

Emergency Medical Services in Response to Motor Vehicle Crashes in American Indian Reservations and Communities

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Abstract: The focus of this exploratory study is emergency medical response (EMS) for motor vehicle crashes (MVCs) in American Indian reservations and communities, where an average of 656 MVC fatalities occur each year. We conducted a national survey of tribal governments, first responders, and others with strategic perspectives on the quality, strengths, and needs of EMS response in these regions. We summarize the input of 189 study participants about the overall quality of EMS response and factors contributing to the effectiveness of the EMS system in the communities where they work. Questioned about eight steps of EMS response (from placing a 911 call through transfer to a trauma center), respondents expressed least confidence in the very first step, on which all other stages of response typically hinge: 58% of all respondents assert that cell phone signal is not adequate to place 911 calls. Study participants from Alaska and the Pacific Northwest were more concerned about all aspects of EMS response systems than were respondents from other regions. Only 40% of respondents from Alaska and the Pacific Northwest (compared with 77% of all other respondents) agreed that people injured in MVCs could be transferred to an emergency room in timely manner; they were also less likely to judge EMS quality in their communities to be equitable with EMS quality in adjacent, non-Native areas. Across all questions, study respondents with tribal government affiliation were consistently more optimistic regarding EMS response to MVCs in reservations than respondents without such affiliation with tribal governments. Based on this exploratory study, we present five recommendations about research questions and methods for additional research. *The authors are presenting this paper at the CICD conference for discussion as a pre-Covid baseline for a follow-on study that we hope to conduct. The proposed study would be a longitudinal comparison of pre- and post-Covid emergency medical response service quality and gaps in reservations, conducted with an eye towards recommendations for EMS improvement.*

Introduction

Motor vehicle crashes (MVCs) are one of the leading causes of injuries to American Indian and Alaskan Native (AIAN) populations.^{1,2} Indeed, MVCs are the leading cause of unintentional injury for AIAN people ages one to 44.³ Their MVC fatality rate is the highest of any U.S. ethnic or racial group,⁴ and their rate of hospitalization due to MVC-related injuries is twice the rate of the general U.S. population.⁵ An average of 656 fatalities per year have been reported in the 5-year period from 2010 to 2014 in reservations and other tribal areas where tribal governments have the greatest influence on engineering, enforcement, emergency medical services, and education.⁶

This exploratory study focuses on one potential factor in the high fatality rate: *the quality of emergency medical services (EMS) response to MVCs in American Indian reservations and communities*. There is emerging concern regarding the influence of EMS quality on MVC fatality rates in American Indian reservations and communities. For example, recent geospatial analyses found that the length of travel time from most points on the road system in reservations in California⁷ and Washington⁸ to the closest emergency room is over one hour, suggesting that effective EMS response time is a concern. Given these concerns, some tribes have begun to explore creating their own tribally operated medical airlift services to serve their communities (Figure 1).

The impetus for this study is that American Indian transportation leaders have named this topic as a high priority for research. In 2017, the Federal Highway Authority's Tribal Transportation Program designed a national survey of tribes to assess their priority concerns about transportation safety issues in reservations. When asked to identify the top three sources of roadway safety risk on their reservations, 27 (18%) of 150 tribal government respondents

selected “slow emergency response time.”⁹ Improving EMS response to crashes was subsequently identified as one of seven priority areas in the Tribal Transportation Strategic Safety Plan⁶ and one of five emphasis areas in the subsequent report to Congress, *Options for Improving Transportation Safety in Tribal Areas*.¹⁰ All of these reports were authored by Native-led committees or are products of data analysis provided directly by public safety, engineering, injury prevention, and law enforcement staff of tribal governments.

