Research

The demographic and clinical practice profile of Australian remote and industrial paramedics: Findings from a workforce survey

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Abstract

Introduction

A large workforce is employed in remote environments in the Australian mining and fuel sectors. Whereas paramedics are increasingly assuming roles as healthcare providers in these locations, little is known about industrial paramedic practice. The aim of this exploratory study was to better understand the demographics, education, clinical practice and work environment of the Australian paramedic workforce in remote and industrial settings to inform future research and education for the emerging specialty.

Methods

Web-based respondent driven network sampling was used to recruit remote and industrial paramedics in this cross-sectional descriptive study. A self-administered questionnaire elicited responses (n=111) about participant demographics, work environment, initial and continuing education, and clinical scope of practice.

Results

Paramedic participants working in remote and industrial settings are predominately male (86.5%) with the majority aged 35 to 44 years (38.7%). Their job titles range widely and include paramedic, intensive care paramedic, industrial, mine and offshore paramedics. Participants report an average of 15.4 years of total healthcare experience and working in the remote or industrial health sector for a mean of 7.1 years, primarily in Western Australia (34.2%). These paramedics often engage in continuing education, with 45% studying at a vocational or tertiary institution at the time of the survey. Most respondents (63.9%) describe their employment as directly or indirectly related to the natural resource sector and 75.7% have experience in remote settings such as camps, mining sites, offshore platforms, vessels or small communities. Most practitioners (59.5%) work in a full-time capacity and can perform core paramedic skills including intravenous cannulation, 12-lead electrocardiogram interpretation, chest needle decompression and restricted drug administration. Additionally, more than 40% of those actively working in the sector report having endotracheal intubation and intraosseous access in their scope of practice. They also administer immunisations, antibiotics and other prescription medications, manage chronic diseases, and perform low acuity skills typically included in a community paramedic role.

Conclusion

This workforce survey is the first of its kind designed to gain a broader understanding of the paramedic practitioners who work in remote and industrial settings and the characteristics of their work environment. Key areas highlighted by this study serve to inform professional regulators, educators and employers with respect to the skills that remote and industrial paramedics perform and the education that is required to support the evolving specialised practice.

Keywords:

paramedic; emergency medical services; industry; mining; remote

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Introduction

The production of precious metals, coal, oil and gas are globally significant industries in Australia (1,2) where a large workforce is employed to work in inhospitable environments. Employees in Australia's mining and fuel sectors commonly work in very remote and isolated locations (3) where paramedics are increasingly assuming roles as healthcare providers to address workers' health and safety needs. As an emerging specialty, little is known about these paramedic practitioners and their remote practice.

The remote worker's health needs

Although data sources vary, there are reportedly 50,000 to 100,000 employees on shift every day in Australia's resource sector (4). Working in potentially hazardous environments, remote staff are at risk for serious injuries (5,6). Furthermore, they can suffer from minor ailments including dental problems, ear, eyes, nose and throat conditions, respiratory infections, sexually transmitted diseases and skin or soft tissue issues (1,7,8). These employees may also face specific occupational health-related risks including tropical and infectious diseases (9), hyperbaric diving injuries (10,11) as well as altitude-related illness and chemical exposures (12). Compounded by the effects of isolation and high stress, workers can also experience worsening mental health and chronic disease states (4,13). Often working in fly-in fly-out or drive-in drive-out rotations, remote employees require scheduled and preventive healthcare services in addition to traditional emergency medical response (14).

Paramedics working in remote and industrial settings

First aid attendants or occupational health nurses with off-site physician support historically played key roles in providing healthcare in industrial settings (15,16). Paramedics are increasingly being hired to work remotely. This is due in part to a shift from vocational to tertiary education and expanding scope of practice, combined with nursing workforce shortages (17,18). In 2012, the Council of Ambulance Authorities estimated that 1–2% of the paramedic workforce provided services to industrial or mining operations (19). While the exact number of paramedics working in remote settings is unknown, in 2019 there was an estimated 4700 of 17,323 registered Australian paramedics employed by the private sector other than state ambulance services (20). A comprehensive description of this workforce is not yet available.

The industrial paramedic

Paramedics are an ideal practitioner for the remote setting and well positioned to meet the remote worker's varied healthcare needs. Their training prepares them to readily adapt their practice to suit uncontrolled, unpredictable and potentially hazardous environments (21,22). Experts in emergency response, paramedics are well regarded for their ability to perform a wide range of complex, invasive and often life-saving clinical interventions (23,24). As a regulated health profession

with a flexible scope of practice, paramedics can readily respond to the needs of the patient population they serve and are now routinely providing non-emergent and scheduled healthcare for remote workers (20,25,26).

