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Rurality as a factor in ambulance use in health emergencies

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Research

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Abstract

Introduction

Ambulance use in rural and remote parts of Australia has been reported anecdotally to be lower than urban areas. Experiences of paramedics in rural locations gave rise to questions of whether this phenomenon was occurring and to what degree.

Methods

Data from emergency department (ED) records was obtained from the Hunter New England Area Health Service from 1 July 2008 to 30 June 2009. In total, 354,909 records were obtained. These records were de-identified and analysed to determine the method of arrival to ED, specifically in high acuity patients.

Results

People from inner regional areas are 41.5% less likely overall and 27.7% less likely in serious health emergencies to attend EDs by ambulance compared to people in major cities. People from outer regional and remote areas are 55.1% less likely overall and 27.9% less likely in serious health emergencies to attend EDs by ambulance compared to people living in major cities. Logistic regression modelling indicated rurality was a significant factor in ambulance use in adults in areas outside major cities and in children in inner regional areas. Age was a significant predictor of ambulance demand with older people using ambulances more.

Discussion

This study indicates disparity between rates of ambulance use in urban and non-urban areas. The concept of unmet need should be considered as a more complex phenomenon than simply a utilisation gap and exploration of unmet need is warranted.

Conclusion

A clearer understanding of how rurality affects ambulance use has a number of implications for ambulance services.

Keywords

rural health; ambulances; utilisation; unmet need; rural populations

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Introduction

Demand management is an increasing issue for ambulance services in all Australian jurisdictions. Demand management traditionally focuses on managing inappropriate use of ambulance services primarily in urban areas (1-4). Conversely, there exists anecdotal evidence of underutilisation of ambulance resources in rural and remote areas. Many rural people experiencing health emergencies who choose to self-transport to an emergency department (ED) may potentially be exposing themselves to clinical or physical risk and excluding themselves from the benefits of early (and potentially life-saving) intervention by paramedics. Underutilisation also has likely significant impacts on ambulance services related to workforce satisfaction and skills retention.

The phenomena of unmet need and underutilisation are largely unmeasured and have not been fully explored. In New South Wales (NSW) there is excellent data capture around ambulance activity, but few mechanisms to measure the number of potential patients not accessing ambulance services. Clarification is required to determine if there are differences in ambulance utilisation in serious health emergencies between patients in metropolitan areas and patients in rural and remote areas and the degree to which the phenomenon of underutilisation occurs. An analysis of ED presentation data was undertaken to better understand ambulance use between urban and rural populations and build a profile of the effect of rurality and other characteristics on ambulance use.

Methods

To measure usage levels relative to potential demand, a retrospective cohort study was undertaken using ED data from the Hunter New England Area Health Service (HNEAHS). This study examined the patient mode of arrival (ambulance versus other means) to EDs from 1 July 2008 to 30 June 2009. A variety of demographic and clinical data was collected including age, gender, home postcode, ED location, presenting problem, ED diagnosis code (by ICM-10) (5), ED diagnosis description, triage category and mode of arrival. This data set was compared against inter-hospital transfers during the same period which were determined to constitute less than 9% of ambulance movements into EDs within the data set analysed and unlikely to confound the analysis as most inter-hospital transfers are to larger centres with greater numbers. Options for mode of arrival included ambulance (including air ambulance, helicopter retrieval and internal ambulance – none of which constituted a significant proportion of responses), private vehicle, public or community transport, police and walking. The overwhelming majority of non-ambulance arrivals were by private vehicle.

Patient postcodes were stratified in line with the Australian Standard Geographic Category (ASGC) (6) and categorised as either living in a major city, inner regional area or an outer regional/remote location as determined by their home address. Hospitals within the HNEAHS were stratified by service classification (7).

The severity of the patient's condition was determined by the Australasian Triage Score (ATS). This standard is used nationally for determining the acuity of a patient at an ED on arrival. The scale ranges from 1 to 5 (Table 1) (8). Triage categories were stratified to either 'high acuity' (ATS 1-2) or 'low acuity' (ATS 3-5). Patients in the 'high acuity' group would have been initially triaged with a condition which is considered to be immediately or imminently life-threatening and require timely assessment and treatment (Table 1).

