

2019

Disaster medicine and the role of the physician assistant

<https://hdl.handle.net/2144/38600>

"Downloaded from OpenBU. Boston University's institutional repository."

BOSTON UNIVERSITY
SCHOOL OF MEDICINE

Thesis

DISASTER MEDICINE AND THE ROLE OF THE PHYSICIAN ASSISTANT

by

DANIEL EVANS

B.A., Bowdoin College, 2012

Submitted in partial fulfillment of the
requirements for the degree of
Master of Science

2019

© 2019 by
DANIEL EVANS
All rights reserved

Approved by

First Reader

Kevin Ryan, M.D.
Assistant Professor of Emergency Medicine

Second Reader

John Weinstein, Ph.D., M.S.
Director of Research, PA Program
Assistant Professor of Medicine

ACKNOWLEDGMENTS

I'd like to thank all those that have helped me complete this thesis including Dr. Ryan, Dr. Weinstein, and David Flynn.

DISASTER MEDICINE AND THE ROLE OF THE PHYSICIAN

ASSISTANT

DANIEL EVANS

ABSTRACT

Background

Natural disasters disrupt the local healthcare structure impacting patients both acutely and chronically and, thus, requiring well-trained, organized and rapid healthcare response teams to treat patients quickly and efficiently. Physician Assistants have become a valuable member of the healthcare team and possess skills that are applicable to disaster medicine. Unfortunately, inconsistencies in legislation and regulations of physician assistants across states have caused confusion within the profession and have acted as barriers for physician assistants to respond.

Objective

This is a proposed survey project to evaluate the perceived impact of state physician assistant disaster medicine legislation on access to care, and team communication and efficiency. This study hypothesizes that state legislation that allows temporary suspension of supervision requirements, out-of-state provider provisions, and liability coverage provide better access to care and improved team communication and efficiency.

Methods

The survey project consists of a multi-phase process for validating and then distributing a survey to post-disaster responders to evaluate access to care, team communication and efficiency and physician assistant practice effectiveness. The project will focus on Texas and South Carolina as both are found in high-risk storm areas while having differing laws around physician assistant disaster response with Texas having more conducive legislation to seamless physician assistant disaster response. The survey responses will generate specific indexes evaluating access to healthcare, team communication and efficiency and physician assistant practice effectiveness. These indexes will then be analyzed using two-tailed, independent samples t-tests to evaluate the hypothesis that a friendlier legislative climate for physician assistant responders yields improved clinical care.

Conclusion

Natural disasters are an inevitable and unfortunate scenario that requires action by healthcare responders to avoid increased mortality and morbidity. Barriers to entry for competent healthcare clinicians, such as trained physician assistants, should be eliminated to enhance the disaster relief response. Specifically, supervisions requirements, out-of-state provisions and liability coverage should be adjusted to allow a seamless response for physician assistants who are willing and able to respond. In doing so, there may be a benefit to overall access to care and team communication and efficiency.

TABLE OF CONTENTS

TITLE.....	i
COPYRIGHT PAGE.....	ii
READER APPROVAL PAGE.....	iii
ACKNOWLEDGMENTS	iv
ABSTRACT	v
TABLE OF CONTENTS	vii
LIST OF TABLES	ix
LIST OF FIGURES	x
LIST OF ABBREVIATIONS	xi
INTRODUCTION.....	1
Background.....	1
Statement of the Problem	4
Hypothesis	5
Objectives and specific aims	5
REVIEW OF THE LITERATURE	7
Overview	7
METHODS.....	24
Study design	24

Study population and sampling	25
Intervention.....	27
Study variables and measures.....	28
Data collection.....	30
Data analysis.....	30
Timeline and resources.....	31
Institutional Review Board.....	32
CONCLUSION	34
Discussion.....	34
Summary and public health significance.....	35
Appendix A	37
Appendix B.....	39
LIST OF JOURNAL ABBREVIATIONS	42
REFERENCES	43
CURRICULUM VITAE	47

LIST OF TABLES

Table	Title	Page
1	Number of Articles Reporting an Increase or Decrease in Health Problems after Floods or Storms	9
2	Study Participant Inclusion and Exclusion Criteria	26
3	Survey Overview	28-29
4	Personnel Breakdown	32

LIST OF FIGURES

Figure	Title	Page
1	Geographical Map of Hurricane Risk in the United States	24

LIST OF ABBREVIATIONS

AAPA	American Academy of Physician Assistants
ASPR	Assistant Secretary for Preparedness and Response
BU	Boston University
CERT	Community Emergency Response Team
DHHS	Department of Health and Human Services
DMAT	Disaster Medical Assistance Team
DMORT	Disaster Mortuary Team
EMAC	Emergency Management Assistance Compact
EMT	Emergency Medical Technician
FEMA	Federal Emergency Management Agency
MRC	Medical Reserve Corps
NDMS	National Disaster Medical System
NRF	National Response Framework
NVRT	National Veterinary Response Team
PA	Physician Assistant
PAHPA	Pandemic and All-Hazards Preparedness Act
PTSD	Post Traumatic Stress Disorder
TLP	Triage Liaison Provider
UEVHPA	Uniform Emergency Volunteer Health Practitioners Act
USPHS	US Public Health Services

INTRODUCTION

Background

Natural disasters are an inevitable consequence of expanding civilization and nature. Our history is full of examples of destruction caused by earthquakes, hurricanes, tsunamis, floods, tornadoes and wildfires. Without preparation and proper response plans, the impact of these disasters is drastically magnified leading to human casualties, infrastructure collapse, and economic disarray. Thus, it is critical for the establishment of disaster relief protocols to mitigate such catastrophic outcomes. From a healthcare perspective, disasters, whether manmade or natural, inflict both acute and long-term damage that stretches and often overwhelms the healthcare resources of surrounding communities and, as such, have played a role in shaping populations, landscapes, and politics. Storms, such as Hurricane Katrina or Superstorm Sandy, have caused devastating effects to the communities in their respective regions -- 1,500 lives lost and 780,000 people displaced by Katrina¹ and approximately 300 people lost and \$71 billion in damages from Sandy.² While the damage inflicted by these two specific storms is certainly tragic, it is equally concerning that, in 2018 alone, there were 282 natural disasters reported worldwide which inflicted major damage to nearby communities,³ including multiple in the United States, such as the Montecito mudslides, flooding in Maryland, Hurricane Florence and Michael and the California wildfires.⁴

Climate analysis suggests that this trend will not slow. From 1980-2014, it is estimated that the frequency of loss-relevant natural disasters worldwide approximately tripled and these numbers are set to increase in the years to come with both a rise in the *number* of natural disasters, stemming from an increase in weather-related events linked to climate change and rising sea water levels, and an escalation in *devastation* from each due to socio-economic factors, such as population growth and urbanization.⁵ With this increase in frequency and devastation, it is paramount that response efforts are designed to ensure the proper allocations of resources within the major tenets of disaster response: Mitigation, Preparedness, Response, and Recovery.

To mitigate the consequences of disasters and to provide the necessary support in the affected community, multiple levels of support are necessary. In the United States, these efforts occur on a federal, regional and local level. At the federal level, The Stafford Disaster Relief and Emergency Assistance Act (1988) laid the framework through which the federal government provides disaster aid. The act allows the Federal Emergency Management Agency (FEMA), organized within the Department of Homeland Security, to lead overall operations of the disaster response, including the coordination and triaging of responsibilities to additional government agencies. However, federal response is often delayed 48-72 hours and requires local and state responders -- Emergency Medical Technicians (EMT),

Medical Reserve Corps (MRC), Community Emergency Response Teams (CERT), or other volunteer organizations -- to act quickly and effectively.

