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REVIEW

PARAMEDIC WORKFORCE DISPARITIES MARKED BY GEOGRAPHICAL POSITIONING: COMPARISON OF RURAL AND URBAN REGIONS

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ABSTRACT

Introduction: Effective service delivery and the wellbeing of the paramedic workforce is reliant on confounding factors and is effectuated by geographical positioning. It is important to be aware that there may be several disparities between the rural and urban workforce due to differences in circumstances. However, there is limited literature available examining these. The objective of this review was to investigate where and how these disparities exist to make recommendations in achieving equity in the paramedic workforce and thus achieve patient-centred care universally across rural and urban populations.

Methods: The JBI approach was used to perform a scoping review to assess the availability of literature. Key words including paramedic*, EMT, urban OR metro*, rural OR remote and disparit* were inserted into the search engines MEDLINE, CINAHL Plus and Scopus. Titles and abstracts of the 282 results were screened by two authors and inclusion and exclusion criteria applied. The full text of the remaining 77 results were screened to inform the results of the review.

Results: The search identified 282 potentially relevant articles, of which 33 informed the results of the review. The included studies identified emerging themes relevant to the objective, including: (1) the skills, training availability, and confidence of the workforce; (2) resourcing of ambulances inclusive of both workload and caseload and access to resources; (3) timings of each group regarding response, scene, and transport; and (4) the health status of paramedics in each subset location.

Conclusion: This review identified several disparities between rural and urban paramedic locations to the point that it is negatively impacting equitable patient-centred care. Further research is recommended to establish why these disparities exist and the extent to which these disparities are impacting the ability to achieve equity in the paramedic workforce across these two geographical divides.

INTRODUCTION

The paramedic discipline has a responsibility to the community to provide front-line emergency and low acuity out-of-hospital care. Paramedics are continually faced with evolving caseload and workload which is deemed taxing emotionally, mentally, and physically (Sofianopoulos, Williams, & Archer, 2012). Their

treatment and transport of critical patients highlights significant skill deployment where errors in judgement or lapses of concentration may result in fatal consequences. Therefore, their ability to undertake such duties effectively is dependent on several confounding factors (Meadley et al., 2020).

In many countries significant percentages of the population reside in rural or remote areas. For example, in Australia approximately 7 million people reside in rural and remote areas, accounting for 29% of the population. This denotes one in ten living in a small town with a population of less than 10,000 people. Conversely, 71% of the population reside in a metropolitan or urban setting which reflects a population of 100,000 or more residents (Australian Institute of Health and Welfare, 2018). With a variety of ambulance organisations servicing such diverse populations it is important to be aware that there may be disparities between the rural and urban workforce due to differences in circumstances. To effectively identify the cause of paramedic workforce issues, the comparison of geographical positioning must be explored. It is hypothesised that the rural workforce is subject to different organisational and psychosocial stressors arising from servicing diverse patient demographics with poorer access to services. Thus, it would be inappropriate to utilise unified support strategies to both the urban and regional cohort. However, there is limited literature discussing the disparities which exist in the paramedic workforce between these differing locations. The objective of this scoping review was to investigate where and how these disparities exist to make recommendations in achieving equity in the paramedic workforce and thus achieving optimal patient-centred care universally available across rural and urban populations.

METHODS

Methodological Framework and Reporting

This scoping review adheres to the JBI methodology and the preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews (PRISMA-ScR). The search was registered through the OSF register DOI 10.17605/OSF.IO/D3EPF.

Inclusion Criteria

For evidence to be included within the scoping review, articles must have met a pre-determined set of inclusion and exclusion criteria outlined in Table 1. These were developed in line with the PCC (population, concept, context) which were discussed and unanimously agreed upon by all authors.

Search Strategy

The search strategy aimed to locate only published studies. A three-step strategy was utilised for the review. An initial limited search of MEDLINE ALL and CINAHL (EBSCOhost) was undertaken to identify articles on the topic. The text words contained in the titles and abstracts of relevant articles, and the index items used to describe the articles were used to develop a full search strategy for MEDLINE ALL, CINAHL (EBSCOhost) and Scopus (see appendix 1). These databases were selected as they are archives

Criteria for Inclusion	Criteria for Exclusion
Population - Relating to the paramedic workforce explicitly	Nature of the research aimed at the hospital or tertiary perspective
Context - Comparison of the metropolitan or urban paramedic and regional, rural, or remote paramedic	Relating to out-of-hospital healthcare provided by nurses, GPs, or other healthcare professionals whose primary location of work is in hospital
Context - Comparable health care systems	Studies older than 10 years
Concept - Pertaining to the differences in scope of practice and times in both subset locations	Patient outcome focused pertaining to morbidity and mortality
Concept - Identifying incidence and prevalence of disease within the paramedic cohort from differing geography	Concerning the role of treatments or assessments for specific interactions
Concept - Pertaining to the identification of organisational or patient stressors across both subset locations	Grey literature
English language	Not original research, i.e.., literature review, systematic review, meta-analysis

Table 1. Inclusion and exclusion criteria.

for allied health professional, nursing, and pre-hospital or paramedicine literature. This was important as the extent of the existing literature on the topic was unknown.

Key search terms were identified in current research and used as specific search terms including: paramedic*, ambulance, EMT, emergency medical technician*, prehospital, pre-hospital, and out-of-hospital. Other key terms included: urban, metro*, rural, remote, regional, comparison*, imbalance*, disparit*, differ*, dissimilar*, contrast* and variation*. Search terms were combined with appropriate Boolean terms and truncation symbols. The search strategy, including all identified key words and index terms, was adapted for each database and/or information source.

Evidence Screening and Selection

Following the search, all identified citations were collated and uploaded into EndNote and duplicates removed. The initial search of MEDLINE, CINAHL (EBSCOhost) and Scopus resulted in 489 results following the application of limits by date restricting data to within the last ten years (2013-2023). Following the removal of duplicates, 282 articles were left for screening. Following a pilot test, titles and abstracts were screened by two independent reviewers for assessment against the inclusion criteria for the review. Potentially relevant sources were retrieved in full, of which there were 77 articles, and their citation details were imported into the JBI System for the Unified Management, Assessment and Review of Information (JBI SUMARI). The full text of selected citations was assessed in detail against the inclusion criteria by two independent reviewers. Reasons for exclusion of sources of evidence at full text that did not meet the inclusion criteria were recorded and reported in JBI SUMARI. Any conflicts that arose between reviewers at each stage of the selection process were resolved through discussion or with an additional reviewer/s. Of the 77 texts screened in full, 33 were included in the scoping review. The results of the search and study inclusion process were reported in full and are presented in a Preferred Reporting Items for Systematic Reviews and Meta-analyses extension for Scoping Reviews (PRISMA-ScR) flow diagram (see appendix 2).

Data Extraction

Data was extracted from papers included in the scoping review by two independent reviewers using a data extraction tool developed by the reviewers (see table 2). The data extracted included specific details about the participants, concept, context, study methods, and key findings relevant to the review objective. Any disagreements that arose between reviewers were resolved through discussion with an additional reviewer.

Data Analysis and Presentation of Results

The data was analysed and charted in line with Arksey and O'Malley's fourth stage of performing a scoping review. This is referred to as a process that extracts and summarises the data in a descriptive and logical way from which further narrative can be written. Six criteria were used to analyse and present the results of each study which included: author(s) and year of publication, location, aim, participants, methods, and key findings. Table 2. Summary of Articles Included, provides an overview of the 33 articles included in this scoping review.

RESULTS

The above search strategy identified 282 potentially relevant articles, of which 33 informed the results of the scoping review. The included studies identified four emergent themes relevant to the objective. The key themes identified in the literature include the disparities that exist between the skills and confidence of the rural and urban workforce followed by the notable differences which could be seen between the caseload, workload, and access to resources between these areas. Additionally, there was also a significant difference in the response and transport times between rural and urban locations accompanied by a disparity in the health status of rural and urban paramedics.

