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Predictors of Ambulance Transport to Hospital for Older People Living in Tasmanian Aged Care Facilities: A Retrospective Cohort Study

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ABSTRACT

Objectives: To quantify factors associated with paramedic transport to hospital for older people in residential aged care facilities (RACFs) and supported accommodation, and to identify modifiable drivers of non-transport.

Study Type: Retrospective cohort study using routinely collected electronic patient care records, analysed with gradient boosting models and multivariable logistic regression.

Setting: Ambulance Tasmania attendances to RACFs and supported accommodation across Tasmania, 1 January 2018 to 31 December 2024.

Study Population: All eligible ambulance attendances for people aged 65 years or older at these facilities.

Main Outcome Measures: The primary outcome was transport to hospital. Scene time and clinical status at first assessment, summarised using the National Early Warning Score 2 (NEWS2) and Shock Index, were descriptive variables and candidate predictors.

Results: Of 23,317 attendances, 19,386 (83.1%) resulted in transport and 3931 (16.9%) did not. Most attendances were low risk. Crew skill set, calendar month, initial pain score, respiratory rate and NEWS2 category were the strongest predictors of transport. In adjusted logistic regression, extended care paramedic attendance was associated with markedly lower odds of transport than attendance by standard paramedic crews (adjusted odds ratio, 0.09 [95% CI, 0.07–0.12]), corresponding to an adjusted transport probability of 0.50 compared with 0.85 for intensive care paramedic crews, 0.86 for standard paramedic crews and 0.69 for other crews.

Conclusions: Paramedic transport decisions for RACF residents were strongly associated with acute illness severity, but crew skill set was also independently associated with transport. Attendances managed by extended care paramedics had lower adjusted probabilities of hospital transport. These findings suggest that extended-scope paramedic models warrant prospective evaluation in this setting.

JEL Classification: Emergency medicine, Health occupations, General medicine, Gerontology

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Plain Language Summary

The Known: Older people in residential aged care are frequently transferred to hospital after ambulance attendance, but some transfers may be avoidable and predictors of transport are poorly understood.

The New: In 23,317 Tasmanian ambulance attendances, 83.1% resulted in transport. Most attendances had low illness severity; of which 80% were transported; transport increased with illness severity. Crew skill set was also important; extended care paramedic attendance was associated with lower adjusted transport probability.

The Implications: Extended-scope paramedic models may support care in place for selected residents, but need prospective evaluation with resident outcomes, case selection and follow-up pathways.

1 | Introduction

Older people aged 65 years and over in residential aged care facilities (RACFs) or supported accommodation are often frail and have complex health needs, placing them at higher risk of adverse events and acute illness than their community-dwelling counterparts [1–3]. These episodes often escalate care, with transfer to an emergency department for assessment or treatment. In Australia, use of emergency medical services by older adults has risen, increasing strain on ambulance services and emergency departments [4]. Similar increases in ambulance transports from long-term care have also been reported in Canada [5].

When older people in aged care services experience acute illness, injury or changes in health status, they are commonly transferred to hospital [6, 7]. Yet, some transfers are described as potentially avoidable—that is, episodes for which timely assessment or treatment might have been provided safely in the RACF or community setting [8]. However, definitions of avoidable transfers vary and local service availability is a major determinant [9, 10]. In a systematic review, the proportion of transfers considered potentially avoidable varied widely across settings [11]. For the older person, such transfers can lead to unnecessary interventions and iatrogenic harm [12], while also contributing to inefficiencies in the broader healthcare system [13, 14].

Understanding the factors that influence resident transfer to hospital is complex, because research is limited in several key areas. There is no consensus definition of an appropriate transfer of an older person from an RACF or supported accommodation to an emergency department [15]. Australian aged care nurses report competing pressures when deciding whether to request paramedic attendance at an aged care service [16] and paramedic transport decisions are shaped by both clinical and non-clinical factors [17, 18]. Few studies have examined Australian ambulance datasets. Dwyer et al. reviewed Ambulance Victoria records and reported that RACF residents experience higher ambulance use than older people in the community and identified factors that predict hospital transfer, including rural location, higher comorbidity, certain high-risk medications and paramedic clinical impressions of acute illness or injury [4, 19]. Cox et al. reported on the predictors of ambulance call-out for a sample of residents from 15 RACFs in the Australian Capital Territory [14]. The authors found that higher comorbidity, higher anticholinergic burden, male sex and younger age were associated with ambulance attendances. However, although that study found that 87% of attendances resulted in transport to an emergency department, it did not examine predictors of conveyance. Neither study reported on illness severity, even though illness severity has been shown in international research to predict the likelihood of transport [20]. There is little empirical evidence on what predicts paramedic transport to hospital rather than treatment in place. Understanding these predictors is essential for designing interventions that strengthen in-place care, enhance paramedic decision-making and improve the alignment of care with residents' goals and clinical needs. The aim of this study was to identify the factors that predict whether older residents of Tasmanian RACFs are transported to hospital or managed without transport after ambulance attendance, and to determine which predictors are modifiable.