Despite a vast network of local, state and federal response teams, the chaotic, unpredictable and resource-sparse nature of disaster medicine demands constant evaluation on how to improve response capabilities. Necessary reform includes the need to remove regulatory barriers preventing capable medical providers from responding to disasters and, in some cases, expanding the scope of proven practitioners. For example, pharmacists, dentists, physician assistants (PA) and EMTs have all seen their roles expanded during natural disasters to better meet healthcare demands.^{6,7,8,9} In regards to the PA profession specifically, PAs have responded at all management levels and have proven to be capable leaders in the disaster community despite numerous barriers.¹⁰ In 2006, guidelines were published by the American Academy of Physician Assistants (AAPA) to help guide PAs seeking disaster medicine opportunities. These guidelines are broad and state that physician assistants: 1) prepare in advance; 2) work through established channels; 3) support physician directed health care teams; 4) prepare for scarce medical resources; 5) carry qualifications; 6) be familiar with standards of disaster response; 7) maintain respect for the cultural needs of those in need; and 8) prepare to provide support in the manner most needed by the organization at that time.

However, the guidelines do not provide a thorough understanding of barriers to entry for physician assistants when attempting to respond to disasters and how to best navigate those barriers. As outlined by the AAPA (Appendix A), PA practice during a disaster or emergency varies greatly state by state within three pertinent categories of regulation: supervision requirements, out-of-state responder provisions and liability coverage. This variation acts as a barrier to entry for physician assistants looking to respond to disasters, despite the fact that physician assistants are proven, effective clinicians.^{11,12} Ideally, during a disaster, all states would have laws and regulations to modify the supervision requirements of PAs, provisions that allow for out-of-state PAs to respond, and sufficient liability protection when providing medical aid.

Statement of the Problem

There is inconsistency in how states regulate physician assistant personnel when providing medical response in the wake of disasters. These inconsistencies fall into three general categories: Supervision requirements, Provisions for Out-of-State PAs and Liability Protection. Only thirteen states have developed legislation that follow general AAPA guidelines and, within this subset, four states require an official declaration of a disaster and two require PAs to be part of a specific disaster response team. Seven states have no state laws or regulations with language addressing the regulation of PA practice during an emergency and there is a patchwork of regulation that make up the remaining states (Appendix A). This lack of consistency is a barrier to providing care during a vulnerable

time for patients left without typical healthcare resources. With the incidence and severity of disasters continuing to climb, it is critical to optimize the response of physician assistants in a time of need.

Hypothesis

States that best align themselves with the general law and regulation language suggested by the AAPA provide a more effective PA response that results in increased access to medical care, improved team efficiency, improved treatment of chronic illnesses and physician assistant practice effectiveness.

Objectives and specific aims

It is the purpose of this thesis to discuss the current state of disaster medicine response, the opportunity for physician assistants to provide disaster medical support, and to propose a preliminary study aimed at investigating the potential benefit of state law and regulation conducive to PA disaster response. With little existing literature on the function of PAs in disaster medicine, it is the hope that this review and proposed study will open a broader discussion and prompt further investigation into embracing physician assistants in disaster medicine response.

The specific aims of the project include:

1. Reviewing current disaster response protocols, challenges to seamless PA response and evidence of capable PA clinical care

2. Developing a survey for distribution to healthcare professionals responding to disasters evaluating access to care, team communication and efficiency and the effectiveness of physician assistant practice
3. Evaluating the impact of state law and regulation that is conducive to PA clinical response.

REVIEW OF THE LITERATURE

Overview

Disaster Medicine Health Impact

Emergency response has and continues to evolve in organization, strategy and technology to combat threats such as natural disasters, cyberwarfare, and Chemical, Biological, Radiological and Nuclear (CBRN) hazards. Each of these threats strains the healthcare system by causing surges in the demand for healthcare services, destruction to health infrastructure, and damage to the public health system.¹³ These stresses lead to catastrophic damages –from 1980-2008 more than 12,000 casualties and \$480 in economic loss – indicating a need to improve response efforts.¹⁴

Of the numerous types of disasters, severe storms and floods are the most frequent in the United States. These types of disasters pose unique challenges to providers on the ground. From 1980-2008, storms and floods accounted for 368 and 123 natural disasters and 63% and 7% of deaths from natural disasters, respectively.¹⁴ This devastation is caused by primary hazards during the acute phase, like wind and debris, and secondary hazards occurring over time, such as displacement, exposure to floodwaters, contaminated drinking water, and injury during cleanup and reconstruction.

During the acute phase of Superstorm Sandy, 43 deaths occurred due to primary hazards, such as drowning, falling trees, falls, and electrocution, while secondary

hazards, such as carbon monoxide poisonings and contaminated flood and drinking water, continued for months.¹⁵ Other major causes of medical issues from floods and storms include displacement, overcrowding, damaged infrastructure, musculoskeletal injuries, malnutrition, increased transmission of communicable disease, and lack of preventive medicine supplies.¹⁶ Disasters are also dynamic in nature, meaning that consequences evolve over time, including how and why patients present to clinical response. For example, poisonings (such as CO poisoning), lacerations and corneal abrasions are all noted to occur most often within 4 weeks of a disaster, while gastroenteritis cases tend to present acutely and linger for as long as eight months post-disaster.¹⁶

Management of chronic illnesses is often disrupted during disasters, leading to disease exacerbations such as increased HbA1C in diabetic patients, increased stroke, hypertension and myocardial infarctions or worsening asthma.¹⁶ One study analyzed the impact of Hurricane Katrina in 2007 on chronic illness management and found that 20.6% of Katrina survivors with chronic illnesses had their treatment cut back or terminated because of the disaster. These chronic illnesses included cancer, cardiovascular health, diabetes, digestive conditions, kidney disease, migraine headaches, arthritis, respiratory conditions such as asthma and COPD, and psychiatric problems.¹⁷ The prevalence of mental health illnesses also increases after natural disasters. Hurricane Katrina in particular has been studied extensively and storm victims were found to have increased levels of anxiety and

depression and post-traumatic stress disorder (PTSD) in the months following the hurricane.¹⁵ In fact, a survey-based study assessing serious and mild-moderate mental illness demonstrated that post-Katrina respondents had an estimated prevalence of all categories of mental illness significantly higher than that of pre-Katrina respondents using the K6 screening tool.¹⁸ Of the reasons responsible for interruption in care, access to physicians accounted for 41%.¹⁷ While the lack of access to medical care is not surprising, it does highlight the need for capable clinicians to respond to disasters and provide much needed care to disaster victims. In general, major floods and storms cause an increase in healthcare demand across multiple disciplines (Table 1), highlighting the complex range of patient needs in disaster medicine. Physician assistants are a capable workforce with baseline educational training that, when supplemented with proper additional disaster medicine training, could allow them to meet these wide-ranging patient needs.

	Storm		Flood	
	Increase	Decrease	Increase	Decrease
Injuries/Poisoning	17	2	-	-
Infectious and Parasitic Disease	26	3	13	-
NCSs and Chronic Illnesses	13	2	3	-
Contact with Health Services	7	-	-	-
Skin Complaints	2	-	-	-

Table 1: Number of Articles Reporting an Increase or Decrease in Health Problems after Floods or Storms (adapted from Saulnier et al. *No Calm After the Storm: A Systematic Review of Human Health Following Flood and Storm Disasters*.¹⁶)

Disaster Medicine Organization and Personnel

To meet the healthcare demands of patients during a disaster, response is directed from the federal, regional, state and local level. As communication and organization are paramount to an efficient and adequate response, over the years, the government has enacted legislation that provides a framework for resource allocation within the four phases of disaster management: Preparedness, Response, Recovery and Mitigation.¹⁹ These key pieces of legislation allow teams to respond and function in a cohesive, productive manner.

