

Social Vulnerability of Pediatric Populations Living in Ambulance Deserts



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KEYWORDS

- Ambulance deserts • Rural health • Socioeconomic • Poverty • Uninsurance
- Mortality risk

KEY POINTS

- An ambulance desert (AD) is defined as a populated area outside of a 25-minute drive time from where an ambulance is located.
- Many (approximately 20%) of those in rural areas living in ambulance deserts are children.
- Children living in ADs are also challenged by having a greater proportion of adverse social determinants of health, such as poverty and uninsurance.
- The potential for adverse health outcomes among vulnerable children experiencing acute illness or injury within ADs deserves further study.

INTRODUCTION

Of the 4.5 million people living in areas of the United States with limited access to ambulance services (referred to as ambulance deserts [ADs]), approximately 1 in 5 (20%) are children aged 18 years and younger.¹ Ambulance deserts are defined as populated areas in the United States that are not accessible within 25 minutes of where an ambulance is stationed.² This lack of timely response to a 911 call by emergency medical service (EMS) providers can result in serious adverse health consequences, including death, for children and families facing an acute illness or injury.

Most people expect that when they call 911 an ambulance staffed by trained professionals will come to their aid within a reasonable time frame, and then treat and

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transport them to the nearest hospital or emergency department if necessary. Unfortunately, this expectation is limited to communities that have the resources necessary to support an ambulance service and that have community members who are willing and able to staff their local ambulance service, often on a volunteer basis.^{3–5} Less than 10% of ambulance services are affiliated with local hospitals or clinics^{6–8} and have not been well integrated into the health care sector(s). The reasons for this lack of integration are in part linked to how ambulance services were originally regulated and funded. The gaps in coverage illustrated by the AD study have provided evidence that the current regulations governing ambulance service provision are not adequately supporting and reimbursing ambulance services and are in need of reform.

Historically, ambulance services have been viewed as a transportation service and overseen by the US Department of Transportation.⁹ With the technological development of portable medical devices and procedures, ambulance services have transitioned from a transportation role to the provision of medical services, capable of saving lives and administering care out in the field. Unfortunately, much of the care provided by EMS providers is not billed and paid for by health insurance carriers. Insurance reimbursement for prehospital services has been limited to instances when EMS providers bring patients to the hospital or emergency department.¹⁰ However, EMS providers not only play a critical role in caring for patients experiencing a traumatic injury or illness, but they also serve an important role in responding to calls and caring for patients who do not need to be hospitalized or brought to the emergency department.

In addition to the fact that the EMS field has been evolving and is gaining recognition as an important component of the health care infrastructure, rural areas face additional challenges when it comes to financial sustainability. Even if insurance carriers and third-party payors were to reimburse EMS providers for responding to all 911 calls and for providing health care and/or public health services out in the community, other issues make it challenging for ambulance services to sustain themselves financially. The low volume problem that has plagued rural hospitals and clinics is also an issue for EMS providers. EMS providers are not typically reimbursed for time spent on call and time spent behind the wheel when responding to calls. Driving long distances round trip in remote rural areas, along with supporting the high fixed costs associated with equipping ambulances with the latest technology has made it difficult for ambulance services to break even.¹¹ The high fixed and variable costs associated with setting up a rural ambulance service, and training/maintaining EMS certification, has led to many communities imposing mill levies, collecting donations, and holding fundraising activities to support their local ambulance service(s).

Many communities have been relying on volunteers willing to take on the costs associated with training and certification. Aging rural communities, along with the out-migration of young people, has led to the erosion of rural communities' volunteer base,^{12,13} leading to many ambulance services closing because of staffing shortages.

The combination of these factors has led to gaps in the provision of ambulance services known as ADs. Prior work funded by the Federal Office of Rural Health Policy (FORHP) within the Health Resources and Services Administration (HRSA) has documented that ADs are more likely to exist in rural areas. Because Maine ranks among the most rural states in the nation, researchers at the Maine Rural Health Research Center have a strong interest in determining the extent to which rural pediatric populations live in ADs and identify the socioeconomic risk factors associated with living in ADs nationwide.

The next section discusses the unique needs of rural pediatric populations, and the risks associated with lacking adequate EMS services trained to care for pediatric

patients. This is followed by the authors' findings from a state-level analysis of the variation in the socioeconomic characteristics of pediatric populations living in ADs. Finally, the need for reform options that will facilitate expanding the footprint of EMS providers in rural communities is discussed.