Thus, among people with the greatest knowledge and interest in roadway safety on reservations, there are many questions about the quality of EMS response in their communities. However, no systematic research has been conducted to identify what, if any, EMS problems exist in American Indian reservations and communities. Because little research has been conducted on the quality of EMS response to MVCs in reservations, we designed this research project as an exploratory study to improve the initial scoping of the nature of an emerging, poorly defined public policy problem.^{11, 12}

Methods

This study consisted of a national survey of people with immediate knowledge and interest in roadway safety on reservations to collect and analyze their insights about EMS as a factor in MVC fatalities. We conducted an online survey administered through Qualtrics® during a 38-day period from January 28 through March 6, 2019. The survey was distributed using a purposeful sampling strategy to secure participation from respondents with particularly relevant knowledge of the topic.^{13,14} We were particularly interested in the perspectives of transportation professionals working with tribal governments because they have the most immediate, direct knowledge of risks and options to improve roadway safety in reservations. Practical, experiential knowledge is especially valuable for understanding complex systems in which localized

dynamics are particularly salient to problem-solving¹⁵ such as EMS needs and response systems. Therefore, we distributed the survey through four email lists: (1) the tribal chairperson or administrator identified by the Bureau of Indian Affairs as the lead contact of each federally recognized tribal government (583 individuals); (2) the police chiefs or other key contacts for Bureau of Indian Affairs (BIA) and tribal law enforcement agencies, as of 2016 (204 individuals); (3) the lead staff from state departments of transportation working with tribes (71 individuals); and (4) other strategic stakeholders (307 individuals). The list of other strategic stakeholders was assembled by the research team to include individuals who have expertise or interest relevant to this project, including members of the Tribal Working Group of the First Responder Network Authority, the lead contact person for all current and prior Federal Highway Administration (FHWA) Tribal Transportation Assistance Program offices, all members of the Transportation Research Board's standing committee on Native American Transportation Issues, and other scholars and professionals who have published or expressed an interest in roadway safety in reservations. We encouraged the recipients to forward the survey to others with particular interest or information on the topic.

To inform the development of the survey instrument, we searched literature in the transportation, public health, public safety, and regional planning fields for studies on tribal transportation safety issues and EMS quality in reservations.^{9, 16, 17} Prior research specifically on the topic of EMS response to MVCS in reservations is limited. We therefore constructed the survey based upon recognized barriers to effective EMS response in rural areas (e.g., address and mapping data for emergency dispatch, access to MVC sites in remote areas, travel times to emergency rooms or trauma centers, the coordination of different providers in the chain of care).^{18,19} We also consulted with two leading research-oriented groups of tribal transportation

safety experts, including the Tribal Transportation Safety Management System Steering Committee and the Native American Transportation Issues Committee of the national Transportation Research Board. Based on the information obtained through the literature review and these consultations, we identified the topics for inclusion in the survey.

Ambulatory, hospital, and trauma center access. The accessibility of hospitals and emergency services to MVC sites on the reservation is important, given the high percentage of remote and rural areas found in Indian country and the difficulty in collaboration and effective transportation planning. Even when Indian Health Service (IHS) facilities are present on reservations, they are not necessarily sufficient or physically accessible to serve the entire reservation population.²⁰ An analysis of hospitalization rates in California found that for injuries that in theory can be cared for solely through ambulatory care without hospital admission, AIAN people are hospitalized at twice the rate of the California population as a whole; the authors concluded that the disparity was partly due to the absence of adequate ambulatory care, including care from EMS first responders, at an MVC site for AIAN people.²¹ Therefore, we included survey questions about the training and resources of first responders providing ambulatory care and the time needed for transfer to hospitals and trauma centers.

Inter-governmental relations in reservations. Roadway safety demands strong collaboration across multiple sectors, disciplines, and levels of government.²² Indeed, EMS response chains involve complex hand-offs among organizations, between tribal and nontribal 911 dispatch centers, law enforcement (e.g., tribal police, city police, county sheriff, state patrol), first responders, and medical clinics.²³ Effective coordination among all of these actors becomes all the more important in the landscape of reservations,^{17,24} yet it seems to be even more challenging due to questions of sovereignty and jurisdiction. In theory, tribal sovereignty could

simplify roles and authority for transportation safety planning and response,²⁵ yet there is frequently confusion or outright conflict over whether tribal, federal, state, or local government has authority, responsibility, and rights over territory, populations, road ownership, and policing.^{26, 27, 28} Therefore, we included survey questions about who provides what aspects of EMS response in American Indian reservations and communities, the presence and/or absence of inter-jurisdictional agreements, and whether inter-jurisdictional coordination supports effective EMS response.

