2024

Exploring US National and Vermont Emergency Medical Services: Slower and Lower Rural Care

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A thesis submitted to the faculty at the University of Vermont in partial fulfillment of the requirements for the degree of Bachelor of Arts in the College of Arts and Sciences Department of Geography and Geosciences

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Defended May 1, 2024

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Abstract:

Research demonstrates that modern Emergency Medical Service (EMS) systems do not provide care equitably to all patients, particularly across different landscapes. In this research, I explore the differences between rural and urban EMS nationally and within Vermont. Utilizing a mix of qualitative data derived from interviews with EMS providers, quantitative data from local and national-level monitoring organizations, and cartographic approaches, I generated an understanding of the current EMS landscape from a social and spatial perspective. Specifically, I explored the application of the theory of "taskscapes" onto EMS systems to evaluate understandings for a more equitable EMS future.

Acknowledgments:

I owe many people a debt of gratitude for their support, from my roommates ensuring I got a breath of fresh air on my writing days or my family and friends checking in with me throughout this process. I would like to especially thank Dr. Meghan Cope for her continued and caring support, guidance, and oversight throughout this process. I am also deeply grateful to Dr. Mary Burke and Dr. Cheryl Morse for generously agreeing to sit on my defense committee. Additionally, I would like to thank the UVM Office of Fellowships, Opportunities, and Undergraduate Research for funding my research process through a 2023 Summer Research Award. Lastly, I want to acknowledge everyone who graciously donated their time to my research through interviews and ride-alongs. It goes without saying that while this research is mine, I did not do this on my own, so to everyone I extend an extremely grateful thank you.

Figures:

Unless otherwise noted all data tables and statistical queries compiled by author utilizing the NEMSIS data cube using data with approval by NHTSA.

Unless otherwise noted all cartography done by author on ArcGIS using publicly available data with specific data sources noted at bottom of each map.

Chapter 1: Introduction

In a medical emergency, the concept of 9-1-1 is simple: someone in distress calls, and someone with the appropriate training responds. But what constitutes a response? What happens when the nearest medical asset is five minutes away, as in most urban settings, versus fifteen or more minutes out, as in a typical rural response? Research consistently shows that on critical calls such as car accidents and cardiac arrests, the faster the response, the more likely a patient will survive and later thrive (Miller et al. 2020; Stitcher 2005). Additionally, over fifty years of research exists on the best locational placement for pre-hospital medical units (Volz 1971; Chanta et al. 2014; Luo et al. 2022). Despite this knowledge, rural communities still endure above-average delays for the same care. With all the technological and medical advancements of the twenty-first century, why do these disparities still exist?

In addition to issues of distance and scarcity of EMS, geographic research demonstrates that rural residents are often subject to social constructions and stereotypes such as being 'tough,' 'strong,' 'independent,' and self-sufficient enough to live in an isolated region. Further, this social ascription of character spills over into an estimation of value. Large counties or regions often leave out their rural constituents when planning and rural individuals are less likely to buy in or need a given system because of their low populations (Henry & Drabenstott 1996). As a result, there is less economic investment (Henry & Drabenstott 1996). Assumptions and lack of communication mean that rural residents often feel that urban health systems' managers do not care about their community members, while from the urban perspective, rural populations are perceived as an unnecessary draw on systems they rarely use. After this divide forms, it is not uncommon to see a narrative follow that casts rural life as less important and, therefore, less valuable (Jacobs & Munis 2022). When these two perspectives are placed in tension with one

another — a less supportive rural emergency medical services (EMS) system and a social construction of lower value to rural lives — the question is what truly causes this systemic EMS difference.

It is important to note that rural systems are not the only ones with challenges; urban systems consistently must contend with system overuse and having more need than availability. It does not matter if you live near an ambulance station if that ambulance is across town on a call. Urban systems also contend with road construction and traffic that a rural system often does not. However, extensive research into these questions provides new pathways to care for urban residents.

It is not the goal of this work to 'fix' the American EMS system, but rather to utilize national data, current discourse, and a case study of Vermont to view EMS systems and needs as more than just distance and location. Currently, EMS systems generally encompass urban and rural spaces and yet the needs of the two landscapes could not be more different. Through this piece, I will show that urban and rural systems should be viewed on their own terms to respond to the unique activities and needs of EMS care within those spaces. Additionally, I will demonstrate how Ingold's (1993) taskscape can be utilized as a powerful tool in understanding specific landscape needs and in turn generating responsive EMS systems. Taskscape theory is helpful because by viewing the tasks of a community as interrelated elements of dwelling upon and with a landscape we can more appropriately respond to the needs of that community (Ingold 1993).

Koeze et al. (2020) lay out a display of everywhere in the US where Americans live greater than thirty minutes from a medical center, calling to action industry leaders and community members to reinvigorate our rural medical system. However, it is critical to remember that the ride to a hospital in an ambulance is, for many, a step that must also be

prioritized in this call to action. As more and more rural hospitals close, the burden falls on EMS to care for rural patients, yet rural systems consistently have fewer resources than their urban neighbors (Koeze et al., 2020). The authors seek to lay the groundwork for further research into solutions that would make the two systems more equitable and bring patients to the focus of care. My research aims to fill the void in existing knowledge and begin understanding the background in EMS system differences.

Through evaluation of my research questions, I was able to explore key points of interest for identifying a theoretical framework with which to evaluate them. Specifically, I look at both geographic and social levels to evaluate: Why and how do differences in emergency medical services emerge? What structures or policies influence rural and urban contexts of EMS delivery? What are the impacts of these differences on equity? And lastly, how can the use of the taskscape theoretical framework assist in the generation of more equitable care?

Chapter 2: Context and Positionality

Historical Context of the EMS System:

In 1865 the United States saw its first ambulances, first in Cincinnati and then New York, staffed by surgeons with crude and rudimentary instruments as well as a "quart of emergency brandy" (Bucher and Zaidi 2021). These early attempts at pre-hospital care were largely hospital based and aimed at streamlining the process of care, but not necessarily improving a patient's outcome. This system, or lack thereof, remained largely untouched outside of Cincinnati or New York until the first World War almost 40 years later when local fire departments, hospitals, and funeral homes began staffing hearses as ambulances across the Mid-Atlantic (Bucher and Zaidi 2021; EMS Memorial 2021). Care systems shifted away from hospital surgeons entering the field to provide earlier care, to volunteers being called by fire or police departments to transport critically injured patients to the hospital (Bucher and Zaidi 2021; EMS Memorial 2021). These systems were disjointed, hyper-localized, and at many times unregulated in non-urban settings (Bucher and Zaidi 2021; EMS Memorial 2021). Simultaneously, larger urban centers — notably Cincinnati, New York, Los Angeles, Seattle, and Miami— were beginning to experiment with best practice medicine out of their already existing fire department networks (Bucher and Zaidi 2021). These networked systems in the early 1950s and '60s began to note that ambulances could be used to prolong life and not just serve as transport services as early cardiopulmonary resuscitation (CPR) research was rolled out into the field. All these networks, whether a local funeral home in New Jersey or the Los Angeles Fire department, are socially seen today as the EMS before EMS; existing disconnected from one another and based on local needs without any direction or guidance from national agencies.

Then in the late 1960s and early 1970s the pieces all fell into place and the United States began to form a nationally supervised EMS system. Most critically, the 1966 publishing of

Accidental Death and Disability: The Neglected Disease of Modern Society by the National Academy of Sciences (NAS) calling for major changes to pre-hospital care throughout the country. This watershed report to President Johnson, viewed internally as the white papers for EMS, identified a nationwide spike in motor vehicle collisions (MVCs) resulting in deaths with an all-time high in 1965 where MVC deaths surpassed deaths from the Korean war (Edgerly, 2013; National Academy of Sciences, 1966; Shah, 2006). The NAS report notes that with the increasing American dependency on cars and the interstate system this number would likely only get higher if nothing were done (National Academy of Sciences, 1966). Further it asserts that many of these deaths could have been prevented if a pre-hospital care system were in place to help patients at the point-of-accident (National Academy of Sciences, 1966). This report, coupled with the 1968 rollout of the 9-1-1 national emergency system number, along with a growing body of military research from the battlefields of Vietnam demonstrating that point-of-accident care reduced patient morbidity and increased post-incident quality of life, spurred a moment of opportunity coupled with a demonstrated need and pushed the nation's government to act (Bucher and Zaidi, 2021; EMS Memorial, 2021; Shah, 2006).

Following this increased push for EMS provision and assistance in attention to preventable loss of life, Congress passed the Emergency Medical Services Systems Act in 1973, securing over $50 million annually in funding for a series of years to ensure states had the resources needed to begin their EMS networks (S.2410, 1973; Shah, 2006). Additionally, just prior to this, in 1972, the Health Services and Mental Health Administration was charged with medical oversight of EMS, stating a national desire to have EMS step more formally into the role of care provision and away from simply transport (EMS Memorial, 2021). These two actions formalized the EMS system as a state-based task, with national funding, support, and oversight.

These developments constituted an initial step from the federal government to recognize the varying local needs of states while still providing a supporting backbone from which to create systems of care.

In the early 1970s Robert Volz's published a study entitled *Optimum Ambulance Location in Semi-Rural Area,* a first of its kind piece which sought to statistically identify the ideal ambulance placement for communities beginning to build ambulance networks (Volz, 1971). Volz's groundbreaking work changed the framework of EMS development from one of responsive care to economic efficiency, a framework that has been continuously reexamined and reworked over the past 50 years (Xing Fu et al., 2022; Jonk et al., 2023; Chanta et al., 2014). This statistically based work ensured that dollars going into the EMS system best served the community as a whole and underscored the need for economically efficient management of the inherently costly EMS system. I will address later why this body of work, while critical. should be approached with caution. While research shows you can optimize the use of a dollar, that also must balance with the qualitative needs of patients throughout a system.

Parallel to these shifts, a national formalized Emergency Medical Technician (EMT) and Emergency Medical Technician – Paramedic (EMT-P / Paramedic) educational standard was emerging through the National Registry of EMTs (NREMT) in the early 1970s (nremt.org, Edgerly, 2013). The NREMT, along with a handful of state organizations, took on the active design of initial education to ensure standardized competency in the newly developing system. Initially, the two-tiered certifications were designed to provide broad but basic access through the 4-month EMT curriculum and specialized care through paramedics. Paramedics were first educated through one of ten programs, having a 400-hour class requirement and a 100-hour clinical requirement (Edgerly, 2013). In 1980, a third tier of provider was added, the Emergency

Medical Technician - Intermediate (EMT-I) (nremt.org). The goal of the EMT-I was to provide more advanced care in predominantly rural spaces that could not afford to have or do not have an appropriate representation of paramedics. The EMT-I certification, unlike the EMT or Paramedic required prior experience of providers to have an EMT certification, thus leading to shorter educational timelines for advanced care. Over time the EMT-I was redeveloped to have additional adjunct certifications for the provider to defibrillate (EMT-Defibrillation), or administer IVs (EMT-IV), and then it was ultimately renamed in 2011 to the Advanced Emergency Medical Technician, AEMT, and given the scope of the EMT-I, EMT-Defibrillation, and EMT-IV all in one 4-month course (nremt.org). This requirement was further expanded over time to include more clinical skills as EMTs, AEMTs, and paramedics continued to demonstrate productive competence and confidence in the field. This responsive development was made to ensure certifications were kept current with best practice and educational requirements were appropriately intensive without becoming prohibitively restrictive. Further, the ability to access education has widely expanded from ten paramedic programs and a handful more of EMT certifications to nationwide opportunities with many community colleges, universities, EMS organizations, and independent educational academies teaching EMT, AEMT, and paramedic level classes in every state (nremt.org; Edgerly, 2013; EMS Memorial, 2021). Certification management has generally consolidated with the NREMT now managing certifications for or having certification reciprocity to all fifty states and all American territories, with each state or territory independently managing their licensure separately (nremt.org). Further, the NREMT manages biannual certification renewal for active providers and helps manage communications on national best practices of care (nremt.org; Edgerly, 2013). It should also be noted that there has been a recent addition of a certification level called the emergency medical responder (EMR)

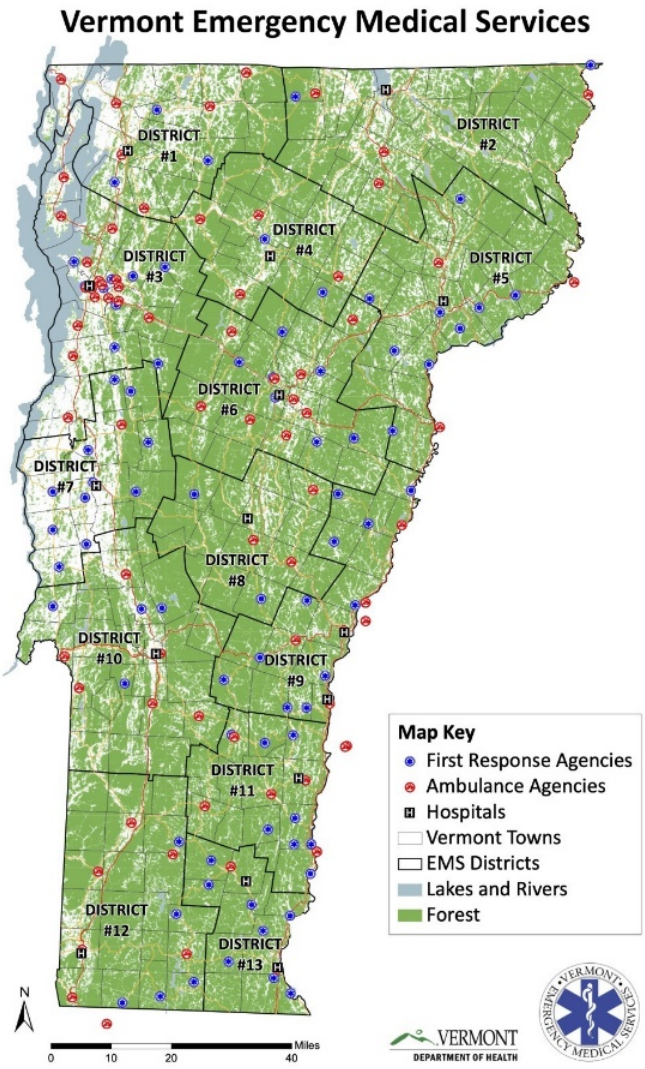
which is a roughly one-month course that aims at mass certification of first response care. Due to the newness of this certification and the nature of care EMRs provide, I intentionally excluded them from the scope of my research.

EMS provision throughout the US has a slow history of trial-and-error stories as providers, communities, and governing bodies sought to design the optimal ambulance networks for ideal provision of service to their communities. With annual protocol reviews at the national and state levels, as well as amendments to the certification processes and availability, systems leaders have spent the past six decades attempting to define the optimal EMS system (Edgerly, 2013). However, stakeholders are still consistently forced to balance the need to preserve life, first noted in the NAS report, and the need for economic efficiency, initially explored by Volz (1971). This tension is not unique to EMS all of healthcare (and to a degree every field) is forced to tension the stretch of a dollar and the needs of their patients. In 2014, Chanta et al. propose a bi-objective model for ambulance placement which seeks to balance these two needs, which finds ways to stretch the dollar in the name of equity. Research to reduce this tension exists, and has existed from 1971 until today, however this is an ever-present balance in healthcare that systems and services at every level must decide how to address.

Vermont's EMS history is less well documented, but I was able to piece together an oral history through conversations with older providers with whom I work at Charlotte Rescue and UVM's IREMS. Vermont's EMS was founded between fifty and fifty-five years ago throughout the state based on a series of EMT and AEMT ambulances. Early in its conception the Vermont EMS system was put under the administration of the Vermont EMS Director and the Vermont EMS agency (VTEMS), which operate as a branch within the Department of Public Health. VTEMS oversees licensure within the state and supervises every EMS district leadership.

Another early movement by VTEMS was to break the state into thirteen EMS districts (see figure 1 below) which each have their own administrative boards, medical direction hospital, and medical director overseeing their operations. This allowed VTEMS to focus on statewide protocols, licensure, and bigger picture issues, while the individual districts focused on local needs and practice. Over the past fifty years VTEMS has developed from a small organization providing EMT and AEMT care in a rural state to a larger network providing full scope care, integrating paramedics between the 1980s and early 2000s depending on the district, with roughly 170 agencies and over 3,000 providers. VTEMS is undergoing growth as call volumes increase nationally and within the state due to growing populations and the ongoing homelessness and opioid crises. Additionally, as I work through this research in early 2024, the state house is debating a large funding bill, H.622, for EMS that would serve to strengthen statewide oversight and trauma systems.