The Australasian College of Paramedicine specifically uses the term 'industrial paramedic', differentiating this non-traditional paramedic role from event and defence medics (27). Acknowledging this practice as a relatively new subspecialty, Acker and colleagues (28) define an industrial paramedic as one who "provides emergency response, primary healthcare, chronic disease management, injury prevention, health promotion, medical referral and repatriation coordination at remote mining sites, offshore installations and other isolated industry settings". These industrial paramedics are further characterised as having limited access to healthcare resources, employing the use of telemedicine and relying on remote medical oversight or topside support (28). While the above description has been proffered, clear definitions of this and similar non-traditional paramedic roles remain elusive. It is challenging to definitively differentiate remote paramedic practice in an industrial type setting from that of extended care practice in a rural outback community. Bowles and colleagues propose that the practice setting for industrial paramedicine is associated with a remote, hazardous environment (29). For this report, the researchers submit that it is this combination of extended distance from tertiary care, potential hazards and risk to employees, and being associated with the resource sector that most clearly defines remote or industrial paramedic practice.

Aim and rationale

Despite it being a unique role with specialised practice, there is a paucity of research investigating industrial paramedicine. The aim of this exploratory study was to better understand the demographics, education, clinical practice and work environment of the Australian paramedic workforce in remote and industrial settings. This paper reports on a subset of findings from a larger workforce study which included research to gain a better understanding of how remote and industrial paramedicine is practised across Australia. The outcomes of this study can inform future research and education for the emerging specialty of industrial paramedicine.

Methods

Survey instrument

This cross-sectional descriptive study was an exploration of the characteristics of the Australian industrial paramedic workforce. Though available survey instruments were deemed unsuitable, two existing surveys were used to inform the development of a new instrument for this study. These included the 'rural allied health workforce study' survey by Keane and colleagues (30) and the 'confidence in common procedures and conditions' survey by Worley and colleagues (31). The first survey draft was piloted by two paramedic academics and six content matter experts in rural and remote paramedic practice. Feedback was

used to inform changes reflected in the final version of the web-based survey. The survey instrument was then deployed using Survey Monkey® and included questions used to determine participant demographic information and employment details, education and experience and clinical expertise. Though not reported here, participants were also asked to provide details on the patient presentations they encounter, methods of medical consultation and referral pathways, patient transport options and perceptions of continuing professional development for industrial paramedics.

Participants and recruitment

The participants in this research were paramedics who either had previous experience or were actively providing medical services in remote or industrial settings within Australia at the time of the survey. For the purposes of this study, potential participants were relied upon to self-identify as those with experience in remote or industrial settings. Participants were sourced using web-based respondent driven network sampling (WebRDNS) (32). This form of internet respondent-driven sampling is found to be highly efficient and effective for reaching specialised and small populations (33). The method used social networking sites such as LinkedIn, Facebook and Twitter to broadcast invitations to participate in the study. In this network-based (ie. snow-ball type) sampling method, initial participants who fit the recruitment criteria were invited to send invitations to members of their networks who share the same professional attributes.

The survey was available online for 100 days between September and December 2015. The researchers offered an extended timeframe to ensure that any potential participant who worked a fly-in-fly-out rotation would have the opportunity to complete the survey. A short invitation with the survey link was posted in specific social network communities where remote and industrial paramedics were likely to be members. For example, the 'remote medics', 'paramedics and emergency service officers within the natural resources', 'medicine and the natural resources industry' and other LinkedIn groups were targeted for disseminating the survey invitation. Likewise, the hashtags #remoteparamedic and #industrialparamedic were utilised to broadcast the survey link on Twitter. Targeted individuals from the largest private employers of remote and industrial paramedics in Australia were also sent an email invitation. These organisations included Aspen Medical, International SOS, MSS Strategic Medical Services, SiteMed, St John Ambulance Western Australia, St John Ambulance Northern Territory, ER24, First Call Medical, Wilson and Pinnacle Safety. Participants known to the research team or recommended by other participants were also invited via email to complete the survey. Lastly, Paramedics Australasia posted the survey information in the monthly issue of 'Rapid Response' and on their website. Reminders were sent via email and social media approximately every 3 weeks during the sampling period with a notable spike in responses seen immediately following each reminder.