We also gathered data on study participants' attitudes in the following areas: the extent of their concern about MVCs; their comparison of EMS response in reservations and other areas; their assessment of the quality of factors contributing to the overall functioning of the EMS system (e.g., 911 and dispatch system, the accessibility of MVC locations, the training and equipment of responders, and distance to hospital or trauma center); residents' confidence about calling 911 for help; and the quality of inter-jurisdictional coordination for EMS response. Respondents estimated the length of time required for EMS response, provided data on aspects of EMS response in their area, and supplied basic demographic information. The survey consisted of a set of closed-ended questions and one optional, open-ended question in which respondents could share their concerns and observations in their own terms, including their two to four highest priorities for improving EMS response in the American Indian reservations and communities where they work.

To reduce respondent fatigue and to encourage completion, we limited the length of the survey so it required 6-8 minutes to complete, and we informed potential respondents of that expectation in our invitation to participate. The survey was designed using well-recognized best practices for avoiding bias in responses, including randomizing the list order for "check all that

apply” menus of possible responses (e.g., identifying respondents’ roles as community leader, injury prevention specialist), avoiding framing language that could steer their input in a particular direction, and varying the order of questions with similar response format (e.g., a Likert scale of strongly disagree to strongly agree for statements about respondents’ perceptions of conditions in the American Indian communities/reservations where they work, such as “There are many road-related injuries,” and “EMS response to road-related injuries is adequate”).²⁹ In addition, we avoided double negatives and used terms that we observed to be in common usage in our four preceding years of ethnographic research with transportation and safety professionals working in reservations.³⁰

Data analysis of close-ended questions consisted of calculating the percentages of study participants selecting each option from the menu of optional responses. We also performed Pearson’s chi-squared tests to evaluate the probability that differences between: a) study participants from Alaska and the Pacific Northwest and other areas arose by chance; and b) study participants with a tribal government affiliation and without a tribal affiliation arose by chance. Analysis of textual responses to open-ended questions was performed using commonly used qualitative research methods of iteratively identifying themes, coding data for themes, and identifying patterns of convergence and divergence within the themes;³¹ the results from the open-ended questions, along with analysis of 20 follow-up interviews with selected survey participants, will be reported in a separate paper.

Results

The survey was distributed through four email lists to 1,165 individuals or organizations, including tribal leadership (583 people), law enforcement (204 people), state government tribal liaisons (71 people) and other strategic stakeholders (307 people). We attempted to find updated

contact information when our initial invitations bounced back; approximately 3% (35) of the invitations could not be delivered. Out of the 1,133 invitations that did not bounce back, a total of 189 individuals participated, with an estimated response rate of 17%.¹ Respondents were permitted to answer only questions they felt sufficiently well informed to answer. A majority (72%) of study participants (n=189) answered all survey questions. Demographic information was collected from study participants, including their job position, organizational affiliation, and region of the country (Table 1).

Key Finding 1: High levels of concern about roadway safety in reservations

We asked two questions regarding respondents' assessment of road safety issues in the American Indian communities and reservations where they work. The responses indicate a high level of concern, with 91% (137 of 150) strongly or somewhat agreeing that "Road safety is a serious issue" and 77% (115 of 150) strongly or somewhat agreeing that "There are many road-related injuries" (Table 2).