The federal response in particular has been shaped by a series of legislation over the past 70 years. In 1950, the Federal Disaster Relief Program was established allowing a state governor to request Federal support *during* a disaster. This was expanded upon by the 1966 Disaster Relief Act, which included the provision of recovery efforts in rebuilding communities *after* disasters. In 1979, the Federal Emergency Management Agency (FEMA) was created to help provide an organized response across all disciplines of disaster relief – a necessary step in developing structure and leadership within disaster response. Further enhancements were made over the years, including the Stafford Act of 1988 (revised in 2010), Homeland Security Act of 2002, the Pandemic and All-Hazards Preparedness Act (PAHPA) of 2006 (reauthorized in 2013 and 2019), and three important directives driving the development and implementation of these efforts: Homeland Security Presidential Directive (HSPD)-5 Management of Domestic

Incidents, HSPD-21 Disaster Health Care in 2007, and Presidential Policy Directive (PPD)-8 National Preparedness in 2011.²⁰

Of particular significance to the healthcare response are PPD-8 and PAHPA. PPD-8 is a replacement of HSPD-8 and maintains directives for an all-hazards approach to disaster response and provides guidance on financial, technical, and training support. PAHPA has been instrumental in delegating responsibility of public health and medical response to the Office of the Assistant Secretary for Preparedness and Response (ASPR) within the Department of Health and Human Services (HHS), broadening access to information, communication and funding, and optimizing our National Disaster Medical System to respond to medical surge. Of specific relevance to physician assistants responding across state lines, PAHPA directed the linkage of state verification systems through the development of the Emergency System for Advance Registration of Volunteer Health Professionals (ESAR-VHP), as well as an endorsement for waving licensing requirements -- all methods for improving the quick and seamless response of healthcare professionals to disaster areas.

Healthcare is one of the tasks FEMA delegates to ASPR, granting the authority to organize the response to best meet healthcare needs. ASPR strategizes within the National Response Framework (NRF), a framework providing further guidance along the five principles of engaged partnership, tiered response, flexible

operational capabilities, unity and readiness. Specifically, ASPR bears the responsibility of Emergency Support Function 8 – Public Health and Medical Services. To carry out this mission, the ASPR leverages the National Disaster Medical System (NDMS) and its Disaster Medical Assistance Teams (DMATs), Disaster Mortuary Assistance Teams (DMORTs), National Veterinary Response Teams (NVRTs), and Trauma/Critical Care response teams.²¹ These teams are built to bolster existing infrastructure but often arrive 2-3 days into the disaster, leaving the local and regional response teams to provide care for the first 48 hours.

Together these pieces of legislation have shaped the federal disaster response landscape as it stands today. However, given the delay in the federal response, it is paramount that local responders are prepared to act and be flexible with their responsibilities to effectively deal with the acute consequences of natural disasters. Local responders are made up of Emergency Medical Service first responders (EMTs, paramedics) and organized teams, such as the Medical Reserve Corps (MRC) and Community Emergency Response Teams (CERT). These groups are made up of volunteers and are often trained to provide a variety of basic medical tasks and non-clinical tasks.^{22,23} Flexibility and teamwork are key to rapid and effective response but may not be enough to provide relief in larger disasters. In these scenarios, the state governor may be petitioned to reinforce the local response with state aid. Once activated, the state Emergency

Management Organization can help coordinate relief from the National Guard, Nongovernmental Organizations, Emergency Management Agencies or enact mutual aid agreements, which allow neighboring states to also respond to the crisis. It is at this level -- providers operating under state law, as opposed to federal law – in which many physician assistants run into difficulty or confusion about state regulation and law.

Legal Considerations, PA Supervision and Expanding Scope of Practice

Supervision requirements of PAs are outlined in state law and have traditionally used the term “supervision” to denote the mandatory relationship between physicians and PAs. This definition has slowly changed over the years as the profession has matured and access to healthcare continues to be a leading public health issue. The gradual transition has been highlighted by updating “supervision” to “collaboration” in many states though a more drastic and controversial movement in the form of “Optimal Team Practice” (OTP) has started to gather momentum. In OTP, amongst other items, the mandatory supervision requirements are eliminated to reduce administrative constraints. While a drastic change in supervision requirements in “normal” practice environments can certainly be debated, the fact that these updates are occurring highlights the opportunity for updates in more dire, resource scarce scenarios, such as those after a natural disaster. In an effort to help guide the regulation and law around PA practice in disaster medicine, the American Academy of Physician

Assistant's (AAPA) identified three broad categories that impact how easily PAs can respond and operate within the disaster arena. These three categories are: 1) Physician Supervision; 2) Out-of-State PA response; and 3) Liability coverage. While there has been some success -- approximately 30 states have adopted language that modifies supervision requirements -- only 13 states include language similar to the AAPA's proposed guidelines within all three general categories.²⁴

Many healthcare professions have had to deal with policies surrounding their ability to respond in the case of disaster. In 2016, an article in the Journal of Disaster Medicine and Public Health Preparedness noted the legal challenges and concerns that various healthcare practitioners faced when attempting to respond to Hurricane Sandy.⁸ The topics covered included scope of practice, licensure portability, credentialing and liability concerns – similar to the general categories highlighted by the AAPA.

As it pertains to scope of practice, it was specifically noted that it may have been beneficial to allow independent practice of physician assistants for certain services. In fact, an expanded scope of practice was implemented in other disciplines during Hurricane Sandy; the governor, Andrew Cuomo, expanded the practice of pharmacists to include administration of the tetanus vaccine.⁸ This was viewed as a small but practical expansion in a time of need. It was also not an

isolated example as expanding the scope of practice has been used in other disaster scenarios as well. During the 2009 H1N1 pandemic, expanded scope of practice was granted for certain providers in 14 states to provide patients proper access to vaccinations. The laws defining this practice, however, not only varied state by state and by provider type but were enacted through differing platforms including executive order, governor proclamation and local EMS authority. For example, in Maryland, the governor issued an executive order to allow EMT-Paramedics to deliver the H1N1 vaccine over a 3-month time frame. Similarly, in New York during the pandemic, the governor issued an executive order allowing an expanded cadre of providers, including physician assistants, to provide H1N1 vaccinations over a 30-day period. In Massachusetts, the commissioner of public health designated dentists, paramedics, pharmacists and medical and nursing *students* to be authorized through emergency regulations to deliver seasonal influenza and H1N1 vaccines. Unfortunately, while authorized with benevolence, these instances of expanded scope have been confusing and poorly executed, leading to suboptimal vaccination rates⁷ and a lesson in providing clear directives and a uniform approach when expanding scope of practice in the future.

Responders must be able to respond appropriately and without unnecessary, confusing and inconsistent barriers that may impede care. Stated simply by the National Highway Traffic Safety Administration in 2007 and highlighted by Catlett et al, as every situation cannot be accounted for during planning, it is

assumed the scope of practice of EMS providers must be flexible and may be modified in an acute disaster.⁶

Expansion of scope is not the only arena in which there has been an effort to ease the burden on responding healthcare workers; licensure portability is another area of emphasis. Healthcare practitioners are licensed at the state level and, thus, licensure portability has continued to be a dilemma in disaster medicine as personnel often cross state lines in response to the disaster. There have been multiple attempts at easing this burden – through the DMATs, the Emergency Management Assistance Compact (EMAC), Mutual Aid Agreements, and the Uniform Emergency Volunteer Health Practitioners Act (UEVHPA) in 2006 – however, there continues to be barriers to a seamless transition across state lines.