Skills and Confidence of the Workforce

The main theme emerging from the literature was the disparity in skills and confidence of rural paramedics compared to their urban counterparts. Disparities emerged between the rural and urban workforce in four areas: training and education, scope of practice, skill acquisition and maintenance, and confidence. The disparities in training and education between rural paramedics and their urban counterparts impacted on their ability to provide high-quality patient care and impacted on their career development. Paramedics working in rural areas had less training (initial and ongoing) and were often working to a lower scope of practice as extended care and specialist roles were more frequently metro-based. Due to the lower call volume in rural areas, paramedics had less frequent exposure to certain types of calls, increasing the risk of skill erosion, and many reported feeling less confident in utilising their skills than their urban colleagues.

Several studies noted the lack of training for paramedics in rural locations impacted on their opportunities to undertake more advanced or specialised roles resulting in disparities in the scope of practice between rural and urban paramedics (A. Alanazy, Fraser, & Wark, 2021; Alanazy Ahmed Ramdan, Fraser, & Wark, 2021; Irvine, Doan, Bosley, Col-

beck, & Bowles, 2022). Paramedics in Saudi Arabia reported opportunities for enhanced education and training were not available to those based in rural locations and staff were expected to travel to urban locations to undergo additional training (A. Alanazy et al., 2021; Alanazy Ahmed Ramdan et al., 2021). Furthermore, staff were expected to relocate to urban areas on completion of their additional training as roles incorporating the extended scopes of practice were only utilised in urban locations (A. Alanazy et al., 2021; Alanazy Ahmed Ramdan et al., 2021). This impacted the level of care that could be delivered to patients in rural locations which was further compounded by a reliance on volunteers to supplement the workforce shortages.

This correlation between frequency of exposure and confidence was reported across a range of presentations, including trauma triage, management of patients having acute myocardial infarctions, out of hospital cardiac arrest management, stroke recognition, and management of mental health patients (Coleman, Barry, Tobin, Conroy, & Bury, 2019; Deeb et al., 2020; Emond et al., 2021; Hodell et al., 2016; Martin Lorelle et al., 2020; Ro et al., 2013). One US study reported under triage of trauma patients was higher among patients in rural areas (8.6% versus 3.4% in urban areas). This was attributed to the infrequent exposure of rural paramedics to trauma cases and the lack of continuing professional development in trauma care (Deeb et al., 2020). Rural paramedics in one US study reported challenges with stroke recognition due to infrequent exposure which was in contrast to their urban colleagues who reported difficulties with stroke recognition arising from language barriers due to the diverse population in the large urban cities (Emond et al., 2021). Paramedics in rural Australia reported lack of confidence with managing complex cardiac patients due to infrequent exposure and lack of training (Martin Lorelle et al., 2020). The notable exception with regards to frequency and confidence was in relation to paediatric airway management where Irish paramedics reported confidence in undertaking the skill with 70% of paramedics having been exposed to this in practice, yet only 23% had received any formal training to prepare them for paediatric airway management (Coleman et al., 2019).

Lack of exposure was problematic in most rural locations as was managing the disparity between the characteristic caseloads for rural which saw more trauma than urban who dealt with more medical calls. Several strategies to counter the impact of infrequent exposure were discussed with one Australian study noting that it would be beneficial for rural paramedics to have professional development sessions in managing mental health patients delivered by specialised mental health professionals (Emond et al., 2021). While potentially beneficial, the study highlighted the challenge of this approach due to the lack of specialised mental health professionals working in rural areas. Feedback from paramedics in an Irish study was that 85% of them would welcome refresher training in paediatric airway management to be conducted by specialists in the hospital environment; however, most acknowledged the logistical challenges as this would require them to travel to urban areas to complete the training (Coleman et al., 2019). Conversely, one US study reported that paramedics in rural areas found it easier to obtain feedback on stroke recognition from other healthcare professionals than their urban colleagues due to the strong interprofessional relationships they had developed with staff at the local hospital (Hodell et al., 2016). This feedback was an important learning tool to develop their confidence in managing strokes due to the infrequent exposure to this type of case.

One Australian study noted a disparity between the outcomes of paediatric out-of-hospital cardiac arrest (OHCA) patients measured through return of spontaneous circulation (ROSC) with urban ROSC rates of 32.5% compared to 20.7% for rural patients despite similar response times (Irvine et al., 2022). A further disparity noted was the paramedic scope of practice with Critical Care Paramedics (CCPs) being present at 92% of the urban OHCA calls and only 63% of the rural OHCA calls. This is noted as one potential contributory factor as the presence of CCPs at OHCA calls has been shown to improve outcomes, however other potential contributory factors include the time taken for paramedics to be called, as patients may not be immediately discovered in rural settings, and the aetiology which was linked to survival rates was found to vary between urban and rural patients (Irvine et al., 2022). Paramedics in the Saudi Arabian study suggested training should be tailored to be more representative of the types of cases typically encountered in their local area (A. Alanazy et al., 2021). It was argued that this would promote confidence in managing trauma cases and potentially reduce skill erosion. This targeted education strategy was also suggested in the Australian study by Irvine et al. (2022) in response to the varied aetiology of paediatric OHCA between rural and urban areas.

There was widespread consensus concerning the disparities between training and education, scope of practice, skill acquisition and maintenance, and confidence of rural compared to urban paramedics. The suggested solutions varied, and while many reported challenges associated with working in rural areas, others identified benefits of working in a more rural setting as part of a more collegial professional community.

Resourcing (Caseload, Workload, Access to Resources)

Caseload

Another theme which emerged from the literature illustrating a disparity between the rural and urban paramedic workforce was the workload and consequent caseload between the two geographical locations and associated resourcing to these areas. When considering caseload, a study conducted by Sariyer, Ataman, SofuoÄlu, and SofuoÄlu (2017), concluded there were less emergency service calls placed in rural regions than urban areas. However, when comparing per 1000 residents, it was found that there was a higher proportion of calls coming from rural regions. This is further complimented by another study conducted in Taiwan whose rural areas had a greater demand per capita than urban regions (Wong Ho, Lin, & Lin, 2019). In addition, rural areas were also seen to service larger geographical locations when compared to urban areas (Lu & Davidson, 2017). This is also shown in an Australian study that identified a consequence of working in an area with rural geography is greater demand on the emergency healthcare system during hot and cold waves (Jegasothy, McGuire, Nairn, Fawcett, & Scalley, 2017). Furthermore, Hegenberg, Trentzsch, Gross, and Pruckner (2019) found that emergencies were more prevalent in urban areas during the day and suggested this was largely due to inbound commuters. They also shared that the number of cases with a prehospital emergency trained physician dispatched was 1.5 times higher in the urban environment than rural locations (Hegenberg et al., 2019). Lastly, A. R. M. Alanazy, Fraser, and Wark (2022) in a Saudi Arabian study investigating differences in non-transports between

rural and urban hospitals found that all patients who were treated in the urban environment were transported to hospital. This was not the case in the rural cohort where a small percentage of patients were treated at the scene and not transported to hospital (A. R. M. Alanazy et al., 2022).

Workload

When looking at workload, the literature proposed this was generally more medically dominated in urban areas and more trauma dominated including traumatic out-of-hospital cardiac arrests in rural areas (Alanazy Ahmed Ramdan et al., 2021; A. R. M. Alanazy, Wark, Fraser, & Nagle, 2020; Irvine et al., 2022; Moafa Hassan, van Kuijk Sander Martijn, Alqahtani Dhafer, Moukhyer Mohammed, & Haak Harm, 2020). It was also suggested by Moafa Hassan et al. (2020) that more male patients were seen in rural areas whilst more female patients were seen in urban areas. To further break this down, A. R. M. Alanazy et al. (2020) shows that during trauma cases, rural patients' injury patterns were associated more with fractures, lacerations and head injuries while urban patients more frequently presented with wounds and burns. Overall, the on-scene death rates compared by A. R. M. Alanazy et al. (2020) were low for both rural and urban areas however were more prevalent in the rural locations. When looking into patient-specific treatment, rural paramedics in Poland were seen to treat more on scene and had a higher utilisation of C-spine collars when compared to urban areas where they were seen to gain intravenous (IV) access more frequently than their rural counterparts (Aftyka, Rybojad, & Rudnicka-Drozak, 2014). Cui Eric et al. (2021), found that electrocardiograms (ECGs) of an ischaemic nature were more common in rural areas than urban indicating more ST elevation myocardial infarctions and morphine administration which was two times more common in rural than urban areas. This demonstrates there is a difference in workload and caseload between the rural and urban environment. Whilst there are no direct disparities identified so far in the literature, it is important to also investigate the effect that access to resources has on these factors.

