International Journal of Paramedicine

Published by the National EMS Management Association (USA)

RESEARCH REPORTS

ASSESSING AUSTRALIAN AND NEW ZEALAND PREHOSPITAL CLINICIANS' TRAINING, EXPERIENCE, AND CONFIDENCE WITH OUT-OF-HOSPITAL CHILDBIRTHS: A MIXED METHODS ONLINE QUESTIONNAIRE

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Recommended Citation: Hill, M., Flanagan, B., Hansen, S., Hopper, L., & Mills, B. (2026). Assessing australian and new zealand prehospital clinicians' training, experience, and confidence with out-of-hospital childbirths: A mixed methods online questionnaire. *International Journal of Paramedicine*. (14). 50-69. https://doi.org/10.56068/TQYU1140

Keywords: volunteers, obstetrics, birth, out-of-hospital birth, born before arrival, emergency medical services, EMS, paramedicine

Disclosures: None.

Funding: This research was undertaken with assistance from a PhD scholarship awarded as part of an Edith Cowan University Vice Chancellor's Research Fellowship.

Acknowledgements: The authors wish to acknowledge the assistance of the Australasian College of Paramedicine (ACP) for assistance with promoting their survey.

Received: October 13, 2025
Revised: January 13, 2026
Accepted: January 17, 2026
Published: April 14, 2026

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ABSTRACT

Introduction: Unplanned out-of-hospital births (OOHBs) pose significant risks, particularly in rural areas where access to maternity services and response times may be limited. Given that OOHBs are uncommon, prehospital clinicians use these specialized skills infrequently, leading to skill and knowledge decay, impacting clinician preparedness and confidence in managing these presentations. This research investigates prehospital clinicians' perceptions of training, experience, and confidence in managing OOHBs.

Methods: Australian and New Zealand paramedics and volunteers were recruited via social media and asked to complete a cross-sectional mixed-methods questionnaire. Training and exposure were assessed via multiple-choice, matrix, or open-text responses. Confidence in recognizing and managing an OOHB situation (antenatal, second stage, third stage, and postpartum care) was assessed utilizing summed scores of Likert scale responses. Independent samples t-tests compared means between groups.

Results: In total, 222 participants were included in the study, with 147 (66%) being female. Participant ages ranged from 18–72 years old. One hundred and sixty-eight participants (76%) had exposure to laboring or birthing patients prehospitally, and 123 (55%) participants had assisted with at least one OOHB. Complications reported (n=531) included stillbirth, neonatal death, postpartum hemorrhage, and maternal death. Obstetrics refresher training was undertaken by 141 participants in the previous 12 months.

Participants who had previous experience managing an OOHB were significantly more confident recognizing and managing an OOHB compared to participants without previous management experience. Paramedics expressed more confidence recognizing and managing OOHB situations compared to volunteers. However, for participants with children, confidence was only greater for antenatal care (not second stage, third stage, and postnatal care) compared to participants without children.

Conclusion: Participants with prior real-world exposure to OOHBs indicate a greater level of confidence in recognizing and managing OOHB situations. Targeted, practical training and ongoing in-service education are recommended to build capability and improve outcomes in these high-risk, low-frequency events.

Occasionally, births occur before birth parents arrive at their planned birthing location, typically a maternity suite or hospital. Situations where births do not occur in the planned location are known as unplanned out-of-hospital childbirths (OOHB) (Flanagan et al., 2017). In Australia in 2022, 2,622 births occurred in an unintended location outside of a hospital or occurred in a community healthcare center (excluding planned home births). These OOHBs comprise 0.9% of all births in Australia, increasing from 0.4% in 2010 (Australian Institute of Health and Welfare, 2024). Similar increases in OOHBs have been reported in Finland, the United States of America (USA), Israel, and the United Kingdom (UK) (Cash et al., 2022; Ovaskainen et al., 2015; Siman-Tov et al., 2021; Unterscheider et al., 2011). There is some evidence OOHBs were increasing prior to SARS-CoV-2, however there are documented changes to hesitancy to engage with healthcare services following the pandemic, which may contribute to the growing number of OOHBs (Thornton & Dahlen, 2018; Townsend et al., 2021).

Multiple factors contribute to OOHB incidence, including multiparity, inadequate antenatal care, illicit drug use, closure of birthing units in rural regions, or precipitous labor (Beeram et al., 1995; Helen Haines MP, 2024; Javaudin et al., 2019; Lazi & Taka , 2011; Ovaskainen et al., 2015). Some birth parents desire minimal medical intervention and may delay seeking care, while others receive advice to attend the maternity ward when in active labor (Flanagan et al., 2019; Vik et al., 2016). There are reported increases in OOHBs associated with a decline in maternity services in Australia, the USA, Norway, and Sweden (Engjom et al., 2014; MacDorman & Declercq, 2019; Örtqvist et al., 2021).

Birthing events are rare for prehospital clinicians, forming <0.05% of all callouts (Flanagan et al., 2017). Skills rarely practiced, such as those required for OOHBs, are subject to rapid decay, with classroom-acquired competencies often returning to baseline within 12 months (Woodman et al., 2021). Australian undergraduate education for paramedic students usually involves didactic and workshop simulation training; however, exposure to birthing is unlikely (Hill et al., 2023). Opportunities for in-service or continuing professional development (CPD) can overlook less common complaints, such as OOHBs, for more frequent events, such as falls causing traumatic injury (Corman et al., 2025; Hill et al., 2023). This can lead to educational 'blind spots' where there are absences in understanding of a condition (Tackett et al., 2022). Consequently, prehospital clinicians report feeling unprepared to manage OOHB cases in the absence of regular upskilling (Hill et al., 2024; Hill et al., 2023; Persson et al., 2019; Vagle et al., 2019).