Key Finding 2: Bottlenecks in EMS response systems

The survey asked respondents to compare EMS response quality between reservations and adjacent areas; 50% (76 of 150) judged it to be about the same, while 42% (63) judged it to be worse on reservations and 7% (11) judged it to be better. We then asked 10 questions regarding the quality of EMS response specifically in reservations (Table 3). The first two were general questions about whether EMS response is adequate and well-coordinated, and the data indicate some dissatisfaction with the quality of the EMS system as a whole. Asked if EMS response to road-related injuries is adequate, 40% (60 of 150) somewhat disagreed or strongly

¹ We do not know how many people received the survey out of the 1,133 emails that did not bounce back. Also, we intentionally utilized a snowball sampling strategy in which we asked email recipients to forward the invitation to other individuals who have particular knowledge and interest in the topic. Therefore, we can only estimate a response rate of 17% (189 respondents out of the 1,133 emails that did not bounce back).

disagreed, while 27% (41 of 150) somewhat or strongly disagreed that EMS coordination is good among the groups that need to work together.

The other eight questions concerned specific aspects of a sequence of EMS response, beginning with the initial call (e.g., cell phone signal is adequate for 911 calls), through dispatch (e.g., dispatchers and responders can accurately locate the crash site), through first responder access and training (e.g., first responders can easily get to crash sites), through treatment in an emergency room or trauma center (e.g., a nearby hospital is ready to handle most road-related injuries). A 911 call is usually the first step in activating EMS response to a MVC. Study participants demonstrated the lowest level of confidence in this facet of EMS response (Table 3). Asked if cell phone signal was adequate for 911 calls, 58% (83) of respondents (n=143) disagreed (31% somewhat disagreed and 27% strongly disagreed). In the areas in which there was *highest* confidence – the availability of a nearby hospital prepared to handle most road-related injuries, and the adequacy of the training and equipment of first responders – a much smaller number of study participants (83 respondents) answered the question.

Key finding 3: Elevated concern from Alaska and the Pacific Northwest

Study participants in Alaska and the Pacific Northwest (US Department of Transportation Region 10) were more concerned about EMS systems in AIAN reservations, villages, and communities, compared with the rest of the country (Figure 2). Not all respondents from this region (or others) answered all questions, but we broke all responses into two regional sub-populations (Alaska and Pacific Northwest vs. all other) to test regional differences. In three aspects of EMS response quality, statistically significant ($p < 0.05$) differences were found:

- *Time to hospital transfer.* Asked to estimate, on a sliding scale, how many minutes it usually takes after an MVC to transfer the injured to a hospital, if needed, respondents

from Alaska and the Pacific Northwest (n=39 respondents) on average estimated 72 minutes, versus 41 minutes for all other regions combined (n=89 respondents) ($p=0.005$).

- *Emergency room access.* Asked if injured persons could be transferred to an emergency room in a timely manner if needed, 60% (30 of 50) of Alaska and Pacific Northwest respondents somewhat disagreed or strongly disagreed, compared with 33% (31 of 93) of respondents from all other regions ($p = 0.018$).
- *EMS service equity for American Indian reservations or communities and surrounding areas.* Asked whether service was “better, worse, or about the same” for American Indian or Alaska Native reservations and communities compared with surrounding regions, 46% (28 of 52) of Pacific Northwest respondents, compared with 39% (38 of 98) of respondents from other regions, considered EMS service *worse* on the reservations than for surrounding communities ($p = 0.041$). Notably, 0% (0 of 52) of respondents from Alaska and the Pacific Northwest considered EMS response in American Indian communities to be better, whereas 11% (11 of 98) of respondents from other regions considered service better on reservations.