Fig. 1, Vermont Emergency Service Locations (healthvermont.gov)



Positionality:

It is important to acknowledge the underlying perspectives and positions that I enter this research with. I am primarily a full-time student and accordingly am completing this research as a requirement for my graduation from the UVM Honors College; likely I would not undertake this research otherwise. However, given the requirement to complete a thesis, I wanted this project to be meaningful to me and relevant to not just my academic major, geography, but also my current career field, EMS. Accordingly, the creation of this project was guided by three

things: my academic interest in health geographies, my time in EMS, and my experiences with EMS education. I work EMS as an AEMT at three services within VTEMS District 3 – UVM Rescue, Charlotte Fire and Rescue, and Vergennes Rescue – where I am a volunteer at UVM and paid at Charlotte and Vergennes. I can largely credit the beginning of my learning and career in EMS to UVM Rescue, whose care, and station, is centered in the urban core of VTEMS District 3. I also work as an instructor for EMT and AEMT courses at the University of Vermont's Initiative for Rural Emergency Medical Services (IREMS). On the other hand, I have never worked in VTEMS District 13 and have only spent time in the area as a tourist. While I attempted to ensure that any personal biases were avoided throughout my work, I cannot assume I was able to fully eliminate bias. I took steps to avoid personal biases by interviewing practitioners from throughout the state who come from a wide range of backgrounds. Further, I utilized multiple literature research methods to minimize confirmation bias, including keyword search, snowball searching, and additional techniques. Additionally, I ensured that my work was reviewed by my thesis advisor, Professor Cope, and reviewed by my peers. I also, in conversation with my peers, spent time understanding my personal opinions and biases that are rooted in my positionality and named those to Professor Cope to further verify that they were accounted for and mitigated during the research process. That said, I was able to utilize my insider status to expand the benefits of this research as I suspect my interview participants were more open to being interviewed and with what they shared given their perception of me as part of their community. Lastly, my existing presence within this community allowed me to draw anecdotal data findings and analysis which filled the voids in existing research.

Chapter 3: Literature Review

Existing research into EMS systems encompasses both rural and urban networks separately and as a combined network (Nesbit et al. 2022). This body of research bridges empirical rural scholarship, urbanism, statistical analysis, and urban planning, with more conceptual work on social justice, economic power, and the theoretical "taskscape" (Ingold 1993; Scott 2021). The literature becomes clear that EMS systems in rural and urban areas are generally created without respect to underlying social biases; rather, systems are designed using statistical analysis aimed explicitly at economic efficiency. Further, due to the differing physical and social geographies of rural and urban spaces, there are significant barriers to generalized system revisions without further exacerbation of inequity, such as differences in roadway networks or land use types. Therefore, I will utilize the taskscape theory to unpack the differing landscapes from a perspective of equity to demonstrate how systems can be designed in accordance with the needs of the people they serve (Ingold 1993).

Understanding Rurality and Urbanity:

To fully explore rural and urban pre-hospital medical care, we must first situate ourselves in an understanding of what constitutes urban and rural spaces. Ingold (1993) identifies the landscape of a space as a reflection of its form, a co-created relationship between the hyper localized needs of natural and human inputs within a given space (Ingold 1993, 157). Almost thirty years later Atkinson et al. (2020, 1903) note that a "community is the sum of its parts" and further that "aspects of local life…are not simply individual." It has long been understood and accepted by geographers that a given location is neither merely a space nor a place, but a contextualized landscape for a community (Schein 1997). Accordingly, when approaching

studies which look at both rural and urban spaces, it is critical to ensure baseline understandings of both spaces are appropriately situated within their own context (Smith 2008).

Differentiating urban and rural spaces is both a question of social and technical definition. The technical definition is theoretically simple, the US Census Bureau clearly states that "to qualify as an urban area, the territory … must encompass at least 2,000 housing units or have a population of at least 5,000," and "rural encompasses all population, housing, and territory not included within an urban area" (Census.Gov, 2023). However, in practice, the definitions are not so simple, with regular changes to what qualifies as urban, and subsequently rural, as well as a handful of other special case definitions such as the New England 'places.' There exists, even at the most technical level, a significant gray area which even the Census Bureau cannot figure out.

Conversely, Jacobs et al. (2022) highlight how socio-cultural the identification of "rural" and "urban" truly is, finding in their study that the US has become acutely divided due to what they identify as "place-based resentment." Specifically, the authors argue that place-based connection is a strong predictor of political identification, which is increasingly powerful as recent political leaders utilize increasingly polarizing rhetoric surrounding issues that voters consider to be central to their place connection. They further state that this political polarization is not only a predictor of voting trends but has become a source of resentment towards the 'other side,' finding that socially identified "rural" spaces were more likely to vote against democratic values and those voters likely considered those values to be "urban" in nature, and vice versa. Jacobs et al. (2022) found a growing resentment from rural and urban spaces to each other, noting that communities no longer see themselves independently but in comparison to their urban or rural neighbors. This increasing polarization is another indication of the critical need for

understanding equity and the EMS system within specific landscapes to ensure the taskscape is reciprocal with its given space (Jacobs et al. 2022).

To complicate this gray area, I reference the work of Woods (2005) who suggests that rurality and urbanity are truly defined experientially and not by quantitative metrics, suggesting instead that these quantitative metrics really exist for governmental and administrative efficiency. That is, the day-to-day realities of human interaction generate descriptive and experientially responsive definitions (Woods 2005). Woods (2005) additionally notes that these social definitions are truly only followed for social interactions and yet more varieties of interactions generate increasingly different and nuanced definitions to be followed within them. He ultimately does not define rurality (the focus of his piece), but identifies these multiple layers of complexity which must be accounted for when defining rurality and urbanity.

When differentiating spaces simply based on quantitative metrics, the qualitative image of the spaces can easily become forgotten (Smith et al. 2008). It is these qualitative elements and "characteristics" which constitute culture and generate the structures of rural and urban space (Smith et al. 2008, 57; Ricketts 2000). Significant existing research finds that rural residents are less likely to have consistent access to insurance, healthcare, and emergency services due to physical distances and further due to cultural perceptions of 'toughness' and 'independence' within those spaces (Caldwell et al. 2016; Luo et al. 2022; Smith et al. 2008). Conversely, urban spaces are reporting increasingly overcrowded hospitals and delayed EMS responses due to increasing call volumes, which in turn has discouraged utilization of medical resources despite availability (Koeze et al. 2020). Additionally, racial, and socio-economic disparities are known to exacerbate barriers to care in both rural and urban regions, though urban areas are the subject of a larger body of research on these barriers compared to rural spaces (Caldwell et al. 2016;

Alanazay, Fraser, and Wark 2022). With all this in mind it becomes clear that rurality and urbanity are not simply census designations and population metrics, but socio-cultural structures that generate and occupy unique landscapes, which must be observed and attended to within their own contexts. This leads mixed-method research, such as the present project, to engage with multiple definitions of rurality and urbanity, using quantitative boundaries when analyzing quantitative data, and expanding into qualitative methods to expand contextually to socio-cultural understandings of diverse landscapes.

Here we see that a parallel problem — ineffective and inequitable EMS systems — occurs within urban and rural spaces. Yet as my work will show, research is vastly different in rural and urban spaces. Rural research focuses almost explicitly on structures of inequity in the abstract and urban largely exploring system design and efficiency in discrete settings with almost no overlap between the two. I do not argue that the urban system is perfect, or this lack of research into equity is necessarily the best course of action, but this difference demonstrates the generalized disdain held against rural spaces throughout geographic research and larger social discourse. I argue that to create better EMS systems, researchers must lean into the differences between the urban and rural setting to better understand and care for their respective populations, but first we must acknowledge this historic bias and ensure that future research grapples with both the rural and urban setting from a space of understanding and future oriented care.

Medical Equity:

As I begin to unpack ideas of medical equity in rural and urban spaces, it is important to realistically define medical equity as a baseline for this discussion. Accordingly, pre-hospital medical equity should be approached from two distinct scales: equity and medical equity. It is

not the intent of this work to solidify a definition of any of these terms; I simply seek to create a contextual understanding of equity as it pertains to socio-spatial identifications and medical care.

Smith et al. (2008) note how quantifiable data, such as differing response times, call volumes, or patient outcomes, is easier to address with an optimization formula than by truly understanding and unpacking the roots of rural and urban differences. However, EMS research is still broadly stuck on ideas of quantity, and lives in fear of more theoretical analysis of concepts such as equity. By avoiding theoretical concepts researchers are able to avoid any terms that could be debated. Due to the ethical and moral ambiguity around what is 'right,' when equity is applied to specific ideas, definitions quickly become debates. Health- or medical equity is most commonly defined as an absence of inequity within a fair system (Luo et al. 2022; Weil 2017; Institute of Medicine 2003). However, as the Institute of Medicine (IOM) notes in their 2003 review of cases of inequity and medical bias, equity is abstract and intangible for an already overburdened medical system. By understanding medical equity as a set of guiding principles as opposed to a specific goal, equity becomes a day-to-day expectation compared to an ethical guiding principle. This is similar to the concept of the Hippocratic Oath which doctors must pledge themselves to, in which doctors are not saying everything they will do, but rather stating agreement with a series of principles that frame their care. The IOM specifically identifies racial and ethnic discrimination as current sources of inequity within the medical field; this understanding is broadened by Caldwell et al. to include the dimensions of economic standing and gender (Institute of Medicine 2003; Caldwell et al. 2016). Additionally, previous work into fostering medical equity focuses largely on the target of minimizing inequity (Caldwell et al. 2016; Luo et al. 2022). As both Luo et al. (2022) and Caldwell et al. (2016) note, in our modern health system, inequity is identifiable and quantifiable. Caldwell et al. additionally echo the IOM

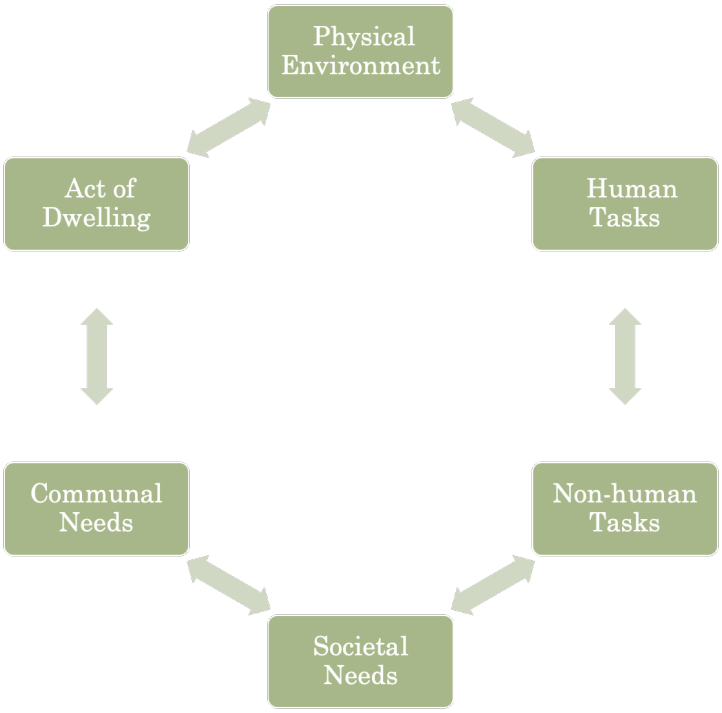
and note that for marginalized groups already struggling with medical inequity, geographic isolation such as rural living can exacerbate effects of pre-hospital medical inequities. All this demonstrates that inequity exists both demographically and geographically, which when combined puts some residents in acute danger.

While this body of research exists within the healthcare field, there was very little application of those findings onto the pre-hospital setting beyond and work and findings of Caldwell et al.'s (2016) study. During my national data analysis, I was able to find minor trends, noted in chapter five, however this was largely where available information ended as neither my discourse analysis nor case study generated significant findings in this regard. From my personal experience within Vermont, I would reasonably expect that there exist lines of inequity according to age within the state given the aging population and tendency of older rural Vermonters to age in place. From non-research-oriented conversations I have had with providers outside Vermont it seems that there exists a social understanding among providers that Caldwell's findings ring true and inequity is exacerbated and created specifically along demographic factors. However, due to the limited sample of available data-points, discourse, and research findings, coupled with the scope of an undergraduate thesis, I chose to limit my research scope to readily available findings and conversations. I argue that this lack of research and discourse becomes an unspoken reinforcement of the inequities facing marginalized individuals when accessing pre-hospital care and medical care more broadly. Given personal experience, I suggest that future research looking to expand understandings built by Caldwell and the IOM would be significant, informative, and critical to the field.

The Theoretical Taskscape:

My aim in this paper is to promote understandings of (in)equities within pre-hospital medical care, contextualized to rural and urban settings. Accordingly, when identifying a framework for conceptual understanding, Ingold's (1993) taskscape theory became the clear metric. Ingold bases his argument on two key ideas: human life is a process of time, and life occurs in combination with landscape. For Ingold, the human experience occurs within its chronological occurrence of events. Though those experiences are not discrete, they occur within a landscape which is a combination of the physical objects and the human and non-human natural elements within that space, which independently have a chronology of existence. This activity in a landscape is the act of *dwelling*, and at the nexus of dwelling is the performance of landscape specific tasks temporally bounded to a given moment, this being the taskscape. This is demonstrated in figure two below, showing the interconnected nature of any element of the landscape. By engaging with one element in context to every other one, researchers are able to engage with the landscape directly as a taskscape. Ultimately, this approach suggests that our systems should be designed *with* particular landscapes in mind, rather than in an acontextual or abstracted frame.

Fig. 2, Taskscape Framework Model



Dunkley (2009) demonstrates that this framework can be successfully applied in conceptualizing life within an applied taskscape. In particular, she explores the idea of wilderness therapy camps as a utilization of *dwelling* within a landscape to effectively care for residents within the program. Further, Dunkley (2009) notes that part of the success of the camp taskscape is the specific landscape which became interlocked with the goal of therapeutic outcomes. Similarly, Premo and Tostevin (2016) applied the taskscape as a framework for understanding the likelihood of cultural transmission, finding communities from different landscapes must be understood as unique spaces with unique and independent cultures. However, they also found that by sharing a taskscape such as a shared foraging space and system, culture is more likely to transmit (Premo and Tostevin 2016). Additionally, Jampel (2016) applies Ingold's taskscape to cattle raising lifestyles in the Ecuadorian Andes as a method for understanding human-wildlife conflict. Arguing that by viewing cattle raising as a task which must occur on the

landscape it becomes a taskscape, which in turn makes it easier to deconstruct the needs of dairy farmers in the context of the wildlife. All three of these authors demonstrate that by applying the taskscape framework a landscape can be more effectively understood with respect to its cultural needs.

If we use Dunkley (2009), Premo and Tostevin (2016), and Jampel (2016) as models, it becomes clear that a framework, specifically the taskscape, can be applied to appropriately situate EMS as a function of a specific space and not a network of a given hospital or agency. In this paper, I propose that by similarly viewing the system of EMS in rural and urban settings as acts of *dwelling*, the provision of care becomes a taskscape which can be used to understand localized challenges to equity and medical care within each landscape.

Applying Ideas of Equity to Existing Scholarship:

Research on EMS in both urban and rural spaces has shown how to design efficient response systems in each, but solutions rarely consider the needs of both contexts together (Reif et al. 1999; Miller et al. 2020; Odom et al. 2022). Little research looks simultaneously at the rural *and* urban systems, or those systems in the context of equity (Luo et al. 2022). Restricting analysis to either rural or urban medical equity allows for appropriate understandings of medical equity in the respective spaces. Through this research I intend to explore that gap, specifically, identifying the contextual nature of medical equity and evaluating the respective needs through the framework of the taskscape.

Current research explores replacements for EMS and the ongoing presence (or lack thereof) of formal medical centers (Caldwell et al. 2016; Huang et al. 2018; Patel et al. 2020; Tribble 2019). EMS alternatives have begun to arise in recent years, specifically paramedicine, which seeks to provide at-home, non-emergency, and routine patient care (Huang et al. 2018).

Though this field is new and under-studied, Huang et al. (2018) notes that paramedicine is most effective when it fills a niche, but it can only apply to a specific urban or rural setting for each program. As a result, paramedicine and similar programs would not serve as an effective solution for narrowing the divide between rural and urban EMS (Huang et al. 2018). However, by re-exploring this service type using the taskscape approach, I argue that paramedicine is a highly productive solution when co-created with a specific landscape. Regarding formal medical centers, the general trend over the past twenty years has been the closure of rural hospitals due to costs in exchange for a smaller critical access center or urgent care in rural settings and large mega-complex hospitals in urban settings (Reif et al. 1999; Patel et al. 2020; Tribble 2019). The broad idea is to stabilize patients in the rural setting and move them to the better-equipped urban setting. However, this only works for the patients who can afford steps like costly interfacility transports, leaving EMS responsible for those left behind. Accordingly, conversations around finding a solution which will appropriately serve both the rural and urban system simultaneously are impractical. These solutions may work as short-term band-aids, but their lack of geographic specificity removes their ability to provide care equitably to both communities. Further, by continuing to look at rural hospitals as steppingstones to urban centers, the rural system is removed as independently functioning, instead becoming part of the larger urban network. By recreating this analysis from a taskscape perspective, we can explore the systems as independent healthcare landscapes while still holding space for the value of collaboration between the systems.