Data analysis

The data were tabulated and descriptive statistics calculated using the frequencies dialog in IBM SPSS Statistics for Windows Version 25.0.

Results

The survey was completed by 119 eligible participants who had experience providing healthcare services in remote or industrial settings in or around Australia. Eight participants who identified their role as doctors or nurses were excluded from the results; 83 of the remaining 111 participants indicated that they were actively providing medical care in a remote or industrial setting and subsequently completed the clinical skills inventory.

Demographics

The survey revealed that respondents were predominately male (n=96, 86.5%) with the majority aged 35–44 years (n=43, 38.7%). Most (n=99, 89.2%) participants were Australian citizens who lived across all states/territories but predominately in Western Australia (n=28, 25.2%). Three respondents (2.7%) identified as Aboriginal or Torres Strait Islander. Respondent characteristics are outlined in Table 1.

Table 1. Respondent demographics

Demographic item	N (%)
Gender	
Male	96 (86.5%)
Female	15 (13.5%)
Age (years)	
25-34	26 (23.5%)
35-44	43 (38.7%)
45-54	29 (26%)
55-64	12 (10.8%)
65-74	1 (0.9%)
Citizenship	
Australian	99 (89.2%)
Other	12 (10.8%)
State/territory of residency	
Western Australia	28 (25.2%)
New South Wales	18 (16.2%)
Queensland	18 (16.2%)
South Australia	16 (14.4%)
Victoria	15 (13.5%)
Tasmania	4 (3.6%)
Northern Territory	2 (1.8%)
Australian Capital Territory	1 (0.9%)
Outside of Australia	9 (8.1%)
Total	111 (100%)

Table 2. Employment and employer characteristics

Characteristic	Response	N (%)
Location of employment (state/territory)	Western Australia	38 (34.2%)
	Queensland	18 (16.2%)
	South Australia	18 (16.2%)
	New South Wales	12 (10.8%)
	Victoria	5 (4.5%)
	Tasmania	1 (0.9%)
	Australian Capital Territory	1 (0.9%)
	Northern Territory	1 (0.9%)
	Offshore platform or vessel	7 (6.3%)
	Outside of Australia	10 (9.0%)
Healthcare experience (years)	1-5	16 (14.4%)
	6-10	32 (28.8%)
	11-15	21 (18.9%)
	16-20	11 (9.9%)
	21-25	10 (9.0%)
	26-30	13 (11.7%)
	>30	8 (7.2%)
Remote or industrial work experience (years)	1-5	56 (50.5%)
	6-10	39 (35.1%)
	11-15	12 (10.8%)
	16-20	2 (1.8%)
	21-25	0 (0.0%)
	>25	2 (1.8%)
Employment location	Metropolitan or large regional centre (>25,000 population)	9 (8.1%)
	Rural centre (5000-24,999 population)	18 (16.2%)
	Remote centre (<4999 population)	17 (15.3%)
	Very remote (mine, camp or remote work site)	58 (52.3%)
	Offshore platform or offshore vessel	9 (8.1%)
Employer type	Natural resources company	41 (63.9%)
	Supplier of goods or services to natural resources company	30 (27%)
	Government	25 (22.5%)
	Not for profit company	11 (9.9%)
	Other	4 (3.6%)
Company size (number of full time staff)	1-50	35 (31.5%)
	51-100	10 (9%)
	101-500	20 (18%)
	501-1000	9 (8.1%)
	>1000	37 (33.3%)
Total	111 (100%)	
Employment status for those actively working	Full-time (>12-month contract)	66 (59.5%)
	Part-time	4 (3.6%)
	Casual	13 (11.7%)
Total	83 (100%)	

Employment job title and experience

Participants were asked to select their current job title from a list. The most common titles included: paramedic (n=34, 21.6%), intensive care paramedic (n=21, 18.9%), emergency services officer (n=19, 17.1%), industrial paramedic/mine/offshore medic (n=16, 14.4%) or retrieval paramedic (n=4, 3.6%). Other participants selected emergency medical technician, emergency medical responder, safety manager, clinical manager or other.