Data analysis

Data analysis was undertaken using SAS 9.2. Descriptive data is presented as percentages. Multivariate logistic regression was undertaken to assess the relationship between rurality and odds of transport to ED by ambulance. Due to the size of the data set we report 99% confidence intervals for odds ratios.

Ethics

Ethics approval was sought and granted by the Human Research Ethics Committee (Royal Prince Alfred Hospital Zone).

Results

All ED activity from 1 July 2008 to 30 June 2009 was included in the cohort which constituted 354,909 records. 163 (0.04%) records were excluded due to incomplete data in key fields.

Of the 354,746 cases analysed, 20,164 (5.68%) were 'high acuity' by the definition set for this study (ie. ATS category 1 or 2). Ambulance use varied by severity with 80.3% for ATS 1 patients and 4.5% for ATS 5 patients. The patterns of ambulance use by rurality and acuity are shown in Table 2. Ambulance utilisation was substantially lower outside major cities, including in persons with high acuity conditions (Table 2). When stratified for age and rurality, children have very low rates of ambulance use (major cities 10.3%; outer regional 4.8%) and older adults had higher rates of use (major cities 59.3%; outer regional 28.6%). When only high acuity cases were analysed, the pattern was similar but with a smaller difference between age groups (Table 3).

Table 1. Australasian Triage Score (8)

ATS Category	Response	Description of category	Example conditions (not exclusive)
Category 1	Immediate assessment and treatment	Immediately life-threatening	<ul style="list-style-type: none"> • Cardiac arrest • Respiratory arrest
Category 2	Assessment and treatment within 10 minutes	Imminently life-threatening Important time critical condition	<ul style="list-style-type: none"> • Airway risk • Severe dyspnoea • Cardiac chest pain • Major multi-trauma • Severe pain
Category 3	Assessment and treatment within 30 minutes	Potentially life-threatening Situational urgency	<ul style="list-style-type: none"> • Severe hypertension • Moderate blood loss • Moderate-severe pain
Category 4	Assessment and treatment within 60 minutes	Potentially serious Situational urgency Complex presentation	<ul style="list-style-type: none"> • Mild blood loss • Vomiting • Moderate pain • Minor limb injury
Category 5	Assessment and treatment within 120 minutes	Less urgent Clinico-administrative	<ul style="list-style-type: none"> • Mild pain with no risk • Minor wounds • Minor symptoms of low-risk conditions

Table 2. Ambulance use by patient home postcode stratified to ASGC for all patients and high acuity patients

	All patients (ATS 1-5)			High acuity patients (ATS 1&2)		
	Major cities	Inner regional	Outer regional*	Major cities	Inner regional	Outer regional*
Other Transport	73.4%	84.5%	88.1%	43.0%	58.8%	58.9%
Ambulance	26.6%	15.6%	11.9%	57.0%	41.2%	41.1%

* Includes remote population in the sample

Notable differences were seen when comparing the health services utilised by patients experiencing serious health emergencies. In high acuity patients, those who attended a community hospital (eg. multi-purpose service facilities) had used ambulances less often to get there (24.9%) than those who attended tertiary referral hospitals (65.9%).

Logistic regression was used to determine the impact of rurality on ambulance use. In children in inner regional areas and adults outside major cities, rurality was an indicator of reduced ambulance use when compared to populations living in major cities. Gender was not a factor in ambulance use in adults and a very weak indicator in children.