Increased distances to maternity care for rural parents increase the likelihood of prehospital clinician's, including volunteer ambulance officers (VAOs), assisting with births (Dietsch et al., 2010). Registered paramedics require a bachelor's degree; however, VAOs are reliant on in-service training to understand the management of any condition (South Australia Ambulance Service, 2025b, 2025a). Metropolitan regions are serviced by paramedics, while rural and remote regions have greater dependence on VAOs to attend emergency ambulance requests. VAOs typically provide supportive care without invasive treatments such as cannulation and fluid resuscitation (Hill et al., 2024).

Unplanned OOHBs have worse outcomes than in-hospital or planned homebirths. Studies report OOHB neonates have a mortality rate five times higher than those born in hospital (Hilde M Engjom et al., 2017; Ovaskainen et al., 2015). Commonly identified OOHB complications include postpartum hemorrhage and perineal tears for the birth parent,

and hypothermia or prematurity for the neonate (Javaudin et al., 2019; McLelland et al., 2018; Thornton & Dahlen, 2018). These complications can be life-threatening and require a competent clinician to prevent adverse outcomes (Hänninen et al., 2023; Vagle et al., 2019).

While these presentations may be rare, prehospital clinician's must be adequately trained and competent in these situations, particularly as parts of Australia and New Zealand can be many hours from definitive maternity care. Given the high-risk nature of OOHBs and the limited resources available in the prehospital setting, the preparedness of prehospital clinicians is central to ensuring safe and effective care for both the birth parent and neonate. This research sought to determine the perceived levels of experience, training, and confidence in recognizing and managing OOHB presentations of Australian and New Zealand paramedics, ambulance officers (AO), and VAOs (collectively known as prehospital clinicians). VAOs were included because they frequently attend OOHBs in rural settings, despite limited entry-to-practice and more foundational training than registered paramedics. As their exposure to OOHBs is potentially similar, examining all prehospital clinician groups provides a more accurate picture of capability and training needs across the workforce.

METHODOLOGY

Study Design

Participants completed an embedded mixed-methods online cross-sectional questionnaire delivered through Qualtrics software (Provo, UT) and promoted via social media networks (Facebook, LinkedIn, and Twitter). A non-probability sampling methodology was utilized, including convenience and snowball sampling. Additionally, the survey was promoted via one Australian state-based ambulance service [service redacted], and advertised through the ACP (Australian College of Paramedicine) website, the leading paramedic professional body in Australia and New Zealand (Australasian College of Paramedicine, n.d.).

The questionnaire was based on a previous survey for medical students undergoing an obstetrics clerkship and modified for this research, as the focus aligned with training, experience, and confidence (Sabourin et al., 2014). It was further refined using prehospital obstetrics training materials from two Australian universities, with additional expert input from a midwifery academic. The number of items assigned to each stage of labor was informed by the breadth and complexity of presentations typically encountered in prehospital obstetric care. This process ensured coverage of the most clinically relevant recognition and management tasks for prehospital clinicians. Questionnaire face and content validity were established through consultation with four registered paramedics, two of whom were dual-qualified midwives; all reviewers teach at tertiary institutions, and consideration was given to prehospital clinical environments, paramedic scope of practice, and current clinical practice guidelines. The questionnaire (see supplementary material) included two sections: (1) demographic factors; and (2) experience, training, and confidence regarding OOHBs.

Experience questions considered seven potential situations the participant may have attended (e.g., 'A mother in active labor, we transported her to hospital') and asked them to quantify how many cases they have attended for each situation. Open-text responses

were available for complications not included in our list. Training questions considered the level and recency of training received (e.g., advanced first aid). Confidence questions were divided into: (1) antepartum (five questions), (2) second stage (29 questions), (3) third stage (two questions), and (4) postpartum (six questions) concerning confidence in recognizing a situation, and confidence in managing the situation. Confidence questions utilized Likert scales ranked on a 6-point scale (1=low confidence, 6=high confidence). All other questions were forced response/dichotomous response options.

Two elective open-ended questions were also included:

1. What are the factors that most contribute to any fears/anxieties you might have about obstetric emergencies and OOHBs?
2. Are there any barriers to training regarding OOHB?

Participants

Inclusion criteria included being a registered paramedic (which also includes AOs and intensive care paramedics or similar roles) or VAO, residency in Australia or New Zealand, employment with an emergency ambulance service within the previous five years, and aged 18+ years. The survey was active from 21 July 2021 until 31 December 2022. Participants with a dual qualification in Midwifery were excluded due to their advanced obstetric qualifications. Based on Australian Health Practitioner Regulation Agency (Ahpra) 2021 data for operative paramedics, 138 respondents were an appropriate sample size based on a 95% confidence interval and an estimated 90% of prehospital clinicians lacking confidence with childbirth, using the Australian Bureau of Statistics sample size calculator (Australian Bureau of Statistics, 2023; Paramedicine Board Ahpra, 2021; Persson et al., 2019).

Procedure

Participants clicked on the generic survey link circulated through social media, email, or the ACP website, directing them to the Qualtrics survey platform. After reading the information letter, participants confirmed consent to participate in the research. Completion of the questionnaire took approximately 15 minutes. Upon completion, participants received a message confirming responses were recorded and were thanked for their participation.

Ethics

The research was approved by the Edith Cowan University Human Research Ethics Committee (2021-02390). Governance was approved through the [redacted] ambulance service research governance committee. All responses were anonymous, with no identifiable information collected.

Analysis

Quantitative Data

Questionnaire data were downloaded into IBM SPSS 24.0 (SPSS Inc., Chicago, Ill., USA). Demographic, training, and experience questions were analyzed using descriptive statistics. Responses for perceived confidence in recognizing and managing care were summed to create a composite (mean) score for each participant. Internal consistency

of the scale was evaluated using Cronbach's alpha, which reports a number between 0 and 1. Reliability determines how accurately a questionnaire measures a variable, with a Cronbach's alpha above 0.7 indicating good reliability (Kılıç, 2016). The internal consistency was =0.76 (Kılıç, 2016).