Access to Resources

When taking into account the access to resources that paramedics need to be operational compared to urban areas, rural locations have an increased frequency to require 4x4 vehicles as well as Global Positioning System (GPS) in order to reach their patients (Alanazy Ahmed Ramdan et al., 2021). Alanazy Ahmed Ramdan et al. (2021) highlighted this need as well as the trend that limited resources were available to facilitate this. This is further alluded to in Alanazy Ahmed Ramdan, Wark, Fraser, and Nagle (2019) sharing that there are less ambulance stations in rural areas, along with less staff and reduced equipment that may not be suited to the rural environment. The issue of lack of resources in rural environments is again highlighted by Bush, Glickman Lawrence, Fernandez Antonio, Garvey, and Glickman Seth (2013) whose findings suggest that ECGs were being performed less in rural than urban areas, stating that the largest barrier preventing rural clinicians from performing an ECG was a lack of availability of equipment and certification in these areas resulting in a strong recommendation for increased training and resources in rural areas to correct this disparity. Lastly, another significant disparity in the literature is presented by Alanazy Ahmed Ramdan et al. (2021) highlighting

there was insufficient access to trauma facilities and retrieval resources when compared to urban areas. This has also been recognised by Yeap, Morrison, Apodaca, Egan, and Jansen (2014) who recommended regionalisation of trauma care and retrieval capacity to improve these disparities for the paramedic workforce.

Timing

A significant and obvious difference between urban and rural populations is distance between health services. This has significant impacts on paramedic work which is reflected in driving time and its related impact. Due to variations in where studies were undertaken, it was not possible to combine results, with many different definitions of urban, rural, times, and paramedic workforces. However, it was clear that prehospital time was extended in rural areas overall (Ashburn Nicklaus et al., 2022; Clark David, Winchell Robert, & Betensky Rebecca, 2013; Lu & Davidson, 2017; Newgard Craig et al., 2017; Ro et al., 2013; Stopyra et al., 2022; Yeap et al., 2014). One study, based in Japan, contradicted this with fairly similar results for the two areas and a slightly longer prehospital time in urban areas (Masuda et al., 2018).

Response time was also extended in rural areas (Aftyka et al., 2014; A. Alanazy et al., 2021; Ashburn Nicklaus et al., 2022; Connolly et al., 2022; Cui Eric et al., 2021; Hsu, Wu, Huang, Lee, & Cheng, 2021; Lu & Davidson, 2017; Newgard Craig et al., 2017; Ro et al., 2013; Stopyra et al., 2022). Masuda et al. (2018), once again contradicted this with largely similar results with a slightly longer response time in the urban setting (Masuda et al., 2018). A study based in Saudi Arabia (Alanazy Ahmed Ramdan et al., 2021) also indicated that older vehicles were more likely in rural areas, which may increase travel times and specifically response times when they were not equipped with GPS. However, time at the scene was similar between urban and rural areas (Ashburn Nicklaus et al., 2022; Ashburn et al., 2020; Newgard Craig et al., 2017). Stopyra et al. (2022) identified a significantly longer on scene time for rural patients (16.6 mins) than urban patients (15.4 mins). Masuda et al. (2018) once again contradicted this with a longer time at the scene in urban areas (Masuda et al., 2018).

Time to transport patients to hospital was also extended in rural regions (Alanazy Ahmed Ramdan et al., 2021; Ashburn Nicklaus et al., 2022; Cui Eric et al., 2021; Lu & Davidson, 2017; Newgard Craig et al., 2017; Stopyra et al., 2022). In their Japanese study, Masuda et al. (2018) identified that part of the delay in transport to hospital was related to the services provided at the initial hospital in rural locations as being insufficient Ð their study was related to time taken to primary percutaneous coronary intervention (PPCI) in management of acute myocardial infarction. Dual dispatch of emergency medical services and firefighters was also shown to reduce response time in rural Sweden and showed an increase in 30 day survival rates in urban populations; however, limited impact was seen in rural locations (Nordberg et al., 2015). In a study of ECG utilisation, Bush et al. (2013) found that ECGs were more likely to be undertaken in patients with longer transport times and suggested that this was possibly due to the length of time available to do so (Bush et al., 2013).

Paramedic Health Status

The literature has identified that there is a consequential disparity that exists in the health status of paramedics between the rural and urban workforce. Studies have identified that rural paramedics have significantly higher rates of fatigue, depression, anxiety, and stress than their urban counterparts. This is in addition to poorer sleep quality and less reported physical activity (Courtney, Francis, & Paxton, 2013). While there is an increased incidence and prevalence of disease in rural paramedics, it is also evident that rural paramedics have higher metabolic risk profiles and cardiovascular health metrics (Cash, Crowe, Bower, Foraker, & Panchal, 2019). Urbanicity was identified as a key risk factor for reporting suboptimal cardiovascular health. The findings were statistically significant as 57% of the urban cohort had optimal cardiovascular health while the rural workforce reported optimal health in a mere 43% of the population. The health metrics denoting cardiovascular health included smoking, body mass index, diet, physical activity, blood pressure, cholesterol, and blood glucose (Cash et al., 2019). While the evidence is synonymous regarding the disparity, there is a lack of insight into the contributing organisational, geographical, and personal factors underpinning this theme. One identified contributor is that of the organisational parameters of shift scheduling and the influence on worker health. The literature is unanimous that there is a need for organisational input to be able to implement custom designed workshops, psychoeducation, and contemporary psychological treatment modalities (Courtney et al., 2013). Stress is also a well understood factor of poor health and the rationale for this stress has been shown in qualitative data to differ greatly between each cohort. Rural paramedics cited poor flexibility to change shifts, traumatic cases, and organisational pressure while urban paramedics highlighted a large workload as their causative factor (Alanazy Ahmed Ramdan et al., 2021). However, it is noted that the assessment and conceptualisation of stress does vary across studies. While the specific influences on the paramedics' health is not reported in the review, the high rates of mental health disorders, sleep disorders, cardiovascular disease, and low levels of physical activity are widely reported between the rural and urban regions. These are at elevated rates in the rural paramedic workforce highlighting a key disparity between the subset locations.

DISCUSSION

The aim of this scoping review was to investigate the disparities that exist among the paramedic population based on geographical location and the influence that rurality has on this. This review has identified several disparities among the rural and urban paramedic population including disparities in the skills and confidence of the paramedic workforce, workload, caseload, resourcing, response, and travel times as well as the health status of paramedics. Upon further research these disparities appear to be systemic across other health services and areas of employment and highlight the impact the geographical divide has on public and private sector workforces.

Disparities in skills and confidence within the workforce between rural and urban locations is something which literature identifies as occurring among more than just the paramedic population. Rosvall (2020) examines the disparities between the types of skilled work carried out overall between rural and urban areas and found that people

residing in urban areas generally have a higher prevalence in engaging in higher-skilled career paths such as scientists and engineers. In contrast it was also found that the rural locations had what was perceived as lesser-skilled career paths such as machinists and laborers (Rosvall, 2020). Similarly, Bennett et al. (2020) conducted a study in America which identified that urban emergency departments had more board-certified emergency medicine physicians than in rural areas indicating a disparity in the skill proficiency between these areas. More recently, this has again been seen in a study conducted by Kett, Bekemeier, Patterson, and Schaffer (2023) comparing the workforce competencies and training needs between rural and urban public health in the United States. However, whilst this study found that urban areas had greater skills relating to decision-making, health equity, diversity, and inclusion, rural areas were better in community engagement and cross-sectorial partnerships. This indicates that not all disparities between rural and urban healthcare were at the disadvantage of the rural location, however this is not something which was identified in the paramedic population in the literature reviewed for this study.

