-type: none"> <li>• Dallas Presbyterian’s weakest point was its Emergency Room (ER):               <ul style="list-style-type: none"> <li>○ Dallas Presbyterian met or exceeded 75 percent of 138 specific measures of care, but its ER failed to meet all five national patient safety and quality benchmarks the hospital reported. Those measure how long it takes for patients to be seen, admitted, or otherwise cared for in the ER.</li> </ul> </li> <li>• ER at Presbyterian was outsourced.</li> <li>• No clear picture of Mr. Duncan’s current situation at all points in time.</li> </ul>
Commitment to resilience	<ul style="list-style-type: none"> <li>• Long lag times between the detection of Ebola in Mr. Duncan and actions related to the treatment of his family, the paramedics, and the nurses. Lag times around reports and feedback.</li> <li>• Lack of coordination among agencies (nurses flying on airplanes).</li> <li>• Lack of training in safety and cleaning procedures.</li> </ul>
Deference to expertise	<ul style="list-style-type: none"> <li>• Hospital showed lack of deference to nurses’ expertise with initial reaction of blaming the crisis on the nurses. The Union needed to defend the nurses.</li> <li>• Deference to expertise showed in decision to transfer infected nurses to specialized hospitals with more expertise.</li> </ul>

Key questions associated with preoccupation with failure at THPH are: To what degree had the hospital considered an Ebola crisis? To what degree was the hospital's culture one that seeks out and encourages bad news? Our hypothesis is that THPH was experiencing a low sense of urgency about Ebola, and that there was a low expectation of an Ebola crisis in the U.S., and in the hospital itself. Ebola had been associated with third-world countries and U.S. doctors and volunteers were going to Africa to treat and help. Hubris may have developed around the superiority of U.S. medicine and expertise in treating Ebola, which also has implications for the second mindfulness strategy: reluctance to simplify.

Important questions about reluctance to simplify at THPH are: Was the hospital taking its prior success for granted? To what degree was the hospital's culture one that shuts down information that could interrupt operations or surface weaknesses in patient care? Several factors suggest lack of careful detail and specificity in creating a picture that was less simple and more complex. The key blind spot was ignoring the travel history of Mr. Duncan. Travel history was recorded, but did not raise a red flag. The physician did not ask the question: Had Mr. Duncan traveled? The only reference to Africa came in a brief nurse's note. Similarly, CDC guidelines for PPE were not up to date.

Questions that address THPH's sensitivity to operations are: When problems started to occur, were hospital authorities accessible and available, especially to people on the front lines? To what degree was the hospital's culture one that enables individuals to catch most of the small errors that would normally go unnoticed and be left to cumulate? Information that has been made public after the crisis suggests that THPH's weakest point was its ER. The hospital exceeded seven national quality benchmarks for strokes, earned perfect scores on a number of surgical measures, met six of ten criteria on heart attacks, and had nearly no infections from IV insertions, about 75 percent fewer than national benchmarks. In contrast, THPH's ER failed to meet all five national patient safety and quality benchmarks. For the year ending March 31, 2014, patients in the hospital's ER waited 44 minutes on average before their first contact with a health care professional – 50 percent longer than state and national waits. Patients spent more than five hours in the emergency department, on average, before being admitted – more than an hour longer than state and national averages. This was the operational environment in which Mr. Duncan first arrived with early symptoms of Ebola, and was sent back home.

When errors cannot be prevented, a mindful strategy encompasses commitment to resilience. Key questions to ask about THPH's commitment to resilience are: How much training on Ebola did the hospital provide to its employees? To what degree was the hospital's culture one that encourages informal networks of people who self-organize to solve problems in novel ways? The available information shows low response speed, lack of coordination in the response, and lack of training. For example, it took several days to put Duncan's family in quarantine and have hazardous materials removed from their apartment. One of the nurses who had treated Duncan flew in a commercial aircraft. Nurses at THPH complained about the lack of training in safety and cleaning procedures in general.