Independent samples t-tests were conducted to compare mean summed scores for confidence in recognizing and managing OOHBs and complications between paramedics and VAOs; between prehospital clinicians who have children compared to those without children; and between prehospital clinicians with prior experience/exposure to OOHBs and those without. Significance level was set at =0.05 (Petrie & Sabin, 2019). Effect size was determined by Cohen's d. An effect size is a value measuring the strength of a relationship between two variables in a population. According to Cohen's (2013) guidelines, an effect size of 0.2 is small, while 0.7 represents a moderate to large practical impact (Cohen, 2013; National University, 2024).

Qualitative Data

Word frequency tables and mind maps were generated using NVivo software (NVivo 12 Plus) to provide an overview of free-text responses. An iterative approach was undertaken to code transcripts, where two researchers (MH, BM) established an open-coding protocol identifying key themes in the questionnaire's free-text responses. From these responses, selective coding then formed overarching themes within the data (Braun & Clarke, 2006).

RESULTS

Altogether, 271 participants commenced the online questionnaire, however, 49 participants were removed from analysis due to not completing all demographic questions (n=14), not meeting inclusion criteria (n=25), or not completing a minimum 75% of the questionnaire (n=10) including key demographic, experience, training, and confidence questions, with 222 participants included in the final analysis. No statistical differences were found for any demographic information between those excluded and included.

Demographic Results

Age, gender, role, and place of residence are described in Tables 1–4. Cumulative years of employment equaled 362 years across all roles (Table 3). Most participants were aged <45 years (n=172; 77.5%), were female (n=147; 66.2%), and were registered paramedics (n=133; 59.9%). Participants represented New Zealand and all Australian States and Territories.

Three participants identified as Aboriginal or Torres Strait Islander (1.4%) and one preferred not to say (0.5%). Slightly over half of the participants were childless (n=116, 52%), with four preferring not to say (1.8%).

Age Bracket (n=222)	Total Participants	Percent
18-25	36	16.2%
26-35	93	41.9%
36-45	43	19.4%
46-55	43	19.4%
56-65	5	2.2%
66-72	2	0.9%

Table 1. Demographics – Participant age breakdown.

Gender (n=222)	Total Participants	Percent
Female	147	66.2%
Male	71	32.0%
Non-binary	2	0.9%
Prefer not to say	2	0.9%

Table 2. Demographics – Participant gender breakdown.

Role (n=222)	Total Participants	Percent Total Participants	Cumulative Years Worked in these Roles	Bachelor's Degree Held	Metro	Rural
Paramedic	133	59.9%	183	117	98	35
Ambulance Officer (AO)	18	8.1%	62	7	14	4
Intensive Care/Critical Care/ Mobile Intensive Care Paramedic or similar*	31	14.0%	36	26	21	10
Volunteer Ambulance Officer (VAO)	40	18.0%	81	2	14	26
*Note: * Denotes advanced practitioners trained to manage high-acuity patients using skills beyond those of standard paramedics*						

Table 3. Participant roles, bachelor's degree (paramedical science or similar), and rural or metropolitan location.

Obstetrics Training

Participants disclosed the recency of their last obstetric training activity (Table 5). Participants could select multiple options. One-third of participants suggested completing training in the previous two years through their employer. CPD received the largest response for undertaking OOHB training within the last two years, with a reliance on online courses as opposed to in-person training.

Place of residence (n=222)	Total Participants	Percent
New Zealand	15	6.7%
Australian Capital Territory	7	3.2%
New South Wales	20	9.0%
Northern Territory	4	1.8%
Queensland	18	8.1%
South Australia	11	5.0%
Tasmania	4	1.8%
Victoria	56	25.2%
Western Australia	87	39.2%

Table 4. Demographics – Country, state, or territory where participants reside.

Participants were asked the extent to which they felt their current training had prepared them to attend an OOHB (Figure 1). The scale was ranked from 0 (unprepared) to 10 (very prepared). Most participants selected between zero and five (n=154), indicating lower preparedness, with only one intensive care paramedic selecting 10.

Experience with OOHBs

Participants were asked which birthing situations they had attended, with responses recorded in Table 6. The largest exposure to birthing was in the early stages of active labor, where the birth parent could still contact their midwife or obstetrician and be transported to the planned place of birth.

Overall, 123 participants (55%) reported assisting with a birth, with an estimated 474 births occurring across the 222 participants. Sixty-four participants with >10 years' service assisted with 331 (70%) births. Rural births accounted for 101 cases (21%), averaging 3.33 births per rural participant, compared to 373 metropolitan births with an average of 4.29 births per participant. Six births occurred in VAO care, averaging 2 births per VAO participant.

Table 7 depicts complications encountered. An estimated 531 complications were managed throughout the labor and birthing process, with 135 participants (61%) experiencing at least one complication.

Altogether 130 complications were managed by 33 rural participants, averaging 3.94 complications per participant, compared to 401 metropolitan complications managed by

Level of Training	Percentage Completed this within the Last 2 Years n=x/222* (x%)	Number of Participants Completed at any Time n=x/222* (x%)
Completed an obstetrics course as part of a Paramedical Science degree	27 (12.2%)	159 (71.6%)
Completed obstetrics training as part of an advanced first aid course	25 (11.3%)	49 (22.1%)
Completed annual refresher course in obstetrics through my employer	72 (32.5%)	141 (63.5%)
Completed a course in obstetrics as part of my Continuing Professional Development (not through your employer)	30 (13.5%)	47 (21.2%)
Read or completed an online course about obstetrics, complications, and out-of-hospital childbirth as part of my Continuing Professional Development	91 (41%)	111 (50%)
Other types of training not already listed [Free Text] • Post-graduate studies – diploma or degree (n=11) • Self-directed learning (n=5) • Employer induction training (n=3) • Placement with OBGYN/maternity service (n=3) • Mandatory in-service training (n=3) • Undergraduate nursing/midwifery degree completed/partially completed (n=2) • Obstetric emergency course (n=2) • Session with midwife (n=2) • As part of the registered nurse role (n=1) • Training for the birth of own child (n=1) • Hypno-birthing (n=1) • Undergraduate medical training (n=1)	15 (6.8%)	35 (15.8%)
*Note: *Denotes that participants had the ability to respond to more than one section, so percentages will not add up to 100.*		

Table 5. Participant descriptions and approximate timing of obstetrics training level received.