Key finding 4: Greater optimism from tribal governments compared to study participants from other organizations

The fourth notable finding is that study participants who are currently affiliated with tribal governments consistently have more optimistic views about roadway safety and the ability of EMS to adequately respond to emergencies in reservations in comparison with study participants without tribal government affiliation (Figure 3). For five of the ten questions about the quality of the EMS system overall or specific facets of the system, statistically significant differences were found at the $p<0.05$ or $p<0.01$ level:

- *Seriousness of MVC issues in reservations.* Asked if there are many issues with road-related injuries in reservations, only 72% (78 of 109) of tribal government affiliates somewhat agreed or strongly agreed, compared with 88% (50 of 57) of respondents without tribal affiliation ($p = 0.0072$).
- *Quality of EMS response.* Asked if EMS response to road-related injuries is adequate, 68% (70 of 109) of tribal government affiliates agreed or strongly agreed, compared with 44% (25 of 57) without tribal affiliation ($p = 0.016$).
- *Dispatch quality.* Asked if dispatchers and responders could accurately locate the site, only 37% (40 of 107) of tribal respondents somewhat disagreed or strongly disagreed that they could, compared to 58% (30 of 52) of non-tribal respondents ($p = 0.012$).
- *Ability to access MVC sites.* Asked if first responders can easily get to crash sites, only 27% (29 of 107) of tribal government affiliates somewhat disagreed or strongly disagreed that they could, compared to 54% (28 of 52) of non-tribal respondents ($p = 0.0067$).
- *Airlift options.* Asked if timely airlift to a trauma center is possible when needed, only 26% (28 of 107) of tribal government affiliates somewhat disagreed or strongly disagreed that this would be possible, compared to 61% (21 of 52) of non-tribal respondents ($p = 0.019$).

Discussion and Recommendations

This study was by design exploratory, intended to improve initial understanding of an under-studied but consequential public health problem, namely the quality of EMS response to MVCs in American Indian reservations and communities. While definitive conclusions cannot be reached from these data given the study design and small sample size, the study does accomplish

a few intended purposes of exploratory research, including identifying key areas of concern and scoping topics for additional research. Having anticipated a modest number of respondents, we intentionally used a theoretical sampling strategy of asking people with particularly relevant knowledge of MVC and EMS issues in reservations to optimize the quality of the input. The great diversity of reservation settings is both an asset and a liability in this national survey; contextually specific responses will likely be most effective in improving safety in given reservations.

However, in one area there is a strong convergence of concern at the national level, suggesting that it should be a priority to address this issue, namely a bottleneck at the first stage in activating EMS response. Of all stages of EMS response, study participants are *least* confident that cell phone coverage is adequate to place a 911 call for help (Table 3). ***This is particularly troubling because a 911 call is usually the first step in activating EMS response to a MVC, with all subsequent steps hinging on this step.***

We utilized good practices for survey design, as described in the methodology, but unintended effects can still ensue from language choice, the format and order of questions, and other aspects of study characteristics (e.g., low response rate). For example, in this paper we have not interpreted the results of our question about “residents’ confidence about calling 911 for help,” because the presence or absence of “confidence” may reflect multiple factors, including their ability to reach a dispatcher, their trust that police or other first responders will treat them with respect and competence, their anticipation of the overall performance of the EMS system, etc. We asked the question in an open-ended way to avoid leading and to discover whether there are confidence issues which would merit additional, more focused further study, which we now intend to pursue.

EMS response to MVCs is a high stakes issue for American Indian and Alaska Native people, reservations, and communities. This exploratory study finds several areas of concern that merit additional analysis. We recommend additional research specifically in these five areas:

1. ***Focus on dispatch issues in reservations, particularly relating to cell phone coverage and dispatchers' ability to pinpoint MVC sites.*** Dispatch effectiveness was the study participants' area of highest concern, and all other components of an effective EMS response depend on the ability to place the first call for help.
2. ***Focus additional sub-regional data collection and analyses on Alaska and the Pacific Northwest.*** This region is home to many AIAN communities and is too geographically and culturally diverse to generalize across the entire region. However, several findings of this study suggest that there is elevated concern that requires further analysis. Study participants from Alaska and the Pacific Northwest estimated that the average time between an MVC and transfer to an emergency room was 72 minutes (versus 41 minutes for other regions combined), which is well beyond the "golden hour," so named because people experiencing traumatic injuries from MVCs are much more likely to survive and avoid irreversible damage if they can receive emergency care in a hospital or trauma center within 60 minutes.³² At statistically significant levels, compared with all other regions of the country, study respondents from Alaska and the Pacific Northwest were less confident that people injured in MVCs could be transferred to emergency rooms in a timely manner and that EMS quality in American Indian reservations and communities was equitable with EMS quality in adjacent areas.
3. ***Investigate the reasons for differences in perspective between roadway safety stakeholders who are and are not affiliated with tribal governments.*** Almost always, the