It has long been noted that rural individuals often live farthest from care services, spurring a larger body of research on the rural EMS network. To compound the challenge of physical distances, rural lives are perceived as less valuable to the medical system; as Tribble

notes “a lack of accountability can lead to mostly for-profit providers…putting profits first” when selecting for whom and where to provide care (Reif et al. 1999; Tribble 2019; Patel et al. 2020; Xing Fu et al. 2022). By starting conversations about system development with a baseline, and at times unconscious, devaluation of the rural patient, there is effectively no way to generate equity. Further, Chanta et al. (2014) notes that, in traditional models for ambulance placement, rural spaces are seen as less necessary due to call volume. However, reduced call volume means ambulances are placed farther apart, and accordingly rural residents are forced to wait longer for the same access to care. A volume-based planning system creates a generalized EMS network rather than generating specialized care networks which are responsive to their landscape needs. To compound the lack of emergency care, Levine et al. (2021) found that at-home care systems which are often excellent ways to treat patients before they require pre-hospital and hospital care, have significant barriers in rural settings due to the physical geographies of the space. The authors show that by creating a landscape-specific care system, in this case acute at-home care for rural residents, the health network can become more equitable to all residents. This is important to consider because rural regions consistently have more traumatic incidents and worse outcomes of medical incidents (Becot et al. 2020; McFalls et al. 2021). Rural residents have become subject to a system where social and economic assumptions about them reduce their access to healthcare while their physical geography reduces their access to at-home preventative care *and* increases their risk of injury, a system that does not equitably provide for their needs.

Conversely, the increasingly dense urban environment is beginning to put an equivalent strain on the medical system, and the construction of urban spaces provides its own set of challenges to EMS response (Xing Fu et al. 2022; Chanta et al. 2014). Notably, in the built environment that Xing Fu et al. (2022) identify, with its increasingly complex road networks and

traffic, responders are forced to take longer and longer to respond to a given emergency. Additionally, with annually increasing call volumes across the board and reduced medical facilities in rural areas, urban providers are being pulled into suburban or urban-rural boundary zones to assist in call coverage (Miller et al. 2020). With their providers stuck in traffic or pulled away to an emergency in the neighboring towns, urban residents are forced into a differing form of inequity: a stagnant EMS system. The EMS system has been highly adaptable to changes in care style but has been slow to move away from certain traditional, and therefore perceived as *better*, practices. As an example, most major urban departments still utilize large type 1, truck mounted, ambulances, yet urban spaces outside the US have consistently demonstrated the increased safety and efficiency of type 2, van style, ambulances because of their smaller and more nimble size. I suggest that by applying Ingold's (1993) taskscape theory to system creation, the flaws of the urban system can be mitigated by a system design which specifically addresses the needs of *dwelling* within the urban landscape.

Further, most current debates do not acknowledge the need for equitable care in both types of spaces and accordingly do not explore how system reform can more equitably treat all patients in all contexts. Failing to answer the question; how can EMS equitably exist in a system that is not explicitly urban or rural, such as Vermont? In the modern era, with readily available metrics after every response, agencies seek to find system deficiencies and ensure more independent coverage of their service area (Chanta et al. 2014). Further, due to COVID-19, previously limited budgets have expanded with emergency funding, leading to services and regions desiring to make their systems more efficient financially and for their patients (Luo et al. 2022). I aim for this research to be relevant to the current wave of system revisions occurring nationally. My research will demonstrate there is a substantive difference between the needs of

rural and urban EMS, and that that currently generates differences in equity because of the way we produce and reproduce our EMS system. I further will establish that through a shift in mindset to the taskscape theory and intentional further research we can begin to generate systems that prioritize and highlight equitable care.

Chapter 4: Methodology

This research encompassed a mix of methods to demonstrate and analyze the links and differences between urban and rural EMS systems. I undertook text analysis to identify broader discourses about rural and urban EMS, generated an overview of national-scale data, and performed a focused case study analysis of two Vermont EMS districts using quantitative data and semi-structured interviews with service providers. This approach is influenced by Jonk et al. (2023) and Reif et al. (1999) who demonstrate the need for a multi-scalar perspective when exploring questions surrounding the EMS system to understand and account for system complexities. Bearing in mind the goal of my research is to explore and generate a baseline understanding of differing equity resulting from system differences within pre-hospital care networks, I specifically employed these methods to create understandings of the EMS system and generate an image of differences within Vermont.

This research and its below stated methodology was approved for use by UVM Institutional Review Board (IRB) approval for Human Subjects Research. UVM IRB STUDY00002575 and MOD00013941.

National-Level Data Analysis:

First, I completed a national-level data analysis using NEMSIS (National Emergency Medical Services Information System), to create a baseline understanding of response metrics and differences between rural and urban regions. All response metrics and their geographic associations are publicly available through the NEMSIS website which receives and publishes data on behalf of the National Highway Transportation Administration. By first situating my research within a national scale, I was able to set a broad context for my regional investigation. Initially the intention for this section was to utilize the 2022 full dataset published by NEMSIS

for download, however due to complexities with the required software and the timeline of this project it became unrealistic to analyze the data in this way. Instead, 2017 through 2019 data was accessed through the NEMSIS 'data cube,' available online on the NEMSIS website.

This phase of research was almost entirely quantitative with a focus on creating a snapshot of rural and urban prehospital care as it currently exists. The NEMSIS data cube provided me with the published and de-identified call data from roughly 113,000,000 calls between the beginning of 2017 and the end of 2019. Data is logged by each EMS service within each state utilizing differing software and methods, however, all states gather data independently for assorted uses and this is then voluntarily submitted to NEMSIS for national research, trend assessments, and tracking uses (nemsis.org). Data is de-identified, cleaned to follow common standards, and amalgamated into a national pool. Therefore, no data qualifies for HIPPA protections, and I can assume that the data provides a representative sample of EMS throughout the United States. The data cube allows users to query the information by provided metrics against provided measures within the three-year period. Users are additionally able to layer queries, filter responses, and auto calculate complex fields. However, for relevance and scope of my research I limited my searches to single or double layered queries to provide the clearest and most concise data.

My query terms were influenced by three key factors: availability within the data cube options, common terms identified during the literature review phase of my thesis proposal, and queries which I had not seen come up with any frequency during the initial proposal literature review. I then reviewed the findings of each query for relevance, and results were exported for later analysis. I opted to utilize the same four query measures on every search due to their prevalence in discourse around EMS challenges and success: total count, average scene response

time in minutes, average transport time in minutes, and average total call time in minutes. My final list of metric queries included:

- Patient Demographics
    - Race
    - Gender
    - Age
- Geographic Region of Incident
    - US Census Regions
    - Urbanity
    - Population Density per Square Mile
- EMS Unit Response
    - Transport Mode from Scene
    - Response Mode to Scene
    - Level of Care of this Unit
- Destination Hospital Capability

To ensure I produced equivalent findings despite being unable to use the full raw data set, I supplemented my data cube searches with existing national scale analysis completed by Koeze et al. (2020) and Jonk et al. (2023). Koeze et al. (2020) is a *New York Times* popular media piece which combines mapping, the American Community Survey, interviews, and independent research to identify places *Where Americans Live Far From The Emergency Room*. While NEMSIS is an extremely detailed resource, Koeze et al. (2020) helped me ensure my data was not monolithic and added a qualitative element to my national findings. Additionally, NEMSIS data does not break down by state within the data cube, and the Koeze et al. (2020) piece

provides state breakdowns to ensure a more representative understanding when transitioning national data to the case study of Vermont. Similarly, the research by Jonk et al. (2023) provides data on 'ambulance deserts,' or regions without adequate ambulance access vis-a-vis the national standard, for forty-one states including Vermont. These analyses supplemented my own findings by allowing me to identify regions within the US where trends I identify through NEMSIS data are playing out. Further, the specific context of Vermont allowed me to pull relevance more appropriately from my national findings to begin my Vermont case study. Additionally, Jonk et al. (2023) identify national data on ambulance placement and distribution of levels of care which NEMSIS data is unable to provide.

Discourse Analysis:

To compensate for the scarcity of public media coverage of EMS-related issues, I expanded the usual scope of texts included in discourse analysis to include scholarly reports and findings. By exploring documents written for various audiences by various authors I was able to ground my work in the research and discourse of an entire field and, in turn, generate a conversation which will be more broadly applicable than just within two regions of Vermont. Basing roughly one third of this work within public and specialist discourse allowed for two critical elements of my research design. First, identifying where this work exists within already established research to ensure I am building and not repeating on existing knowledge, and more importantly guaranteeing a diversity of opinions and theories surrounding my research to reduce bias and baseline a well-rounded understanding. This approach generated a clear image of current public perceptions of rural and urban EMS systems both from outside and within the system. The findings from this work were used to design the interview questions for the Vermont case study. This method was chosen to serve as a bridge between the quantitative analysis of my national

data and the qualitative conversations which occurred at the Vermont level. While originally intended to occur last, due to delays in interview recruitment the text search and discourse analysis became the second research step. I engaged in a two-phase, three-pronged text analysis of relevant academic research, legal statutes, and public media. For each piece, there was an initial read for meaning, followed by an extended read for key ideas and findings, and then a final reading to identify relevance in comparison with other pieces.

Utilizing a two-phase approach, I identified key themes in scholarly literature and then explored their usage and application within popular discourse. For both phases, in order to ensure I gathered a representative sample I primarily used a standardized keyword search, using the terms: Emergency Medical Services, EMS and Equity, EMS Networks, EMS Systems, Rural and/or Urban EMS. All searches were duplicated with the replacement of "EMS" for "pre-hospital medicine", and then tripled with the search for "pre-hospital emergency care". For the initial phase, all searches were performed on Google Scholar, Academic Search Premier, GEOBASE, and Global Health research databases accessible through the University of Vermont library system. Following initial search findings, a snowball method was used on references of interest and commonly referenced pieces to generate supplemental findings. Then applying these themes to a second phase, I re-ran all standardized keyword searches through Google search to identify popular media sources. This was additionally followed by a snowball method of referenced pieces to identify further findings.

With a few key exceptions, relevant findings in these searches were almost exclusively housed within academic literature. The trend was largely a lack of non-academic discussion except when ‘things go wrong.’ This was demonstrated in my two most productive popular media pieces, Koeze et al. (2020) and Tribble (2019), which both discuss equity as secondary to

loss of life, or potential for loss, as opposed to raising awareness of equity prior to care interactions.

This method yielded thirty-five findings which were initially read for general meaning. During this first review, sixteen pieces were removed from analysis as they were more relevant in application for my literature review or as bibliographic content. The nineteen remaining were then read two additional times: first for key ideas and then for relevance. An overview of findings from those two reviews is detailed below in figure 3.

Fig. 3, Discourse Analysis Table

Abbreviated Title	**Author, Year**	**Key Words**	**Relevance**
Emergency Medical Services System Act	93rd Congress	Planning, Operation, Trainings	Set national interest and funding for a representative EMS system.
Emergency Medical Services In Rural and Urban Saudi Arabia:	Alanazy et al., 2022	Rural, Urban, Perceptions	Applying social perceptions of rural/urban EMS systems to growth.
Intersection of Living in a Rural Versus Urban Area and Race/Ethnicity...	Caldwell et al., 2016	Rural, Urban, Equity, Planning	Explored ideas of equity in rural/urban EMS. Specifically, looked at access to care and effects on EMS.
Improving emergency service in rural areas:	Chanta et al., 2014	Rural, Urban, Equity, Coverage	Exploring coverage models for EMS systems and proposes a reimagination of traditional practice.
Birth of EMS:	JEMS, 2013	N/A	Historical context piece identifying the growth and development of EMS.
The Role of the Built Environment in Emergency Medical Services Delays...	Xing Fu et al., 2022	EMS, Urban, Rural, Built Environment,	Explored the effects of distance on EMS response to MVCs. Compares those results with the effects of the built environment EMS provides care within.

Development of sustainable community paramedicine programmes:	Huang et al. 2018	EMS, Rural, Urban, Resource Utilization	Identifies alternative healthcare techniques which could reduce EMS burden.
Unequal Treatment:	Institute of Medicine Committee, 2003	Equity, Healthcare, Access	IOM report detailing the current (2003) state of healthcare equity in the US and proposing points of change.
Ambulance Deserts:	Jonk et al., 2023	EMS, Rural, Urban, Ambulance Deserts	National study identifying geographic disparities in ambulance placement and exploring related trends.
Where Americans Live Far From The Emergency Room	Koeze et al., 2020	Healthcare, Rural, Hospitals	Popular media piece which applies the effects of rurality to the lived experience in the US.
Locating emergency medical services to reduce urban-rural inequalities	Luo et al. 2022	EMS, Equity, Rural, Urban	Quantitative study on Wuhan province of China to identify statistically optimal ambulance placement models.
2022 Systematic Review of Evidence-Based Guidelines for Prehospital Care	Martin-Gill et al., 2023	System, EMS, Review	Review of protocols throughout the US in 2022 and how those care systems have been working for patients.
History of EMS	MercyFlight UNK	N/A	Additional historical context piece.
The effect of rural hospital closures on emergency medical service...	Miller et al. 2020	Rural, Access, EMS, Hospital	Research into the effects on patient outcomes with increasing distances to a hospital in rural spaces.
Emergency medical services Milestones 2.0: What has changed?	Nesbit et al., 2022	EMS, Care, Hospitals	Identifying historical changes in EMS care systems and how that has benefited patients.
Rural Health Research Community Perceptions of the Effects of Rural Hospital...	Reif et al., 1999	EMS, Rural, Equity, Hospitals	Explores the effects of hospital closure on healthcare networks, and the downstream effects on EMS and rural residents.
The changing nature of rural health care	Ricketts, 2000	Policy, EMS, Rural, Urban	Identifies changing trends in rural healthcare and the effect that has on rural residents.
Accidental Death and Disability:	National Academy of	EMS, Healthcare, System	Considered EMS White Paper, identifies a need for EMS which

	Sciences, 1966		the US administration must mobilize resources to provide.
After A Rural Hospital Closes, Delays In Emergency Care Cost Patients Dearly	Tribble, 2019	Hospitals, Rural, Access, Equity	Firsthand account of the effects of rural hospital closure and the unrealistic EMS burden that places in rural spaces.
Risk, rescue and emergency services:	Yarwood, 2010	EMS, rural, Access	Network analysis of mountain rescue teams and their roles given local spatial boundaries and need.

Upon reflection, I think by simplifying certain search terms or using more than one popular media search engine I may have been able to diversify these results, however, given my research I do believe this list to be representative of the current research and discussions. Observing the key words I identified during my second read, rural is noted 13 times, EMS 11, urban 8, and equity 6, with all other terms being mentioned 4 or fewer times. Overall, these demonstrate that academic literature and popular discourse tend to focus most predominantly on rural EMS, discussing and ultimately relegating urban needs and equity as secondary.

Vermont Case Study:

The final step of this research was a case study within Vermont. Unlike many states that follow municipality or county-based models, VTEMS divides its districts into thirteen regions, each with a central medical center. I drew upon key themes identified during my discourse analysis, national data trends, and publicly accessible data on Vermont EMS, to create a 'snapshot' of these two research areas. Originally this case study was broken into two distinct sections, the first being explicitly quantitative, with relevant maps and data summaries, and the second explicitly qualitative, with the interview series. However, after initial research it became clear these data sources were too deeply intertwined to separate and accordingly the quantitative

and qualitative approaches were combined. While all the research leading up to this point served to generate an understanding of ideas of equity and EMS at the national scale, in this section I explored what these national trends mean to a local setting. By contextualizing these more abstract findings to the real-world setting of Vermont, I demonstrated a need for continued and expanded research into ideas of medical equity within the pre-hospital setting.

The set up of this case study mimicked Alanazy et al. (2020), Caldwell et al. (2016), and Reif et al. (1999). I specifically drew upon Reif et al. (1999) who explore the effects of rural hospital closures on the surrounding communities. As a central element of their research, they interviewed medical providers within the rural health systems affected to gain a perspective on trends (Reif et al. 1999). Additionally, Alanazy et al. (2020) compare rural and urban EMS networks in Saudi Arabia through semi-structured interviews with providers. Their work sought to understand impositions to care from a qualitative lens by performing interviews and expanding those findings onto the system. Both Reif et al. (1999) and Alanazy et al. (2020) used interviews to generate network-wide qualitative understandings, which led me to utilize interviews in my case study methods. Alanazy et al. (2020) also demonstrate the power of specifically geolocating research, in their case Saudi Arabia, to keep interview findings relevant to a given system. Further, Caldwell et al. (2016) explored equity in the pre-hospital care system of the US through interviews with providers, demonstrating that interviews can successfully be extrapolated into broader conversations of equity. All three of these studies further utilize interviews and some combination of discourse or data analysis to generate multi-dimensional qualitative and quantitative studies of the EMS system. This further led me to include the earlier discourse analysis and national scale data in my broader methods to ensure my research was successfully situated in larger current understandings. All three pieces demonstrate that the combination of

methods I selected for this project can effectively produce high quality in-depth research on EMS systems.