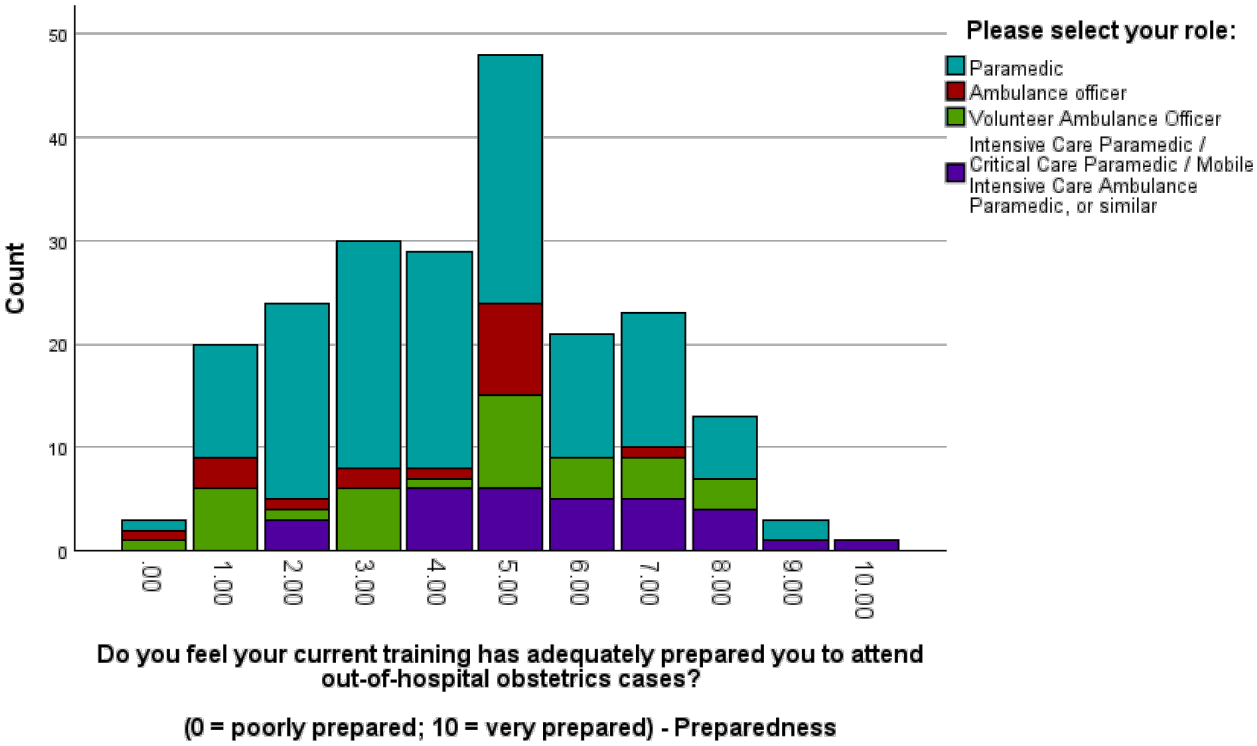

Figure 1. Participant rankings of the extent they felt their training had prepared them for attending OOHBs.

Birthing Presentations (n=168, 54 participants with no experience):	Participants Responding 'yes' (%)	Average Number of Experiences Per Participant with at least one experience
A mother in the early stages of labor. We left her at home and advised her to contact her midwife or obstetrician when in active labor.	40 (23.8%)	4.93
A mother in the early stages of labor. We drove her to the hospital or maternity clinic.	142 (84.5%)	6.35
A mother in active labor. We drove her to the hospital.	145 (86.3%)	5.78
A mother in active labor. We waited until her midwife arrived for an expected home birth.	22 (13.1%)	2.95
A mother in active labor. I helped with the birth.	123 (73.2%)	3.85
A mother who had given birth before my arrival, but the placenta had not birthed.	120 (71.4%)	3.48
A mother who had given birth before my arrival, and the placenta had birthed.	60 (35.7%)	3.27

Table 6. Participant prior birth situation experience.

102 prehospital clinicians averaging 3.93 complications per participant. Rural participants managed seven neonatal cardiopulmonary resuscitations, seven stillbirths, and one maternal death. Three VAOs managed four complications: one premature labor, one neonatal cardiopulmonary resuscitation, one stillbirth, and one miscarriage.

Birthing Complications* (n=168; 54 participants have never attended an obstetric case):	Participants Responding 'yes'
Premature labor (earlier than 38 weeks gestation)	101
Antepartum hemorrhage	71
Postpartum hemorrhage	75
Vaginal tear	39
Breech presentation	22
Face presentations	10
Shoulder dystocia	19
Cord prolapse	26
Nuchal cord (Umbilical cord around the neonate's neck)	33
Any other malpresentation	10
Neonate requiring respiratory assistance (ventilations)	41
Neonate requiring cardio-pulmonary resuscitation	26
Multiple birth	16
Stillbirth	26
Death of the mother	5
Other [Free Text] • Meconium in amniotic fluid (n=1) • En Caul (n=1) • Amniotic fluid embolism at home (n=1) • Failure to progress from the maternity unit (n=1) • In the field C-section, due to cardiac arrest of the mother (n=1) • Miscarriage (n=2) • Uterine inversion and postpartum hemorrhage (n=1) • Low blood glucose in baby (n=1) • No comment left (n=2)	11

Table 7. Participant experiences with birthing complications.