Finally, critical questions about THPH's deference to expertise are: Who made the key decisions when the crisis emerged? To what degree was the hospital's culture one that values expertise and experience over hierarchical rank? While data about THPH's specific decision processes used during the Ebola crisis are not available to us, the hospital's lack of deference to nurses' expertise was public. THPH's initial reaction was to blame the crisis on the nurses; the union needed to swiftly and strongly defend the employees.

## Mindfulness at THPH: The Normative Model

Our normative model of the events leading up to the Dallas Ebola crisis focuses on what *should* have happened, rather than what *did* happen. Similarly, Harrald et al. (1990) developed a normative model to characterize the events in the decision-making process of the response to the 1989 Exxon Valdez oil spill in Alaska. They state that “a normative model is a description of what should have happened, assuming that a decision maker had access to all relevant information and possessed the ability to sort and to correctly process this information” (Harrald et al. 1990: 19). Table 3 summarizes examples of our normative recommendations.

**Table 3. Mindfulness at Texas Health Presbyterian Hospital: Normative Recommendations**

Mindfulness strategy	Examples of mindfulness	Organizational culture supporting mindfulness
Preoccupation with failure	<ul style="list-style-type: none"> <li>• WHO communicates to CDC in March, 2014 that Ebola had reached epidemic proportions in West Africa; WHO recommends CDC to put the U.S. ER infrastructure on alert.</li> <li>• CDC blankets ERs, trauma centers, hospitals, EMS, fire, law enforcement, and dispatch with notice of the epidemic, clear definition of transmission pathways, toxicity of the virus, and proper type of PPE and barrier facilities required.</li> <li>• CDC issues strict guidelines regarding the presence of each Ebola symptom, stages of the disease process, and appropriate treatment for each stage.</li> <li>• All first-responder agencies have a set of protocols in place regarding communication, processes, PPE, and decontamination procedures.</li> <li>• CDC provides all players with information regarding appropriate decontamination agents and protocols for proper application.</li> </ul>	<p>-An <i>error management culture</i> supports THPH proactively seeking out the errors made in the hospital, discussing the errors in a safe environment, learning from the errors, making adjustments, and ensuring lessons are shared.</p> <p>-A <i>reporting culture</i> supports the reporting of issues and alerts from WHO regardless of how remote the danger may have appeared.</p> <p>-An <i>informed culture</i> supports proactively seeking information from the CDC regarding appropriate decontamination agents and protocols for proper application.</p> <p>-A <i>learning culture</i> supports scanning the environment looking for potential dangers, and first-responder agencies having protocols in place regarding communication, processes, PPE, and decontamination procedures.</p>

**Table 3. Mindfulness at Texas Health Presbyterian Hospital: Normative Recommendations (Continued)**

Reluctance to simplify	<ul style="list-style-type: none"> <li>• CDC guidelines for PPE are current, and clearly indicate the type of PPE required and the associated protocols.</li> <li>• CDC guidelines clearly describe the Ebola transmission process, with emphasis on the definition of “airborne.”</li> <li>• IT systems are updated to raise highly visible red flags regarding symptoms and travel from West Africa; all personnel are trained to a heightened sense of awareness and diligence in following the script of questions, recording the answers, and communicating to the rest of team.</li> </ul>	<p>-An <i>error management culture</i> creates potential scenarios in relation to operations regardless of how remote the risks in operations may appear.</p> <p>-A <i>reporting culture</i> supports development of scripts and the communication of information to others in the health care team.</p> <p>-A <i>learning culture</i> supports updating hospital IT systems and training programs that create a heightened sense of awareness and diligence.</p>
Sensitivity to operations	<ul style="list-style-type: none"> <li>• Management is accessible to workers on the front lines, but employees are empowered to solve problems as they arise.</li> <li>• Hospitals hold meetings with all health care workers to discuss the potential severity of the Ebola situation; appropriate protocols and changes in processes are made to foster better communication and teamwork.</li> <li>• Hospitals discuss with all personnel the entire supply chain of Ebola patients in the health care system--from the 911 call to treatment by HAZMAT EMS, transport to ER, and decontamination; it is important for all health care workers to understand the big picture of the necessary inter-agency responses and required coordination.</li> </ul>	<p>-An <i>error management culture</i> encourages individuals to pay attention to what might go wrong as well as anticipating issues.</p> <p>-An <i>informed culture</i> supports holding meetings with all health care workers and discussing the potential severity of the Ebola situation. This would lead to appropriate measures and better communication among the teams.</p> <p>-A <i>learning culture</i> promotes the big picture supply chain issues of which all health care workers should be aware.</p>