Furthermore, the disparity between rural and urban paramedics' caseload, workload, and access to resources to carry out operational duties was also evident in the literature. A difference in the number of cases between rural and urban areas can also be seen in other medical professions and is displayed throughout Cosgrave, Hussain, and Maple (2015) who completed an Australian study looking into the retention of mental health staff in rural New South Wales (NSW). This study found that rural staff believed they had a higher workload in rural areas than urban areas which is also consistent with Steinhaeuser, Joos, Szecsenyi, and Miksch (2011) whose comparison of rural and urban general practitioners (GPs) in Germany found that rural GPs were working an average of four more hours a week than urban GPs. This trend is also displayed across Malatzky and Bourke (2018) and McGrail, Humphreys, Joyce, Scott, and Kalb (2012) who focus on the challenges faced by Australian rural health professionals, with GPs concluding that the workloads and number of patients seen in the rural cohorts was greater than the urban areas studied.

When looking into the type of work carried out, Anderson, Saman, Lipsky, and Lutfiyya (2015), another study comparing the differences between rural and urban healthcare professionals in Mexico and Alaska, highlight the variation in the type of work carried out in the different geographical locations. This study found rural locations had a higher incidence of substance abuse and economic disadvantage and were more culturally diverse when compared with urban locations (Anderson et al., 2015). Similarly to the resource inequities which were seen between rural and urban paramedics, Cosgrave et al. (2015) show that this carries over into other health professions suggesting that an influence of mental health workers leaving rural areas in favour of urban locations is due to fewer resources in the way of service referral options. Additionally, Anderson et al. (2015) also comment on rural healthcare providers having access to less resources than urban areas, ultimately limiting the provision of specialised care. Overall, there is quite a similar representation of disparities relating to rural/urban caseload, workload, and resource allocation in multiple health professions as identified in the paramedic profession.

One of the most obvious differences between rural and urban paramedic work was the increased distance and therefore time taken to reach and transport patients (Spencer-Goodsir, Anderson, & Sutton, 2022). This disparity was frequently discussed in the literature located in this scoping review, particularly in relation to response times and transport times being extended (Alanazy Ahmed Ramdan et al., 2021; Ashburn Nicklaus et al., 2022; Ashburn et al., 2020; Cui Eric et al., 2021; Lu & Davidson, 2017; Newgard Craig et al., 2017; Stopyra et al., 2022).

This increased driving time is not unusual in literature related to emergency services and has been related to distance from services in literature related specifically to paramedic transport in rural areas (Adeyemi, Paul, & Arif, 2022; Miller, James, Holmes, & Van Houtven, 2020; Smith, English, Whitman, Lewis, & Gregg, 2022). Discussion about adverse terrain indicates that such driving conditions can be dangerous, particularly in rural and remote areas with poor road conditions, lighting, and adverse weather conditions, however urban areas also have issues related the possibility of additional vehicles being involved or traffic congestion (Liu, 2022; Spencer-Goodsir et al., 2022; Wubben, Denning, & Jennissen, 2019). Similar issues have also been identified in literature related to firefighting, where response times are also considered to be important (Wan Jusoh et al., 2023). Issues of fatigue increase workplace safety considerations, especially related to driving during "irregular hours," during shift work, or even after a shift has been completed, and are more likely in rural areas due to the amount of time spent driving during a shift. This is further discussed in the literature related to police services (Taylor, 2020) and taxi driving (Mahajan & Velaga, 2022) and specifically to rural paramedics (Courtney et al., 2013; Pyper & Paterson, 2016).

Lastly, the health disparities identified in the evidence base are ubiquitous that populations living or employed in rural areas are at a disadvantage compared to their urban counterparts. The data is skewed to increased rates of mortality and morbidity with an increased rate of hospitalisation (Mitchell & Lower, 2018). While this is generalised to the greater population of these locations, the evidence is supported among allied health professionals. Tham, Pascoe, Willis, Kay, and Smallwood (2022) identified that there was a statistically significant higher prevalence of mental illness in the rural workforce despite a reduced workload compared to the urban healthcare worker (Tham et al., 2022). The evidence is congruent with this among other emergency personnel and is seen in Johnson et al. (2020) who also identified rural firefighters as a particularly vulnerable subgroup for mental health related illness requiring specific intervention. This study highlighted that this subgroup was less likely to engage in treatment compared to urban personnel which may be due to the unavailability of empirically-based treatments in the regions (Johnson et al., 2020). Similarly, data has been found among the police and child protection workforces as shown in the findings of Roberts et al. (2021) that the rural professionals had higher rates of stress and burnout which was suggested to be related to organisational factors (Roberts et al., 2021). Overall, whilst this study has shown a significant disparity between paramedic health in rural and urban areas, literature from other emergency service professions indicates that this disparity may be common to other professionals.

LIMITATIONS

When examining the available literature, there was very limited research that explicitly explored the differences between the rural and urban paramedic workforce. As paramedicine is an emerging profession the number of articles reviewed were generally small. It is also possible that while the search terms of the strategy were broad, the authors may not have captured all available literature. Cross-national findings were reviewed of comparable pre-hospital emergency systems; however, only studies published in English were included potentially limiting results. It is worth noting that there is no consistent definition of rurality and for the purposes of this review all definitions were accepted despite the inconsistencies.

CONCLUSION

Through the literature identified in this scoping review, it was established that there were several disparities present amongst the rural and urban paramedic workforce. This was represented through differences in skills and confidence which showed lesser opportunities for a more advanced skill set in rural locations. Access to resources and varied workloads/caseloads was another prominent difference which ultimately saw the rural locations having to cover a geographical location larger in size with a greater caseload and less resources per capita than their urban counterparts. Both response time and transport times were seen to be generally greater in rural locations, and lastly, the overall health status of paramedics was seen to be generally poorer in rural areas.

This review has been able to ascertain that there are disparities present between the rural and urban paramedic locations to the degree that it is detrimental to providing good patient centred care. There is some evidence to suggest there has been an attempt to address these disparities, more specifically the issues of lesser resources in rural areas through dual dispatch of other emergency services. However, this was shown to have limited impact in rural areas despite showing benefits in urban locations.

This is why further research is highly recommended to establish the reason why these disparities exist and determine if it is due to lack of financial funding to rural areas, money being focused on the wrong services, or the fact that these disparities have gone by unnoticed. It is important to investigate the extent to which these disparities are impacting the lives of paramedics and the provision of emergency healthcare to explicitly target areas where patients and employees need further support including resources, upskilling, and education to achieve equity in the paramedic workforce across these two geographical divides.