Seamless and effective response to disasters is paramount at all levels of disaster medicine yet challenges continue to exist. For physician assistants, a review of state laws governing physician assistants identified approximately 24-30 states that allowed for an expanded scope of practice for disaster situations.⁹ Language such as that found in Arizona Legislation, which specifies that PAs responding to a natural disaster may do so without supervision requirements²⁵, allows for flexible PA deployment

Disaster Medicine Needs and Evaluation of Physician Assistant Clinical Care

In 2007, a study published in *Disaster Management & Response* assessed the professional competency of health care providers during Hurricanes Katrina and Rita.²⁶ The goal of the study was to understand the knowledge, skills and abilities required of healthcare providers to adequately respond to disasters by deploying a survey to NDMS and US Public Health Service (USPHS) team members who responded to Hurricane Katrina and Rita. The survey was designed to identify the most common competencies used during the disaster, areas responders felt least prepared in and recommendations they would give to someone responding to a similar event. The study found that basic clinical care and triage were the two most frequently used skills, while the most frequently identified aspects in which they felt unprepared revolved around organization and the systems through which care was delivered. Overall, 22% of responders felt they didn't have the skills to provide optimal care and, when asked which skills in particular, responses included: ventilator care, casting, suturing, Personal Protective Equipment use, IV access/therapy, and how to operate without sufficient equipment. Finally, another result from this study was the impact of experience on survey answers. When categorizing the responders into First-Time Responders and Moderately Experienced Responders, first time responders identified a lack of personal preparedness for the disaster environment as the issue they struggled with most, while the more experienced responders focused on system related issues, such as transporting patients and patients with evolving levels of acuity.

In this context, it is interesting to note that only 5% of the 200 participants were PAs. This relatively low participation rate is unfortunate as the skills used most frequently and which providers feel least experienced in, basic clinical care and triage skills, are skills taught during PA training and refined in practice.

Additionally, anecdotal stories from recovery efforts after Hurricane Katrina,¹¹ Hurricane Maria, and Hurricane Irma¹² highlight the positive impact PAs can have on relief teams. The evidence is slowly mounting that PAs should have the opportunity to expand their presence in disaster medicine.

Despite the PA profession originating from US Navy corpsmen in 1965 in the days after the Vietnam War, there is limited information available on PAs in the disaster medicine field. In place of peer-reviewed literature, anecdotal stories of PAs have emerged highlighting care provided by PAs in a number of roles ranging from treating gastroenteritis to lymphoma and dialysis patients. Individual PAs have also been selected for leadership roles, such as deputy commanders of Disaster Medical Assistant Teams.¹⁰ While there is limited research on PAs specifically in disaster medicine, there is a growing body of literature that has evaluated many aspects of PA clinical care that translates to disaster relief, including triage, primary care, emergency medicine and pharmacology

For example, triaging is practiced extensively in disaster medicine and, thus, is a skill that providers should be fluent in during a disaster response. A 2012 study by

Nestler *et al.* used an observational cohort of 724 patients to evaluate the use of a PA in triage at an emergency department. The study compared eight pilot days of PA led triage to eight control days of physician led triage. Though the study was strictly observational and of a short time frame, the study found that the length of stay was shorter (median 229 minutes vs 270 minutes, $p < 0.001$) and fewer patients left without being seen (1.4% vs 9.7%, $p < 0.001$) when triage was led by PAs.²⁷ Physician assistants were able to competently act as a triage liaison provider (TLP), a function that was normally carried out by a medical doctor at this particular hospital in Minnesota. However, further studies should also be conducted as the study does have weaknesses: it was done within the organized confines of hospital walls, not in a make-shift tent often used in the field; Emergency Severity Index 1 and 2 (Higher severity) cases were not triaged by a Triage Liaison Provider (TLP) and, as such, were not part of the pilot study; Pediatric care was excluded from the study; behavioral health patients were excluded; the PAs selected had at least 4 years of experience, reinforcing the need for previous experience and training no matter what the supervisory level is in the field. The above-mentioned characteristics make it difficult to translate the results to the disaster medicine field as the structure and organization available to the providers in this study is not available during the acute phase of a natural disaster. Thus, the length of stay may be shorter, and the number left without being seen fewer, than those same metrics observed in disaster medicine. Despite these study flaws however, triage is a skill that can directly translate from the Emergency

Department to a Disaster Medicine scenario and with some supporting data such as the results from this study, further efforts to embrace PAs in the disaster medicine field should be pursued.

A second example of how PAs can support patients' needs after a disaster involves primary care. During a disaster, access to and continuity of primary care is disrupted and, consequently, affects the management of chronic illnesses, such as diabetes, cardiovascular health and dialysis needs. This void in management of chronic illnesses is an area in which physician assistants have proven to be very effective. In 2014, Yhang et al. published a clinical research study in the American Journal of Medicine that compared Nurse Practitioners, Physician Assistants and Physicians in their management of Diabetes. The group conducted a retrospective analysis of veterans who were newly diagnosed with diabetes in 2008 and evaluated their care over a 5-year period. The results of the study showed that management was comparable across all three professions with Hemoglobin A1c being comparable with no significant difference at diagnosis (HbA1C 6.6% (NP), 6.7% PA, 6.7% MD; $p>0.05$), initiation of first and second medication (HbA1C 7.5-7.6% and 8.0-8.2%; $p>.05$), and after 4 years of follow-up (Mean HbA1C 6.5% for NP, PA and MD; $p>0.5$).²⁸ These results demonstrate that physician assistants and nurse practitioners demonstrate diabetes management comparable to physicians, an important element of chronic care management with more than 29 million Americans diagnosed with diabetes. However, weaknesses

did also exist within the study as patients were seen disproportionately by doctors (15,050 vs 1,367 for physician assistants) and 15% of patients managed by PAs also had primary care visits with doctors, making it difficult to assess a PAs true impact on care given a smaller sample and overlapping visits. In addition, patients primarily seeing PAs had less diabetic specialist appointments and there were fewer patients using insulin, suggesting that those patients seen by PAs may have been less complex cases than those seen by MDs. Despite these weaknesses, the demand for primary care support in the aftermath of natural disasters, particularly floods and hurricanes, coupled with this evidence suggesting adequate PA-guided primary care supports the notion that PAs should be provided an unencumbered opportunity to respond to disasters and provide medical care for chronic illnesses such as diabetes.

Disaster medicine also presents a unique challenge as a responding clinician will need to provide care for patients of all ages, genders and presentations. As such, it is important to analyze multiple patient populations to determine the flexibility of physician assistants responding to disasters. In particular, the pediatric population is a vulnerable patient population that clinicians must be able to respond to.²⁹ In 2017, Pavlik et al. published a study analyzing physician assistant management of pediatric patients in the emergency department and compared management to Emergency Physician (EP) care and combined care (PAs and EPs). The retrospective analysis of 10,369 pediatric patients focused on recidivism rates

within 72 hours, a measure often used as a proxy for outcomes in an Emergency Department. The results showed that there was no increase in re-visits in the population of patients seen by PAs-only, with recidivism rates being 6.8% for PAs and 8.0% for Emergency physicians, suggesting that the pediatric clinical care provided by PAs in an emergency department is sufficient.³⁰ Further evidence and support for leveraging more physician assistants in a disaster scenario, where patients will be of all ages and all presentations.