DISCUSSION

Rural Pediatric Health and Health-Related Social Needs

Previous studies have documented that rural children are more likely to live in poverty,¹⁴ live in primary care and mental health professional shortage areas,¹⁵ and have limited access to dental¹⁶ and telehealth services,¹⁷ as well as suicide prevention or family crisis services.¹⁸

Pediatric Mortality Risks

A recent study (2021) found that rural children tend to be at higher risk of death due to unintentional injury (12.4%) compared with their urban peers (6.3%).¹⁹ Deaths among children were driven primarily by accidents and other injuries, including motor vehicle accidents, drowning, fire, suffocation, firearm injuries, and poisoning. Rural children's mortality rates associated with motor vehicle accidents were twice as high (3.1%) as urban child mortality rates (1.5%), and motor vehicle accidents were the leading cause of death among children aged 5 to 13 years. A study conducted in Wisconsin found that teenagers aged 15 to 19 years had the highest rate of pediatric ambulance runs, with motor vehicle accidents representing the most common type of injury.²⁰

Rural-residing children experience higher suicide mortality than children living in urban areas.²¹ During the coronavirus disease 2019 (COVID-19) pandemic, rural pediatric emergency department visits and subsequent hospitalizations for suicide or self-harm increased significantly, highlighting a pressing need to find ways to meet the behavioral health needs of rural pediatric populations.²¹

Rural Emergency Medical Service Pediatric Capabilities

Children represented a modest share of all EMS responses (6.3% of 911 responses in 2019,²² 13% of EMS transports from 1997 to 2000²³). Based on data from the 1997 to 2000 National Hospital Ambulatory Medical Care Survey, children's annual EMS utilization rates were 26 EMS visits per 1,000 children compared with 66 EMS visits per 1,000 adults ($P < .001$).²³ Approximately two-thirds (62%) of pediatric patients were transported because of injury or poisoning.²³

EMS agencies face unique challenges when responding to pediatric calls, which may lead to poorer quality of care compared with adults. For example, EMS providers may lack training or have limited opportunity to practice skills on pediatric patients.^{24–26} A statewide study of pediatric behavioral health-related EMS encounters in Florida found that 25% of calls were related to substance use and that EMS services were ill equipped to care for pediatric patients, particularly in areas where limited psychiatric services were available.²⁷ Another study found Tribal EMS services generally faced higher than average ratios of ambulance to service populations and often lacked medical directors and the ability to provide pediatric continuing education.²⁸ In addition, ambulances may lack equipment in the sizes optimal for serving pediatric patients.²⁶ These challenges may be worse among rural EMS providers with lower volume, particularly in EDs.

Ambulance Deserts and Pediatric Populations

Given children's vulnerability to accidents and sudden illnesses, living in rural areas—particularly ADs—may present unique risks for children. In an AD, where access to

timely emergency medical care is limited, the inability to swiftly respond to these emergencies significantly increases the risk of adverse outcomes including morbidity and mortality. Without prompt access to emergency medical care, even minor incidents can escalate into life-threatening situations. Prolonged response times may lead to poorer outcomes for children in acute medical crises, such as severe allergic reactions, respiratory distress, or traumatic injuries.

To address causes and solutions to rural ADs it is critical to understand adverse social determinants of health affecting children. The authors addressed the socioeconomic characteristics and geographic location of pediatric populations living in ADs within 8 states within the continental United States: Northeast (Vermont and Maine), South (Texas, North Carolina), West (Montana, New Mexico) and the Midwest (Indiana, Missouri).¹ Census block-level AD data were obtained from the Maine Rural Health Research Center. The socioeconomic characteristics of children living in ADs were obtained from the 2016 to 2020 American Community Survey 5-year estimates and included age, gender, race, education levels, employment status, federal poverty levels (FPLs), geographic location, and insurance status.²⁹ Rural urban continuum codes were used to identify ADs falling within rural and urban counties,³⁰ while the 2019 rural urban commuting area (RUCA) codes were used to identify ADs within each of the 4 categories of urban, large rural, small rural, and isolated small rural census tracts.^{31,32} Ambulance locations and deserts were identified and mapped using the ArcGIS Desktop ArcMap version 10.8.1.³³

Using these research methods, pediatric risk factors associated with living in ADs included: living in more remote rural locations, older pediatric populations (particularly teenagers aged 15 to 17 years), being Native American, living in high poverty areas, and living in areas with high uninsurance rates. The fact that teenagers aged 15 to 19 years experienced among the highest mortality rates for motor vehicle crashes²⁰ and the fact that they also face among the highest odds of living in ADs, accentuates the need to address these gaps in acute care services. This same study documented that more remote rural locations tended to have higher rates of pediatric ambulance runs, an alarming statistic given that the AD study has documented that pediatric populations living in more remote rural locations are 8 times more likely to live in ADs.