Data from the more ‘urban’ Vermont EMS District 3 (VTEMS D3), which serves Chittenden, northern Addison, and southern Grand Isle Counties, and the largely ‘rural’ VTEMS D13, serving Windham County, was used to create an understanding of what an urban and rural system can look like through imagery and maps. (See maps in figure 4, figure 5 and Appendix C) I critically note that due to the geographies of each district, multiple providers within District 3 see themselves as rural providers despite their proximity to urban spaces.

Fig. 4: VTEMSD3/D13 and Hospitals Map

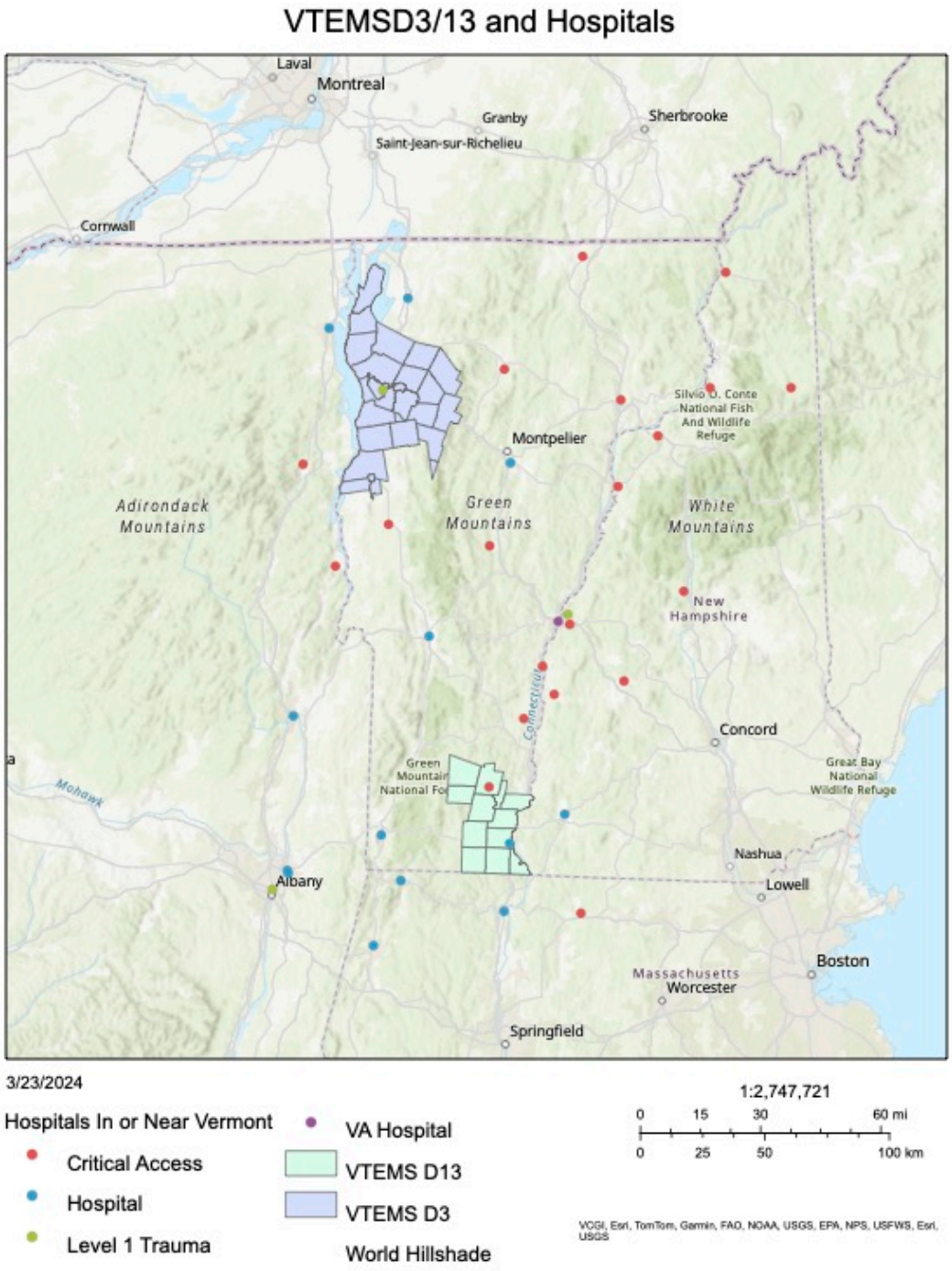
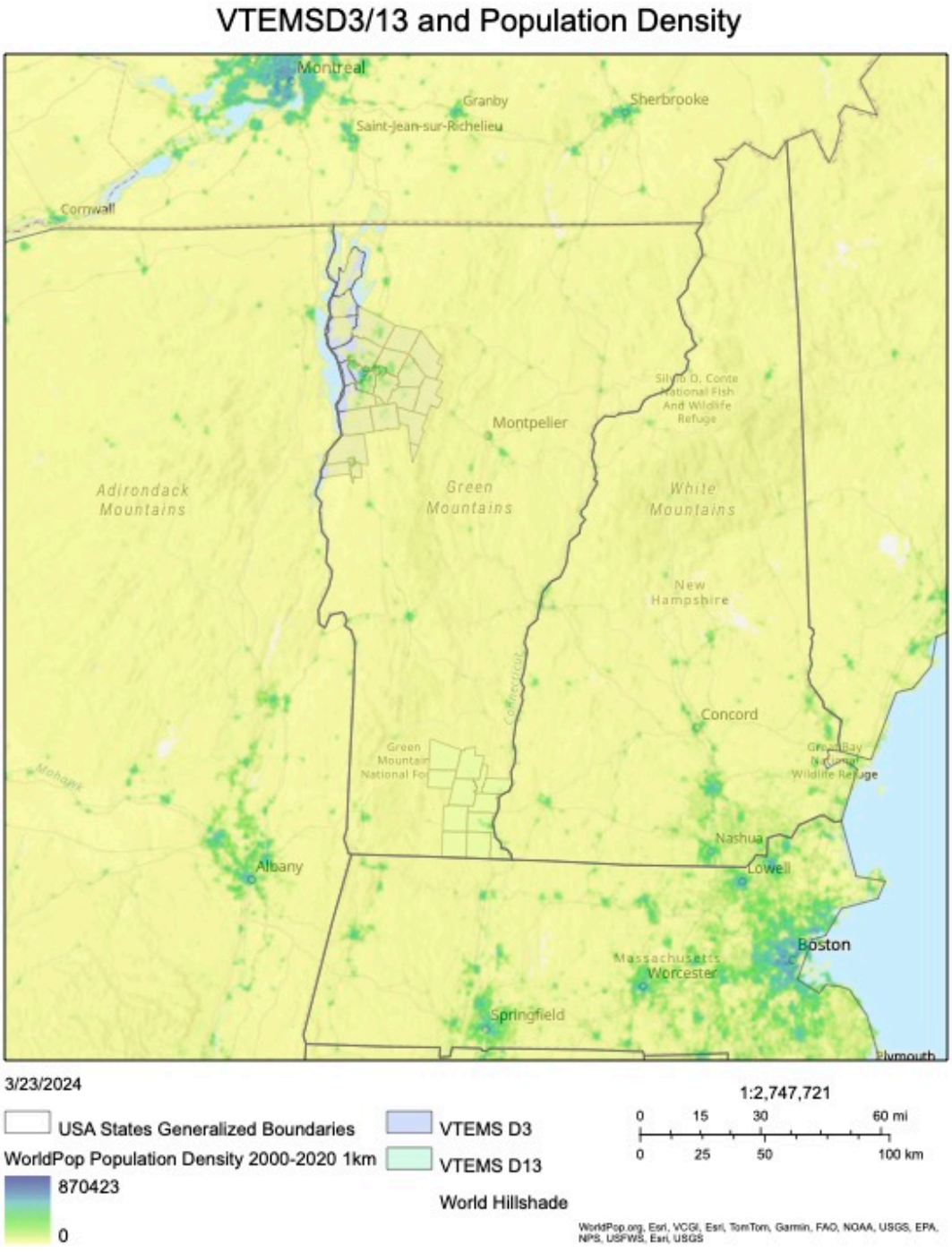


Fig. 5: VTEMSD3/D13 and Population Density Map



Data was collected to create rough profiles of both districts including number and placement of EMS units, approximate number of providers, and a brief picture of each service area's demographics. This data was largely gathered through VCGIS's open data portal, with some additional hand gathering done through Google Earth or Google and then pinned onto maps using ArcGIS Pro. Through this data gathering I was able to generate a 'snapshot' of differences, similarities, and complexities of the research areas and provide an image of what the actual landscape of rural and urban EMS currently looks like in Vermont.

Additionally, I explored the lived experience of rural and urban EMS practitioners, using questions informed by my findings from the discourse analysis. I conducted a series of interviews using a standardized question set to understand the perceptions and feelings EMS providers have on equity vis-a-vis the rural or urban EMS system they work within. Questions fell broadly into two categories 'General' and 'Research Based.' The full interview questionnaire can be found in Appendix A, and the coding reference for interview participants can be found in Appendix B. The goal of the general questions was to generate a profile (which was later de-identified) of the respondent through questions asking about their EMS history, perspectives on equity, and experiences with equity on EMS calls. Questions included:

- (Q5) Why did you first engage with EMS?
- (Q12) Can you think of a time you were involved in or heard about where the resources available within your District did not meet the needs of the patient? Being aware of HIPPA protocols, can you describe the general situation for me?
- (Q14) How would you define 'equitable care' in EMS work?

The research-based questions aimed to situate the respondents' perspectives in the larger discourse of EMS. The questions were all based off the findings of one or more scholarly papers on EMS systems or EMS equity, and the questions focused on provider perceptions and experiences surrounding that specific academic finding. As my research progressed, it became clear that these questions sparked the most interesting discussions of equity. While this was not

intentional, I suspect it was due to the questions themselves being more complex, thus providing more opportunity for complex and nuanced answers. Participants were not provided with the referenced research prior to the interview but were offered the studies following the interview if desired. This decision was made to gain individual opinions from respondents and try to limit respondents mimicking the researchers. A sample question from this section is:

- (Q1) Research indicates that distance to hospitals has a direct correlation to patient outcomes, with increasing distance resulting in worsening patient outcomes. Given your personal career experience how do you feel about this, would you agree or disagree, why? (Patel and Singhvi 2020; Volz 1971; Luo et al. 2022)

I attempted to arrange ten interviews, five in VTEMS D3 and another five in VTEMS D13. VTEMS D3 providers were recruited directly either through connections I or a co-worker previously had with possible respondents, eight individuals were contacted about participation, four agreed, and three ultimately sat for an interview. In VTEMS D13 I attempted to recruit providers through large scale email request and a snowball sample. All providers working for the main EMS provider in D13 were contacted via a general email through their work, and after initial contact with a possible respondent snowball sampling was used. Three providers agreed to be interviewed, and one ultimately sat for an interview. Respondents who did not end up participating in an interview all cited an already full workload from their one or more EMS jobs and needing to take the time to complete other tasks. Respondents were provided an informed consent sheet, which every respondent verbally acknowledged. Respondents were further informed they could withdraw participation at any time, withdraw answers to any individual questions, or additionally add information by email at any time. No respondents opted to withdraw participation in part or whole, and two respondents opted to add additional information after the conclusion of the interview.

To assist in rounding out my research of the Vermont EMS system, I additionally engaged in ethnographic observation on two occasions. First, I observed the December 2023 EMS Advisory meeting, a monthly statewide meeting of VTEMS statewide and district leaders which aims to advise both the statewide VTEMS office and VT Legislature about the ongoing activities and needs of VTEMS districts and agencies. On this occasion, the advisory meeting was focused on finalizing the details of their annual report to the VT Legislature. Then I observed the Burlington Fire Department during a 12-hour shift on a 'ride-along' with BFD Engine 3. During the shift, I observed the daily goings-on of a professionalized fire agency including on multiple medical calls. Neither of these observations were research gathering focused, instead the goal was to ensure I approached my perspectives of Vermont from a well-rounded frame to avoid reproducing existing inequities and minimize my own bias. Both experiences were allowed by the organizers under the condition of observational attendance only, however select quotes from the advisory meeting were pulled for direct reference in my work with permission from the individuals quoted.

Ultimately the design and adaptation of these methods very explicitly targeted my research questions. With the national data and discourse analyses serving to address my questions of difference, structural influence, and impacts of equity, by generating an understanding of the current system and how it was formed. Then the Vermont case study applied all this to directly understand if a theoretical framework, such as the taskscape, could help address and dismantle these inequities. By best understanding these differences at a national and local scope, research can begin to expand on already existing discourse and literature and move to frameworks which potentially bring solutions.

Chapter 5: Findings and Analysis

Historically and today EMS systems have been designed in the name of economic efficiency and not in the name of the people they serve (Volz 1971, Xing Fu et al. 2022, Jonk et al. 2023, Chanta et al. 2014). Further, this prioritization of economically efficient design leaves rural spaces with consistently reduced access to EMS and, more broadly, all types of healthcare (Xing Fu et al. 2022, Jonk et al. 2023, Rickets 2000, and Caldwell et al. 2016). As can be seen in figure 6, this reduction creates a physical scar on the landscape with rural EMS appearing to be sparse compared to urban cores throughout Vermont. The urban cores are the homes of any given region's largest hospitals (often rated as specialty care centers for trauma, strokes, cardiac, pediatrics, or burns), hospitals that set best practices and regional/statewide protocols, which ingrains an inherent urban bias into daily patient care (see figure 7).

Fig. 6, Map of Greater Vermont Showing EMS Locations and Population Density

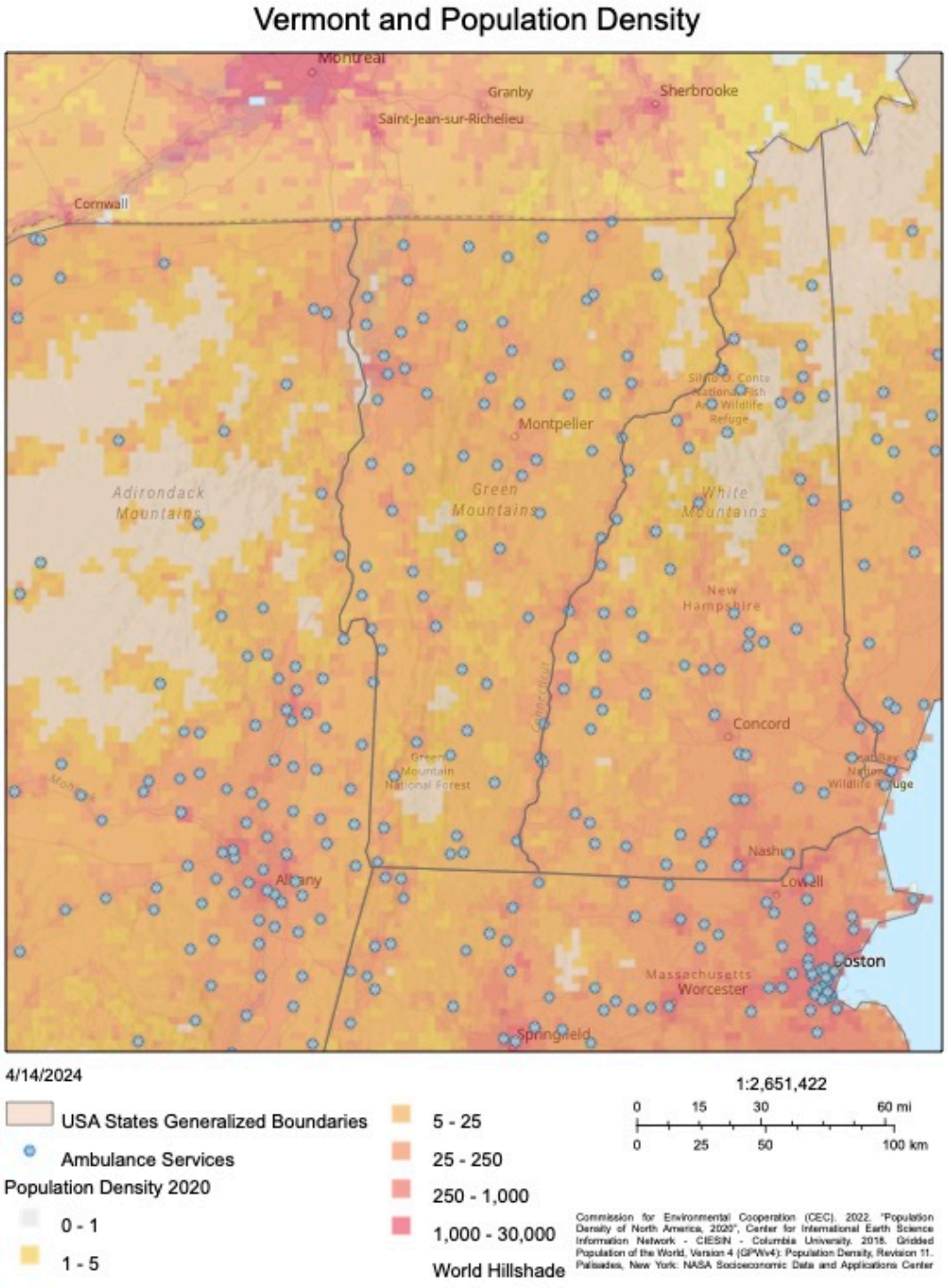
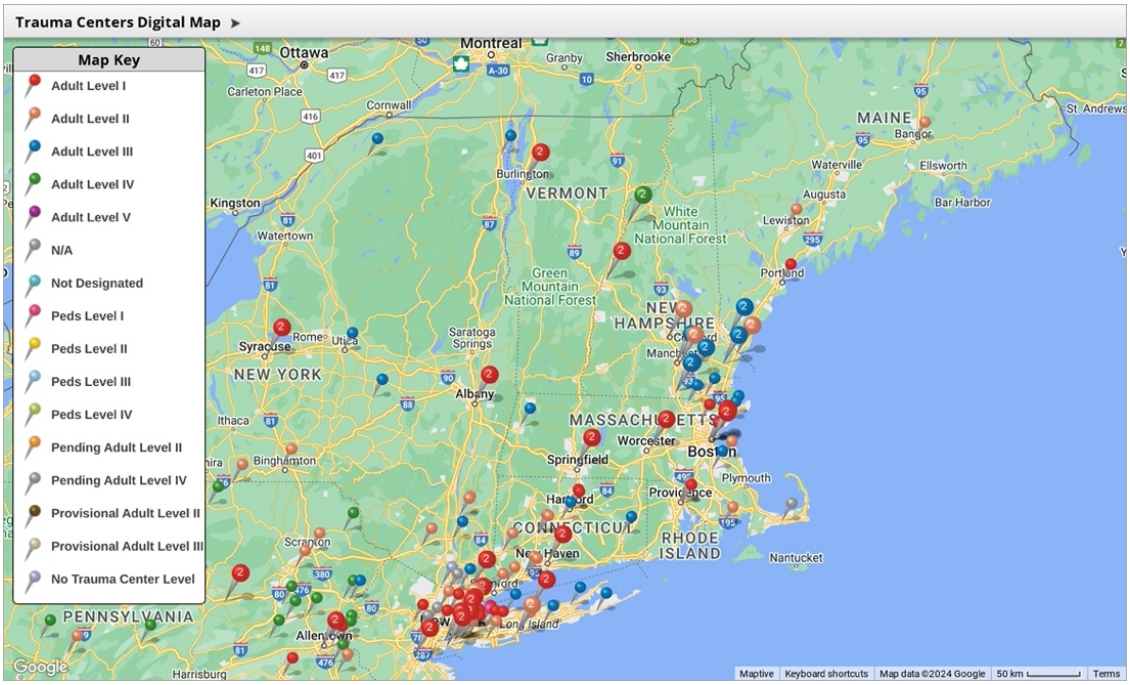