Author(s) & year of publication	Aim	Participant characteristics	Methods	Relevant Findings	Theme(s)
Aftyka A, Rybojad B, Rudnicka-Drozak E. 2014.	Compare interventions in urban and rural areas by paramedics with particular emphasis on response time and on-site rescue activities.	All emergency medical teams were included from two emergency medical service substations in Poland.	Retrospective analysis of 1624 EMS events from two emergency medical service substations in Poland.	Urban areas had shorter response times and distances were usually less than 10 km while in rural areas less than 10 km in distance was found in only 7.2% of cases. Paramedics more often acted exclusively on site or ceased interventions in rural areas. Rural areas associated with increased use of collars and decreased use of intravenous access.	2,3
Alanazy ARM, Fraser J, Wark S. 2022. Saudi Arabia	Investigate EMS cases that resulted in non-transports in the urban and rural areas of Saudi Arabia.	Randomly drawn sample of de-identified patient records from the primary provider EMS service in Saudi Arabia.	Retrospective, cross-sectional study of 800 records over 12 months. A random sampling method was used to select records and data analysed.	Case presentation did not differ between areas, and the most common reason for non-transport in both areas was refusal of treatment and transport. Of the 310 non -transports across locations, 10 were treated on scene and released by rural EMS while no urban patients were treated and released.	3
Alanazy ARM, Fraser J, Wark S. 2021. Saudi Arabia	To gain insights from frontline workers about organisational factors impacting on discrepancies in rural and urban EMS outcomes.	20 participants employed by Saudi Red Crescent EMS as technician (6 rural; 4 urban), paramedic (0 rural; 3 urban), or EMS station manager (4 rural; 3 urban), all with a minimum of 5 years experience with the EMS; total of 10 rural and 10 urban.	Semi -structured interviews in Arabic, translated to English between 2019 – 2020 until data saturation was reached. Hermeneutic phenomenology with Braun & Clarke's thematic analysis.	Three themes: organisational factors;, EMS personal issues, and patient factors. This article reports on organisational factors only. Variations between rural and urban areas included longer response and transport time in rural areas, but also impacted on by traffic in urban areas. Some rural areas required 4x4 vehicles and GPS and had limited services available. Rural areas were more likely to have trauma whilst urban areas were more likely to be medical. Skilled paramedics were less likely in the rural areas, impacting on scope of practice. Similarities between rural and urban areas included poor coordination between services and high numbers of non-urgent callouts.	1,2,3,4
Alanazy A, Fraser J, Wark S. 2021. Saudi Arabia	To determine issues influencing work practices of EMS personnel in Saudi Arabia.	EMS personnel (frontline paramedics and emergency medical technicians, and mid-level station managers) from Saudi Red Crescent working in rural and urban areas in Riyadh. Minimum of five years experience in EMS. Participants all male.	Hermeneutic phenomenology design. Semi-structured interviews. Interview guide based on findings of previous quantitative research. Interview focus on identifying areas for improvement not on experience of work. Interview guide piloted. Follow -up interview conducted after analysis. Thematic analysis (Braun & Clarke).	20 interviews (10 urban, 10 rural). EMT's 10, paramedics 3 (all urban), and managers 7. Main themes impacting delivery of EMS services: factors related to EMS personnel, patients, and organisation. Sub-themes included working conditions, stress, education, and training and resources. Specific geographical issues: lack of education opportunities in rural areas, paramedic training only available in urban areas, challenges accessing patient, more trauma calls in rural areas, more medical calls in urban areas, lack of trauma facilities or air support in rural areas so longer travel times, less stations / /staff in rural areas, reduced access to equipment, equipment that is older or not suited to the unique challenges of the rural environment, staff retention harder in rural areas (burnout) and staff dependent on volunteer assistance. Local training to reflect local caseload would be beneficial. Quality of urban and rural EMS services impacted by organisational factors. Recommendations to address identified barriers include policy change (increased female recruitment), enhanced training for rural personnel, increased public awareness of EMS role.	1,3,4
Alanazy ARM, Wark S, Fraser J, Nagle A. 2020. Saudi Arabia	Examine the utilisation of prehospital EMS resources across rural and urban areas.	Random sample of rural and urban patient care records from the Saudi Red Crescent Authority EMS. 559 men and 241 women patients were sampled.	Cross-sectional study utilising random sampling of electronic databases.	Deaths on scene were higher in rural areas than urban areas, however overall death rate was low between the two. Urban areas workload consisted more of medical cases whereas rural areas had a 50/50 split of medical and trauma cases. Rural patients were more likely to experience fractures/ lacerations and head injuries, Urban patients more frequently endured wounds/burns. Nil significant difference in airway, breathing, extrication, and immobilisation treatment; however, urban patients were significantly more likely to receive circulation treatment. Rural patients were five times more likely to receive advanced treatment over urban patients; however, overall numbers were still small.	3

Table 2. Summary of characteristics articles included.

Author(s) & year of publication	Aim	Participant characteristics	Methods	Relevant Findings	Theme(s)
Ashburn NP, Hendley NW, Angi RM, Starnes AB, Nelson RD, McGinnis HD, et al. 2020. USA	To investigate scene time and transport time in adult and paediatric trauma patients.	Adult & paediatric trauma patients transported to Level I and Level II trauma centres by ground, ambulance under emergency conditions. 2179 patient records identified. 2077 patient records included in analysis. 92.4% (n=1919) adult, 7.6% (n=158) paediatric. 68.8% (n=1428) males. Excluded non-emergency transports and patients deceased on scene.	Retrospective cohort study of penetrating and blunt trauma patients transported to Level I and Level II trauma centres by ground ambulance under emergency conditions over five-year period (2013-2018). Cohort drawn from regional and multijurisdictional area (five counties across North Carolina) served by ALS-level EMS agencies. Two counties included urban centres. Geographic categories determined by the Centres for Medicare and Medicaid Services Ambulance Fee Schedule (AFS). Descriptive statistics and linear mixed-effects modelling.	80.6% (n=1675) blunt injury, 19.4% (n=402) penetrating injury. 20.1% (n=416) rural. Target scene time goal of 10 mins exceeded in 64.7% of cases. Mean scene time 14.2 minutes. Mean transport time 17.5 minutes. Scene time for adult trauma patients, blunt and penetrating, significantly greater than scene time for paediatric trauma patients. Shorter scene times for paediatrics, males, penetrating injury, blunt trauma in rural areas. Transport time for adult trauma patients, blunt and penetrating, comparable with transport time for paediatric trauma patients. Shorter transport times for males, non-white patients, patients in urban areas.	2
Ashburn NP, Snavely AC, Angi RM, Scheidler JF, Crowe RP, McGinnis HD, et al. 2022. USA	To quantify differences in rural and urban areas for prehospital times for cardiac patients.	ESO Data Collaborative dataset of 1332 EMS agencies, a total of 428 ,054 encounters during 2013-2018. 10.3% were rural. Rural areas were defined as less than 2 ,500 people.	Statistical analysis including generalised estimating equation.	Rural cases had a median response time of 10.0 min in comparison with 5.0 min in urban areas. Median scene time 16 min rural; 16 min urban. Median transport time 27.0 min rural; 12 min urban.	2
Bush M, Glickman LT, Fernandez AR, Garvey JL, Glickman SW. 2013. USA	Identify patient, geographic and EMS agency related factors associated with failure to perform a prehospital ECG.	Data from the Prehospital Medical Information System in North Carolina Patients greater than 30 yrs and had a prehospital complaint of chest pain.	Retrospective cohort Study. Data obtained was entered using a web-based interface or exported by EMS agencies using commercial software which was certified compliant.	Lowest proportion of prehospital ECG utilisation was found to be in the most rural populations. Persons with less transport times were significantly less likely to have a prehospital ECG conducted than longer transport times. Biggest barrier to performing prehospital ECGS was found to be the under availability of ECG equipment and Ems certification which was more prevalent in rural areas. This study recommends increased ECG equipment availability and training in rural areas particularly due to a higher probability of having a non-paramedic crew in these areas.	2,3
Cash RE, Crowe RP, Bower JK, Foraker RE, Panchal AR. 2019. USA	Compare the distribution of cardiovascular health metrics between EMTs and paramedics and identify associations between demographics and employment characteristics.	Nationally certified emergency medical service professionals. 24,708 EMS professionals were surveyed and included in the study.	Cross sectional survey based on the American Heart Association's Life's Simple 7 with multivariable logistic regression analysis to estimate odds ratios.	Factors associated with optimal cardiovascular health included education level, higher personal income and working in an urban versus rural area (OR = 1.31).	4
Clark DE, Winchell RJ, Betensky RA. 2013. USA	To determine the effect of emergency care on patient outcomes related to traffic injuries.	Pre-existing data from 2002-2003 Fatality analysis Reporting System which collates national data from the USA.	A variety of statistical analyses including regression modelling.	Increased hazard with rural location. First 30 min of EMS intervention beneficial for patients, but not for those who do not reach a hospital within that 30 min timeframe. Despite the impact of delay crash prevention is a more effective strategy.	2,3
Coleman N, Barry T, Tobin H, Conroy N, Bury G. 2019. Ireland	To explore training, clinical practice, and experience of Irish Advanced Paramedics (APs) in paediatric airway management and to examine attitudes of clinicians.	Graduates of AP training program at University College Dublin (n=453). Sample of 382 contacted. 75% of AP respondents based in urban or mixed environments.	Anonymous survey. Survey piloted. Survey not validated.	Response rate of 48%. 70% of participants exposed to paediatric case requiring airway management, but only 23% had formal training to manage this. 40% of population rural. Challenges related to response times, transport times, and high risk of skill erosion due to infrequent exposure. 85% wanted refresher training in the hospital environment.	1,2,3
Connolly MS, Goldstein PJP, Currie M, Carter AJE, Doucette SP, Giddens K, et al. 2022. Canada	Investigate the differences in OHCA survival between urban centres and rural areas.	Data collected from Emergency Health Service electronic patient care record system.	Retrospective cohort study over 12 months with multivariable logistic regression covariates.	Paramedic response time was shorter in urban than rural areas as well as estimated time to defibrillation resulting in a higher number of ROSC in urban areas. Throughout the study urban and rural areas had a similar number of shockable rhythms, rural areas had less defibrillation resulting in ROSC. Rural mean time to defibrillation = 17.2 mins, urban mean time to defibrillation = 10.8 mins.	2

Table 2 (cont.). Summary of characteristics articles included.