The participants were also asked to describe the characteristics of their current or previous employment experience in remote practice or industrial organisations. Respondents reported having a mean of 15.4 years (range=2–42, SD=9.78) of healthcare experience and being employed in the remote or industrial health sector for a mean of 7.1 years (range=1–35, SD=5.34). Most of the respondents (n=84, 75.7%) described working or having worked in small rural and remote settings such as camps, mining sites, offshore platforms or vessels or communities with fewer than 5000 people. This work was performed primarily in Western Australia (n=38, 34.2%). Many respondents (n=71, 63.9%) reported working for natural resource companies either directly or indirectly. Of the 83 active employees who responded, they were primarily (n=66, 79.5%) working full-time contracts (>1 year duration) while 15.7% (n=13) were employed on a casual basis (Table 2).

Education

The majority (n=68, 61.2%) of these remote paramedics stated that they held a university qualification at the bachelor or postgraduate level. When asked about continuing education, 45% (n=50) were currently studying at a vocational or tertiary institution when they completed the survey. Most of those studying (n=42, 84%) reported being enrolled in bachelor or master's degrees in paramedicine, health science, nursing, public health or emergency management. The remainder were primarily enrolled in certificate III or certificate IV courses in occupational health and safety, marine operations or training and assessment. At the time they were first employed as remote paramedics, 68.5% (n=76) held a paramedic diploma

or bachelor's degree at minimum while 31.5% (n=35) reported starting as remote healthcare workers with certificate II, III or IV qualifications (Table 3).

Clinical skills

Of the 111 survey participants, 83 were actively employed in remote or industrial areas. These participants were asked to identify from a list of clinical skills which were included in their scope of practice. One actively employed participant did not complete this component of the survey. Consistent with expectations, the vast majority of practitioners reported that they were able to perform core paramedic skills including: supraglottic airway insertion (n=81, 98.8%), chest needle decompression (n=59, 71.9%), intravenous cannulation (n=72, 87.8%), manual defibrillation (n=76, 92.7%), 12 lead ECG interpretation (n=63, 76.8%), traction splint application (n=79, 96.3%) and restricted drug administration (n=79, 96.3%). Additionally, many active practitioners report having endotracheal intubation (n=35, 42.7%) and intraosseous access (n=49, 59.8%) in their scope of practice as well as the ability to administer immunisations (n=40, 48.8%), antibiotics (n=50, 60.9%) and other prescription medications (n=44, 53.7%). A detailed clinical skills inventory is presented in Table 4.

Discussion

Gender imbalance

The aim of this study was to develop a baseline to better understand the Australian industrial paramedic workforce with respect to the demographics, experience, education, clinical skill set and work environment. As expected, results of this study revealed that the participants are well represented by paramedics from across all Australia. Many (n=38, 34.2%) work in Western Australia while 25.2% (n=28) also reside in this state known for its robust natural resource sector. The participant characteristics in terms of gender balance closely reflects the global remote industrial workforce where most offshore workers are male (34). Interestingly, this is in contrast to the broader

Table 3. Respondent education

Response	Highest education completed before employment in remote and industrial	Highest education completed at time of survey	Education currently studying at vocational or tertiary institution
Doctorate	1 (0.9%)	2 (1.8%)	2 (4%)
Master's degree	3 (2.7%)	14 (12.6%)	16 (32%)
Postgraduate certificate or diploma	4 (3.6%)	22 (19.8%)	8 (16%)
Bachelor's degree	27 (24.3%)	30 (27%)	10 (20%)
Diploma or advanced diploma	41 (36.9%)	31 (27.9%)	8 (16%)
Certificate III or IV	22 (19.8%)	11 (9.9%)	6 (12%)
Year 12 or certificate II	13 (11.7%)	1 (0.9%)	0 (0%)
Total	111 (100%)	111 (100%)	50 (100%)

paramedic workforce. To compare, the Australian Health Practitioners Regulating Agency (Ahpra) Paramedicine Board reports that 55.6% of practising paramedics are male (35), while our survey revealed that 86.5% (n= 96) of industrial paramedic respondents identify as male. This gender imbalance raises important questions about the remote working environment especially for female paramedics who are interested in pursuing industrial careers. In similar professions such as medicine and nursing where more research is available, imbalance has led to bias, role strain and professional alienation (36,37). Research on

gender balance in paramedicine is gaining momentum (38,39) and future studies can explore the implications of a highly male dominated employment setting.