Fig. 7, Map of New England Showing Hospital Locations and Certification (traumacenters.org)



Throughout my research, it became clear that EMS systems are not designed, maintained, or even viewed equitably. Since inception, EMS has focused on generation of *one system* which could provide pre-hospital care in the pursuit of prolonging and preserving life (National Academy of Sciences 1966; Shah 2006). I take issue with the one system perspective and argue that my findings demonstrate EMS must be viewed as distinct localized systems which work collaboratively in a larger network. Further, I suggest an analysis into EMS systems using Ingold's (1993) taskscape approach will yield the landscape-based information that should be prioritized and centralized in the continued development and redevelopment of EMS.

National Level Findings:

At a national level, my goal was to explore the data and discussions of the current EMS system, and how that served or under-served the populations within those spaces. Overwhelmingly, the data showed rural residents receiving slower care at a lower level, which

was then exacerbated by processes of marginalization and exclusion for some social groups. This trend of what I term as ‘slower and lower (quality) care’ was clear both in the NEMSIS data and within the Koeze et al. (2020) and the Jonk et al. (2023) national studies.

Looking first to the NEMSIS national data the slower and lower trend becomes immediately clear. Figure 8, below, shows that the least dense regions by population have average response times three minutes longer, transport times eighteen minutes longer, and total call time thirty-one minutes longer as compared to the densest regions. This, coupled with data demonstrating that as a region gets increasingly rural the likelihood that a lower certified provider will respond to the call becomes higher (See Appendix D).Additionally, in low density areas staffing is made up of 20% EMT, 6% AEMT, and 47% paramedic, compared to high density areas where the split favors AEMT and paramedic level care, with 25% EMT, 2% AEMT, and 58% paramedic (minor certification levels disregarded for standardization). The gap is further exacerbated in the spaces where population density is between 11 and 999 per square mile, I suspect this to be due to the increasing trend of professionalized paramedic level services operating out of suburban fire departments or mass contracting for suburban regions and excluded this data due to project scope. While these two data sets do not paint the whole picture, they show yet again an increased likelihood for rural residents to receive *slower and lower* care.

Fig. 8, Average Call Times by Population Table, 2017-2019

Population Density - Rate per sq mile	Count Of Events	Avg. Scene Response Time in Minutes	Avg. Transport Time in Minutes	Avg. Total Call Time In Minutes
< = 10	1,086,516	12.8	33.8	89.0
11 - 99	11,173,045	10.6	26.6	71.7
100 - 999	31,054,165	9.4	19.0	61.0
> = 1000	61,751,491	9.4	15.6	58.8
Not Recorded	8,011,727	14.3	22.8	81.9

Jonk et al. (2023) further expand on this disparity, observing a higher percentage of *ambulance deserts* (ADs) in rural counties within every research category, and a difference of 720 more overall, (see figures 9 and 10), notably finding "over 80% of urban counties had less than 5% of their populations living in ADs compared with 56% of rural counties" (Jonk et al. 2023, 19). The Jonk et al. (2023) findings go hand in hand with the NEMSIS data to demonstrate that there is a systemic difference in the care available to rural and urban residents. Koeze et al. (2020) further expand this understanding by adding a quantitative dimension to this disconnect, finding that in California alone 794,000 people live over 30 minutes from the nearest hospital, with an overwhelming proportion of those individuals also living in or directly above qualifications for an ambulance desert (see figure 11) (Koeze et al. 2020). These two studies find that as the realities of rural livelihoods combine with the inequities facing rural EMS, the effects of living in a rural space amplify significantly and predispose a rural resident to inequitable health outcomes.

Fig. 9, Percent Population Living in Ambulance Deserts (Jonk et al. 2023)

Categories		Rural Counties		Urban Counties		All Counties	
		Number	Percent	Number	Percent	Number	Percent
1	0-1%	542	31.5	541	53.9	1,083	39.7
2	2-5%	422	24.5	273	27.2	695	25.5
3	6-15%	441	25.6	135	13.5	576	21.1
4	16-50%	259	15.0	47	4.7	306	11.2
5	51-100%	59	3.4	7	0.7	66	2.4
Totals		1,723		1,003		2,726	

Note: Categories were chosen based on population tiers

Fig. 10, Percent Population Living In Ambulance Deserts Map (Jonk et al. 2023);

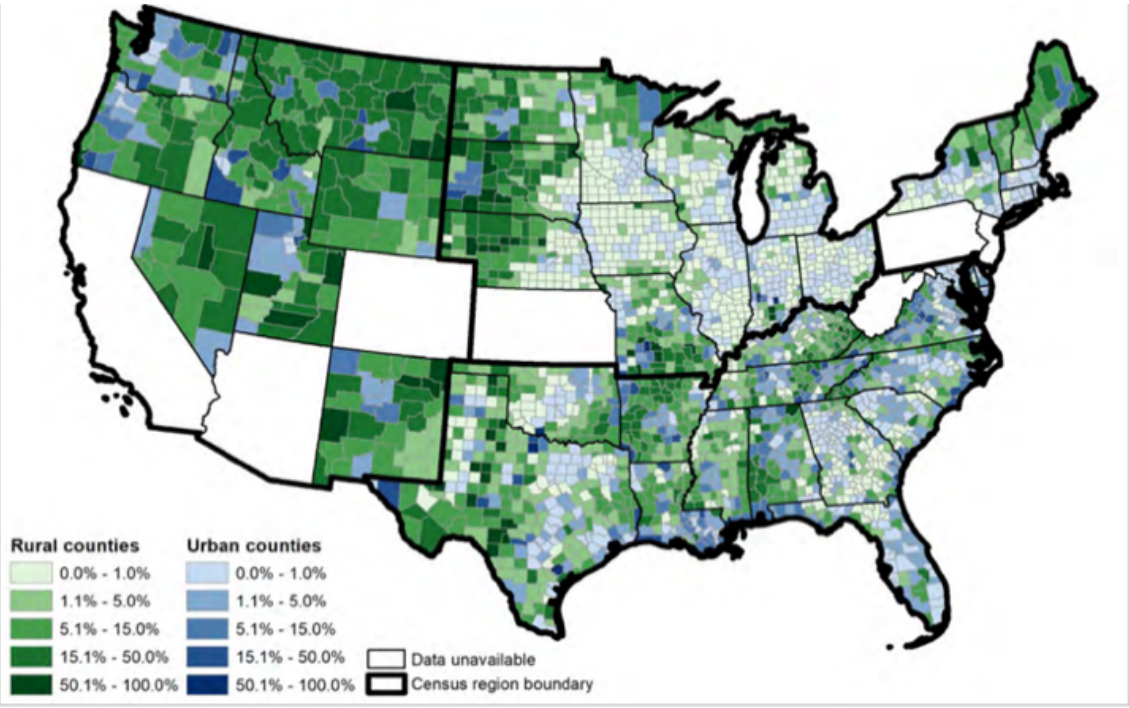


Fig. 11, Population Greater than 30-minutes from a Hospital (Koeze et al. 2020)

People living outside a 30-minute drive from the nearest hospital

RANK	STATE	ALL AGES	RANK	STATE	65 AND OLDER
1	California	794,000	1	California	151,000
2	Florida	551,000	2	Washington	112,000
3	Arizona	541,000	3	Florida	111,000
4	Washington	537,000	4	Arizona	106,000
5	Missouri	347,000	5	Oregon	82,000
6	Texas	347,000	6	Missouri	75,000
7	Colorado	343,000	7	Texas	75,000
8	New York	331,000	8	Virginia	69,000
9	Oregon	326,000	9	New York	66,000
10	Virginia	325,000	10	North Carolina	63,000

By The New York Times • Source: 2014-18 American Community Survey

Caldwell et al. (2016) also observed a similar compounding effect of rural inequities to marginalized residents in rural areas. Their qualitative findings, discussed further below, are also represented across national data, as demonstrated in figure 12. Observing the data table as a whole and simply comparing white and Black or African American populations, the difference in response time grows steadily from twenty seconds to two minutes and ten seconds from the most urban to the most rural spaces. When looking at high density regions the difference between response time for white residents and residents of color is only thirty seconds at the longest; however, when looking at the least dense regions response times gain as much as two minutes for residents of color. It should be noted that consistently Native Hawaiian or Other Pacific Islanders had shorter response times, however, I suspect this to be due to limited call volume and specific population development patterns that were outside scope of this research. Additionally, in the least dense areas, Native Hawaiian or Other Pacific Islander, Hispanic or Latino, and

Asian populations all experienced lower response times than white populations; I suspect this to be due to an overall reduced non-white population in rural spaces and a lack of breakdown data that would account for differing demographic densities within each given population density.

Fig. 12, Response Time by Population Density and Race

Population Density - Rate per sq mile	Race	Avg. Scene Response Time in Minutes
<= 10	American Indian or Alaska Native	14.5
	Asian	11
	Black or African American	13.4
	Hispanic or Latino	11.4
	Native Hawaiian or Other Pacific Islander	11.8
	Not Applicable	15.8
	Not Recorded	13
	White	12.3
11 - 99	American Indian or Alaska Native	11.6
	Asian	10.7
	Black or African American	11.7
	Hispanic or Latino	10.5
	Native Hawaiian or Other Pacific Islander	11.1
	Not Applicable	10.3
	Not Recorded	10.2
	White	10.6
100 - 999	American Indian or Alaska Native	10
	Asian	9.7
	Black or African American	10.8
	Hispanic or Latino	10.1
	Native Hawaiian or Other Pacific Islander	10.1
	Not Applicable	8.7
	Not Recorded	8.8
	White	9.5
>= 1000	American Indian or Alaska Native	10
	Asian	10.5
	Black or African American	10.2
	Hispanic or Latino	10.2
	Native Hawaiian or Other Pacific Islander	9.6
	Not Applicable	8.4
	Not Recorded	8.3
	White	10

National Level Analysis:

Data from the Jonk et al. (2023) and Koeze et al. (2020) studies as well as NEMSIS national statistics all definitively demonstrate the danger of single metric analysis and demand a need to re-evaluate our modern understandings of EMS system design. I specifically observed that researchers' overdependence on the vague idea of 'response times' or 'response efficiency' has generated a system which disregards responses to rural regions. All this, with glaring and overwhelming data that shows *slower and lower* care is prevalent in rural regions, many of which meet the qualifications of an ambulance desert.

Broadly, I found that current EMS research overutilizes response times as a metric of system design while simultaneously ignoring the effects of this design to rural spaces. This finding is based on the work of Volz (1971), Chanta et al. (2014), and Luo et al. (2022), who all attempt to generate a 'best placement' formula for EMS systems. Chanta et al. (2014) expanded their project's scope to a bi-objective system, and then Luo et al. (2022) went further to develop a multi-metric system to reduce inequities within rural and urban EMS systems. Yet, both Chanta et al. (2014) and Luo et al. (2022) work under presumptions of differing standards of care for rural and urban spaces. As the NEMSIS data overwhelmingly demonstrates, even within a data pool that has reimagined systems which utilize distribution formulas like Chanta et al. (2014) or Luo et al. (2022), rural communities in the United States receive care slower than their urban counterparts. Of course, service provision in rural spaces is inherently challenged geographically in ways that are less relevant in urban areas, and generating a system with perfectly equivalent response times would be nearly impossible. However, I think this is a perfect demonstration of why we must reject a one-system perspective and begin imagining rural and urban EMS systems for what they are — two distinct taskscapes with different cultures, needs, and activities that work connectedly within a broader healthcare network.

Further, when observing the findings from the Jonk et al. (2023) and Koeze et al. (2020), the potential critique of slower and lower levels of care in rural areas as simply a result of their geography, must be called out as willful ignorance. When the data exists and is presented so clearly as can be seen in figures 9,10, and 11, yet nothing is done, it is no longer a 'reality of rurality' it is a system that refuses to include equity within its systemic understandings. As an example, I take Panton, VT. The town of Panton has no ambulance, and if Vergennes Area Rescue Squad (VARS) is occupied with another incident then a resident of Panton must wait upwards of half an hour for Charlotte Volunteer Fire and Rescue Services (CVFRS) to arrive, and then must further survive a transport that can be at times over an hour long. I highlight Panton, not because it is an ambulance desert, but because it is *not*. Panton is primarily served by VARS who is six minutes away, yet with VARS out on one call Panton becomes an ambulance desert instantly as CVFRS is at least twenty-five minutes away in perfect conditions. Here we see a 'perfectly optimized system' using statistical methods, following the VTEMS D3 response matrix to ensure the successively closest ambulance is always responding (see Appendix B), failing to appropriately serve its communities with a standard of equity. However, on UVM's campus in Burlington, if UVM Rescue is busy, the next five available mutual aid ambulances are all within an eight-minute response. Examples such as these demonstrate that the response matrix within VTEMS D3, and more broadly this use of response statistics as the primary driver for ambulance placement, fails to account for the realities of difference in rural and urban environments. Instead, if administrators create EMS systems using a taskscape mindset with the primary goal of supporting the dwelling within that specific landscape, then these realities may be able to be mitigated and urban and rural residents may be able to enjoy the same guarantee of EMS.

Discourse Findings:

I do think it is important to note that there is a critical lack of academic, legal, and popular media discourse surrounding inequities facing urban residents beyond a small handful of academic papers about system development which mention equity, and the occasional popular media article when the actions of EMS professionals violate principles of equity (e.g. the death of Elijah McClain at the hands of paramedics and police (Slevin and Brown, 2024)). For the scope of this project I constrained my analysis to available texts; however, I speculate that broader research into the lack of attention to urban inequity in EMS would be a powerful addition to the field. With the understanding of this input constraint, similar to the national data analysis, my discourse analysis found a commonly identified trend of reduced equity within rural healthcare settings. Often, this discourse focused primarily on identifying points and reasons for rural disadvantages with very little conversation on next steps for the field.