Finally, in any aspect of medicine, pharmacology and the appropriate distribution of medications to patients is incredibly important. During and in the aftermath of disasters, medication distribution, especially to patients suffering from chronic illnesses, is disrupted, which can put strain on retailers and response teams as they attempt to provide relief.³¹ As a possible member of a responding team, it is, therefore, critical that a PA be comfortable prescribing medications for acute and chronic illnesses. A cross-sectional analysis of surveys distributed from 2006 through 2012 was completed focusing on physician, NP, and PA prescribing quality for chronic illnesses seen in the outpatient setting. The study sampled 701,499 patient visits, 1.6% of which were PA visits, and focused on 13 validated pharmacologic quality indicators. After adjusting for confounding patient and provider characteristics, 12 of the 13 quality indicators showed no statistically significant difference when care was provided by PAs compared to physicians with the lone exception being “selected antibiotic use for acute otitis media” (OR

0.20, 95%CI: 0.06-0.72). As is the case with most analyses comparing across provider type, a major weakness of the study is the fact that physicians made up 96.8% of the outpatient visits examined, while NPs and PAs each accounted for only 1.6%.³² This imbalance may limit the ability to accurately assess NP and PA practice as the sample size is much smaller. However, despite this, it is important to recognize that during a disaster, the ability to provide additional access to proper medication management, particularly for continuity in chronic illness management, can have a dramatic impact on patient outcomes and PAs should have every opportunity to offer this to disaster victims.

The devastating impact of disasters is well understood and the health needs of disaster victims are well established. As it pertains to physician assistants, the inconsistency in laws and regulations across states is limiting the ability of teams to deliver the most effective care. The following proposal is designed to measure the benefit observed in states with regulations that remove barriers to a PA wishing to respond to a disaster and is in the spirit providing empirical evidence to help direct legislation in the future.

METHODS

Study design

This initiative will be a survey-based study designed to investigate the potential benefits of state law and regulation that includes optimal practice guidelines for physician assistant practice during disaster response. As noted in the Introduction, these guidelines can be categorized broadly into modified physician supervision requirements, out-of-state provider provisions and liability coverage. This proposal will help provide much needed empirical data to help understand the impact of physician assistants and the importance of consistent regulatory language. This study will be implemented in two states and will span approximately 5 years due to the unpredictable nature of natural disasters.



Figure 1: Hurricane Risk in the United States³³

Study population and sampling

Two clinician populations will be compared in this study: one from the state of Texas and one from the state of South Carolina. The states were selected based on their regulations around the use of physician assistants in disaster medicine and their location within the “high risk” territory for hurricanes (Figure 1). The state of Texas allows for temporary suspension of PA supervision, allows out-of-state credentialed PAs to respond to disasters, and provides liability protection. The state of South Carolina has no such specific language regarding PAs. Thus, Texas most closely follows the guidelines outlined by the AAPA, while South Carolina is furthest from the language. The specific language for these two states can be found in Appendix B.

The study population from each state will be all providers, both from in and out-of-state, who respond to a pre-determined category of natural disaster and deliver medical aid directly to patients. In response to Hurricane Harvey in 2017, the Federal Government sent approximately 1,110 medical personnel to Texas³⁴ while approximately 700 medical personal were deployed from the state level.³⁵ In response to Hurricane Florence in 2018, the South Carolina Department of Health and Environmental Control deployed approximately 700 staff to prepare for medical needs.³⁶ DHHS deployed approximately 500 medical personnel to support the healthcare infrastructure.³⁷ To the best possible extent, healthcare providers associated with organized response groups will be made aware of

this effort ahead of time to maximize the response rate. The inclusion and exclusion criteria can be found in table 2.

<p><u>Inclusion Criteria:</u></p> <ul style="list-style-type: none">• All providers operating under state law that provide direct medical aid to patients• Clinicians defines as physicians (MD and DO), physician assistants, nurse practitioners, nurses, EMTs, and pharmacists
<p><u>Exclusion criteria:</u></p> <ul style="list-style-type: none">• Relief personnel with non-clinical duties

Table 2: Study Participant Inclusion and Exclusion Criteria

Due to the chaotic and unpredictable environment of a natural disaster, convenience sampling will be used to survey healthcare clinicians who responded to a hurricane declared an emergency. Based off of the number of healthcare workers cited in the response to Hurricane Harvey and Hurricane Florence, it is expected that the total population size of healthcare relief workers in each state would be between 1200-1800 individuals. With an expected response rate of 15%,³⁸ the survey responses are estimated to be approximately 450 total responses with Texas responders accounting for approximately 60% of responses. Assuming an alpha of 0.05, 80% power, an effect size of 0.5 (moderate effect size per Cohen³⁹), the proportion of SC responders $q_1 = 0.4$, and the proportion of TX responders $q_0 = 0.6$, the required sample size is 134 (80 from Texas and 54 from South Carolina), far less than the expected number of responses.

Study Recruitment

Prior to the start of this study, local, state and federal points of contact will be determined in order to a) make the teams aware of this initiative and b) establish appropriate listservs for survey distribution. These listservs will include but are not be limited to DMATs, SMATs, MRCs, American Red Cross, CERTs and other non-profit relief organizations. These listservs will be used for survey distribution and follow up.

Intervention

This study will evaluate the benefits of providing laws and regulations for PA practice during a disaster response that allow for modified physician supervision requirements, processes allowing for out-of-state PAs to practice and liability protection. Specific language found in the state laws and regulations of Texas and South Carolina can be found in Appendix B. In summary, when there is an official declaration of an emergency or disaster in the state of Texas, a physician assistant may provide care with or without supervision if the physician is not available, a physician assistant employed federally or in another state may provide care without holding a Texas license, and, as long as the PA is acting within the scope of license, a PA is immune from liability. These are explicitly outlined in the Texas legislation and stand in stark contrast to those in South Carolina, where there is no language around modified supervision requirements for PAs in disaster

medicine scenarios and limited language allowing out-of-state providers to practice.

Study variables and measures

As this is a novel study, the initial phase of the project will include a pilot survey sent to the Boston Emergency Medical Services and Massachusetts DMAT teams to validate the survey questions and solicit feedback on the feasibility of the project. The survey questions will then be adjusted to appropriately reflect any feedback from this pilot.

Once the survey is finalized, it will be distributed to providers in each state post-disaster recovery efforts. It will be organized into five categories, as outlined in Table 3 with any updates generated from the pilot. An index will be created for the primary and secondary outcomes: Team Communication and Efficacy, Access to Care and Physician Assistant Practice Effectiveness. Each index is comprised of 4 questions, each with a 1-5 Likert Scale Response. The response scores will be added together to produce a final score from 0-20 for each index category.

Demographics:
Age
Sex
Prior Disaster Medicine Activation (Y/N)
Type of Clinician (MD/DO, PA, NP, Nurse, Pharmacist)
Years of Experience as a clinician
Relief Organization (if applicable)
State Deploying from

State Deploying to
Federal Employment (Y/N)
Background Questions
If not a PA:
- Do you work with PAs in a clinical capacity during disaster relief missions?
- How much time did you spend working with a physician assistant?
- How comfortable would you be with a PA providing care unsupervised during a disaster?
If a PA:
- What level of PA supervision was provided during your team's medical activation period?
- Was there temporary suspension of PA supervision during your team's medical response activation period?
- How would you rate your comfort level in making clinical decisions during your disaster response activation?
Survey Questions (Responses on Likert Scale 1-5: N/A, 1 – Very Poor, 2 – Poor, 3 – Average, 4 – Good, 5 – Very Good)
Category 1: Team Communication and Efficiency
1. How would you rate your team's communication when providing medical care?
2. How would you rate the efficiency of care provided to patients?
3. How would you rate your team's ability to triage care?
4. How would you rate your team's overall healthcare response to the disaster?
Category 2: Access to Healthcare
1. How would you rate your team's ability to offer the appropriate scope of clinical care?
2. How would you rate your team's management of chronic illnesses?
3. How would you rate your team's acute management of patient's medical needs?
4. How would you rate the access to care for patient's?
Category 3: PA Practice Effectiveness
1. How would you rate the impact on access to care by having a physician assistant?
2. How would you rate the effectiveness of acute clinical care provided by the PA?
3. How would you rate the ability of PAs to manage chronic illnesses during a disaster?
4. How would you rate the ability of the PA to communicate effectively with the team?