**Table 3. Mindfulness at Texas Health Presbyterian Hospital: Normative Recommendations (Continued)**

Commitment to resilience	<ul style="list-style-type: none"> <li>• Hospitals and first-responder agencies demonstrate a sense of urgency and situational awareness of the possibility of an Ebola patient presenting.</li> <li>• Hospitals are prepared to diagnose and treat Ebola--barrier facilities are in place, the proper PPE is available, and health care workers have been trained in donning/doffing of PPE and all aspects of patient handling.</li> <li>• Drills are conducted with various first-responder agencies in order to simulate operations under high-stress conditions.</li> </ul>	<ul style="list-style-type: none"> <li>-An <i>error management culture</i> promotes a heightened situational awareness and sense of urgency.</li> <li>-A <i>flexible culture</i> supports in health care workers the need to adapt to unanticipated situations.</li> <li>-A <i>learning culture</i> supports efforts in drills and training, and is actively scanning the environment for possible surprises.</li> </ul>
Deference to experience	<ul style="list-style-type: none"> <li>• During crises, those individuals who have expertise, regardless of formal position title in hospital, are sought out for counsel.</li> <li>• Hospital management has conducted an honest audit of Ebola response capability; those which find they are not equipped to handle Ebola patients have plans in place to transfer any patients to hospitals that are equipped.</li> </ul>	<ul style="list-style-type: none"> <li>-An <i>error management culture</i> supports individuals looking for advice from others when preventing and managing errors.</li> <li>-In a <i>fair and just culture</i>, leaders are the first to report errors that they have committed. Employees are encouraged to put the team ahead of their own self-interest to “save face.”</li> </ul>

Several key issues need to be considered. The first issue that naturally emerges is the efficacy of the CDC’s communication to U.S. health care institutions and first-responder organizations that might potentially be faced with an Ebola patient. When did WHO communicate to the CDC that there was a threat, regardless of how remote, of Ebola transmission to the U.S. through international travel? WHO did not declare the situation in West Africa as an international emergency until August 8, 2014, although it had been contacted as early as March, 2014. When did the CDC communicate to health care entities that there was a threat, regardless of how remote, of an Ebola patient showing up in an ER or being the subject of a 911 call? How definitive was the information given in the CDC’s initial issuance of protocols? Did health care workers have access to the correct type of PPE and have training in its use (particularly donning and doffing)? Were these workers prepared to follow established barrier facility protocols for treatment and limit the amount of exposure to patients? Each of these questions will be addressed in our normative model describing what should have happened.

**Preoccupation with Failure**

Awareness of the possibility of failure is critical throughout all the entities involved in the Dallas Ebola crisis. Ideally, WHO should have begun communications with the CDC shortly after March, 2014 regarding the Ebola epidemic in West Africa. Although, at that time, the disease had not spread significantly throughout West Africa nor threatened other continents, the danger of

transmission through international travel should have been communicated once Ebola was transmitted into the large population centers in Guinea, Sierra Leone, and Liberia. Consequently, the CDC should have then proactively blanketed all U.S. hospital ERs, free-standing emergency clinics, urgent care clinics, and first-responder organizations with information to warn them of the potential threat. Included in this communication should have been (1) a detailed protocol for scripts of questions for patients presenting with certain symptoms, (2) a protocol for the appropriate type of PPE required to prevent transmission of the virus to health care workers, (3) instructions for proper donning and doffing of PPE, and (4) directives regarding the precautions necessary to treat Ebola patients effectively, including barrier facility infrastructure and recommendations regarding when to transfer patients to a hospital better equipped to treat Ebola.