Job title, experience and scope of practice

The findings revealed that paramedics who work in these rural and remote sectors have a wide range of job titles. Only 14.4% of those surveyed specifically work as industrial, mine or offshore paramedics. The vast majority (n=55, 49.5%) are employed as paramedics or intensive care paramedics. While the data does

Table 4. Active clinicians (n=82*) who selected 'Yes' to having a skill in their scope of practice

Clinical skill	N Yes response	% Yes response
Airway		
Insert supraglottic airway devices	81	98.8%
Endotracheal intubation	35	42.7%
Medication facilitated intubation	12	14.6%
Use of CPAP or BiPAP	27	32.9%
Use of mechanical ventilators	19	23.2%
Needle decompression	59	71.9%
Chest tube insertion	14	17.0%
Surgical airway access	31	37.8%
Medication		
Intravenous cannulation	72	87.8%
Administration of blood or blood products	6	7.3%
Intraosseous access	49	59.8%
Administer immunisations (tetanus, influenza, hepatitis or other)	40	48.8%
Administer restricted medications (S4, S8 or other)	79	96.3%
Administer antibiotics	50	60.9%
Dispense prescription medications	44	53.7%
Cardiac		
Manual defibrillation	76	92.7%
Synchronised cardioversion	31	37.8%
Transcutaneous pacing	24	29.3%
12-lead ECG interpretation	63	76.8%
Fibrinolytic medication administration for ST elevation myocardial infarction	28	34.1%
Trauma		
Specialised wound management (suturing, stapling)	32	39.0%
Reduction of dislocations (patella, fingers, other)	27	32.9%
Application of traction splints for long bone fractures	79	96.3%
Use of haemostatic agents (Quickclot or other)	27	32.9%
Laboratory		
Drug and alcohol testing	58	70.7%
Point of care testing of blood and other specimens (blood gas, urinalysis, or other)	31	37.8%
Order and interpret blood results	7	8.5%
Order and interpret X-rays	5	6.1%
Other		
Urinary catheterisation	22	26.8%
Emergency dental care	27	32.9%

*One participant indicated they were active but did not complete this portion of the survey

not reveal whether particular titles are associated with specific practice settings, the results do suggest that more work needs to be done to delineate non-traditional paramedic roles. This is similar to Australian state ambulance services where frontline paramedics also have inconsistent job titles (40).

The survey findings show how remote and industrial paramedicine is representative of a mature and highly experienced workforce that employs a broad scope of clinical practice; 76.5% of those surveyed are over the age of 35 years (n=85), which may indicate that paramedics are more likely to start their careers elsewhere before moving to the industrial setting. Almost half (49.5%, n=55) of the respondents had worked in the remote sector for over 5 years and 85.6% (n=95) reported having over 5 years of experience working in healthcare. This is advantageous to the mining and fuel sectors whose employees benefit from this clinical experience. Remote paramedic practice is complex, often lacking direct clinical supervision and requires a broad scope of practice that extends beyond traditional paramedic roles (41).

A scope of practice is defined as “the area of someone’s profession in which they have the knowledge, skills and experience to practice safely and effectively according to the standards prescribed by a professional or regulatory body” (42). In resource limited areas such as remote camps and offshore oil platforms, it is desirable to have all health professionals working to their maximum scope allowable though this may be restricted by boundaries imposed by organisations, legislation or the profession (43). The expanded skillset that paramedics require in these settings is driven by the needs of the specific patient community (34,44) and is not necessarily evidence based in this under researched area (45). The survey results indicate how paramedics in the industrial environment become a ‘Jack or Jill of all trades’ in many respects. They need to be prepared to manage a wide range of minor to major medical and traumatic conditions necessitating anything from endotracheal intubation and intraosseous access to urinary catheter insertion and emergency dental care. As expected, the trauma and resuscitation skills that participants identified align with what is required to treat serious injuries that can occur in industrial settings (5). Of equal import to a community of remote workers are the skills related to primary care, health prevention and chronic disease management (34). Consistent with contemporary community paramedicine models (25,46), the data reveals how many participants are administering immunisations (n=40, 48.8%), dispensing prescription medications (n=44, 53.7%), providing specialised wound care (n=32, 39%) and performing drug and alcohol testing (n=58, 70.7%).

These findings validate the suggestion by authors that industrial paramedicine is indeed a specific emerging area of specialty practice (22,28). They also signal that some paramedics with an extended scope of practice may be performing skills that they are not trained to do in their entry to practice education (47). While flexibility and adaptability are hallmarks of the paramedic

profession (48) there may be inherent risks associated with highly autonomous roles that require a broad range of skills which are not underpinned by comprehensive education. Similar to the more established health professions of nursing and medicine, specialty areas in paramedicine will naturally evolve. It is vital that remote and industrial paramedicine clinicians have the professional knowledge and education to support their practice (49).