group of respondents who work for tribal governments was *more optimistic* about roadway safety and EMS response than respondents who do not have a tribal government affiliation. This contradicts a previous study which found that roadway safety stakeholders who did not have direct, experiential knowledge of reservations consistently and strongly underestimated roadway safety risks for pedestrians in particular.¹⁷ On the other hand, there is a well-documented trend of associating life on reservations with tragedy, despite their beauty and meaning and the love that many native people have for these places,²⁸ so possibly roadway safety stakeholders from outside reservations pathologize reservation communities and exaggerate the severity of conditions through misplaced assumptions. Or, possibly the distinctions we observed between the two groups — which we defined to examine whether there might be differences — were artifacts of our categorization scheme or idiosyncratic features of our relatively small survey population. We recommend additional research because roadway safety in reservations is a highly complex problem that requires sophisticated coordination among organizations and groups of people with different knowledge bases, organizational functions, and jurisdictions.

4. ***Identify examples of productive inter-jurisdictional coordination.*** Effective EMS response depends on good coordination through the chain of response, from first responders to trauma centers. In rural areas generally, and especially in the complex checkerboard of tribal/nontribal land ownership and overlapping jurisdiction in reservations, often this involves multiple agencies. Therefore, to improve safety in reservations, both tribal organizational capacity and intergovernmental relationships may need to be strengthened (e.g., establish memoranda of understanding across

agencies). Identifying best practices and successful case stories and models could support this work.

5. ***Improve definitional clarity on these geographic regions.*** With over 650 MVC fatalities annually in reservations and communities where tribal governments have interest and responsibility, the issues of EMS response to MVCs in these areas is inherently important. However, some important definitional work remains to be done. Specifically, many injury prevention and transportation safety professionals conflate statistics referring to AIAN people (regardless of geographic location, including the approximately 78% who do not live in reservations) with statistics on MVCs of all people (AIAN and other) in reservations. There are good reasons for the heterogeneity of definitions, but confusing them makes it difficult to characterize the extent and nature of MVC problems, which may ultimately hamper implementing safety and EMS response improvements.



Figure 1. Launch of Oglala Lakota Air Rescue, the first native-owned medical airlift service, on July 2, 2019. Photo Source: Oglala Sioux Tribe.

Table 1. Respondent Demographics: Job Position, Organizational Affiliation, and Region of Country

Job Position	N=178	Percent
Roadway engineering, planning, or maintenance specialists	66	27%
Community leaders	39	16%
Law enforcement professionals	34	14%
Medical first responders (fire, ambulance, EMS)	29	12%
Injury prevention specialists	23	9%
Researchers	9	4%
Hospital or primary care providers	5	2%
Miscellaneous (tribal government chairpersons, tribal council members, grant writers, emergency response coordinators, safety data managers, state/federal government employees who liaise with tribes)	39	16%
Organizational Affiliation	N=178	Percent
Tribal government	118	59%
State government	29	15%
Bureau of Indian Affairs	14	7%
Business	7	4%
Other federal agency	6	3%
Local government	6	3%
University	6	3%
Region of Country	N=177	Percent
Alaska and Pacific Northwest	59	33%
Southwest and Hawaii	32	18%
South Central	25	14%
Upper Midwest	22	12%
Mountain/Rockies	21	12%
Southeast	7	4%
New York	4	2%
National/multi-region	3	2%
New England	2	1%
Central Midwest	2	1%

Table 2: Levels of concern regarding road safety: national sample of transportation safety specialists working in AI/AN reservations and communities (n=150).