Similarly, first-responder agencies, after receiving these directives from the CDC, should have ensured adherence to these protocols with assurance of adequate supply of proper PPE, training in its use, as well as other safety-related procedures, and established additional protocols specific to type of agency. For example, an ambulance crew of two paramedics should minimize exposure by following a script when interacting verbally with a potential patient through a closed door, as well as ensuring that only one of the paramedics (in full PPE) has patient contact. In this scenario, the “clean” paramedic would drive the ambulance, while the “dirty” paramedic would conduct all patient care. Proper protocols should also have been issued for decontamination of personnel and ambulances (e.g., exact percentage of bleach solution and exact spraying time requirements).

If the first responder is a fire department, as is often the case in medical calls of unknown nature, the fire officer should ensure crew safety by following similar protocols. The officer might initiate verbal contact through a closed door, and upon determination of a potential threat due to a positive answer to the “travel from West Africa question” retreat the scene and wait for EMS with full PPE to arrive and assess the patient. Similarly, police officers, although not dispatched in medical emergencies, might already be on scene, and should also have an established protocol if patients exhibit these symptoms and have traveled from West Africa. Dispatchers should have a script to follow when answering 911 calls of a medical nature with symptoms presenting that could be attributed to Ebola.

### **Reluctance to Simplify**

The CDC should have issued a comprehensive, definitive description of the Ebola virus transmission process. One early point of confusion regarding CDC guidelines was the definition of “airborne.” The Ebola virus is transmitted through contact with body fluids, and therefore cannot be transmitted through sneezing, as airborne pathogens are (i.e., influenza, measles, and tuberculosis). However, what does airborne really mean? Given that sweat is a body fluid, is it possible that someone standing five feet away and hit with sweat droplets when a patient shakes her head violently could be infected if a sweat droplet came into contact with a cut on the skin or a mucous membrane? Of all body fluids, which ones are the most deadly regarding the potential for disease transmission – blood, vomitus, diarrhea, semen, or saliva? In light of such confusion, the CDC issued revised protocols on October 20, 2014 addressing these critical issues (CDC 2014); however, this was late in the game. This “tightened guidance” focused on three principles regarding PPE: training on donning and doffing PPE, eliminating any skin exposure while wearing PPE, and the establishment of protocols to ensure a culture of worker safety.

THPH’s IT system should have had the question “Have you recently travelled from West Africa?” conspicuously at the top of the electronic medical record; however, it was initially several

screens down. Given the criticality of this piece of information, failure to place it in the most prominent position in the medical record was inviting staff to ignore this detail. Staff should have been trained to a higher sense of awareness of this information, to diligently follow the protocol's list of questions, and effectively communicate the answers to the health care team.

### **Sensitivity to Operations**

Situational awareness is critical to a hospital's ability to catch mistakes. As discussed previously, THPH's ER was a problem *before* the Ebola case. Excessive emergency waiting times can be indicators of overcrowding and understaffing (Mendoza and Sedensky 2014), which can create chaotic conditions, adversely impacting mindfulness. In addition to reducing chaos, management must ensure that someone is paying attention to what can go wrong. Hospital managers and supervisors must be available to front-line employees, but these same employees should be empowered to solve problems as they arise. Mindful hospitals will hold meetings with all health care workers to discuss (in advance) the severity of the Ebola situation world-wide, and the possibility of an Ebola patient presenting to their hospital. Protocols would be in place, and any necessary changes in processes would be undertaken. Additionally, significant effort would be dedicated to improving communication and teamwork throughout the hospital.

All employees – front-line employees all the way up to top management – should understand the entire supply chain of health care in treating Ebola patients. Everyone needs to understand the big picture, where the particular hospital fits in the supply chain, and all the inter-agency communication and coordination required to ensure safety.