Education

The study highlights important findings in the area of initial and continuing education for remote and industrial paramedics. First, it is evident that this specialisation mirrors the broader paramedic profession in Australia where tertiary education is now the required entry to practice. Many of the participants either held a university qualification when they started as remote workers (n=35, 31.5%) or by the time they participated in the research (n=68, 61.2%). Notably, 23.4% (n=26) of the participants report being currently enrolled in postgraduate study ranging from graduate certificates through to doctorate degrees. The data provides a baseline snapshot of the education levels for paramedics in these remote settings and their willingness to complete further study. While more research is required to explore their motivation, these findings are useful to inform educational institutions who are planning distance education programs.

Considering the expanded clinical role, education needs to keep pace as industrial paramedic practice evolves beyond conventional boundaries (26,44). To meet the needs of the main industry stakeholders, Australian undergraduate paramedic courses typically focus on preparing graduates for emergency response within public ambulance services (50,51). Topics such as health promotion, injury prevention, chronic disease management and primary care clinical practice skills are not taught in significant depth in most paramedic courses (17,47,50-52). In the interim, this education gap has been addressed in part by the vocational education and training sector where paramedics can study a certificate IV industrial medic or occupational health and safety course (53). The uniqueness of the remote setting has also prompted some universities to offer specialised postgraduate courses. For example, the University of Tasmania offers a graduate certificate in Healthcare in Remote and Extreme Environments (54) while paramedics can attain a Master of Paramedicine specialising in extended care practice at Charles Sturt University (55). James Cook University also offers a graduate diploma program in Rural Generalist Practice for allied healthcare professionals (56). Ultimately, preparatory education of future paramedics should include foundational knowledge and skills that fully equip them to extend their roles in remote or industrial specialities.

Limitations

There are several limitations associated with this research. Despite significant recruitment efforts, there were only 111

participants in the study and without previous research in this area, it is not possible to know how representative this is of the wider population. As with any survey-based research, self-report bias may be present in the findings. There are also limitations with respect to a lack of accepted definitions for terms used in this research such as remote and industrial paramedicine. While the authors acknowledge that this requires further investigation, we suggest that the recruitment strategy was aimed at participants who fit the intended workforce profile. Of import is that the data is more than 5 years old and thus it is timely to perform a new workforce survey. Since the time this research was conducted, the paramedic profession became regulated under Ahpra who may be able to report on the number of paramedics working in the remote and industrial settings going forward. In addition, since these data were collected there have been significant changes to the global economy including the mining, oil and gas sectors. Accordingly, these findings are not reported in the context of a post-COVID-19 pandemic scenario, in which the impact on the industrial paramedic workforce is unclear.

Conclusion

Remote and industrial paramedicine is a health specialty that is insufficiently researched. This workforce survey is the first of its kind designed to gain a broad understanding of the paramedic practitioners who work in remote and industrial settings as well as their employer and employment characteristics. Key areas highlighted by this study serve to inform professional regulators, educators and employers with respect to the skills that remote and industrial paramedics perform and the education that is required to support the evolving specialised practice.

Ethics approval

This research was approved by Charles Sturt University's Human Research Ethics Committee protocol number 400/2015/25.

Competing interests

The authors declare no competing interests. Each author of this paper has completed the ICMJE conflict of interest statement.