The authors documented significant variation in racial and ethnic disparities across the states, illustrated by relatively high concentrations of Hispanic populations living in ADs in Texas and New Mexico. Native American populations were also at greater risk of living in ADs and were more likely to live in rural areas. Thus, identifying factors that place pediatric minority populations at risk for accessing ambulance services, and integrating and supporting Tribal EMS services within the overall network of ambulance services throughout the states are important policy issues that state EMS offices will need to consider.

Of concern to the sustainability of rural ambulance services is that rural pediatric populations are more likely to refuse transport to an emergency department, particularly among calls taken by Tribal EMS agencies.²² In order to bill for services, current reimbursement policies require that ambulance services transport patients to an ED. Reasons underlying transport refusals, and the impact on patient safety and the financial sustainability of rural ambulance services warrant further study.

SUMMARY

Gaps in the provision of ambulance services are placing children at risk of adverse health outcomes associated with acute illness or injury, particularly in remote rural locations. Given that rural pediatric populations tend to be more socially vulnerable than

urban populations, are more likely to live in health professional shortage areas and face higher mortality and morbidity risks associated with illness or injury than their urban peers,¹ rural ambulance services capable of treating vulnerable pediatric populations are of critical importance. In many remote rural areas throughout the United States, ambulance staff are often the first and only point of care and are an important safety net for areas with high concentrations of uninsured rural populations.³⁴ Finding ways to support ambulance service safety nets in impoverished remote rural locations throughout the United States and ensure that ambulance crews have the proper training to care for pediatric populations should be a high priority among state and federal policy makers.

Promoting reforms that ensure access to timely ambulance services among children, including minority populations living in rural areas, as well as alternative models that support the financial viability of rural EMS while enabling access to coordinated primary and emergent care is an important area of policy concern. Aside from strategies to address workforce shortages by incentivizing health care providers to serve in rural areas,³⁵ proposed (rural) solutions to address social determinants of health, acute behavioral health issues, and acute chronic conditions such as asthma³⁶ and seizures³⁷ include telehealth¹⁷ and expanding EMS-based services in the community. The business case for reimbursing EMS providers caring for patients outside the walls of a health care facility is slowly gaining momentum within emerging models of EMS services known as community paramedicine or mobile integrated health (MIH).^{27,38,39}

Low volume issues and the high costs associated with variable (eg, staff training, standby/on call hours) and fixed (eg, ambulance and equipment) costs imply that rural ambulance services struggle to break even based on the traditional reimbursement model of bringing patients to the hospital or the emergency department. Other rural providers, including critical access hospitals facing similar issues have advocated and received cost-based reimbursement,^{40,41} a concept that policymakers interested in sustaining and filling rural ambulance coverage gaps have been exploring.

In closing, in lieu of badly needed federal and state level reforms, communities interested in supporting the provision of EMS services have been doing so at a grassroots level. To address the need to support communities in their strategic planning efforts, the Maine Rural Health Action Network has developed a toolkit to help communities identify the level of services that they can support using a process referred to as informed community self-determination (ICSD).⁴² This process enables rural community members to work with a team of ICSD guides to evaluate their existing service(s), identify issues, as well as resources and solutions, and guide communities toward developing the type of ambulance service that meets their needs. While EMS providers have traditionally relied on grassroots efforts to organize and support their services, documenting the prevalence of ambulance deserts throughout the United States and the extent to which vulnerable populations, such as children, are living in them, has provided policymakers with the evidence needed to propose much needed policy reforms that will help ensure access to ambulance services.

CLINICS CARE POINTS

- ADs lead to increased pediatric morbidity and mortality.
- Rural communities are less likely to have the financial and personnel resources to support a robust EMS system.
- Rural EMS systems are challenged by a lack of expertise in caring for pediatric emergencies.

- A collaborative system of care that integrates regional pediatric experts with rural EMS programs using simulation training and telemedicine could help bridge the current AD gap.

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