Table 3. Impact of rurality on mode of emergency department arrival for patients with ATS category 1 & 2 in Hunter New England Area Health Service

Effect	Arrived by ambulance		Adjusted odds Ratio*	99% Wald Confidence limits	
	NO	YES			
Adults (16-99 years)					
Major cities	3571 (39.0%)	5578 (61.0%)	1.00	-	-
Inner regional	4307 (56.8%)	3283 (43.3%)	0.49	0.45	0.53
Outer regional/remote	1454 (58.2%)	1045 (41.8%)	0.46	0.41	0.52
Children (<16 years)					
Major cities	940 (70.41%)		1.00	-	-
Inner regional	712 (75.26%)		0.77	0.60	0.99
Outer regional/remote	168 (66.14%)		1.21	0.83	1.75

* Adjusted for gender

Discussion

The data found in this study represented around an eighth of the ED activity in the state of NSW (9). A review of all NSW ED activity found that ED presentation rates were relatively well matched to rurality and population catchment. As such, it is expected that rural ambulance use behaviour would be similar across the state when extrapolating the experience of the data set used in this study across other rural population of the state.

The differences in ambulance use found in this study indicate a significant level of underutilisation by persons who do not live in a major city. This is likely to be most important in persons with high acuity conditions. Underutilisation of ambulance services in high acuity patients implies that a significant number of patients experiencing a serious health emergency are not accessing emergency health services which may have a significant impact on their health outcomes. Ambulances in rural areas of NSW where the study was undertaken carry a wide range of medical equipment and pharmaceuticals with potential capacity for therapies and strategies, such as thrombolysis and stroke bypass, which have proven benefits on patient outcomes. Additionally, using ambulance services provides earlier access to such facilities as rotary-wing response and retrieval. Paramedics operating in rural areas are also potentially impacted by non-utilisation of ambulances in terms of both their sense of purpose and value and their maintenance of skills and knowledge.

The finding of underutilisation creates the potential existence of unmet need. This level of underutilisation found would extrapolate to 27,480 patients state-wide with serious health emergencies who are not accessing ambulance services. While high acuity patients are a relatively small percentage of the overall population who seek emergency health care in hospitals, they do represent the market most suited for ambulance services.

Unmet need poses a unique issue for ambulance services. In an era where increased ambulance use is a major issue for ambulance resource management, there is a clear underservicing in high acuity users who would be considered the target market for ambulance services. Any attempts to increase 'market share' of high acuity patients needs to be undertaken in the context of demand and resource management. The focus should be placed on getting the ambulance to the right patients rather than simply increasing use.

Choosing to access an ambulance service in health emergencies relies on a series of complex decisions made by people under duress generally with a poor grasp of clinical risk or health literacy and is complicated by various community perceptions (10). Increasing ambulance utilisation by patients who may benefit will require complex strategies that account for the myriad of factors involved in decisions to use ambulance services. Factors affecting decision making include cultural issues, personal behaviours, understanding of the function of ambulance services and capacity of paramedics, and capacity to recognise the benefit of paramedics and ambulance services in addressing unscheduled health issues and health emergencies. Such strategies also need to recognise the resource management risks of increasing ambulance workload.

The results of this study found that in the rural areas of the HNEAHS, people were not taking the opportunity to make the ambulance service part of the plan to address these health emergencies when they occurred. Nearly six out of 10 people living outside of an urban area were choosing to face potentially life-threatening health emergencies alone or with the support of lay bystanders.

This study was underpinned by a number of assumptions. First, it is assumed that ambulances provided benefit to high acuity patients – this is borne out in a number of studies of specific conditions which ambulance services attend (11-13). Second, it is assumed that most people present to a hospital near their place of residence. As such, hospital size can be used as a defacto measure of rurality as the smallest hospitals are commonly in the least populous and most remote locations. In this study the smallest hospitals in the sample were uniformly located in the smallest population catchments.

The data set was large and involved a unique mix of urban and rural populations. The sample area includes large proportions of the ASCG categories “Major cities”, “Inner regional” and “Outer regional”, however only a small part of the sample area was classified as “remote” and none of the sample area was classified as “very remote.” For purposes of statistical analysis, data from “Remote” areas was combined with data from “Outer Regional” areas.

The substantial size of the data set supported generalisability. Triage score as the measure of health emergency severity is influenced by subjective triaging practices. Rural hospitals have been shown to have lower levels of inter-rater reliability in emergency triage (14).