	%				
	<i>Agree (strongly or somewhat)</i>	<i>Strongly disagree</i>	<i>Somewhat disagree</i>	<i>Somewhat agree</i>	<i>Strongly agree</i>
Road safety is a serious issue	91	1	7	32	59
There are many road-related injuries	77	6	17	42	35

Table 3: Levels of confidence in general and specific facets of EMS response: national sample of transportation safety specialists working in AI/AN reservations and communities.

	%				
	<i>Disagree (strongly or somewhat)</i>	<i>Strongly disagree</i>	<i>Somewhat disagree</i>	<i>Somewhat agree</i>	<i>Strongly agree</i>
General EMS quality questions					
EMS response to road-related injuries is adequate (n=150)	40	16	24	41	19
EMS coordination is good among the groups that need to work together (n=150)	27	10	17	43	19
Quality of aspects of EMS response					
Cell phone signal is adequate for 911 calls (n=143)	58	27	31	31	11
Residents are confident about calling 911 for help (n=143)	40	18	22	43	16
If needed, injured persons can be transferred to an emergency room in a timely manner (n=143)	43	16	27	38	19
Dispatchers and responders can accurately locate the crash site (n=143)	42	15	27	43	15
First responders can easily get to crash sites (n=143)	34	10	24	51	15
If needed, timeline airlift to a trauma center is possible (n=143)	31	6	25	43	26
A nearby hospital is ready to handle most road-related injuries (n=83)	28	8	20	49	22
First responders have the training and equipment to provide basic life support (n=83)	20	8	12	41	39