The most common discourse I identified across twelve of the twenty reviewed pieces was some form of 'rural residents live farther from healthcare facilities and therefore receive reduced access and lower quality of care' (Alanazy et al., 2022; Caldwell et al., 2016; Chanta et al., 2014; Xing Fu et al., 2022; Institute of Medicine, 2003; Jonk et al., 2023; Koeze et al., 2020; Luo et al., 2022; Miller et al., 2020; Reif et al., 1999; Tribble, 2019). These twelve pieces broke down into three broad types of publication:

1. System Improvement Studies (Alanazy et al., 2022; Chanta et al., 2014; Jonk et al., 2023)
2. Discussions on Ongoing Changes (Koeze et al., 2020; Miller et al., 2020; Tribble, 2019)
3. Equity or Difference Analysis (Caldwell et al., 2016; Xing Fu et al., 2022; Institute of Medicine, 2003; Luo et al., 2022; Reif et al., 1999; Yarwood, 2010)

The first of these categories, system improvement studies, were all formal academic pieces which sought to bring attention and change to the current EMS system. While none of the pieces address equity directly, Jonk et al. (2023), Alanazy et al. (2022), and Chanta et al. (2014) all make assertions and promote understandings of inequity through their analyses. All three find that the current system leaves rural spaces disadvantaged, to varying degrees, and the EMS system as a whole largely discounts this as a 'reality of rurality.' Alanazy et al. (2022) furthers this analysis to include the insight that within EMS systems, rural EMS providers are seen as 'less than' their urban counterparts and accordingly rural systems should be prioritized due to this lower standard. Chanta et al. (2014) expands this discussion further, observing that the current design of EMS systems deprioritizes rural spaces due to a lack of call volume which in turn deprioritizes rural residents and generates spaces of service gaps, resulting in inequity. To compound both phenomena, Jonk et al. (2023) found that this systemic deprioritization leads to ambulance deserts affecting 4.5 million individuals (about seven times the population of Vermont) with an overwhelming 84% of rural counties having at least one desert within them. None of these pieces strove to explore equity as a specific concept, however all three found the current baseline state of EMS so unfair that addressing equity or fairness became central themes within their pieces, collectively demonstrating what Chanta et al. (136, 2014) assert, "patients in urban areas are generally covered at the expense of rural patients."

The second category, discussions of ongoing changes, focused less directly on the EMS system but more broadly on rural and urban healthcare changes and the resulting effects on EMS. All three pieces explored the growing pattern of rural hospital closures throughout the United States (Koeze et al., 2020; Miller et al., 2020; Tribble, 2019). Koeze et al. (2020) found that 8.6 million people live over thirty minutes from the nearest hospital, a population that parallels the

findings of the Jonk et al. (2023) study on ambulance deserts. They further note that these individuals are similarly provided with a lower standard of care due to the type of hospitals (often acute care or critical access) which exist in or around rural spaces (Koeze et al., 2020). Miller et al. (2020) adds to this discussion by identifying a statistical increase in total call time for EMS as rural hospitals close, resulting in fewer ambulances available per call and decreasing rural residents' ability to access consistent and appropriate care in an emergency. Further, Miller et al. (2020) and Koeze et al. (2020) note a subsequent system burden to EMS as EMS units are being consistently asked to provide increasingly lengthy interfacility transport (IFT) for patients between hospitals as the scarcity of hospitals overall is becoming a parallel for reduced advanced care in rural settings. Tribble (2019) humanizes this conversation and recounts the preventable death of Robert Findley in a hospital parking lot. Findley lived in Fort Scott, Kansas and had suffered a serious head injury which required EMS transport to a hospital. However, Mercy Hospital Fort Scott, a hospital within minutes of Findley had recently closed their emergency department and would not be able to accept or care for Findley (Tribble 2019). So, Findley and an EMS crew waited in the parking lot in hopes that their call for a helicopter transport to the next nearest appropriate facility, ninety miles away, would be available (Tribble 2019). Ultimately, a helicopter was located but it was unfortunately too late for Findley who was miles from the nearest facility along rural roads in a scenario where "minutes can make the difference between life and death" (Tribble 2019). And, unfortunately, while Findley lay dying in a parking lot, research by Miller et al. (2020) demonstrates that the extended holding of the EMS crew for his care likely had negative ripples on the entire EMS system of Fort Scott.

The third category, equity, or difference analysis bridged the gap between the first and second. Specifically exploring the broader EMS system and how elements of that system directly

created inequities or differences. These five pieces discussed the broader development of EMS systems in the context of ongoing changes in US healthcare to generate understandings of the direct role or representation they have to EMS. Ultimately finding that the current EMS system tends to centralize urban centers in the name of response and economic efficiency (Caldwell et al., 2016; Xing Fu et al., 2022; Institute of Medicine, 2003; Luo et al., 2022; Reif et al., 1999). Reif et al. began this field of discussion in 1999 by identifying that any reduction in access to healthcare results in undeniable inequity. Establishing that as rural hospitals close, EMS is forced to pick up the 'slack' in the system which results in diminished quality of EMS care and reduced responsiveness (Reif et al., 1999). The IOM expand this theme by both formalizing a definition of health (in)equity – as a critical issue facing medicine, rural medicine, and rural pre-hospital medicine – *and* expanding understandings of inequity beyond explicitly geographic factors to incorporate axes of systemic oppression along the lines of race and gender (Institute of Medicine, 2003). Xing Fu et al. (2022) and Luo et al. (2022) both add dimensions of local context by exploring the role of traffic and the built environment throughout the US and the process of system optimization in the Wuhan province of China, respectively. Both projects assert that while rural and urban systems independently have barriers to care which negatively affect patient outcomes, it is rural areas that are systemically disadvantaged to generate a space of inequity (Xing Fu et al., 2022; Luo et al., 2022). Xing Fu et al. (2022) do explore the specific effects of the urban spatial makeup such as traffic, however, they note that rural areas face comparable challenges with the inefficiency and danger on rural roadway networks. Yarwood (2010) contributes to this conversation that the evolving nature of rural spaces requires comparatively more attention and investment to continue adequate service to patients. Further noting how for Mountain Rescue EMS in England and Wales the developing rural recreation sector is putting an

unforeseen burden on rural EMS which has largely gone unnoticed and unresearched. Caldwell et al. (2016) wraps all of these conversations together and discusses the compounding realities of inequity within EMS. They re-establish the IOM findings that race, ethnicity, and gender generate inequities within healthcare and then add that residents living in rural environments have these inequities exacerbated within the EMS setting simply due their rural residency (Caldwell et al. 2016).

Overall, the common themes I identified showed a clear and consistent trend of deprioritization and resulting inequity within rural spaces as compared to their urban neighbors. Further, the authors reviewed here observed this trend to be well understood and acknowledged within the EMS system, noting a lack of progress towards change. The other eight pieces not captured with these categories provided supporting information which proved useful for analysis and understanding of data, however, they were largely independent pieces which did not align with any common themes.

Discourse Analysis:

I first want to call to light the consistent re-examination of the same issues for the last twenty-five years across multiple scales and spaces. While I recognize the need for consistency in high-quality data to invest in change, the analysis shows that equity does not exist and only one perspective, urban (generally white), is applied to entire systems. I argue that the field has reached a discursive saturation point in and it is now time to shift our mindsets from 'we have a problem' to 'what is the solution.' Here, I recommend the application of the taskscape as a framework to reimagine progress towards positive change.

The texts reviewed here demonstrate that current understandings of inequity exist within a model that states: system A, urban, is used as an inappropriate reference for system B, rural,

and therefore inequity occurs. Beyond the need for immediate corrective action, this also suggests that next steps must be guided by a framework that identifies specific landscape needs, a framework like the taskscape. This is echoed by Yarwood (2010), who identifies that there exists a significant research hole on the geographic needs of EMS, specifically rural EMS, which accounts for the spaces they are in. Xing Fu et al. (2022) finds that in urban systems sprawl and traffic decrease response time and within rural systems rural roadway networks create similar challenges, which they assert leads to poor care outcomes for both communities that are particularly, and inequitably, felt within rural spaces. Reif et al. (1999), Koeze et al. (2020), and Miller at al. (2020) found a disproportionate exacerbation of system burden, across rural EMS systems as rural health centers continue to close, which I characterized as *slower* and *lower* care. Additionally, add here the Chanta et al. (2014) and Jonk et al. (2023) findings which demonstrate that single system design typically sees rural communities as a negligible detail in the name of system efficiency. Further, Caldwell et al.'s (2016) findings add to this body of work an additional frame of inequity that rural marginalized residents must endure in their healthcare systems.

Now, take all these themes and reimagine our understanding of it utilizing the taskscape model. By unpacking the needs of rural and urban spaces individually, each landscape can then be addressed as a discrete taskscape. As an example, I take the constraints of the two landscapes identified in the texts above and apply a taskscape framework to it.

Fig. 13, Taskscape Example Table

	Rural	Urban
Physical Constraint	Undermaintained rural roadway networks and distance	Significant Traffic and Urban Sprawl
Taskscape Application	Consider usage of mobile integrated health to mitigate EMS needs prior to calls and usage or more 'heavy duty' ambulance types.	Consider the application of smaller ambulance types and have units mobile throughout shifts waiting for calls in the most needed locations.
Economic Constraint	High cost of ambulance readiness for a low call volume	High demand for ambulances and limited funds to fill the given need
Taskscape Application	Consider utilization of first response teams within local areas to allow a single transporting ambulance to cover a larger region.	Consider computer aided, location-based dispatching to ensure the closest ambulance is responding to each call.
Social Constraint	Lack of available staffing to fill shift and ambulance needs	Diverse populations with potential language or cultural barriers
Taskscape Application	Consider partnerships with local public works departments to have staff on-call for the ambulance.	Consider investment in regular DEI training and subscription to live phone-based translation services.
Collective Taskscape Solution	Consider a partnership-based staffing model with one centralized ambulance, and first response teams to provide immediate care while an ambulance responds. Additionally consider mobile integrated health in between 911 responses to help reduce overall call volume.	Consider a computer aided and mobile dispatching model to reduce the effects of high call volumes and traffic. Additionally consider DEI and translation investments to reduce barriers to care for diverse populations.

However, these taskscapes are not just rural or urban. Looking at Charlotte, VT and Vergennes, VT, two neighboring rural spaces, the taskscape must further adapt. Vergennes is a small city surrounded by farm communities with one agency serving a large radius of local towns; their ambulances must be able to adapt from long highway drives between towns and to the hospitals to rained out clay-mud farm roads which cannot support large or heavy vehicles. Conversely, Charlotte is a more residential community with a significant number of waterfront

peninsulas which are accessible by AWD or 4WD, and only minimally maintained roadways; their ambulances accordingly must be larger to hold the required specialized gear and still be able to safely traverse the various roadways. Similarly, within urban areas, the taskscape must adapt to each specific space. Looking within Burlington, VT we see the temporal requirements of the taskscape as ambulances must be designed to navigate the city during peak rush-hour on the narrowest streets, pushing towards a smaller ambulance, yet also be able to navigate neighboring communities and carry specialized gear, pushing back towards a larger vehicle. In all these cases, something as simple as the design of each ambulance is modified slightly in response to the given needs of the landscape it serves. Similarly, providers in the urban areas of Vermont (and to a lesser degree some rural regions) must also engage with multiple cultural landscapes. Such as the new immigrant communities of Winooski, where providers must account for language barriers or differing cultural norms around medicine which require adapted care practices. In these taskscapes providers must reimagine their resources utilizing translation services and other training processes to more appropriately account for the needs of the landscapes they serve.

By applying the taskscape here to address the constraints of the landscapes distinctly, EMS systems can be created responsively and responsibly to their communities. Consider the power of a more widespread application of this model to inequities identified through my discourse analysis. What is inequitable with the EMS system has been identified, now our attention must shift to the application of change.

Case Study Findings:

By and large, the results of my case study overwhelmingly mirrored the national data and broad discourses. Vermont appears to have an inequitable system and its providers reinforce that

assessment. This presented itself in two ways: as a physical, (see appendix C) and a social landscape. More importantly, when observing the two in conversation with one another the current state of inequity becomes undeniable and clearly demands immediate change. Vermont's EMS inequity is a compounding danger which starts at the structural level of ambulance placement and is reinforced by social perceptions, rural care abilities, and statistical realities of distance.

At the most basic level, care within Vermont appears inequitable, a physical presentation that was also replicated socially by interview respondents. All providers within VTEMS D3 or D13, working in EMS for greater than two years, with a skill range from recently-advanced AEMTS to paramedics with nineteen years' experience. (See Appendix A for interview questions) These providers all also reside in Vermont, largely but not exclusively, in or adjacent to the communities they serve. Despite a large variation in careers, physical location, and life experience, all the providers' responses largely fell along similar themes: noting EMS as the most visible or only service in rural spaces; a hyperawareness of the context and effects of ambulance deserts; a need for rural self-sufficiency; rural settings having physical constraints affecting patient outcomes; and a palpable social stigma on rural versus urban providers.

Figure 14: Interview Coding Matrix

Interview Identification:	Coded Name:	Current EMS Service Work and District:	Current Certification Level and Overall Time In EMS:	Self-Identified Rural or Urban
VTEMS D3 - 1	James	South Hero Rescue (D3)	AEMT, 2 Years	Rural
VTEMS D3 - 2	Beth	Charlotte Fire and Rescue (D3)	Paramedic, 18 Years	Rural with previous Urban

VTEMS D3 - 3	Chris	UVM Rescue (D3), Shelburne Rescue (D3), Town of Barre EMS (D6)	AEMT, 8 Years	Both – Urban within D3/D13 Case Study
VTEMS D13 - 1	Devin	Rescue Inc. (D13)	Paramedic, 19 Years	Rural with previous Urban

Looking at the Vermont Department of Health's map of EMS services (figure 1) the objective lack of transporting EMS services (red markers) throughout the rural regions of the state is alarming. Within District 13 this stark lack of services is felt with Devin from D13 remarking that of the roughly 500 square miles Rescue Inc is responsible for covering:

> most of it is rural and lacking of other public safety infrastructure, except for maybe a volunteer or call on call Fire Rescue Agency. But I don't know of any towns that we operate in other than Brattleboro that have an established Police Department. Otherwise, they rely, you know, pretty heavily on state police and to a lesser extent, Windham County Sheriff. But Rescue is easily the biggest public safety presence for almost all the communities that we interact with. - Devin

This sentiment was repeated by Alex, Beth, and Chris who all noted that at least part of their coverage area is rural. As Chris commented: "you have to learn to work with what you have and your crew and not necessarily rely on others as much." While outside scope of the qualitative case study, it is also critical to acknowledge the vast regions in D2, D5, D10, and D12 which are left with no transporting ambulance or even first response service (blue marker), on figure 1. While no direct data was found as to why this is occurring, discussions during my ethnographic observation of the VTEMS advisory meeting indicated it may be a result of the localized nature of ambulance agency development in Vermont and the lack of funding available to dedicate to ambulance purchase, upkeep, and staffing within small rural communities.

To compound the effects of the increased distance to care within rural Vermont, rural services often are expected to bear their own costs for support and advanced levels of care, as Devin notes that they, a rural service:

> have to take care of ourselves if we need an extra unit, it's got to come from us. If we need something like RSI [rapid sequence intubation] or ultrasound to be deployed, it's going to have to come from us. - Devin

This 'alone on an island' sentiment was echoed by Alex who self-reported as a rural provider adjacent to the urban D3 core, stating

> we are in downtown South Hero. We are 21 miles from the hospital, which I think is a long transport time given certain circumstances, and if we're covering Grand Isle, we get to be up into 30/35 minutes, 40 minutes and so just that distance. I think, umm sometimes makes it a little nerve wracking. Yeah, especially for patients. - Alex

Conversely Chris presents how different care provision is just twenty-one miles away in Burlington, explaining:

> it's like a safety net of being in the greater Burlington area with having so many fire resources within, you know, 10 minutes, you can have a fire company or two and paramedics. - Chris

My analysis of national data and discourse findings show that increased distance leads to decreased patient outcomes, and that is clearly an experience felt by providers as an ingrained experience within Vermont. Further, that is a fact I can attest to from my personal experience having gone on nearly identical calls in Winooski (while on UVM Rescue), compared to within Charlotte, (while on Charlotte Rescue), which resulted in radically different patient outcomes. Providers across every interview additionally agreed that in some capacity increasing distance to definitive care not only changes patient outcomes but results in a decrease in equity for rural residents.

This was further compounded by a prevalent social stigma identified by every provider within Vermont EMS in which rural providers are viewed as less equipped because they are either perceived to be volunteers, do not have enough patient contact, or both.

> There is a bias between urban and rural providers and I think that especially in Vermont it stems from the you know one, right, call volumes and the difference of like just sheer patient contacts you can't you know maintain yourself as a truly good provider in my opinion without a high number of patient contacts...there's a difference between Volunteer and professional agencies. And I think people have that bias, especially on the professional side. - Chris

> And I'm gonna say yes, I believe that certain urban providers look down on the services that are provided by rural volunteer EMS squads. - Alex

> I think having a background education of a blend of both is the ideal situation.... I think they both have their strengths and weaknesses. - Beth

> 100%...there is a I think there is a perception in EMS in general that if you're working in a high volume urban system, regardless of what level you operate at, regardless of the quality of the perceived quality of the service that you work for or anything like that...there is going to be an assumption that those people are more experienced and potentially capable of delivering a higher level of care. - Devin

While not every rural service has fewer patient contacts than urban ones and not every rural service is volunteer or urban service paid, this social perception was nonetheless persistently noted, and was brought up during conversations at both sites where I completed ethnographic observations. Further, discourse analysis, comments from providers, and my own experience working across both types of spaces demonstrate this perception greatly affects workforce recruitment and retention within rural spaces and reduces the number of rural ambulances that are present or staffed, in turn reducing rural EMS access and equity.