References

1. Norman JN, Ballantine BN, Brebner JA, et al. Medical evacuations from offshore structures. *Br J Ind Med* 1988;45:619-23.
2. Commonwealth of Australia. Why Australia: Benchmark Report 2020. Australian Trade and Investment Commission (AUSTRADE); 2020 August 2020. Report No.: 2205-9415.
3. Bisits Bullen PA. Medics as a channel for worksite health promotion in remote global locations. *Am J Health Promot* 2012;26:352-5.
4. Parker S, Fruhen L, Burton C, et al. Impact of FIFO work arrangements on the mental health and wellbeing of FIFO workers. West Australia: Centre for Transformative Work Design; 2018. Available at: <https://www.mhc.wa.gov.au/media/2547/impact-of-fifo-work-arrangement-on-the-mental-health-and-wellbeing-of-fifo-workers-full-report.pdf>
5. Jones R, Cattani M, Cross M, et al. Serious injuries in the mining industry: preparing the emergency response. *Australasian Journal of Paramedicine* 2019;16.
6. Taylor DH, Casta R, Walker V, Collier F, Fromm RE, Jr. Air medical transport of patients from offshore oil and gas facilities. Historical accident data and initial experience. *Air Med J* 1993;1:21-8.
7. Phillips JC. Medical support by a team of doctors to offshore paramedics. *J R Coll Gen Pract* 1987;37:168-9.
8. Duffy B. Dental problems in the offshore oil and gas industry: a review. *Occup Med* 1996;46:79-83.
9. Aalund LR. Remote paramedics have high level of training. *The Oil and Gas Journal* 1996;94:42.
10. Proctor JC. Distant oceanic paramedical practice: an example of environmental health nursing in remote hazardous locations. *Life Support Biosph Sci* 1998;5:437-42.
11. Harries MG. Medical aspects of the North Sea oil industry. *J R Soc Med* 1983;76:793-5.
12. Vearrier D, Greenberg MI. Occupational health of miners at altitude: adverse health effects, toxic exposures, pre-placement screening, acclimatization, and worker surveillance. *Clin Toxicol* 2011;49:629-40.
13. Rhodes A. Oil companies focus on health care for remote operations. *The Oil and Gas Journal* 1996;94:76-80.
14. Torkington AM, Larkins S, Gupta TS. The psychosocial impacts of fly-in fly-out and drive-in drive-out mining on mining employees: a qualitative study. *Aust J Rural Health* 2011;19:135-41.
15. Levett-Jones T, Bourgeois S. Occupational health nursing. 2011. In: *The clinical placement: an essential guide for nursing students* [Internet]. Chatswood, NSW: Churchill Livingstone.
16. Cox RAF. Medical services to offshore drilling. *Injury* 1970;1:217-25.
17. Joyce C, Wainer J, Piterman L, Wyatt A, Archer F. Trends in the paramedic workforce: a profession in transition. *Aust Health Rev* 2009;33:533-40.
18. Witham H. Remote and rural nursing: an endangered profession? *Aust Nurs J* 2000;7:18-21.
19. Council of Ambulance Authorities. Regulation of Paramedics 2012. Available at: www.caa.net.au/attachments/article/127/2012_Regulation_of_Paramedics_CAA_Submission_Final.pdf
20. National Rural Health Alliance Ltd. The paramedic workforce in rural, regional and remote Australia. 2019. Available at: www.ruralhealth.org.au/sites/default/files/publications/paramedic-fact-sheet.pdf
21. Campeau AG. The space-control theory of paramedic scene-management. *Symb Interact* 2008;31:285-302.