Author(s) & year of publication	Aim	Participant characteristics	Methods	Relevant Findings	Theme(s)
Courtney JA, Francis AJP, Paxton SJ. 2013. Australia	Investigate sleep quality, fatigue, mental health, and physical activity in rural paramedics.	150 Paramedics were recruited from Victoria in Australia and was voluntary and limited to active personnel who worked a rotating roster with a night shift component. 73.1% of respondents were male and 26.5% female.	Cross sectional survey study. Regression analysis of variables within survey and reference groups from previously published studies.	Significantly higher rates of fatigue, anxiety, stress, and poorer sleep quality in rural paramedics in comparison to similar reference group samples. Rural paramedics also reported less physical activity. Nil significant differences in depression were found.	4
Cui ER, Fernandez AR, Zegre-Hemsey JK, Grover JM, Honvoh G, Brice JH, et al. 2021. USA	Evaluate EMS response, scene, and transport times and adherence to proposed time benchmarks for patients with suspected ACS.	EMS suspected patients with ACS defined as a complaint of chest pain or suspected cardiac event with documentation of myocardial ischemia or prehospital ECG or prehospital activation of the cardiac care team. 4667 patients met the eligibility criteria.	Population -based, retrospective study with the North Carolina Prehospital Medical Information System analysing EMS data from 2011-2017.	Scene times were comparable however patients in rural counties experienced longer response and transport times. ECG findings of ischemia were more frequent in rural (77%) than urban (41%). Morphine use occurred twice as often in rural (19%) than urban (9%). STEMI centre activation was different with urban (71%) and rural (49%).	2,3
Deeb A-P, Phelos HM, Peitzman AB, Billiar TR, Sperry JL, Brown JB. 2020. USA	Evaluate differences in prehospital under triage in rural settings versus urban settings.	Adult patients in the Pennsylvania Trauma Outcomes Study from 2000-2017 were included which included 453,112 patients.	Retrospective mixed methods study of a registry between 2000-2017.	Under triage was higher in rural patients (8.6% compared to 3.4%). Lack of a rural trauma centre requiring transfer to an urban centre is a risk factor for under triage.	1,3
Emond K, Bish M, Savic M, Lubman DI, McCann T, Smith K, et al. 2021. Australia	Examine the perceived confidence and preparedness of paramedics in Australian metropolitan and rural areas to manage mental health related presentations.	On road paramedics were sought from five states and one territory. All paramedics across these services were invited to apply. Participants ranged from 21 to 67 years and 66.1% of participants were male compared to 36.4% female.	Cross -sectional study with an online survey of 1140 paramedics nationwide over eight months.	Rural and regional paramedics were generally older with fewer qualifications and were significantly less confident and less prepared to manage mental health presentations ($p = 0.001$) than metropolitan counterparts. Females were less confident than men ($p = 0.003$) although equally prepared to manage mental health ($p = 0.1$).	1,4
Hegenberg K, Trentzsch H, Gross S, Pruckner S. 2019. Bavaria	Investigate utilisation trends between rural and urban municipalities as well as events with and without prehospital emergency physicians dispatched.	Ambulance dispatch data collected between 2007 and 2016 in Bavaria from 26 dispatch centres. Locations were classified into five levels of rurality.	Retrospective observational study utilisation negative binomial mixed effects regression models to investigate differences and utilisation trends. Graphical representation methods used to compare distribution of transport rates and distribution across time.	In Bavaria the number of emergencies with a prehospital emergency physician (PEP) dispatched was 1.5 times higher in large cities than rural areas. Transport rates were similar between rural and urban areas when a PEP was dispatched however, transport rates were higher in rural areas then a PEP was not dispatched. There were a higher number of emergencies in the urban areas during the day this was inferred to be due to the daytime population density increasing due to inbound commuters. Limitation: The authors of this study recognise that they fail to provide explanations and causes for these trends and that these may only be applicable to Bavaria and may not be transferable to other regions with differing healthcare infrastructure and population composition.	3
Hodell E, Hughes SD, Corry M, Kivlehan S, Resler B, Sheon N, et al. 2016. USA	Understand the challenges and barriers faced by paramedics in recognising stroke presentations prehospitally.	28 participants; Paramedics from 12 EMS agencies in rural, urban, and suburban communities.	Thematic analysis from 12 emergency medical service agencies from urban and rural communities. Transcripts were subjected to deductive and inductive coding.	Language barriers were noted in urban areas as an impairment to recognising stroked prehospitally. This was not mentioned in the rural environment. A rural participant acknowledged that stroke calls are rare, and both rural and urban paramedics acknowledged the importance in feedback in improving their recognition of strokes prehospitally; it was identified that this was easier in rural than metropolitan areas.	1
Hsu Y-C, Wu W-T, Huang J-B, Lee K-H, Cheng F-J. 2021. Taiwan	Examine the relationship between outcomes of out of hospital cardiac arrests and the patient's underlying pathology and in urban areas versus rural areas.	Study was conducted in Kaohsiung, which has the second highest population in Taiwan, and all patients that had an out-of-hospital cardiac arrest and were treated by EMS were examined.	Univariate and multivariate logistic regression analyses of 4225 cases from EMS databases between January 2015 and December 2019.	Urban areas were a prognostic factor for more than 24-hour survival (CI = 1.179-1.761). EMS response timing was quicker and rate of attendance by paramedics was higher in urban settings ($p < 0.001$). EMS response time was an independent risk factor for survival to hospital discharge.	2

Table 2 (cont.). Summary of characteristics articles included.