### **Commitment to Resilience**

In addition to hospitals demonstrating a sense of urgency regarding the possibility of an Ebola patient presenting, all personnel should be trained in how to process and communicate information quickly. Hospitals should be prepared to react to the unexpected; hospitals should be prepared to both diagnose and treat Ebola. The initial point of patient contact should understand the importance of the “Ebola script” when asking patients questions. Furthermore, this information should be communicated directly to the ER team in addition to being noted in the electronic medical record. Once an Ebola patient is diagnosed, he or she must be placed into isolation immediately in an appropriate barrier facility in the hospital, and all personnel should follow the hospital's Ebola treatment protocol.

A hospital capable of resilience would have drilled personnel using simulations depicting actual Ebola response scenarios. These drills are critical to ensure that personnel are capable of performing while under stress. Additionally, since wearing PPE is extremely uncomfortable, and therefore, its use should be limited, the quicker and more effectively it can be donned and doffed, the more effective the time wearing it. The only way to ensure this is through repeated practice.

In addition to training and practice internally, the hospital should partner with its constituent first-responder agencies to conduct drills involving appropriate patient handoffs from an ambulance to the ER. Another skill which needs to be practiced is appropriate and effective communication. We detail two hypothetical scenarios to illustrate this point. In Scenario 1, a hazardous materials (HAZMAT) ambulance is transporting a suspected Ebola patient to the ER. The EMS personnel and dispatch have been in constant communication with the hospital to prepare for arrival and resulting handoff; the hospital is indeed capable of handling an Ebola patient, and

appropriate protocols are being followed. The EMS crew has practiced its Ebola protocol; one paramedic remains clean while the other provides patient care. The handoff at the hospital runs smoothly; after transferring the patient, the ambulance and EMS personnel go to decontamination off-site.

In Scenario 2, a regular ALS (Advanced Life Support, but not HAZMAT) ambulance transports a patient who is *not* identified as a potential Ebola patient; the proper protocols have thus not been followed. Upon arrival at the ER, the handoff occurs, but since no identification of the threat, proper PPE is not worn and protocols are not followed. Either at the point of intake or at the point of initial examination (depending upon which health care worker asked the right questions and/or identified the requisite symptoms of Ebola), the possibility of Ebola is suspected, and the hospital changes operating mode. At this point, it is absolutely critical that the hospital contact dispatch and the EMS crew as soon as possible; the crew (and anyone else with whom they have come in contact) needs to be notified of potential exposure to Ebola, and follow appropriate procedures. The worst case scenario would be if the patient did indeed have Ebola, and the transporting unit and personnel were never notified. Remaining on shift and potentially transporting other patients, in addition to contact with other EMS personnel, could pose a serious risk. In order for these breakdowns to be avoided, the protocols and use of PPE and other appropriate procedures must be drilled – not just in the hospital, but in integrated simulations with first responders.

### **Deference to Expertise**

Mindful hospitals suspend the traditional organizational hierarchy in times of crisis. Individuals who have expertise and the most experience need to be sought for counsel and leadership, regardless of official title and place in the organization chart. The hospital's organizational culture must be one where knowledge and experience are valued more than hierarchy. All personnel should understand and respect others' roles in the organization – both official and unofficial. The culture must also focus on teamwork and a shared sense of responsibility. In times of crisis, teamwork must take over and become more important than any one individual.

Finally, management must have conducted a realistic audit regarding the hospital's capability to respond to an Ebola patient. If such an audit shows any weakness in response capability, then management must establish protocols to transfer any patient presenting with Ebola to a facility that is equipped to handle these patients. The fact that only four hospitals in the U.S. are designated as BSL4 and capable of handling such pathogens (e.g., the National Institutes of Health (NIH) in Bethesda, Maryland; Emory University Hospital in Atlanta, Georgia; the Biocontainment Patient Care Unit at Nebraska Medical Center in Omaha, Nebraska, and St. Patrick's Hospital in Missoula, Montana (Stokowski 2014), suggests that the majority of hospitals would *not* be expected to be equipped to respond at this level.