Table 3: Survey Overview

Data collection

Using the curated listserv gathered from local, state and federal agencies, electronic surveys distributed via SurveyMonkey will be sent post-response to providers. The data will be collected electronically and will be uploaded in .csv format to the statistical software, SPSS. Collection will occur for approximately 6 months post-disaster, allowing for sufficient time to gather responses while avoiding a prolonged timeline.

Data analysis

The collected survey data will be analyzed using SPSS statistical software. The demographic and baseline information will be summarized in a baseline characteristics table for each state, identifying the total number and percent of total for each category. For each survey question within the primary and secondary indexes, the mean and standard deviation will be generated. The index scores will then be generated. The index score for each category will be considered a continuous variable that follows a Gaussian distribution and, thus, a parametric analysis will be conducted using the Student two-tailed t-Test to determine the significance of difference in indices between medical responders in the state of Texas and South Carolina.

Timeline and resources

Due to the unpredictable nature of natural disasters, this project will take place over the course of 5 years. This is to allow for ample time to for similar type and size storms to impact both states, Texas and South Carolina.

Prior to initiating the study, approximately 3-4 weeks will be budgeted for IRB approval followed by 6 months of outreach to local and state responders led by the project manager. The purpose of this outreach will be to identify points of contact for each organization, ask for their permission to survey their responders, and develop the appropriate listservs for survey distribution. Of note, this contact list will be updated over time by ongoing communication with these organizations should volunteers be added during the disaster. In parallel, the pilot survey process will occur, managed by the project manager, to get feedback and improve on the survey.

Over the course of 5 years, the project manager will stay aware of the pertinent natural disasters affecting these two states and, once a storm occurs, will reach out to the contacts previously identified. As establishing contact with responders during the acute phase of the disaster will be difficult, once the state of emergency is no longer in effect the survey itself will be deployed to the listserv, as updated from the constant communication with responding teams. Follow-up will occur

over a 3-month timeline by email. The project analyst will then begin analysis of the collected survey data. This is estimated to take 3 months.

Resources will include one project manager who will lead the initial outreach and coordination of tasks necessary to complete the project, one analyst who will help to follow through on analysis and survey completion and one advisor who will serve as a high-level advocate for the project. Breakdown of the personnel is given in Table 3. Planning has accounted for the reality that this project may stretch to a maximum of 5 years due to the unpredictable nature of weather and acknowledges that work may be condensed into smaller time frames as dictated by storm occurrences. Total budget for the project will be approximately \$250,000. This is generated from salaries, capital expenditures, and travel, as needed.

Position	FTE
Senior Level Advocate	.10
Project Coordinator	.25
Project Analyst	.25

Table 4: Personnel Breakdown

Institutional Review Board

This study proposal will be submitted to the Boston University Medical Campus Institutional Review Boards (IRB) for expedited board review as the study is of

minimal risk and falls under the common rule expedited category 10.2.2.4.1.2
which states research employing surveys may be eligible for expedited status.

CONCLUSION

Discussion

The physician assistant profession continues to grow and has proven valuable within the practice of healthcare but faces inconsistent policies across states in how and in what function they are able to respond to disasters. With a trend toward increases in both severity and frequency of disasters, it is therefore critical that the medical response be robust, flexible, and organized. The PA profession is capable of supporting disaster medicine efforts and should have to face minimal barriers to entry.

The lack of existing literature on the evaluation of disaster health personnel and the role of physician assistants in disaster health is a major barrier to providing consistent rules and regulations around PA involvement in disaster medicine.

Therefore, the analysis of the impact varying PA regulations have on disaster medicine is novel and a strength of this research initiative. Empirical evidence on the impact that modified physician supervision, allowance of out-of-state PA practice and liability coverage has on disaster medicine response, outcomes and efficiency can allow legislation to evolve to become clearer and consistent across states.

The weaknesses of this project begins with the inherent uncertainty surrounding natural disasters. It is difficult to evaluate when, where, and to what extent a

natural disaster may cause harm to a community and is, therefore, difficult to account for all external variables. The study attempts to evaluate similar storms in separate states, but we acknowledge the fact that this study may be affected by variables unaccounted for in planning. Rainfall, wind speed, duration of storm, and storm surge are just a few examples of variables that are difficult to control yet may have a significant impact on the overall strength of the storm. However, we do believe the benefit of any empirical data given the lack of literature on the topic outweighs this weakness.

Another potential weakness of the study is the utilization of survey that is distributed after responders return from the disaster. Responses are prone to recall bias and may not provide a complete, accurate evaluation. In addition, the chaotic environment of a disaster may generate a cognitive load that is overwhelming for responders and may compound recall bias. Despite these weaknesses, a survey is the most feasible instrument and, with electronic distribution via email, provides an opportunity for reaching a larger number of medical responders than in-person questioning.

Summary and Public Health Significance

Local, state and federal governments have updated their policies continuously over the years to better respond to such catastrophes and provide much needed healthcare support to combat the public health crisis following major natural disasters ranging from acute trauma to issues such as water contamination from

overflowing sewage, air pollution and even mental health crises. In fact, 10 months after Hurricane Harvey, 16% of residents stated they had a new or worsening health illness and perhaps even more distressing, 3 weeks after Hurricane Harvey a study found 50% of participants reported PTSD and 10 months later only 8% of residents were able to get the healthcare support they needed.⁴⁰ These are public health issues that need to be addressed and the physician assistant profession, a relatively young yet growing profession, is well suited to provide additional healthcare relief. Unfortunately, inconsistencies in supervision requirements, out-of-state practice policies and liability coverage pose barriers to PA response and hinders their ability to provide optimal medical relief when responding. This is despite the fact that anecdotally, PAs have had success in disaster response, providing much needed care to communities in distress. It is, therefore, the aim of this study to begin an evaluation of the benefit of modernizing PA practice laws during disasters in an effort to help eliminate barriers preventing PA professionals with the right skill set from responding to disasters and helping take care of communities in distress.

Appendix A

Table 5: Summary of State PA Regulations for Disaster Medicine²⁴

State	Modified Licensing/Supervision Requirements	Provisions for Out-of-State PAs	Membership in Specified/Authorized Disaster Corps or Registration System Required	Provisions Only Apply During Declared Emergency or Disaster	Liability Protection
Alabama	x			x	
Alaska					x
Arizona	x	x			
Arkansas					
California	x				x
Colorado					
Connecticut	x	x	x		
Delaware	x	x			x
District of Columbia	x	x		x	x
Florida	x			x	
Georgia	x	x		x	
Hawaii	x	x	x	x	x
Idaho	x	x			
Illinois	x	x			x
Indiana	x	x			
Iowa	x	x			x
Kansas					x
Kentucky	x		x	x	
Louisiana	x	x			
Maine	x				
Maryland	x	x			
Massachusetts	x	x			x
Michigan					x
Minnesota	x	x			*
Mississippi					x
Missouri	x				x
Montana	x	x			x
Nebraska					x
Nevada	x	x			x

State	Modified Licensing/Supervision Requirements	Provisions for Out-of-State PAs	Membership in Specified/Authorized Disaster Corps or Registration System Required	Provisions Only Apply During Declared Emergency or Disaster	Liability Protection
New Hampshire		x			x
New Jersey	x	x			x
New Mexico					
New York					x
North Carolina		x		x	
North Dakota					
Ohio	x	x			
Oklahoma			x	x	x
Oregon		x		x**	x
Pennsylvania		x		x	
Rhode Island	x	x			x
South Carolina					
South Dakota	x	x			x
Tennessee					
Texas	x	x		x	x
Utah	x	x	x	x**	x
Vermont					
Virginia				x	x
Washington	x		x	x	
West Virginia		x	x	x	x
Wisconsin					x
Wyoming	x	x		x	

*Physician not liable for services rendered by PA in emergency or disaster situation. No liability protection for PA.