These compounding layers support the clear picture demonstrated in the national data and discourse sections that rural regions are inequitably disadvantaged as a result of *slower* and *lower* care, to which the providers add a picture of more isolated, remote care.

Case Study Analysis:

Jonk et al. (2023) find that 100% of counties within Vermont have at least one ambulance desert, a reality reflected by the exasperation rural care providers expressed with the realities of rural care provision within the state. When observing Vermont EMS Districts 3 and 13 we see stark differences in the physical infrastructure and the quality of care provided within urban and rural spaces. I suggest that by applying the taskscape framework to better understand and address the needs within the communities of VTEMSD3 and D13 we may be able to generate a care network in Vermont that adequately supports the EMS needs of both rural and urban spaces.

Providers during their interviews could not produce one definition of equitable care, with answers ranging from level of care provided to equality in access depending on the respondent. Yet, all rural providers either stated or implied that they felt equity was lacking in their regions. Conversely, urban providers noted that they felt there was appropriate access to care and a reasonable response of EMS in their regions, instead defining equitable care to include a broader context of home health and community paramedicine roles that EMS may support in a revised system. Here I note that urban providers have the luxury of considering more abstract healthcare desires within their conceptions of equity, whereas rural providers seemed to focus on more acute needs for broadly successful patient care. I don’t say this to suggest that urban care systems are perfectly equitable within Vermont, but it is clear when looking at the response matrix, (Appendix B), and Vermont Case Study imagery, (Appendix C) that the system was designed with the needs of Burlington's urban core in mind and not the far reaches of the 700 or so people in Halifax, for example.

I additionally note that Rescue Inc., the main provider of transport EMS in VTEMSD13 and home organization of Devin is already making decisions following a taskscape logic without utilizing the theoretical framework. As Devin notes:

> Rescue does a really good job almost out of necessity of figuring out what this community needs because when you're really resource deprived, you have to be willing to offer creative solutions in order to provide a total package...like mobile, integrated healthcare...a whole division of our company that is dedicated to special programs...handled the majority of the COVID vaccine program for the state of Vermont. We handled a large portion of the...monoclonal antibody therapy...within Vermont...involved in various aspects of the undomiciled populations housing project...we recognized that fire departments were not always able to provide technical Rescue services, so we provide that. - Devin

For Rescue Inc., being responsive to their landscape is not a choice, they must generate a system that serves their communities, because if they do not nobody will. Reminiscent of Ingold's (1993) taskscape framework, Rescue Inc. worked cooperatively with local communities to identify needs, analyzed their physical and social space to identify barriers, and then generated an EMS landscape that appropriately addressed the needs of dwelling within their communities. However, Rescue Inc. is the primary transporting EMS in VTEMS D13, providing care to the entire district except for one community. They do not have to worry about a broader system, because they *are* the system. The leadership of Rescue Inc. and VTEMSD13 can address inequities through their flexible and adaptable care model already embedded into the community.

So, if it works in VTEMSD13, why can this not be applied to District 3? VTEMSD3 providers who work on the rural fringes of the district consistently noted that the EMS resources are hyper-densified in and around UVM Medical Center and the urban core of Burlington, which leaves the outer communities under-served, as one provider, Alex, commented about their service in Grand Isle County: “it's where...[South Hero]...might not necessarily have service if it wasn't for us.” VTEMSD13 demonstrates that this inequity, where the rural community members

of South Hero, Vergennes, Charlotte, Hinesburg, Bolton, and other towns on the fringe of VTEMSD3 are left with slower care, is a *choice* in how we approach our system design.

Beyond that choice, the case study highlights that beyond just understandings of rural versus urban, there additionally exists a quality of *remoteness,* which can exist in both spaces. Providers who identified as rural all noted barriers to care which could be classified as geographic remoteness beyond simply existing in rural spaces, such as inaccessible, damaged roads. Similarly, providers in urban areas noted a dimension of social remoteness including language and cultural barriers, which made working with some patients exceedingly difficult beyond the 'normal' constraints of urban care provision. Having worked in both these spaces I would echo the sentiments of these providers and note that calls which are physically or socially remote go beyond the barriers of the given landscapes and likely have significant effects on the quality of care it is possible to provide. Further, providers in the northern end and southern end of VTEMSD3 (Alex, Beth) both note that paramedics can help bridge the inequities of physical distance by providing higher levels of care. However, both note that with the current staffing crisis within EMS and the largely volunteer nature of many rural services throughout Vermont, it is hard to recruit and retain paramedics to staff, let alone the startup and upkeep costs of equipping and supplying paramedic-level ambulances. Multiple VTEMSD3 providers mentioned that they felt that the lack of state and district level leadership and financial support, compared to 'big-name' agencies in urban centers throughout the state was not accidental. This problem has become so critical that during the VTEMS Advisory Meeting, multiple members stated this to be their top priority to bring to the legislature. One member stated that they felt it constituted an unspoken devaluation of rural providers by leadership across the districts and in state offices.

As an additional note, providers all agreed that it felt plausible to them that patients of color in rural settings were likely to face additional barriers to equity, however providers uniformly noted that the lack of diversity within Vermont made it hard to comment on this specifically. Instead, multiple providers (Beth, Chris, and Devin) expressed that they had observed provider-based discrimination or changes to care practice when interacting with "frequent flyers" or patients who consistently, and often abusively, activate the EMS system. I could not find any studies or data on this phenomenon but, from my own personal experience, I suspect that this trend would be found more broadly if researched. When looking at VTEMSD3 and D13 it becomes clear that how we design our systems matters, and by visioning our systems utilizing a taskscape framework, such as within D13, we can create systems that are based in equitable care for all patients. As seen in D3, when generating systems prioritizing economic or call-based efficiencies we end up with systems that do not adequately provide for their entire patient population. Instead, if VTEMSD3 were to adopt a taskscape framework and break the urban core and rural ring into two different systems serving one network of patients, an EMS landscape could be created that appropriately serves the differing needs of differing spaces.

Chapter 6: Conclusion

I first want to acknowledge the simplicity of the structure of my thesis and name some key limitations in research and accordingly findings. Almost without fail my research would identify a difference in rural and urban EMS, the difference would lead to inequity, and upon reflection that inequity could be addressed and corrected with the application of landscape-based analysis. Accordingly, I was intentionally rudimentary in my findings and analysis section to demonstrate the simplicity and clarity of this issue. One key limitation throughout this work is the very quantitative definitions of rural and urban which I use. While many more holistic and qualitative understandings of these terms exist, due to the very standardized categories used within NEMSIS data I opted to utilize these same quantitative understandings throughout my research. Additionally, I acknowledge the limited conversations of inequity along social or demographic factors within this work. Regrettably, due to the limited timeline and scope of this project coupled with the limited available research and discourse which directly connected EMS with these ongoing conversations, I was forced to limit the scope of this section of my research. However, as I mention throughout my work, I suspect more intentional research into this field would yield meaningful results.

Looking at the work I was able to compile above I am drawn to a medical term, VQ mismatch, which officially means ventilation-perfusion mismatch but colloquially is used to identify skills, understandings, and systems that do not align with the available research and data. I perceive the issue of EMS medical equity to be a VQ mismatch: the current design of EMS systems does not reflect the available research and data, which show EMS systems are not equitably serving their whole communities. My research findings demonstrate a clear and consistent body of research and discourse to support the assertion that EMS systems are not

geographically or socially equitable. Further, VTEMS D13 demonstrates the power of landscape-based systems design and is an unintentional proving ground of the power of the taskscape in equitable EMS system design.

As I suggest in my findings and analysis section, I believe that by shifting our perspectives on EMS system design from a priority of efficiency to a priority of service to individualized landscapes, or generation of taskscapes, inequities can be mitigated and possibly even removed from the EMS system. As demonstrated in the national data and discourse findings, the individual needs of rural and urban landscapes are objectively different, and by continuing to try to apply one system onto both spaces we generate an EMS system which serves one at the expense of the other. Further, when observing the compounding nature of difference — spatial, social, economic, and political — within the two spaces it becomes evident that the two spaces must be viewed within their own specific contexts with awareness to the unique needs and constraints that context creates. I recommend that future researchers utilize a theoretical framework such as the taskscape, to imagine and generate systems which are responsive and related to their landscape and the needs of dwelling within it. Here I bring in Rescue Inc. and my analysis from the Vermont Case study who demonstrate that by responsively generating an EMS system, we can create systems that reduce and nearly eliminate inequities for their rural patients. Ingold's (1993) taskscape theory argues that by observing the specific conditions of specific human beings within a specific space, we can create a specific performance of a task, in this case EMS systems, which generates an optimal outcome. I firmly believe that my research demonstrates that by applying this theoretical framework onto EMS systems we can recognize and counteract current processes of inequity. Specifically, future researchers should look beyond reaffirming the already established discourses of inequity and

apply approaches such as the taskscape framework to EMS systems throughout the US to explore the application of this theory onto the complexities of landscapes throughout our country. I suggest that through this, two key benefits will emerge; first, blueprints for equitable EMS system development and redevelopment, and second, identification of critical areas of need for future studies around equity which this project had limited success in locating.

My intent was never to create an argument which placed urban spaces in opposition to rural spaces and I would argue that that is not what I found, but instead this research consistently demonstrated Chanta et al.'s (136, 2014) findings that "patients in urban areas are generally covered at the expense of rural patients." This difference clearly demonstrates that equity is not present within Vermont or, more broadly, America's EMS system despite health and healthcare being established by the World Health Organization as a basic human right. It is time for EMS research to go a step further, beyond reestablishing that the problem exists, to approaches such as taskscapes that center equitable care.

As I conclude I want to add a personal perspective on this work. I approached this work as a geographer who happened to be lucky enough to research a community I care deeply about. I had expected to find that rural populations received consistently poorer EMS services, simply given my experience working in rural and urban spaces. However, I had not expected to find the pervasive nature that rural populations are systemically deprioritized and forced into slower and lower (quality) care. I found that the specific nature of this slower and lower care within each community is recognized by the providers of each landscape. These providers demonstrated a remarkable ability to shapeshift their training responsively to the constraints of their landscape, making micro-taskscapes at each of their services. Looking back on these findings, providers demonstrated themselves to be savvy, *de facto* geographers with expertise on their communities

whose knowledge and skills exist ready to engage with a new wave of research in service to the generation of equitable EMS systems.

Appendix:

Appendix A: Interview Questions
Section I: General Questions

1. What EMS (Emergency Medical Services) organization(s) do/did you work for?
    i. How long did/have you worked there?
    ii. Where are those services located? If Vermont what District?
2. Where did you get your initial EMS education? What certification level was that for?
    i. Have you since changed certification? To what and why?
3. How long have you been involved in EMS?
4. Why did you first engage with EMS?
5. What keeps you involved in EMS?
6. What brought you to your current service here in VTEMS D3/13?
7. Can you describe the dominant service area and population type of your current service?
8. Would you identify your service area as rural, urban, or something else? Why?
9. What do you see as something your service does especially well for your predominant patient population?
10. Where is one improvement you see for your service to better serve your community?
11. How does the [urban/rural] setting of your service area affect your patient care?
12. Can you think of a time you were involved in or heard about where the resources available within your District did not meet the needs of the patient? Being aware of HIPPA protocols, can you describe the general situation for me?
13. Have you ever witnessed or heard about cases of bias during a patient interaction? This can fall along lines of race, gender, age, economic status, or any other demographic factors. Being aware of HIPPA protocols, can you describe the situation for me?
14. How would you define 'equitable care' in EMS work?
15. Can you tell me about a time when you saw or heard about a shift in your local protocols or procedures which encouraged what you would define as equitable care. Being aware of HIPPA protocols, can you describe the situation for me?

Section II: Research Response Questions

1. Research indicates that distance to hospitals has a direct correlation to patient outcomes, with increasing distance resulting in worsening patient outcomes. Given your personal career experience how do you feel about this, would you agree or disagree, why? (Patel and Singhvi 2020; Volz 1971; Luo et al. 2022)
2. Caldwell et al. (2016) found that individuals who were already pre-disposed to poor health outcomes (resultant of race, gender, etc.) had these factors exacerbated in the rural settings. From your time as an EMS provider can you think of any examples of this you have seen or heard about?
3. A network evaluation of Saudi Arabia's EMS system found that urban providers viewed rural providers as less trained or equipped, and found that there was a provider based perception that

rural residents were more likely to have traumatic injuries. Have you ever experienced any urban or rural social biases such as these or others? (Alanzay et al. 2022)

Section III: Open Response

- That is all the questions I have, thank you for your participation. If there is anything you think I missed which you would like to add, feel free to take some time to do that now.

Appendix B: VTEMS D3 Response Matrix

Vermont EMS District 3
Mutual Aid Response Plan

Approved: December 14, 2023 **Effective: January 1, 2024** **Replaces: April 2023**

Vice Chairperson: John Christman

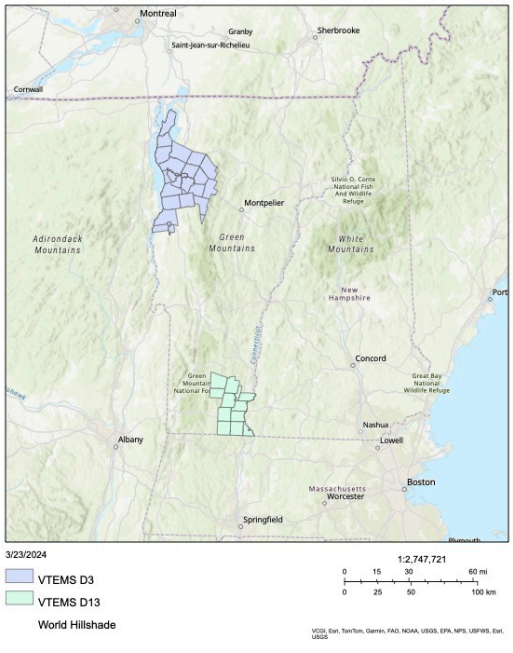
= **Will provide medic intercept when available**

TOWN	AREA /ZONE	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
ADDISON		VARS	VARS	MVAA	Bristol	MVAA	Charlotte	Bristol	Shelburne	VARS	MVAA
BOLTON	East of Bolton Notch Road	Richmond	Richmond	Waterbury	Williston	UVM	St. Mikes	Essex	Stowe	Colchester	Charlotte
	West & including Bolton Notch Road	Richmond	Richmond	Williston	UVM	Waterbury	St. Mikes	Essex	SBFD	Shelburne	Colchester
BURLINGTON	North of Pearl Street	BFD	BFD	BFD	UVM	Colchester	St Mikes	SBFD	Williston	Shelburne	Essex
	South of Pearl Street	BFD	BFD	BFD	UVM	SBFD	St. Mikes	Colchester	Williston	Shelburne	Essex
	University of Vermont	UVM	BFD	BFD	BFD	SBFD	St. Mikes	Colchester	Williston	Essex	Shelburne
CHARLOTTE	North & Including Ferry/ Church Hill Rd	Charlotte	Shelburne	VARS	UVM	SBFD	St. Mikes	Bristol	VARS	BFD	Williston
	South of Rt7 and Ferry Rd	Charlotte	VARS	Shelburne	UVM	SBFD	St. Mikes	Bristol	MVAA	MVAA	Richmond
COLCHESTER	West of Bayside Park	Colchester	BFD	St. Mikes	UVM	Essex	Milton	SBFD	Williston	Shelburne	Charlotte
	East of Bayside Park	Colchester	St. Mikes	Essex	UVM	Milton	SBFD	BFD	Williston	S. Hero	Shelburne
	North of Main / Creek Farm	Colchester	Milton	St. Mikes	Essex	UVM	SBFD	BFD	Williston	S. Hero	GIRS
	College Parkway / RT 15 area	St. Mikes	Colchester	Essex	UVM	SBFD	BFD	Williston	Milton	Richmond	Charlotte
ESSEX JUNCTION	North Quadrant (Pearl/Main and north)	Essex	Essex	St. Mikes	Williston	Richmond	Colchester	UVM	Milton	SBFD	BFD
	South Quatrant (everything south of Pearl/Main St)	Essex	Essex	Williston	St. Mikes	Richmond	Colchester	UVM	Milton	SBFD	BFD
ESSEX TOWN	West Quadrant (North of and including Route 15, West of and including Route 128)	Essex	Essex	St. Mikes	Milton	Williston	Richmond	Fairfax	Colchester	UVM	SBFD
	East Quadrant (South of Route 15, East of Rt 128, all of river road from town line)	Essex	Essex	Richmond	Williston	St. Mikes	Colchester	Milton	UVM	SBFD	BFD
FERRISBURG	L Chicago Rd & North of Four Corners	VARS	VARS	Charlotte	Shelburne	Bristol	UVM	MVAA	Bristol	VARS	SBFD
	South of Four Corners	VARS	VARS	Charlotte	Bristol	Shelburne	MVAA	Bristol	MVAA	VARS	MVAA
GRAND ISLE		GIRS	GIRS	S. Hero	Milton	Alburg	Colchester	Mississquoi	St. Mikes	Essex	AmCare
HINESBURG	East of and including Route 116	Richmond	Richmond	Williston	Charlotte	Shelburne	SBFD	UVM	St. Mikes	Essex	Bristol
	West of Route 116	Richmond	Richmond	Charlotte	Shelburne	Williston	SBFD	UVM	St. Mikes	Essex	Bristol
HUNTINGTON		Richmond	Richmond	Williston	Charlotte	UVM	St. Mikes	Essex	Shelburne	Bristol	SBFD
JERICHO	North of & including 15	Essex	Essex	Richmond	Williston	St. Mikes	UVM	Colchester	SBFD	Fairfax	Cambridge
	South of 15 & North of Barber Farm	Essex	Essex	Richmond	Williston	St. Mikes	UVM	SBFD	BFD	Colchester	Charlotte
	South of & including Barber Farm	Richmond	Richmond	Williston	Essex	St. Mikes	UVM	SBFD	BFD	Fairfax	Cambridge