Confidence Attending an OOHB

Participants' confidence in attending various birth situations and emergencies (five antenatal, 29 second stage, two third stage, six postpartum) was graded from 1=low confidence to 6=high confidence. Supplementary file 1 depicts the birth situations and emergencies posed and includes a question requesting participants rate their confidence in how well they feel they would (1) recognize the situation/complication, and (2) effectively manage the situation/complication. Responses were analyzed as a summed confidence score for each participant for both recognition and management of the OOHB stage. Cohort means are recorded in Table 8.

All Participants	Antenatal (/30) – 5 items		Second stage (/174) – 29 items		Third stage (/12) – 2 items		Postpartum (/36) – 6 items		Total Combined Score (/252) – 42 items	
	Recognition	Management	Recognition	Management	Recognition	Management	Recognition	Management	Recognition	Management
Mean	19.77	18.68	121.94	103.27	9.45	8.36	29.08	26.39	180.61	157.21
Standard Deviation	4.78	4.71	32.43	28.24	2.50	2.31	6.20	6.10	42.79	38.13

Table 8. Confidence with OOHBs - Recognition and management of OOHB stages.

		Mean	Standard Deviation	Two-sided p*^	Mean Difference	Std. Diff	Cohens d
Antenatal Recognition (/30) 5 items	Paramedic	20.41	4.37	<0.001^	3.59	0.96	0.78
	VAO	16.82	5.59				
Antenatal Management (/30) 5 items	Paramedic	19.47	4.31	<0.001^	4.41	0.79	1.00
	VAO	15.05	4.85				
Second Stage Recognition (/174) 29 items	Paramedic	126.55	29.72	<0.001^	28.74	6.48	0.93
	VAO	97.81	36.33				
Second Stage Management (/174) 29 items	Paramedic	107.99	26.63	<0.001^	29.36	5.52	1.12
	VAO	78.63	24.21				
Third Stage Recognition (/12) 2 items	Paramedic	9.74	2.30	0.007^	1.77	0.61	0.73
	VAO	7.96	3.01				
Third Stage Management (/12) 2 items	Paramedic	8.60	2.16	0.002^	1.48	0.47	0.66
	VAO	7.11	2.71				
Postpartum Recognition (/36) 6 items	Paramedic	29.92	5.29	0.004^	5.38	1.74	0.91
	VAO	24.54	8.59				
Postpartum Management (/36) 6 items	Paramedic	27.14	5.52	0.004^	4.84	1.55	0.82
	VAO	22.31	7.55				
Total Combined Score (Recognition) (/252) 42 items	Paramedic	186.96	38.67	<0.001^	39.07	9.15	0.94
	VAO	147.88	50.63				
Total Combined Score (Management) (/252) 42 items	Paramedic	162.24	33.69	<0.001^	38.31	7.56	1.12
	VAO	123.92	36.18				
*Note: *Alpha = 0.05, ^Remains significant after applying Bonferroni correction for multiple comparisons.*							

Table 9. Independent samples T-test: Confidence with OOHBs – Comparison between paramedics and volunteers (VAOs).

Paramedics reported feeling more confident with all components of birthing (antenatal care, second stage, third stage, and postpartum care) compared to VAOs (Table 9). Effect sizes were medium-to-large, indicating the difference between the two groups was meaningful (Table 9).

Participants with children reported feeling more confident with recognition and management of antenatal care compared to participants without children, but no differences were found for second stage, third stage, and postpartum care (Table 10).

Participants who had previously attended at least one OOHB reported feeling more confident with all components of birthing (antenatal care, second stage, third stage, and postpartum care) compared to participants with no prior exposure, reaching statistical significance for both recognition and management of these situations (Table 11). Effect sizes were medium to large, indicating the difference between the two groups was meaningful (Cohen, 2013).

		Mean	Standard Deviation	Two-sided p*^	Mean Difference	Std. Diff	Cohens d
Antenatal Recognition (/30) 5 items	Paramedic	20.77	4.25	0.005^	1.82	0.65	0.39
	VAO	18.96	5.00				
Antenatal Management (/30) 5 items	Paramedic	19.46	4.29	0.027	1.42	0.64	0.31
	VAO	18.04	4.87				
Second Stage Recognition (/174) 29 items	Paramedic	32.97	3.66	0.907	0.60	5.07	0.02
	VAO	32.29	3.50				
Second Stage Management (/174) 29 items	Paramedic	103.78	27.63	0.718	1.59	4.39	0.06
	VAO	102.19	28.92				
Third Stage Recognition (/12) 2 items	Paramedic	9.33	2.51	0.596	-.21	0.39	-0.08
	VAO	9.54	2.53				
Third Stage Management (/12) 2 items	Paramedic	8.43	2.36	0.586	0.20	0.36	0.08
	VAO	8.24	2.28				
Postpartum Recognition (/36) 6 items	Paramedic	28.84	6.44	0.709	-0.36	0.98	-0.06
	VAO	29.20	6.05				
Postpartum Management (/36) 6 items	Paramedic	26.18	6.54	0.810	-0.23	0.96	-0.04
	VAO	26.40	5.68				
Total Combined Score (Recognition) (/252) 42 items	Paramedic	181.68	42.64	0.718	2.42	6.70	0.06
	VAO	179.25	43.09				
Total Combined Score (Management) (/252) 42 items	Paramedic	158.59	36.65	0.544	3.61	5.94	0.10
	VAO	154.98	39.25				
*Note: *Alpha = 0.05, ^Remains significant after applying Bonferroni correction for multiple comparisons.*							

Table 10. Independent samples T-test confidence with OOHBs – Comparison between participants with children vs without.