22. Seel D, Turner M. Industrial paramedic: an emerging speciality? *Journal of Paramedic Practice* 2016;8:350-5.
23. Bigham BL, Buick JE, Brooks SC, et al. Patient safety in emergency medical services: a systematic review of the literature. *Prehosp Emerg Care* 2012;16:20-35.
24. Jensen J, Croskerry P, Travers A. Paramedic clinical decision making during high acuity emergency calls: design and methodology of a Delphi study. *BMC Emerg Med* 2009;9:17-20.
25. O'Meara P, Wingrove G, Nolan M. Frontier and remote paramedicine practitioner models. *Rural Remote Health* 2018;18(3).
26. Reeve C, Pashen D, Mumme H, De La Rue S, Cheffins T. Expanding the role of paramedics in northern Queensland: an evaluation of population health training. *Aust J Rural Health* 2008;16:370-5.
27. Australasian College of Paramedicine. Membership 2021. Available at: <https://paramedics.org/membership>
28. Acker J, Johnston T, Lazarsfeld-Jensen A. Industrial paramedics, out on site but not out of mind. *Rural Remote Health* 2014;14.
29. Bowles RR, van Beek C, Anderson GS. Four dimensions of paramedic practice in Canada: defining and describing the profession. *Australasian Journal of Paramedicine* 2017;14.
30. Keane S, Smith T, Lincoln M, Wagner S, Lowe S. The Rural Allied Health Workforce Study (RAHWS): background, rationale and questionnaire development. *Rural Remote Health* 2008;8:1132.
31. Worley P, Strasser R, Prideaux D. Can medical students learn specialist disciplines based in rural practice: lessons from students' self reported experience and competence. *ibid.* 2004;4:338.
32. Wejnert C, Heckathorn DD. Web-based network sampling: efficiency and efficacy of respondent-driven sampling for online research. *Sociol Methods Res* 2008;37:105-34.
33. Bauermeister JA, Zimmerman MA, Johns MM, et al. Innovative recruitment using online networks: lessons learned from an online study of alcohol and other drug use utilizing a web-based, respondent-driven sampling (webRDS) strategy. *J Stud Alcohol Drugs* 2012;73:834-8.
34. Gibson Smith K, Paudyal V, Klein S, Stewart D. Health, self-care and the offshore workforce - opportunities for behaviour change interventions, an epidemiological survey. *Rural Remote Health* 2018;18.
35. Australian Health Practitioner Regulation Agency. Paramedicine Board of Australia 2019/20 Annual Report. 2020. Available at: <https://www.ahpra.gov.au/Publications/Annual-reports/Annual-Report-2020.aspx>
36. Carte NS, Williams C. Role strain among male RNs in the critical care setting: perceptions of an unfriendly workplace. *Intensive Crit Care Nurs* 2017;43:81-6.
37. Cudé G, Winfrey K. The hidden barrier: gender bias: Fact or fiction? *Nurs Womens Health* 2007;11:254-65.
38. Lewis J, Miles M, Watson TA, Lankford E. Effect of intern and preceptor gender on internship experiences for paramedic training. *Australasian Journal of Paramedicine* 2019;16.
39. Mason P. Identifying the barriers to female leadership in paramedicine. *Irish Journal of Paramedicine* 2017;2.
40. Wilkinson-Stokes M. A taxonomy of Australian and New Zealand paramedic clinical roles. *Australasian Journal of Paramedicine* 2021;18.
41. Adams ME, Lazarsfeld-Jensen A, Francis K. The implications of isolation for remote industrial health workers. *Rural Remote Health* 2019;19:5001.
42. Peate I. Scope of practice: considering how the role of the paramedic continues to change. *Journal of Paramedic Practice* 2015;7:330-1.
43. Saxon R, Gray M, Oprescu F. Extended roles for allied health professionals: an updated systematic review of the evidence. *J Multidiscip Healthc* 2014;7:479-88.
44. McManamny T, Jennings P, Boyd L, Sheen J, Lowthian J. Paramedic involvement in health education within metropolitan, rural and remote Australia: a narrative review of the literature. *Aust Health Rev* 2018;44.
45. FitzGerald GJ. Paramedics and scope of practice. *Med J Aust* 2015;203:240-1.
46. Bigham BL, Kennedy SM, Drennan I, Morrison LJ. Expanding paramedic scope of practice in the community: a systematic review of the literature. *Prehosp Emerg Care* 2013;17:361-72.
47. O'Meara P TV, Stirling C, Walker J, Pedler D. Extending the paramedic role in rural Australia: a story of flexibility and innovation. *Rural Remote Health* 2012;12.
48. Boehringer B, O'Meara P, Wingrove G, Nudell NG. An emergency amendment to the national scope of practice for paramedics in the setting of a global pandemic. *J Rural Health* 2021;37:191-3.
49. The College of Paramedics. College of Paramedics' position statement on the designation of paramedics: undertaking extended scope of practice. *Journal of Paramedic Practice* 2011;3:59-61.
50. Thompson J. Exploring paramedic patient assessment. *ibid.* 2013;5:342-7.
51. O'Meara P, Ruest M, Stirling C. Community paramedicine: Higher education as an enabling factor. *Australasian Journal of Paramedicine* 2014;11.
52. Hou X, Rego J, Service M. Paramedic education opportunities and challenges in Australia. *Emerg Med Australas* 2013;25:114-9.
53. Aslop P. Provision of the training of offshore medics. *Journal of Paramedic Practice* 2011;3:48-9.
54. University of Tasmania. Graduate Certificate in Healthcare in Remote and Extreme Environments 2020. Available at: www.utas.edu.au/courses/chm/courses/m5a-graduate-certificate-in-healthcare-in-remote-and-extreme-environments
55. Charles Sturt University. Master of Paramedicine (with specialisations) 2020. Available at: <https://study.csu.edu.au/courses/allied-health-pharmacy/master-paramedicine>
56. James Cook University. Graduate Diploma of Rural Generalist Practice 2020. Available at: www.jcu.edu.au/courses/graduate-diploma-of-rural-generalist-practice