**For certain provisions.

The information contained in this background and chart is condensed and accurate as of January 8, 2018. This document is intended for background purposes only. For a complete and current version of the statutes and regulations, AAPA encourages you to visit the state's legislative and regulatory website. Many states are currently working on improvements to existing PA statutes and regulations. For information on pending improvements, please contact AAPA.

Appendix B

Overview of Texas and South Carolina Legislation for PA Disaster Medicine Response

Texas ⁴¹

- (a) The supervision and delegation requirements of this chapter and Subtitle B do not apply to medical tasks performed by a physician assistant: (1) during a disaster under the state emergency management plan adopted under Section 418.042, Government Code; (2) during a disaster declared by the governor or United States government; or (3) as a volunteer for a charitable organization or at a public or private event, including a religious event, sporting event, community event, or health fair. (a-1) This section does not apply to medical tasks performed by a physician assistant for compensation or other remuneration. (b) A physician assistant performing medical tasks under this section: (1) is entitled to the immunity from liability provided by Section 74.151, Civil Practice and Remedies Code; and (2) is acting within the scope of the physician assistant's license for purposes of immunity under Section 84.004(c), Civil Practice and Remedies Code. (c) A physician assistant may perform tasks described by this section: (1) under the supervision of any physician who is also performing volunteer work in the disaster, for the charitable organization, or at the public or private event; or (2) without the supervision of a physician, if a physician is not available to provide supervision. (d) A physician assistant employed by the United States government or licensed in another state may perform medical tasks in this state in circumstances described by Subsection (a)(1) or (2) without holding a license in this state.
- (b) EX. OCC. CODE § 204.2045

South Carolina ⁴²

(A) DHEC, in coordination with the appropriate licensing authority and the Department of Labor, Licensing and Regulation, may exercise, for such period as the state of public health emergency exists, in addition to existing emergency powers, the following emergency powers regarding licensing of health personnel: (1) to require in-state health care providers to assist in the performance of vaccination, treatment, examination, or testing of any individual as a condition of licensure, authorization, or the ability to continue to function as a health care provider in this State; (2) to accept the volunteer services of in-state and out-of-state health care providers consistent with Title 8, Chapter 25, to appoint such in-state and out-of-state health care providers as emergency support function volunteers, and to prescribe the duties as may be reasonable and necessary for emergency response; and (3) to authorize the medical examiner or coroner to appoint and prescribe the duties of such emergency assistant medical examiners

or coroners as may be required for the proper performance of the duties of the office.

(B) (1) The appointment of in-state and out-of-state health care providers pursuant to this section may be for a limited or unlimited time but must not exceed the termination of the state of public health emergency. DHEC may terminate the in-state and out-of-state appointments at any time or for any reason provided that any termination will not jeopardize the health, safety, and welfare of the people of this State. (2) The appropriate licensing authority may waive any or all licensing requirements, permits, or fees required by law and applicable orders, rules, or regulations for health care providers from other jurisdictions to practice in this State.

(C) (1) Any health care provider appointed by the department pursuant to this section must not be held liable for any civil damages as a result of medical care or treatment including, but not limited to, trauma care and triage assessment, related to the appointment of the health care provider and the prescribed duties unless the damages result from providing, or failing to provide, medical care or treatment under circumstances demonstrating a reckless disregard for the consequences so as to affect the life or health of the patient. © American Academy of PAs 33 (2) This subsection applies if the health care provider does not receive payment from the State other than as allowed in Section 8-25-40 for the appointed services and prescribed duties. However, if the health care provider is an employee of the State, the health care provider may continue to receive compensation from the health care provider's employer. This subsection applies whether the health care provider was paid, should have been paid, or expected to be paid for the services at the time of rendering the services from sources including, but not limited to, Medicaid, Medicare, reimbursement under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C. Section 512, et seq., or private health insurance.

(D) (1) The appointment of emergency assistant medical examiners or coroners pursuant to this section may be for a limited or unlimited time, but must not exceed the termination of the state of public health emergency. The medical examiner or coroner may terminate the emergency appointments at any time or for any reason, if the termination will not impede the performance of the duties of the office. (2) The medical examiner or coroner may waive any or all licensing requirements, permits, or fees required by law and applicable orders, rules, or regulations for the performance of these duties. (3) Any emergency assistant medical examiner or coroner appointed pursuant to this section is immune from civil liability for damages resulting from services relating to and performed during the period of appointment unless the damages result from providing, or failing to provide, services under circumstances demonstrating a reckless disregard for the consequences. S.C. CODE ANN. § 44-4-570 (L) "Health care provider" means any person or entity who provides health care services including, but not limited to, hospitals, medical clinics and offices, special care facilities, medical laboratories, physicians, pharmacists, dentists, physician assistants, nurse

practitioners, registered and other nurses, paramedics, firefighters who provide emergency medical care, emergency medical or laboratory technicians, and ambulance and emergency medical workers. This includes out-of-state medical laboratories, provided that such laboratories have agreed to the reporting requirements of South Carolina. Results must be reported by the laboratory that performs the test, but an in-state laboratory that sends specimens to an out-of-state laboratory is also responsible for reporting results.
S.C. CODE ANN. § 44-4-130(L)

LIST OF JOURNAL ABBREVIATIONS

<i>Acad Emerg Med</i>	Academic Emergency Medicine
<i>Am J Med.</i>	New England Journal of Medicine
J Am Acad PAs	Journal of American Academy of PAs
J Emerg Med	Journal of Emergency Medicine
J Environ Public Health	Journal of Environment and Public Health
J Gen Internal Med	Journal of General Internal Medicine
<i>J Hum Pharmacol Drug The</i>	Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy
J S C Assoc	Journal of the South Carolina Medical Association
Prehospital Disaster Med	Prehospital Disaster Medicine

REFERENCES

1. Rudowitz R, Rowland D, Shartz A. Health Care In New Orleans Before And After Hurricane Katrina. *Health Aff (Millwood)*. 2006;25(5):w393-w406. doi:10.1377/hlthaff.25.w393
2. Hurricane Costs. <https://coast.noaa.gov/states/fast-facts/hurricane-costs.html>. Accessed March 4, 2019.
3. Ritchie H, Roser M. Natural Disasters. *Our World Data*. June 2014. <https://ourworldindata.org/natural-disasters>. Accessed February 14, 2019.
4. 5 natural disasters that devastated the US in 2018. ABC News. <https://abcnews.go.com/US/natural-disasters-devastated-us-2018/story?id=59367683>. Accessed February 14, 2019.
5. Hoeppe P. Trends in weather related disasters – Consequences for insurers and society. *Weather Clim Extrem*. 2016;11:70-79. doi:10.1016/j.wace.2015.10.002
6. Catlett CL, Jenkins JL, Millin MG. Role of Emergency Medical Services in Disaster Response: Resource Document for the National Association of EMS Physicians Position Statement. *Prehosp Emerg Care*. 2011;15(3):420-425. doi:10.3109/10903127.2011.561401
7. Courtney B, Morhard R, Bouri N, Cicero A. Expanding Practitioner Scopes of Practice During Public Health Emergencies: Experiences from the 2009 H1N1 Pandemic Vaccination Efforts. *Biosecurity Bioterrorism Biodefense Strategy Pract Sci*. 2010;8(3):223-231. doi:10.1089/bsp.2010.0036
8. Hershey TB, Nostrand EV, Sood RK, Potter M. Legal Considerations for Health Care Practitioners After Superstorm Sandy. *Disaster Med Public Health Prep*. 2016;10(3):518-524. doi:10.1017/dmp.2016.33
9. Wiler JL, Ginde AA. State laws governing physician assistant practice in the United States and the impact on emergency medicine. *J Emerg Med*. 2015;48(2):e49-58. doi:10.1016/j.jemermed.2014.09.033
10. How to Help Provide Emergency Disaster Services. *AAPA*. August 2018. <https://www.aapa.org/news-central/2018/08/help-provide-emergency-disaster-services/>. Accessed February 26, 2019.
11. Lynch JS. Disaster response: Physician assistant skills are an important asset. *J Am Acad PAs*. 2009;22(1):36.