		Mean	Standard Deviation	Two-sided p*^	Mean Difference	Std. Diff	Cohens d
Antenatal Recognition (/30) 5 items	Paramedic	20.55	0.36	<0.001	3.16	0.82	0.67
	VAO	17.39	0.83				
Antenatal Management (/30) 5 items	Paramedic	19.54	4.37	<0.001	4.00	0.79	0.89
	VAO	15.54	5.09				
Second Stage Recognition (/174) 29 items	Paramedic	127.34	29.96	<0.001	24.09	6.16	0.77
	VAO	103.25	36.06				
Second Stage Management (/174) 29 items	Paramedic	108.47	26.30	<0.001	24.10	5.30	0.90
	VAO	84.38	29.14				
Third Stage Recognition (/12) 2 items	Paramedic	9.80	2.27	0.005	1.71	0.57	0.70
	VAO	8.09	3.02				
Third Stage Management (/12) 2 items	Paramedic	8.68	2.12	0.003	1.65	0.52	0.73
	VAO	7.03	2.74				
Postpartum Recognition (/36) 6 items	Paramedic	30.07	5.43	0.003	4.78	1.52	0.80
	VAO	25.29	8.02				
Postpartum Management (/36) 6 items	Paramedic	27.22	5.57	0.007	4.09	1.43	0.69
	VAO	23.23	7.50				
Total Combined Score (Recognition) (/252) 42 items	Paramedic	187.73	38.91	<0.001	32.73	8.20	0.78
	VAO	155.00	49.22				
Total Combined Score (Management) (/252) 42 items	Paramedic	164.02	34.93	<0.001	32.56	8.06	0.90
	VAO	131.45	41.54				
*Note: *Alpha = 0.05, ^Remains significant after applying Bonferroni correction for multiple comparisons.*							

Table 11. Independent samples T-test confidence with OOHB – Comparison between participants with prior experience vs participants without prior experience.

Factors contributing to fears and anxieties		Barriers to training	
Comment	Number of responses	Comment	Number of responses
Lack of exposure or experience with OOHB	107	Desire for obstetrics placements (midwife, hospital)	33
Lack of training, skill decay, and lack of practice	57	Poor opportunity or access to obstetrics training	33
Managing complications	26	Need adequate equipment or facilities to train with	27
Distance to definitive care, delays in care, and remoteness	18	Low exposure = low confidence	20
Lack of equipment, resources to manage an emergency	16	Need high-fidelity simulations during training	15
Lack of clinical support	13	Need qualified trainers	14
Reassuring the patient, managing emotions in an adverse event	13	Time limitations	14
Recall of guidelines, maneuvers	11	Lack of practice	8

Table 12. Quantified high-frequency responses to open-text questions concerning OOHBs.

Qualitative Analysis

The question regarding factors contributing to fears and anxieties with OOHB received 179 responses, while barriers to training received 163 responses. The most popular responses to each question are depicted in Table 12.

Qualitative analysis of the open-text responses was combined, as similar themes emerged from both questions (Rouder et al., 2021). Analysis identified four themes:

- Low exposure to birthing impacts confidence
- Minimal ongoing training impacts confidence and competence
- Organizational resourcing impacts confidence
- The complexities of scene management

Low Exposure to Birthing Impacts Confidence

A major factor affecting confidence in managing OOHBs was the lack of prior exposure to birthing, with 129 comments related to this concept. The quote below reflects many opinions:

> *Lack of exposure. We do not get to see what a birth looks like, be it normal or complicated. [Service redacted] needs to come to an agreement with the obstetric hospitals around [city redacted] to allow hands-on, real-life training/experience. It is absolutely insane that we are taught the basics, with no hospital prac[ticum]s, don't do annual refresher training, and then we are expected to go out and manage a complicated birth. What also annoys everyone is how hard it is to get a placement at an obstetrics hospital to observe or participate in delivering a baby. (Participant 35)*

This cohort has a cumulative 362 years of service with 474 births attended, which equates to approximately 1.3 births per year. The limited exposure and practical application of specialized obstetrics competencies impact not only confidence but recall of relevant information in an emergency. 18 participants offered concerns regarding the ability to remember clinical guidelines and specialized maneuvers, which have the potential to impact patient care and outcomes:

> *I feel unsure about preventative measures such as not touching the placenta during labor. I am anxious about small errors which may lead to extreme deterioration due to lack of knowledge and experience. (Participant 148)*

Minimal Ongoing Training Impacts Confidence and Competence

Challenges relating to training and development were frequently mentioned (n=102). The lack of training commenced with undergraduate studies and persisted into organizational training, with many comments regarding minimal in-service obstetrics training provided by ambulance services (n=21):

> *Very poor university training- no Obstet[ric]s/Maternity placements (compared to UK where students help deliver more than 10 babies), very minimal exposure and only occasional refreshers with often very minimal simulation time. Due to the lack of training (initial and ongoing), lack of exposure, rapidly developing nature of emergencies (i.e. neonatal resus) and complexities of care, obstetrics jobs with abnormal outcomes are arguably my biggest fear. (Participant 109)*

> *During induction school, obstetrics training was one day only, on mannequins. There was no clinical placement or realistic scenarios to prepare us. (Participant 42)*

> *Training not offered by employer. (Participant 41)*

Limited interdisciplinary placements shadowing midwives were raised, highlighting obstacles to effective obstetrics education (n=12). The quotes below indicate difficulties in organizing practica and reflect a need to understand differing scopes of practice between the disciplines:

> *Lack of exposure to maternity wards. I was fortunate to have 4 days on maternity ward and had staff reluctant to provide training as their perception was that I was "jumping the queue" by only being there for a short time. They did not recognize that this was our only exposure and training prior to becoming the only clinician on-scene. (Participant 5)*

> *Previous experiences where the outcome was poor - I attended a spontaneous cord prolapse and the baby died. I had no skills to help in that situation. The hospital staff didn't come outside to meet us after we patched, and were waiting in the delivery suites. The emergency center staff took us to theatre, but the whole wing was empty because they were all in the birthing suite. Then the father got code blacked because nobody was helping his wife and child. The women's hospital staff sometimes tend to treat paramedics like idiots, which is a major barrier to learning. (Participant 4)*

Barriers to attending training courses included cost, distance, and time (n=24). Realistic high-fidelity simulations were preferred yet lacking (n=28). It was acknowledged some training could be undertaken online; however, the opportunity to shadow a midwife was preferred (n=46):