Underutilisation and unmet need are related but subtly different concepts. While this study shows significant underutilisation, whether unmet need exists depends on the perceptions of potential ambulance users as to whether their health emergencies would potentially benefit from the involvement of ambulance services. While most health professionals would recognise the value of paramedic interventions in improving outcomes of those experiencing serious health emergencies in the out-of-hospital environment, the general population may not be aware of this gap in care and, as such, does not create the demand for ambulance services or perceive an unmet need themselves.

The rationale for this needs to be explored in the context of a range of social and behavioural models to understand the decision making paradigms used by rural people in serious health emergencies. Through a clearer understanding of

References

1. Gibson G. An analysis of the demand for emergency ambulance service in an urban area. *Am J Public Health* 1971;61(11):2158–61.
2. Rademaker AW, Powell DG, Read JH. Inappropriate use and unmet need in paramedic and nonparamedic ambulance systems. *Ann Emerg Med* 1987;16(5):553–6.
3. Wrigley H, George S, Smith H, Snooks H, Gasper A, Thomas E. Trends in demand for emergency ambulance services in Wiltshire over nine years: observational study. *BMJ*

the processes which lead to ambulance non-use, effective strategies can be developed.

Conclusion

The concept of unmet need is more involved than simply counting how many ambulances are not being called. While this is an effective measure of ‘market share’, it does not fully grasp the complexities of the relationship between ambulance services and patients in achieving improved outcome. However, it is an effective indicator of the potential cohort of patients who may experience benefit from engaging with ambulance services during health emergencies.

Understanding unmet need requires an effective assessment of the needs of those experiencing health emergencies. It is possible that ambulance non-users do not perceive an unmet need, although the benefit of paramedic intervention in serious health emergencies is well recognised by health professionals. This study shows the majority of people in rural areas do not access ambulance services in situations where they are likely to be of benefit in mitigating the effects of their health emergency. Such a situation requires further investigation to determine both the social and behavioural frameworks underpinning rural ambulance non-use and quantification of the potential outcome benefits of more widespread utilisation of ambulances in managing serious health emergencies.

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Competing interests

Buck Reed received a grant from the Rural Research Capacity Building Program during the course of this study. Both authors have completed the ICMJE conflict of interest form.

2002;324:646–7.

4. Hjalte L, Suserud BO, Herlitz J, Karlberg I. Why are people without medical needs transported by ambulance? A study of indications for pre-hospital care. *Eur J Emerg Med* 2007;14(3):151–6.
5. WHO. International Classification of Disease, 2011. Available at: www.who.int/classifications/icd/en/ [Accessed 20 May 2011].
6. Australian Bureau of Statistics. ASGC Remoteness Classification: Purpose and Use. Canberra: Australian Bureau of Statistics; 2003.

7. HNEAHS. Service Classification. 2011. Available at: www.hnehealth.nsw.gov.au/about_us/service_definitions. [Accessed 20 June 2011].
8. ACEM. Policy Document: The Australasian triage scale. *Emerg Med* 2002;14:335–6.
9. AIHW. Australian hospital statistics 2009-10. Canberra 2011.
10. Morgans A, Archer F, Allen FCL. Patient decision making in prehospital health emergencies: determinants and predictors of patient delay. *Journal of Emergency Primary Health Care* 2008;6(3).
11. Morgans A, Archer F, Walker T, Thuma E. Barriers to accessing ambulance services in rural Victoria for acute asthma: Patients' and medical professionals' perspectives. *Aust J Rural Health* 2005;13:116–20.
12. Pozen MW, Berezin MM, Modne L, Riggen R, Hood WB, Jr. Ambulance utilization by patients with acute myocardial infarction. *Am J Public Health* Jun 1978;68(6):568–72.
13. Becker L, Larsen MP, Eisenberg MS. Incidence of cardiac arrest during self-transport for chest pain. *Ann Emerg Med* 1996;28(6):612–6.
14. NSW Health. Triage in NSW rural and remote Emergency Departments with no on-site doctors. Sydney: NSW Health; 2004.