12. After Disasters, PAs Step In To Provide Critical Medical Care. *AAPA*. December 2017. <https://www.aapa.org/news-central/2017/12/disasters-pas-step-provide-critical-medical-care/>. Accessed February 26, 2019.
13. National Health Security Strategy 2019-2022. :24.
14. US Disaster Statistics. <https://disaster-survival-resources.com/us-disaster-statistics.html>. Accessed March 10, 2019.
15. Lane K, Charles-Guzman K, Wheeler K, Abid Z, Graber N, Matte T. Health Effects of Coastal Storms and Flooding in Urban Areas: A Review and Vulnerability Assessment. *J Environ Public Health*. 2013;2013. doi:10.1155/2013/913064
16. Saulnier DD, Ribacke KB, Schreeb J von. No Calm After the Storm: A Systematic Review of Human Health Following Flood and Storm Disasters. *Prehospital Disaster Med*. 2017;32(5):568-579. doi:10.1017/S1049023X17006574
17. Kessler RC, The Hurricane Katrina Community Advisory Group. Hurricane Katrina's Impact on the Care of Survivors with Chronic Medical Conditions. *J Gen Intern Med*. 2007;22(9):1225-1230. doi:10.1007/s11606-007-0294-1
18. Group THKCA. Mental Illness and Suicidality after Hurricane Katrina. *Bull World Health Organ*. 2006;84(12):930.
19. U.S. Response to Disasters and Public Health EmergenciesâWelcome. https://sis.nlm.nih.gov/dis_courses/us_response/index.html. Accessed February 17, 2019.
20. U.S. Response to Disasters and Public Health EmergenciesâSection 3: U.S. Disasters Preparedness and Response Legislation. https://sis.nlm.nih.gov/dis_courses/us_response/03-000.html. Accessed February 18, 2019.
21. National Incident Management System | FEMA.gov. <https://www.fema.gov/national-incident-management-system>. Accessed February 17, 2019.
22. Wanner GK, Loyd JW. EMS, Care Teams In Disaster Response. In: *StatPearls*. Treasure Island (FL): StatPearls Publishing; 2018. <http://www.ncbi.nlm.nih.gov/books/NBK482333/>. Accessed February 12, 2019.

23. Frasca DR. The Medical Reserve Corps as part of the federal medical and public health response in disaster settings. *Biosecurity Bioterrorism Biodefense Strategy Pract Sci*. 2010;8(3):265-271. doi:10.1089/bsp.2010.0006
24. AAPA. PA Practice During a Disaster or Emergency. January 2018.
25. 2016 Arizona Revised Statutes: Title 32 - Professions and Occupations :: § 32-2535 Emergency medical care; supervision. Justia Law. <https://law.justia.com/codes/arizona/2016/title-32/section-32-2535/>. Accessed February 19, 2019.
26. Scott LA, Crumpler J, Tolley J, Jones EM, Wahlquist AE. Disaster Care Provider Workforce Assessment. *J S C Med Assoc* 1975. 2012;108(3):80-83.
27. Nestler DM, Fratzke AR, Church CJ, et al. Effect of a Physician Assistant as Triage Liaison Provider on Patient Throughput in an Academic Emergency Department. *Acad Emerg Med Off J Soc Acad Emerg Med*. 2012;19(11):1235-1241. doi:10.1111/acem.12010
28. Yang Y, Long Q, Jackson SL, et al. Nurse Practitioners, Physician Assistants, and Physicians Are Comparable in Managing the First Five Years of Diabetes. *Am J Med*. 2018;131(3):276-283.e2. doi:10.1016/j.amjmed.2017.08.026
29. Gausche-Hill MM. Pediatric Disaster Preparedness: Are We Really Prepared? *J Trauma-Inj Infect*. 2009;67(2). doi:10.1097/TA.0b013e3181af2fff
30. Pavlik D, Sacchetti A, Seymour A, Blass B. Physician Assistant Management of Pediatric Patients in a General Community Emergency Department: A Real-World Analysis. *Pediatr Emerg Care*. 2017;33(1):26-30. doi:10.1097/PEC.0000000000000949
31. Jhung MA, Shehab N, Rohr-Allegrini C, et al. Chronic Disease and Disasters: Medication Demands of Hurricane Katrina Evacuees. *Am J Prev Med*. 2007;33(3):207-210. doi:10.1016/j.amepre.2007.04.030
32. Jiao S, Murimi IB, Stafford RS, Mojtabai R, Alexander GC. Quality of Prescribing by Physicians, Nurse Practitioners, and Physician Assistants in the United States. *Pharmacother J Hum Pharmacol Drug Ther*. 2018;38(4):417-427. doi:10.1002/phar.2095

33. Phillipmarzouk. US Natural Disaster Risk Maps. *Alert Syst Group*.
<http://alertsystemsgroup.com/earthquake-early-warning/informative-maps/>.
Accessed April 1, 2019.
34. Historic Disaster Response to Hurricane Harvey in Texas | FEMA.gov.
<https://www.fema.gov/news-release/2017/09/22/historic-disaster-response-hurricane-harvey-texas>. Accessed April 20, 2019.
35. Hellerstedt J. Public Health and Healthcare Response to Hurricane Harvey. October 2017. file:///Users/danielevans/Downloads/DSHS-Senate-Finance-Harvey102417.pdf.
36. Hurricane Florence 2018 | SCDHEC. <https://scdhec.gov/disaster-preparedness/hurricane-florence-2018>. Accessed April 20, 2019.
37. FEMA and Partners Respond to Hurricane Florence | FEMA.gov.
<https://www.fema.gov/news-release/2018/09/14/fema-and-partners-respond-hurricane-florence>. Accessed April 20, 2019.
38. What's a Good Survey Response Rate? SurveyGizmo.
<https://www.surveygizmo.com/resources/blog/survey-response-rates/>.
Published July 27, 2015. Accessed June 16, 2019.
39. Cohen J. *Statistical Power Analysis for the Behavioral Sciences*. Routledge; 2013. doi:10.4324/9780203771587
40. The Emerging Public Health Consequences of Hurricane Harvey | NRDC.
<https://www.nrdc.org/experts/juanita-constible/emerging-public-health-consequences-hurricane-harvey>. Accessed July 7, 2019.
41. Texas Occupations Code Section 204.2045âVolunteer Care and Services Performed During Disasterâ2017 Texas StatutesâTexas Statutes.
https://texas.public.law/statutes/tex._occ._code_section_204.2045. Accessed June 16, 2019.
42. 2012 South Carolina Code of Laws: Title 44 - Health :: Chapter 4 - EMERGENCY HEALTH POWERS :: Section 44-4-570 - Emergency powers regarding licensing of health personnel; appointment of in-state and out-of-state providers; liability of appointed providers for civil damages; appointment of emergency medical examiners or coroners; waiver of licensing fees and requirements; immunity. Justia Law.
<https://law.justia.com/codes/south-carolina/2012/title-44/chapter-4/section-44-4-570/>. Accessed June 16, 2019.

CURRICULUM VITAE