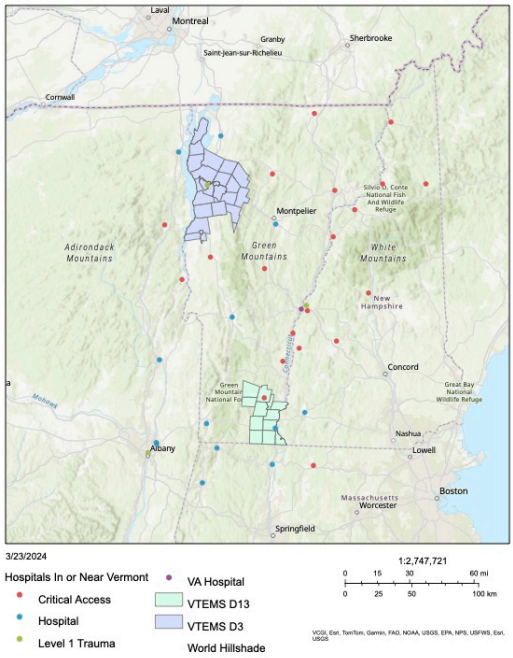
TOWN	AREA /ZONE	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
MILTON	South of Cherry St	Milton	Milton	Colchester	St. Mikes	Essex	S. Hero	Fairfax	UVM	SBFD	BFD
	North of Cherry St	Milton	Milton	Colchester	Fairfax	AmCare	S. Hero	St. Mikes	UVM	SBFD	BFD
	Lamoille River to Sand Bar	Milton	Milton	Colchester	S. Hero	St. Mikes	UVM	Essex	AmCare	SBFD	BFD
NORTH HERO	South of Carry Bay	GIRS	GIRS	S. Hero	Milton	Alburg	Colchester	Mississquoi	AmCare	Essex	St Mikes
	North of Carry Bay	GIRS	GIRS	S. Hero	Alburg	Mississquoi	Milton	Colchester	AmCare	Essex	St Mikes
PANTON		VARS	VARS	Charlotte	Bristol	MVAA	Bristol	MVAA	Shelburne	VARS	MVAA
RICHMOND		Richmond	Richmond	Williston	UVM	St. Mikes	Essex	SBFD	Shelburne	Colchester	Charlotte
ST GEORGE		Richmond	Richmond	Williston	SBFD	UVM	Shelburne	Essex	St Mikes	Charlotte	Colchester
SHELBURNE	North & including Webster Rd	Shelburne	UVM	SBFD	Charlotte	BFD	VARS	St. Mikes	Williston	Colchester	Essex
	South of Webster Rd	Shelburne	Charlotte	UVM	SBFD	BFD	VARS	St. Mikes	Richmond	Colchester	Essex
South BURLINGTON	West of Spear St	SBFD	UVM	BFD	Shelburne	St. Mikes	Williston	Colchester	Charlotte	Essex	Richmond
	East & including Spear St	SBFD	UVM	BFD	St. Mikes	Williston	Shelburne	Essex	Colchester	Richmond	Charlotte
SOUTH HERO		S. Hero	Milton	GIRS	Colchester	St. Mikes	Essex	UVM	Alburg	SBFD	Amcare
UNDERHILL		Essex	Essex	Richmond	Cambridge	Williston	Fairfax	St. Mikes	UVM	Cambridge	Fairfax
VERGENNES		VARS	VARS	Charlotte	Bristol	MVAA	Bristol	MVAA	Shelburne	VARS	MVAA
VERMONT AIR NATIONAL GUARD BASE		St. Mikes	SBFD	UVM	Essex	Williston	BFD	Colchester	Shelburne	Richmond	Charlotte
WALTHAM		VARS	VARS	Bristol	MVAA	Bristol	MVAA	Charlotte	Shelburne	VARS	MVAA
WESTFORD	Northern Westford	Fairfax	Essex	Milton	Cambridge	St. Mikes	Colchester	NEMS	UVM	AmCare	S Hero
	Southern Westford	Essex	Essex	Fairfax	Milton	Richmond	St. Mikes	Williston	Cambridge	UVM	Colchester
	RT 15 area only	Fairfax	Essex	Cambridge	Richmond	St. Mikes	UVM	Milton	Colchester	NEMS	AmCare
WILLISTON	East of & Including Oak Hill Rd + North Williston Rd	Williston	Williston	Richmond	Essex	UVM	SBFD	BFD	St. Mikes	Colchester	Shelburne
	West of Oak Hill Rd + North Williston Rd	Williston	Williston	Essex	Richmond	UVM	SBFD	BFD	St. Mikes	Colchester	Shelburne
WINOOSKI		St. Mikes	UVM	Colchester	Essex	BFD	SBFD	Williston	Milton	Richmond	Charlotte

Appendix C: Vermont Imagery

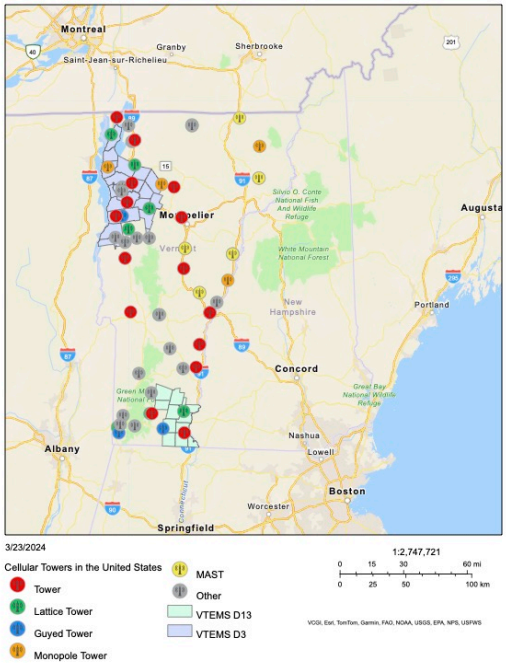
VTEMS D3 and 13



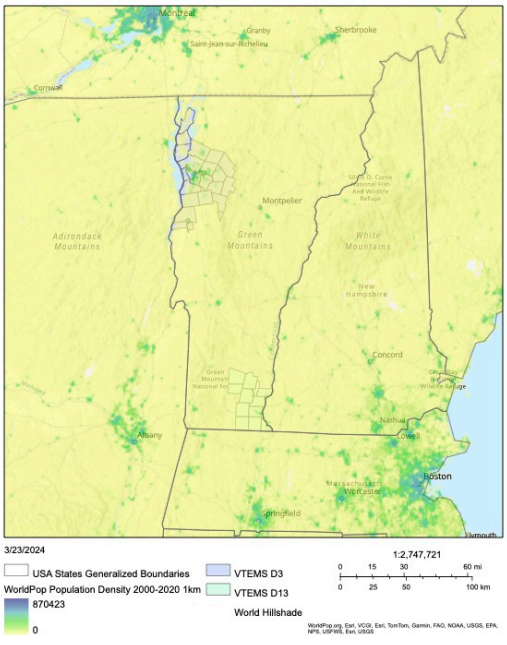
VTEMSD3/13 and Hospitals



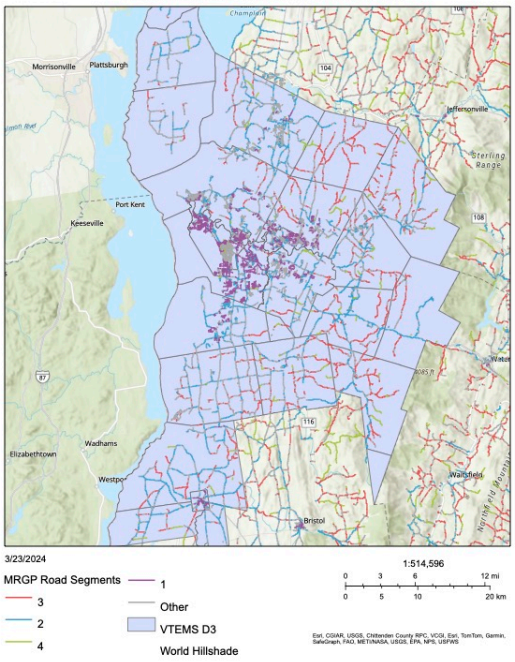
VTEMSD3/13 and Cell Coverage



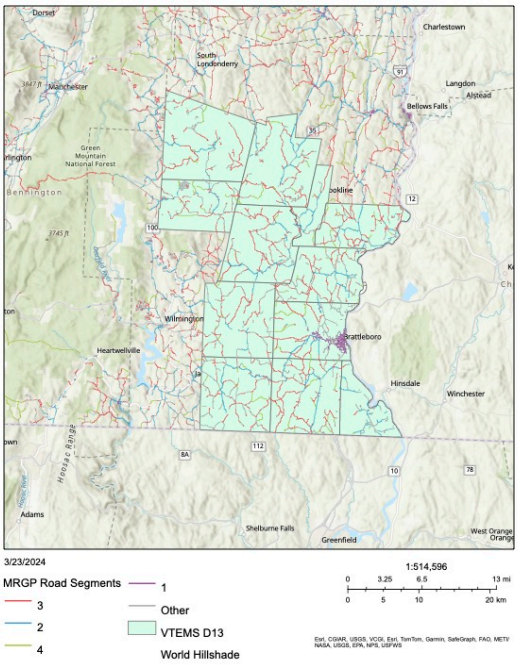
VTEMSD3/13 and Population Density



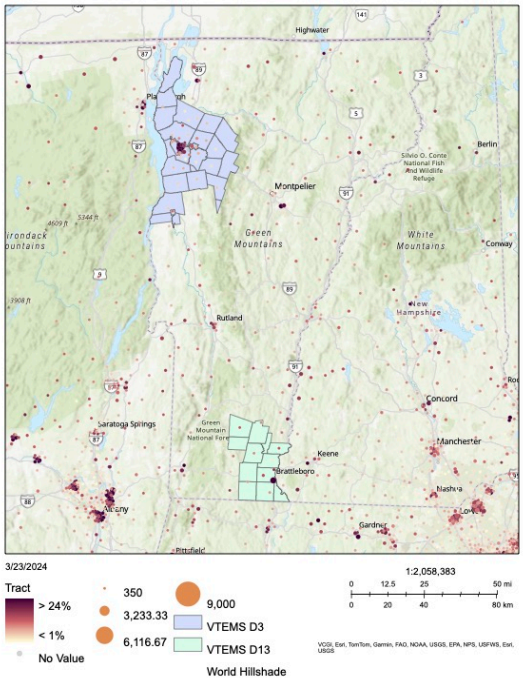
VTEMSD3 and Roadway Travel Class



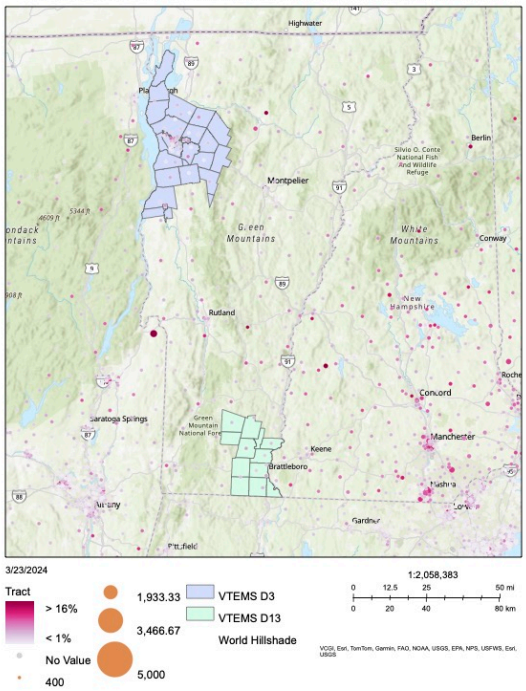
VTEMSD13 and Roadway Travel Class



VTEMS D3/13 and Percent Population Below The Poverty Line



VTEMSD3/13 and Percent Population without Health Insurance



Appendix D: Additional NEMSIS Data Outputs

Level of Care by Population Tables

Population Density - Rate per sq mile	Level of Care of this Unit	Count of Events
<=10	ALS-AEMT	60,675
	ALS-Community Paramedicine	850
	ALS-Intermediate	45,666
	ALS-Nurse	7,959
	ALS-Paramedic	509,195
	ALS-Physician	232
	BLS-AEMT	8,674
	BLS-Basic /EMT	221,032
	BLS-Community Paramedicine	199
	BLS-First Responder/EMR	9,233
	BLS-Intermediate	4,843
	Not Recorded	177,647
	Specialty Critical Care	40,311
>=1000	ALS-AEMT	816,223
	ALS-Community Paramedicine	45,377
	ALS-Intermediate	281,477
	ALS-Nurse	73,095
	ALS-Paramedic	36,090,676
	ALS-Physician	7,203
	BLS-AEMT	458,366
	BLS-Basic /EMT	15,798,981
	BLS-Community Paramedicine	9,585
	BLS-First Responder/EMR	648,869
	BLS-Intermediate	170,184
	Not Recorded	6,279,054
	Specialty Critical Care	1,036,401
100-999	ALS-AEMT	689,322
	ALS-Community Paramedicine	40,985
	ALS-Intermediate	254,996
	ALS-Nurse	31,726
	ALS-Paramedic	20,161,964
	ALS-Physician	4,136
	BLS-AEMT	296,642
	BLS-Basic /EMT	4,970,445
	BLS-Community Paramedicine	5,776
	BLS-First Responder/EMR	212,245
	BLS-Intermediate	101,635
	Not Recorded	3,488,905
	Specialty Critical Care	795,388

Population Density - Rate per sq mile	Level of Care of this Unit	Count of Events
11-99	ALS-Community Paramedicine	13,755
	ALS-Intermediate	184,440
	ALS-Nurse	27,525
	ALS-Paramedic	7,096,260
	ALS-Physician	2,100
	BLS-AEMT	126,377
	BLS-Basic /EMT	1,615,088
	BLS-Community Paramedicine	1,846
	BLS-First Responder/EMR	87,816
	BLS-Intermediate	38,421
	Not Recorded	1,174,315
	Specialty Critical Care	376,476
Not Recorded	ALS-AEMT	140,417
	ALS-Community Paramedicine	3,784
	ALS-Intermediate	49,851
	ALS-Nurse	20,457
	ALS-Paramedic	4,087,313
	ALS-Physician	2,071
	BLS-AEMT	85,036
	BLS-Basic /EMT	2,178,672
	BLS-Community Paramedicine	949
	BLS-First Responder/EMR	30,682
	BLS-Intermediate	17,055
	Not Recorded	995,231
	Specialty Critical Care	400,209

Glossary:

Ambulance Deserts – Locations further than 25 minutes from an Ambulance Station

CPR – Cardiopulmonary Resuscitation

CVFRS – Charlotte Volunteer Fire and Rescue Services

DOT – Department of Transportation

EMS – Emergency Medical Services

EMT – Emergency Medical Technician

EMT – Defibrillation – EMT or EMT-I with an adjunct certification to defibrillate

EMT-I – EMT–Intermediate

EMT – IV – EMT or EMT-I with an adjunct certification to provide IVs

EMT-P / Paramedic – EMT–Paramedic

IFT – Interfacility Transport

IOM – Institute of Medicine

IREMS – Initiative for Rural EMS

MVC(s) - Motor Vehicle Collision(s)

NAS - National Academies of Science

NEMSIS – National Emergency Medical Service Information System

NREMT – National Registry of EMTs

NTSB – National Transportation Safety Board

Service Areas – Region served by a distinct EMS agency(s)

VARS – Vergennes Area Rescue Squad

VTEMS – Vermont EMS

VTEMS D3 – Vermont EMS District 3

VTEMS D13 – Vermont EMS District 12

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Unless otherwise noted all data tables and statistical queries compiled by author utilizing the NEMSIS data cube using data with approval by NHTSA under the below noted terms:

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Unless otherwise noted all cartography done by author on ArcGIS using publicly available data with specific data sources noted at bottom of each map.

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