Author(s) & year of publication	Aim	Participant characteristics	Methods	Relevant Findings	Theme(s)
Lee E, McDonald M, Oâneill E, Montgomery W. 2021. Canada	Evaluate pilot community paramedicine (Connolly et al.) programs from paramedic perspectives to gain recommendations from both rural and urban settings.	Online questionnaire . 158 participants with and without CP experience. 75 participants had self -identified as having CP experience with 6-12 months being the average length of time CP had been practiced at the time of questionnaire completion. 41 of these were from rural areas.	Mixed-methods sequential explanatory study.	Urban CP programs usually have dedicated CPs who devote their whole shift to CP duties. In rural CP programs it is more common for paramedics to undergo both CP work and EMS work in the same shift. Urban paramedics were found to be more positively receptive to CP compared to rural paramedics who preferred EMS duties when asked to choose between the 2. Both rural and urban paramedics preferred to be able to carry out both CP and EMS duties in the same shift. Limitation: CP was only initiated in some areas for a few months before the questionnaire was released.	3,4
Irvine R, Doan T, Bosley E, Colbeck M, Bowles KA. 2022. Australia	To determine epidemiological patterns and characteristics of paediatric OHCA. Prevalence of aetiologies across different groups.	OHCA over 10-year period (2009 - 2019). 1612 patients attended by QAS. Patients up to 18 years. Neonates excluded.	Retrospective analysis of QAS OHCA database.	Lower rate of ROSC in rural areas (20% v 32% urban). More traumatic OHCA in rural areas (26% v 16% urban). 25% achieve ROSC. ROSC higher in urban (32% v 20% rural). Disparities between rural and urban outcomes across age ranges. Disparities in paramedic scope (CCP 92% urban v 63% in rural). Response times similar in rural and metro areas. Better outcomes for witnessed OHCA with defibrillation.	1,2,3
Jegasothy E, McGuire R, Nairn J, Fawcett R, Scalley B. 2017. Australia	Estimating impact of heat and cold events on the utilisation of health services across NSW (ambulance calls, ED visits and mortality).	10-year period (2005 – 2015). NSW – urban, regional, and rural locations.	24 Poisson time-series regression models. Reviewed data on ambulance calls, ED visits and mortality.	Almost 70% of data related to urban areas. Heat waves resulted in a statistically significant increased utilisation of health services. Gradient increases with severity. Cold waves did not have a statistically significant effect on health service utilisation, except in outer regional / remote areas. Ambulance calls did not vary across geographical areas during heat or cold waves. ED presentations and mortality differed between locations. Urban and rural areas may need to prepare in different ways. Low intensity heat waves have greater impact in rural areas leading to excess strain on healthcare system in areas with limited resources (ambulances). Cold waves impact more on ED than on ambulance calls.	3
Lu Y, Davidson A. 2017. USA	To understand the need for and access to EMS.	Fatal motor vehicle accidents (n= 10 ,132) in Texas 2006-2008 from the Fatality Analysis Reporting System.	Statistical analysis of distribution of fatal motor vehicle accidents in Texas from a spatial disparity perspective.	Service areas were larger in rural rather than urban areas. Rural areas had greater fatality rates. Average response times urban 7.19; rural 14.85 min; Average transport time urban 27.85; rural 39.24 min;.	2
Martin LK, Lewis VJ, Clark D, Murphy MC, Edvardsson D, Stub D, et al. 2020. Australia	Factors hindering paramedics and emergency nurses managing STEMIs in rural and metropolitan hospitals.	333 respondents; 293 paramedics; 101 metropolitan paramedics; 209 regional/rural paramedics.	79 item online survey, with descriptive statistics and exploratory factor analysis.	All metropolitan and regional/rural respondents were combined, i.e.., cannot separate paramedics from nurses, however as there were significantly more paramedics than nurses this is still relevant. 73% of metropolitan; 49% regional/rural indicated poor handover in the cath lab environment. Regional/rural paramedics more likely than metropolitan counterparts to complain about too many policies related to STEMIs; inability to achieve commitment to guidelines, e.g.., due to distance, lack of services or being sole practitioner; limited resources; poor hospital coordination, e.g.., off-loading patients; lack of confidence with complex patients; and a lack of reliability within algorithms.	1,3
Masuda J, Kishi M, Kumagai N, Yamazaki T, Sakata K, Higuma T, et al. 2018. Japan	To investigate disparities in emergency care of AMI between rural and metro areas	AMI patients receiving PPCI within 24 hours. Rural cohort (1313) compared with metro cohort (2075). Data collected over a 1-year period (2013).	Observational study. AMI Registry from rural and metro areas used.	AMI patients in rural areas less likely to be transported direct to PCI centre leading to delays in PPCI (43% v 60%). Direct ambulance transport to PCI facility strongest predictor for OTB time <2 hours. Higher prevalence of co-morbidities in rural cohort. Rural cohort had longer hospital stays and higher mortality rates. OTB significantly longer in rural. Time to scene and on scene shorter in rural group but transport times longer.	1,2,3
Moafa HN, van Kuijk SMJ, Alqahtani DM, Moukhyer ME, Haak HR. 2020. Saudi Arabia	Examine differences in characteristics of jobs dispatched my EMS between rural and urban areas in Saudi Arabia.	The population -based registry included all missions deployed over one year in 2018.	Retrospective cohort study with statistical analysis.	Rural areas encountered male patients more frequently and female in urban areas. Urban areas demanded more medical emergencies, and rural encountered more traumatic emergencies. 67.8% of calls were for the high urgent category in metropolitan while rural was 50.8%	3

Table 2 (cont.). Summary of characteristics articles included.

Author(s) & year of publication	Aim	Participant characteristics	Methods	Relevant Findings	Theme(s)
Newgard CD, Rongwei F, Bulger E, Hedges JR, Mann NC, Wright DA, et al. 2017. USA	To describe and evaluate rural vs urban care, severity, and mortality among patients of EMS.	44 EMS agencies transporting 67 047 patients during 2015-2016; only 1 971 (2.9%) were rural Rural defined as 60 mins driving – different to other research.	Statistical analysis including stratified probability sampling.	Rural response and transport times longer, but on-scene time similar to urban. Death in rural areas more likely outside hospital, however mortality not significantly different overall – could be due to limited numbers of rural patients.	2
Nordberg P, Jonsson M, Forsberg S, Ringh M, Fredman D, Riva G, et al. 2015. Sweden	Determine the effects of dual dispatching on response times and region outcomes in OHCA.	OHCA data from January 2004 – -December 2009 divided into 4 subgroups (rural, suburban, urban, and downtown) Patients were greater than 8 years old and cardiac arrest was assumed to be of a cardiac nature and was not witnessed by an EMS crew.	Prospective cohort study and characteristics of each case collected from the Swedish Cardiac Arrest Register. All comparisons of proportions were tested using the Wald Chi-Square test.	This article shows that dual dispatch improves patient outcomes. Dual dispatch of firefighters or police in addition to EMS in cases of OHCA has been shown to reduce response times and has been associated with improved survival rates. The 30-day survival increased significantly in the downtown and suburban populations, while a limited impact was seen in the rural areas. Firefighters were first on scene in 54% rural cases and 27% in downtown area. Dual dispatch significantly reduces response times in all regions (EMS response times remained the same throughout).	2,3
Ro YS, Shin SD, Song KJ, Lee EJ, Kim JY, Ahn KO, et al. 2013. South Korea	Understand trends in outcomes of EMS OHCA according to the community urbanisation level.	Nationwide OHCA database in South Korea including information on demographics. Case sheets from 2006-2010 were reviewed of 119 ambulances operating during this time.	Retrospective nationwide observational study. The outcomes were calculated compared to a standard population.	Median response time 9 min 30 sec in rural areas, 7 min 23sec in urban areas, 6 min 20 sec in metropolitan areas. Transfers to Level 1 and Level 2 Emergency departments were 14.6% rural, 43.4% urban, 65.4% metropolitan. OHCA results in rural areas did not improve over the study period whilst they did in urban and metropolitan areas. This is assumed to be due to improvements made in urban and metropolitan communities but not rural areas suggesting major improvements in EMS resources, quality, CPR techniques, and hospital post- ROSC care have not occurred equally amount these areas.	2,3
Sariyer G, Ataman MG, Sofuoalu T, Sofuoalu Z. 2017. Turkey	Characterise ambulance utilisation rates between rural and urban areas and investigate associated factors.	Total emergency demand was analysed, and data categorised into four sub-categories: gender, age, rural-urban, and reason for the call. All non-emergency calls were excluded.	Retrospective mixed methods study drawn from the State Provincial Health Directorate ambulance services during 2013.	The absolute number of calls from rural regions was less than urban but the rural regions had a higher proportion of calls (i.e., calls per 1000 people). Significant but negative relations identified between rural and urban demand.	3
Stopyra JP, Crowe RP, Snavely AC, Supples MW, Page N, Smith Z, et al. 2022. USA	To examine disparities in prehospital times for rural STEMI patients.	Data collected from 23,655 STEMI patients.	Analysis of prehospital patient database over a 2-year period (2018 & 2019). 1366 emergency service agencies provided access to databases.	EMS intervals significantly longer in rural areas. 60% less likely to meet 60 min target. 8.4% (1994) of participants were rural areas. Increased annual mortality in rural areas. 1/3 of rural patients did not receive a 12-lead ECG within 10 mins on scene. Rural patients less likely to meet the 15 min on scene target.	2,3
Wong HT, Lin T-K, Lin J-J. 2019. Taiwan	To assess differences in demand and misuse of the Emergency Ambulance Service (EAS) rural and urban areas of New Taipei City, Taiwan.	160 ,000 EAS usage records of 67 EAS units extracted from New Taipei City Fire Services Department Misuse was classified as Triage categories 4 and 5.	Statistical analysis – negative binomial regression model.	Rural areas had a significantly higher EAS demand per capita than urban areas. Rural areas showed a link between a lack of medical resources and misuse.	3
Yeap E, Morrison J, Apodaca A, Egan G, Jansen J. 2014. Scotland	Determine the effect of rurality on the level of destination healthcare facility and ambulance response time for Scottish trauma patients.	Prehospital data collected by the Scottish Ambulance Service form 2009-2010 . Data composed of 50.5% male, 48.2% female, and 1.5% gender not recorded . Median age 59 years.	Retrospective analysis of prehospital data. Locations characterised using the Scottish urban/rural classification.	Remote locations are disadvantaged due to prolonged pre-hospital response times, in addition to being transported to hospital which are not as well-resourced in comparison to more urban areas. Call out times increase with degree of rurality as well as travel times. Regionalisation of trauma care and enhanced retrieval capability may improve these disparities. Limitation: This study uses the Scottish urban/rural classification which may not be comparable to other countries.	2