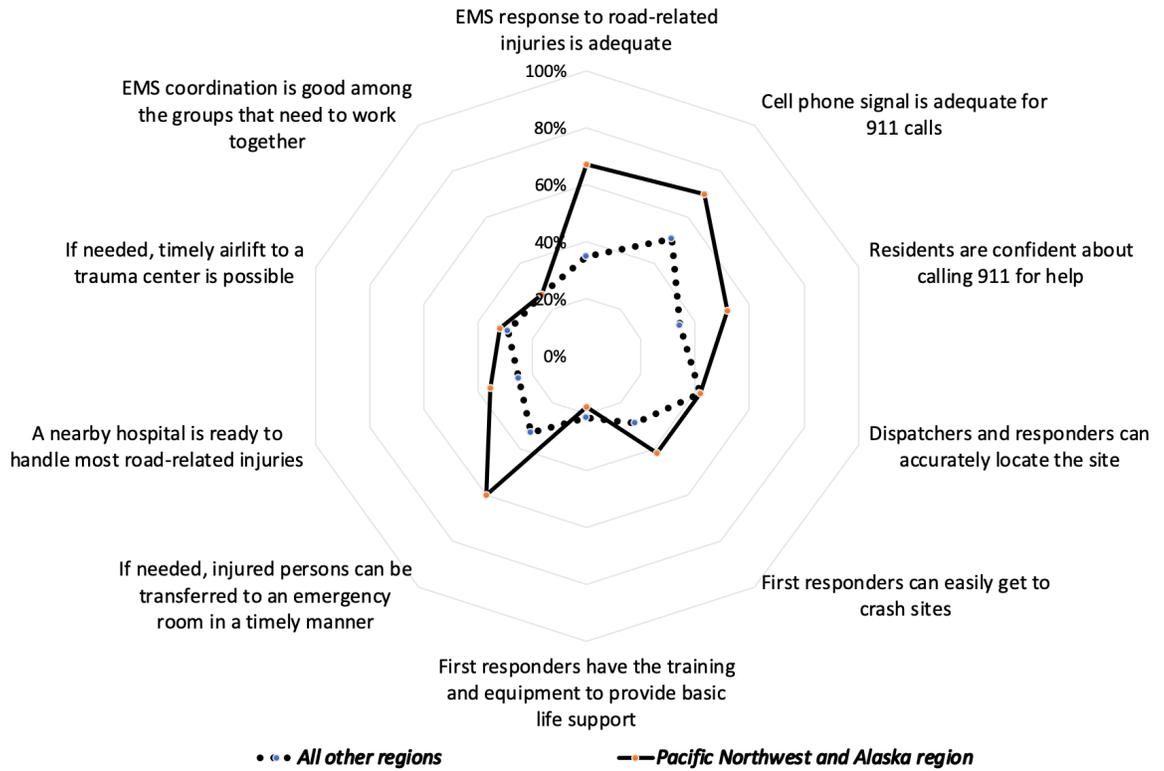


Figure 2: Heightened concern from Alaska and the Pacific Northwest (compared with other regions) about EMS service quality (total percentage who somewhat disagree or strongly disagree).

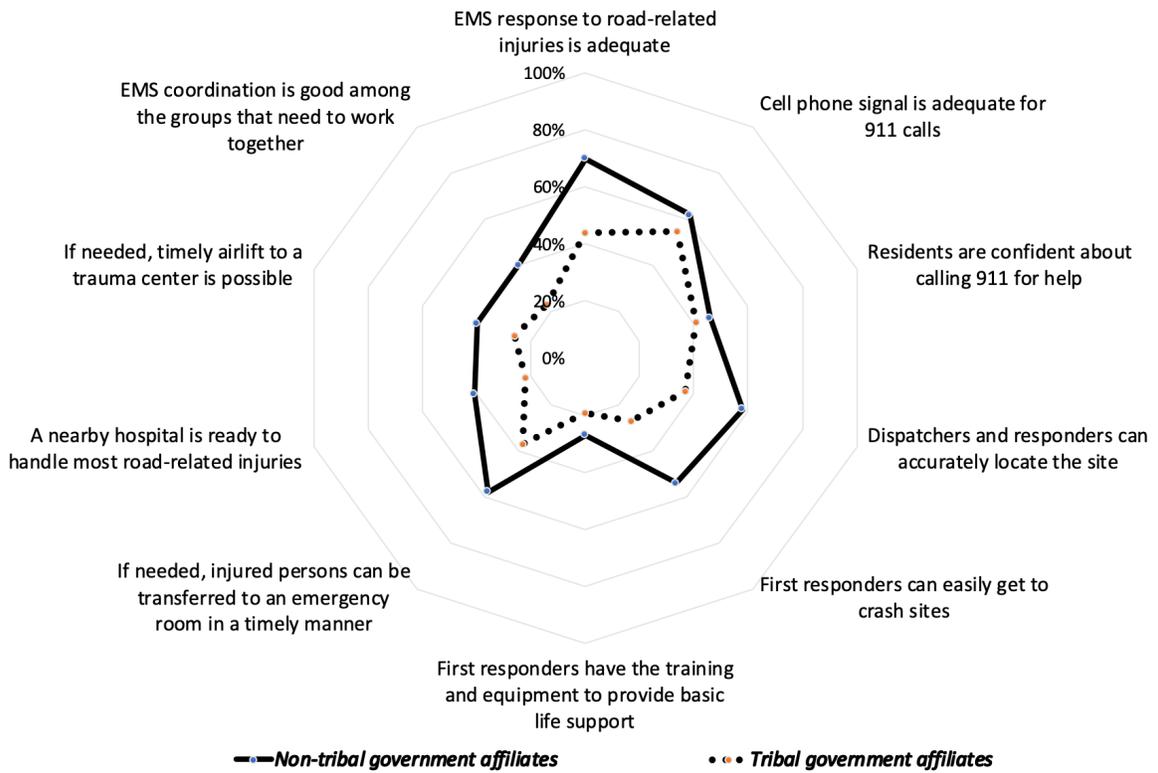


Figure 3: Heightened pessimism (total percentage who somewhat disagree or strongly disagree) among those without tribal government affiliation (versus those with tribal government affiliation) about EMS in reservations.

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