> *Time, cost, available free resources (Participant 112)*

> *Lack of exposure, lack of maternity placements/observation days for existing staff, poor quality and quantity of simulation. (Participant 109)*

Organizational Resourcing Impacts Confidence

Concerns with organization barriers, such as the availability of appropriate infrastructure and equipment to facilitate skills practice, were raised (n=37):

> *Lack of resources- for some reason we can't have training equipment at our depots. (Participant 32)*

Seventeen participants suggested inexperienced facilitators often provided training, and they would prefer facilitators with specialized obstetrics training:

> *Also, very few paramedics with appropriate qualifications to be teaching (e.g. dual registered paramedic/midwife). (Participant 4)*

Twenty-three participants commented on the limited obstetrics equipment available on the ambulance and lack of clinical support, particularly in rural locations. Another consideration voiced by nine participants was the experience and knowledge of their partner, as this could be a VAO in rural locations with limited ability to provide interventions:

> *Lack of exposure and equipment to deal with obstetric emergencies. Often lengthy delays to theatre or whole blood. (Participant 3)*

> *Living rural with no Doctor in town at the moment and worrying about things going wrong. (Participant 156)*

Scene Management

Some comments concerned managing bystanders, handling emotive situations, and even prehospital clinicians managing their own emotions during adverse events were reported (n=26). Additionally, the complexity of one patient becoming two was raised, with the potential for life-threatening complications with both patients (n=15):

> *Scene management. How do I coordinate a newborn resusc[itation] and a PPH [postpartum hemorrhage] for example. Where do I place the baby so mum can see but not be traumatized... how do I keep mum in focus when newborn resus is happening. Very aware of a mother feeling dehumanized in the experience. (Participant 146)*

> *I have not had any births out of hospital that I have had to manage yet. It is hard to imagine the situation without actual experience. Also knowing that the care you provide may have a lasting impact/consequence for the child and their family. That is stressful. (Participant 116)*

Some participants mentioned factors such as having minimal antenatal information or previous birthing history, impacting optimal care. Obstetrics complications are often time-critical, and extrication can be difficult, further impacting prehospital clinicians' anxieties. Some participants working in rural locations discussed distances to definitive care being a considerable concern.

DISCUSSION

The results of this research suggest prior exposure to an OOHB leads to increased confidence attending these cases. Preparation and training are important aspects of medical care, particularly with vulnerable patient groups such as OOHB patients (Persson et al., 2019; Svedberg et al., 2020). Multiple studies report prehospital clinicians feel underprepared and lack confidence managing OOHBs (Gardiner, 2024; Hill et al., 2023, 2024; Persson et al., 2019; Sheikhi & Heidari, 2024; Vagle et al., 2019). Whilst OOHBs are infrequent, they do occur and can have life-threatening complications for both birth parent and neonate (Hilde M Engjom et al., 2017; Flanagan et al., 2017; Lazi & Taka , 2011; McLelland et al., 2018), which places an obligation on emergency ambulance services and prehospital

clinicians to ensure they are adequately trained in management of complications to ensure patient safety and optimal outcomes. Many participants in this study expressed a desire for practical experience beyond high-fidelity simulations, with placement in a maternity unit to gain vital exposure to birthing and practice obstetric skills.

Australian universities often provide one semester of obstetrics coursework for paramedic students; rarely is a maternity placement provided. Courses may combine obstetrics care with other special populations, such as pediatrics (CQ University Australia, 2024; Edith Cowan University: School of Medical and Health Sciences, 2022; University of the Sunshine Coast, n.d.). By necessity, prehospital clinicians are generalists and not specialists (Newman, 2022); however, it is difficult to imagine another aspect of healthcare where a clinician is expected to lead care of medical emergencies involving (potentially) life-threatening complications with so little prior exposure, preparation, or training. Additionally, ambulance resources are severely limited compared to hospital resources (Svedberg et al., 2020), meaning obstetrics care is extremely constrained in the prehospital environment.

In Australia, approximately 67% of the population live in metropolitan areas, while 99.3% of the Australian landmass is considered regional, rural, or remote (Australian Bureau of Statistics, 2022; National Rural Health Alliance, 2025). In metropolitan areas, registered paramedics provide emergency care, whereas rural and remote emergency ambulance organizations rely on hybrid paramedic-VAO subcenters or VAO-operated subcenters (The Council of Ambulance Authorities, 2011). VAOs have less medical education and training than paramedics and are limited to providing first aid and supportive care (St John Ambulance WA, 2022). Therefore, no invasive, potentially life-saving interventions can be administered by a VAO, such as cannulation and intravenous fluids or medications. A recent investigation reported on the challenges of VAOs accessing clinical support in rural emergencies, the lack of obstetric equipment on some ambulances, and the long distances to definitive care, yet VAOs are still expected to handle obstetric emergencies (Hill et al., 2024). This research confirmed that rural clinicians manage as many complications as metropolitan clinicians, including fatalities and stillbirths. Some ambulance services provide telehealth services for prehospital clinicians to access during obstetric emergencies (Gardiner, 2024; The Royal Children's Hospital Melbourne, n.d.). This resource provides excellent clinical expertise and support when required and would be beneficial throughout Australia and New Zealand.