The normative recommendations, presented above, detail what should have happened with the various players' roles in the Dallas Ebola crisis – from WHO to CDC to hospitals to first-responder agencies. What actually happened was quite different from this model. Even though West Africa's Ebola epidemic was growing exponentially, an "it can't happen here" attitude kept the issue from posing a real threat in the U.S. so that when it actually happened, we were unprepared; the "it can't happen here" mentality quickly disintegrated into a perfect storm.

## **Discussion and Conclusions**

The main contribution of this paper is an analysis of the events that led to the 2014 Dallas Ebola crisis from the perspective of organizational mindfulness. We hope to open a debate about the role of organizational mindfulness in detecting, preventing, and managing health care supply chain crises such as that occurring in Dallas. Our normative recommendations can be a starting point for this conversation. We invite supply chain and management scholars and hospital administrators to continue the cross-fertilization of ideas, which can help us to examine hospitals as complex systems with different levels of organizational mindfulness or mindlessness.

Our paper contributes to the supply chain and management literatures in multiple ways. First, as exemplified with the case of the “Ebola crisis chain,” while the concept of mindfulness has been largely absent from supply chain design and management, implementing mindfulness impacts both strategic and operational aspects of the supply chain. Furthermore, the Ebola crisis shows that, in health care, it is not enough for one organization to be mindful, but the close integration and interdependence among partners, such as THPH, CDC, WHO, and first responders, requires a shared understanding of and commitment to the principles of preoccupation with failure, reluctance to simplify, sensitivity to operations, commitment to resilience, and deference to expertise. Past research looking at HROs has primarily examined mindfulness at the intra-organizational level. Our descriptive representations and normative recommendations of the Ebola crisis shed light on the opportunities and challenges of developing mindfulness across organizations, at the supply chain, and even industry levels.

Second, we contribute to both the supply chain and the management fields by proactively integrating the two schools of thought and areas of study. Our interdisciplinary perspective enabled us to envision the events leading up to the Ebola crisis in Dallas as occurring within a complex supply chain of facilities, equipment, information, and people. The health care sector is an ideal setting for cross-fertilization between supply chain and management because concerns about patient safety, medical errors, and service quality are directly connected to the values, norms, assumptions, motivations, and behaviors of people working in organizations.

Third, bridging the supply chain and management perspectives allowed us to incorporate the role of culture in implementing mindfulness. The concept of a “mindful culture” or a “culture for mindfulness” has been suggested in the management field, but confusion abounds among the many types of culture associated with the health care sector and with HROs. We contribute to the body of knowledge on mindfulness by arguing that a mindful culture is an error management culture. Furthermore, we provide an organizing map of how the different cultures relate to each other. We argue that safety culture is a synonym of an informed culture, and a safety/informed culture encompasses a reporting, just, flexible, and learning culture. We also propose that a safety/informed culture views errors as violations from norms and that, in contrast, a mindful culture that supports the four mindfulness strategies requires an error management culture, which sees errors as part of the norms. Describing a mindful culture as an error management culture sheds light on the different conditions that need to be implemented to create such a culture, and the challenges of staying mindful in health care organizations.

Finally, we offer important implications for hospital administrators and managers. We offer our normative recommendations of the Ebola crisis as a proposal, and a detailed scenario, of how the health care sector could or should respond to health care emergencies – including ER management, and hospital service quality and productivity – by building and maintaining a state of mindfulness. It may be argued that our prescriptions would be impossible to implement in

today's resource-constrained health care environment. Evidently, cost/benefit analyses should be conducted at the individual hospital level. Management could then make informed decisions regarding what level of preparedness is appropriate. For example, hospitals may find it infeasible to treat Ebola, and instead focus on triage, isolation, and containment protocols to prepare a patient for transport to a hospital equipped to treat a biosafety level 4 pathogen.