Reference:

Theme 1: Skills and Confidence of the Workforce

Theme 2: Resourcing

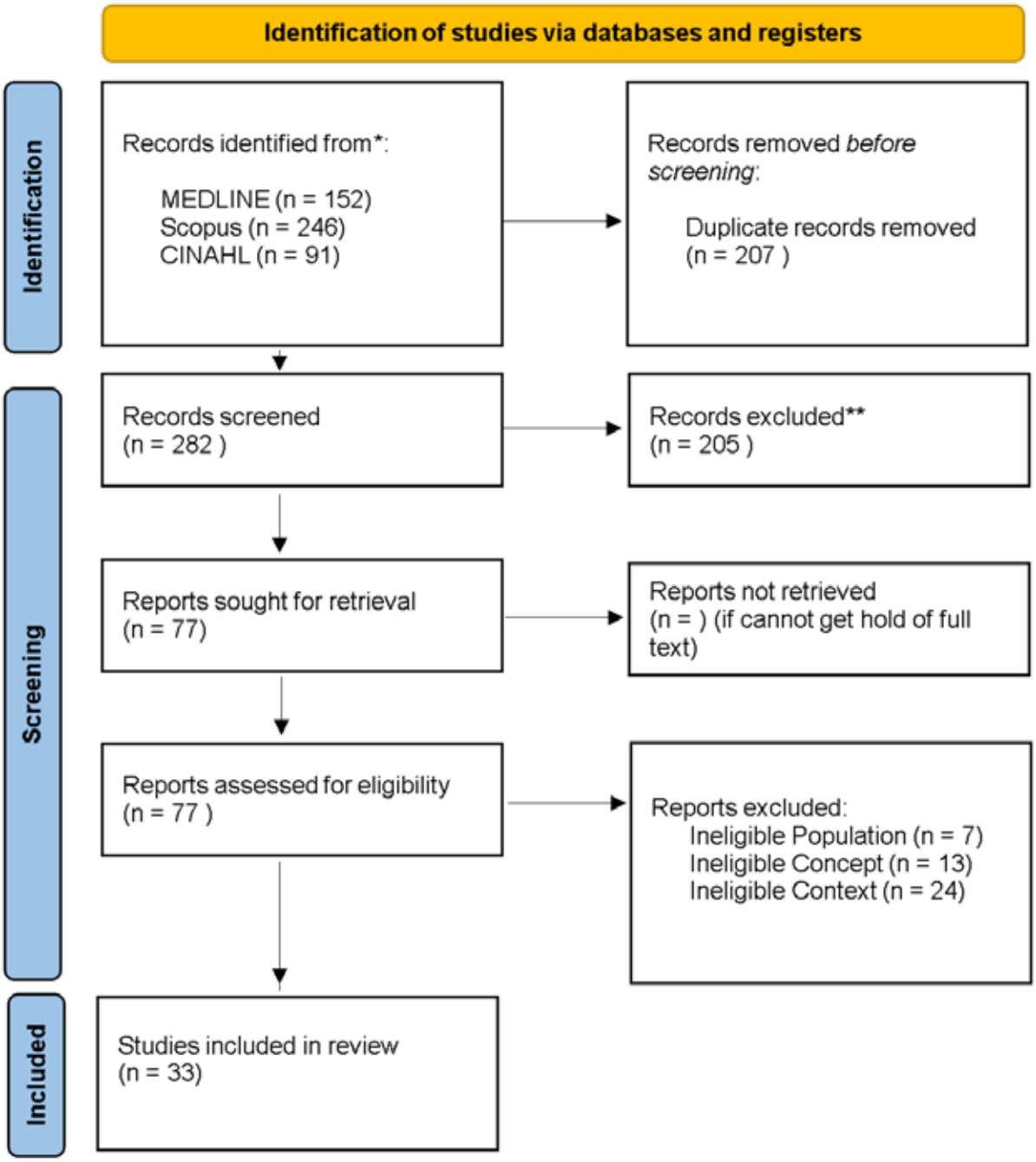
Theme 3: Timing

Theme 4: Paramedic Health Status

Table 2 (cont.). Summary of characteristics articles included.

#	Query	Results
MEDLINE ALL (includes MeSH headings) [1946 to Present] (Ovid). Searched 25/01/2023.		
1	(urban or metro*).ti,ab.	209,181
2	(rural or remote or regional).ti,ab.	459,540
3	Emergency Medical Technicians/ or (paramedic* or ambulance or EMT or emergency medical technician* or prehospital or pre-hospital or out of hospital).ti,ab.	66,891
4	(Comparison* or imbalance* or disparit* or differ* or dissimilar* or contrast* or variation*).ti,ab.	7,945,769
5	1 and 2 and 3 and 4	301
6	limit 5 to (english language and yr="2013 - 2023" and journal article)	152
CINAHL Plus with Full Text (EBSCOhost). Searched 25/01/2023.		
S1	((MH "Urban Areas") OR (TI (urban OR metro*)) OR (AB (urban OR metro*)))	89,452
S2	((MH "Rural Areas") OR (TI (regional OR remote OR rural)) OR (AB (regional OR remote OR rural)))	155,143
S3	(MH ("Emergency Medical Technicians" OR "Prehospital Care") OR paramedic* OR ambulance OR EMT OR "emergency medical technician*" OR prehospital OR pre-hospital OR "out of hospital" OR out-of-hospital)	47,980
S4	((TI (Comparison* OR imbalance* OR disparit* OR differ* OR variation* OR distinction* OR dissimilarit* OR effect* OR experience*)) OR (AB (Comparison* OR imbalance* OR disparit* OR differ* OR variation* OR distinction* OR dissimilarit* OR effect* OR experience*)))	2,594,650
S5	S1 AND S2 AND S3 AND S4	282
	S5 limited to 2013-2023, English Language, Peer Reviewed, Journal Article	91
Scopus. Searched 25/01/2023.		
1	ABS (urban OR metro*) AND ABS (rural OR remote OR regional) AND ABS (paramedic* OR ambulance OR emt OR {emergency medical technician} OR {emergency medical technicians} OR prehospital OR pre-hospital OR {out of hospital} OR out-of-hospital) AND ABS (comparison* OR imbalance* OR disparit* OR differ* OR variation* OR distinction* OR dissimilarit* OR effect* OR experience*) AND (LIMIT-TO (PUBYEAR , 2023) OR LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016) OR LIMIT-TO (PUBYEAR , 2015) OR LIMIT-TO (PUBYEAR , 2014) OR LIMIT-TO (PUBYEAR , 2013)) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (SRCTYPE , "j"))	246
Total from all databases:		**489**
Total after duplicates removed:		**282**

Appendix 1. Queries and results.



Appendix 2. PRISMA-ScR (Page, 2020).
*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).
**If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.

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