This research suggests there are barriers to accessing obstetrics CPD, including cost, availability, and time restrictions. An additional challenge to maintaining obstetrics proficiency is the requirement for specialized equipment (e.g., birthing manikins) to practice with. Furthermore, inadequate/unavailable equipment is a barrier to provision of in-service high-fidelity simulation training, which was desired by our participants. Obstetric emergencies have little overlap with other prehospital emergencies, meaning these skills are not practiced with other medical or trauma presentations, further exacerbating atrophy of obstetrics competencies (Thornton & Dahlen, 2018; Woodman et al., 2021). Foregoing real-life exposure to birthing, high-fidelity simulations may better prepare prehospital clinicians for OOHBs. A systematic review of 15 studies concerning high-fidelity simulation for neonatal resuscitation indicated moderate to large benefits of high-fidelity simulation in skill performance with single-arm or randomized control trials (RCTs), moderate improvements in knowledge with RCTs, and small improve-

ments in knowledge when comparing high-fidelity to low-fidelity simulations (Huang et al., 2019). Simulations are considered an effective educational method in medicine when clinical experiences are limited; however, high-fidelity classroom simulations can be resource-intensive in terms of physical resources and facilitators' time (Astbury et al., 2021). A novel approach is the use of digital technologies, which may be suitable to bridge this theory-practice gap, reducing reliance on training facilitators, established infrastructure requirements, and associated resources. Digital technologies have been successfully utilized in simulation training to provide experiential exposure and enable practice of high-risk procedures in a low-risk environment in medicine and midwifery; however, these technologies are less common in paramedicine (Birtill et al., 2021; Elendu et al., 2024; Georgieva-Tsaneva et al., 2024). Given the low on-road exposure to birthing, experiential exposure to OOHBs via virtual reality could enhance knowledge retention, improve accessibility and active engagement with simulation training, and provide a safe learning environment for this rare presentation (Elendu et al., 2024).

Our participants reported that scene management could be anxiety-provoking for OOHBs. Some fear stems from managing complex emotions in the event of adverse outcomes, such as neonatal resuscitation or death (Hill et al., 2024). Midwives also navigate these difficult presentations. A recent systematic review indicated that midwives who are older and more experienced are better equipped to manage these situations. Coping strategies included empathetic listening skills, communicating with peers, training, and institutional support (Garcia-Catena et al., 2023). Another meta-synthesis interpreting parents' experiences of perinatal loss suggested many clinicians struggle with managing complex emotions, demonstrating compassion, and communicating appropriately with grieving parents (Berry et al., 2021). Research should be expanded into the prehospital environment to produce educational frameworks and content to aid prehospital clinicians' communication skills during difficult discussions, which occur without support from hospital mental health teams.

Other avenues for research include investigation into prehospital clinician confidence attending OOHBs versus actual competence, to determine shortfalls in clinical education and improve patient safety and outcomes. Additionally, this research reveals prehospital clinicians who have been exposed to childbirth are more confident attending an OOHB. Accordingly, practicum opportunities should be explored for prehospital clinicians to ensure experiential exposure to birthing before attendance at an OOHB with possible catastrophic outcomes. Obstetrics placements would also provide interdisciplinary exposure, enabling clinicians from differing specialties to understand each other's scope of practice and competencies. More research into the long-term patient outcomes from actual OOHBs should also occur, to identify where prehospital care can be improved to minimize adverse sequelae.

LIMITATIONS

Online questionnaire data were self-reported and anonymous. Given the self-selection recruitment methodology, participants with an interest in OOHBs may be more likely to participate, contributing to response bias. Additionally, the information participants provided is potentially subject to recall bias and may not be accurate. Open-text responses provided insight into prehospital clinicians' fears and anxieties regarding OOHB; however, are unable to provide an in-depth exploration that qualitative inquiry might.

Further, confidence does not equate to competence in the management of OOHB care (Flanagan et al., 2024); nonetheless, prehospital clinicians without confidence are unlikely to be proficient in managing an OOHB with complications. Given the non-probability sampling method, the sample may not reflect the demographic profile of the wider prehospital clinician workforce. Accordingly, findings should be interpreted as reflecting the views of respondents rather than a representative population sample. Furthermore, results may not be generalizable beyond Australia and New Zealand. However, these results provide insight into OOHB educational gaps and service limitations, which could serve as a benchmark to improve these aspects of prehospital care.

CONCLUSION

This online mixed-methods questionnaire reviewed the training, exposure to, and confidence with attending OOHBs amongst 222 Australian and New Zealand prehospital clinicians. While exposure to a laboring patient wasn't uncommon, assisting with an actual birth occurred rarely, with many serious complications encountered. Participants who had assisted with an OOHB were more confident in their ability to effectively manage these presentations, compared to participants with no prior exposure. Similarly, registered paramedics were more confident than their VAO colleagues, attributable to the higher level of education required for paramedics. Continuing, frequent, and effective education needs to be undertaken in obstetrics care to ensure prehospital clinicians' recency of practice for these vital skills.

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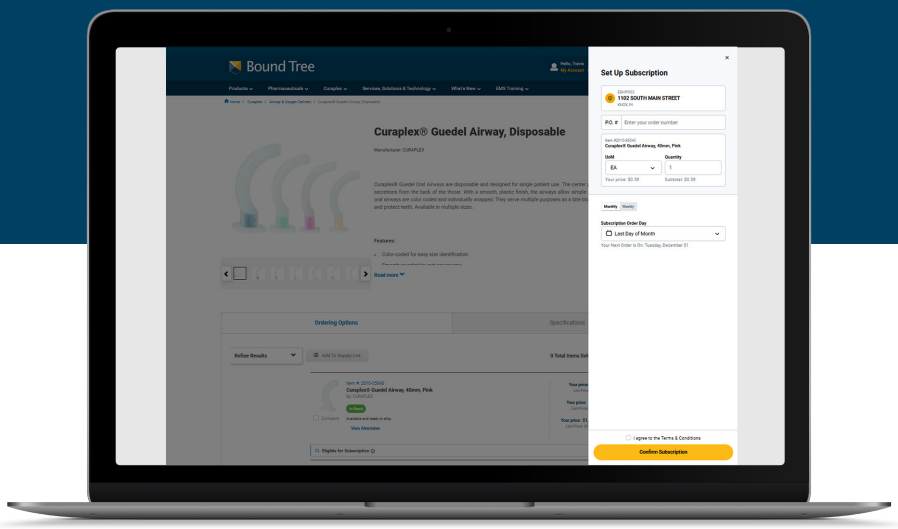

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