### **Limitations and directions for future research**

The main limitation of this paper is that we relied on public sources and archival records to construct this case study of the Ebola crisis at THPH. The pros of this approach were that abundant information was available to us from news sources, health officials, and hospital administrators. THPH administrators, in fact, were often interviewed in the news and also made available to the public the lessons they learned from this crisis. The cons of this approach were that we did not incorporate an insider's perspective into our analysis since we did not conduct direct observations of or interviews with doctors, nurses, or hospital administrators. To alleviate this limitation, we consulted a group of experts during the formation of our case study and models. This expert group included doctors, policy makers, and emergency response leaders.

The next steps in our research agenda include moving from our qualitative analysis to the creation of a formal model of mindfulness in health care that would allow hypotheses testing. Efforts to measure a phenomenon inform theory and help to illuminate its conceptualization. Scale development efforts will be necessary to capture the levels of mindfulness of an organization, and to measure the concept of mindful cultures as an error management culture.

Future research can build on the bridge we created here between the supply chain and management bodies of knowledge. For example, as a field, we are in need of research that humanizes the supply chain by highlighting the "human capital" component. Although there have been tremendous advancements in technology over the years, the health care and emergency response industries are still incredibly labor intensive. As such, more research focusing on the human element in these supply chains is critical. Another inter-disciplinary direction is the synergy between the management and service operations literatures. We see great potential and synergies in exploring how error management cultures are related to the operations management concepts of service failure recovery and fail-safing. For example, the fields of aviation and nuclear power technology have built in series of checks and balances and redundancies to fail-safe their systems in addition to near-miss reporting systems (Barach and Small 2000). In health care, the field of anesthesiology has made tremendous strides in fail-safing (Li et al. 2009); it would be interesting to explore more fully how focusing on error management culture and mindfulness could improve such concepts in health care overall.

In our description of the Dallas Ebola crisis, we touched briefly on the topic of humility in organizations, when we discussed the "how can this be happening here?" mentality of the U.S. media and hospital administrators. Humility is a character dimension that has attracted increasing attention in recent years in the leadership field, both at top and middle management levels (e.g., Owens et al. 2013; Ou et al. 2014; Vera and Rodriguez-Lopez 2004). Humility has been conceptualized as having five dimensions: accurate self-awareness, appreciation of others, teachability, low self-focus, and self-transcendent pursuits. Similarly, the concept of hubris, as exaggerated self-confidence, has also been associated with leaders (e.g., Hayward and Hambrick 1997; Hiller and Hambrick 2005) and their decisions to make bold moves or take high risks. Future studies could examine the role of humility versus hubris in hospital administrators and in their

hospitals' norms and values, as well as how they relate to the level of mindfulness.

Finally, another concept to which we allude in relation to resilience and mindfulness is improvisation. Improvisation has been discussed in a wide range of contexts, including fire disasters (e.g., Weick 1993) and emergency response (e.g., Bechky and Okhuysen 2011; Kendra and Watchendorf 2003). Teams with the capacity to improvise can act spontaneously in trying to respond to problems or opportunities in a novel way (Vera et al. 2014). Part of developing mindfulness is embracing the need to become an effective improviser, particularly in the case of health care emergencies. The culture of hospitals, however, may favor formal plans, norms, and procedures over emergent and flexible action in the form of improvising. Nevertheless, while lives can be saved by having a plan, there are circumstances when lives can be saved by tossing away the plan and improvising. Future research can consider hospital cultures and the degree to which they support the development of an improvisational capability.

## **Acknowledgements**

The authors would like to thank William Hageman, Engineer Operator-Hazmat Technician, Houston Fire Department (Special Operations-Hazmat Team); Hazmat Specialist, Harris County Fire Marshal's Office (Hazmat Team); WMD-Hazmat Specialist, Texas Task Force 1 (Federal Urban Search and Rescue), for his helpful comments and suggestions on earlier drafts of this paper.

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