2 | Methods

This study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement [21]. It was a retrospective cohort study that used routine clinical data from Tasmania, Australia, where Ambulance Tasmania is the provider of emergency ambulance services. Electronic patient care records were extracted for attendances between 1 January 2018 and 31 December 2024, where the ambulance scene was coded as 'Nursing Home/Supported Accommodation' or where the location name matched a curated aged care facility list. Attendances cancelled before ambulance arrival were excluded. The source dataset included attendances for people aged 50 years or older, but the primary analysis was restricted to those aged 65 years or older to align with the conventional older-person aged-care cohort and prior Australian RACF ambulance research. Because the deidentified dataset was episode-based, separate ambulance attendances could not be linked across time for the same resident.

The unit of analysis was the ambulance attendance. We calculated the National Early Warning Score 2 (NEWS2) to estimate illness severity and grouped scores as low (0–4), medium (5–6) or high (≥ 7) risk [22]. The Shock Index score was calculated as heart rate divided by systolic blood pressure; it was analysed as a continuous measure in regression models and summarised descriptively using the conventional threshold of <0.9 versus ≥ 0.9 [23].

Transport to hospital (yes/no) was the only outcome. Scene time and clinical status at first assessment were descriptive variables and candidate predictors, not separate outcomes. Implausible timing and physiological values were set to missing using prespecified range checks, and multivariable analyses used complete cases; no imputation was undertaken. Extracted variables included age, sex, region, facility-area Socio-Economic Indexes for Areas (SEIFA) Index of Relative Socio-economic Disadvantage (IRSD), case date and time, crew skill set, primary clinical impression, physiological observations, medications, clinical interventions and final

on-scene assessment. Sex was recorded in the electronic patient care record as female or male and was analysed as recorded; indeterminate entries were retained in adjusted models where present. SEIFA IRSD was assigned from the ambulance scene postcode and interpreted as an area-level measure of the aged care facility location, not an individual resident socio-economic measure. The dataset was intended as a census of all eligible ambulance attendances during the study period. Transport proportions were therefore calculated within this statewide ambulance-attendance cohort, not for all residents of RACFs and supported accommodation, and not for all clinical events occurring in those settings.

Crew skill set was grouped as extended care paramedic (ECP), intensive care paramedic (ICP), standard paramedic or other. ECPs represented an expanded-scope role orientated to treatment in place and alternative care pathways; ICPs represented an advanced critical care paramedic role; standard paramedics provided routine emergency ambulance care; and other comprised the small residual group of clinical support officer-only, flight paramedic, doctor, nurse and patient transport officer crew configurations.

2.1 | Statistical Analysis

Statistical analysis was performed in Stata version 19, with descriptive statistics generated for all variables. We used a gradient boosting machine (GBM) learning model to explore predictors of conveyance. Predictors in the GBM model were used to inform model specification, not as primary exposures [24]. The first GBM model included only variables available at or immediately after initial paramedic assessment: age, sex, facility-area SEIFA IRSD, region, calendar year, month, day of week, hour of day, crew skill set, initial vital signs, NEWS2 category, Shock Index score, blood glucose, temperature and initial pain score. The second GBM model added variables arising later during on-scene care, including medications administered, clinical interventions and final primary assessment category. The primary regression model included only variables available before or at the time of the transport decision. Crew skill set was the main exposure. Age, NEWS2 category and initial Shock Index score were modelled using non-linear terms; sex, facility-area SEIFA IRSD, region, calendar year, month, day of week, hour of day, initial pain score and grouped final primary assessment category were included as covariates. Because repeat attendances by the same resident could not be linked in the deidentified episode-based dataset, analyses treated attendances as independent episodes and no resident-level clustering adjustment was possible. Confounders were selected using a directed acyclic graph (Figure S1). We modelled potential non-linear associations using fractional polynomials [25]. We undertook a sensitivity analysis for unmeasured confounding using E-values, applied to the adjusted association between crew skill set and transport [26, 27]. Because transport was common, E-values were calculated from marginal predicted probabilities from the adjusted logistic regression. We interpreted these in relation to two plausible unmeasured factors: comorbidity burden and medically directed or pre-arranged transfers.

2.2 | Ethics Approval

The project was approved by the University of Tasmania Human Research Ethics Committee (project ID 30071) on 6 March 2024, with a waiver of individual consent for use of deidentified administrative data.

3 | Results

During the study period, there were 23,317 ambulance attendances to RACFs or supported-accommodation facilities (Figure 1), of which 19,386 (83.1%) resulted in transport and 3931 (16.9%) did not. A total of 20,805 attendances (89.2%) remained for complete-case analyses. Characteristics of the primary cohort are shown in Table 1. Median patient age was 85 years and 13,695 (58.7%) attendances were for people recorded as female. Cases occurred across all Tasmanian regions, with a median facility-area SEIFA IRSD of 973. Standard paramedic crews attended 17,675 (75.8%) cases, ICPs 5055 (21.7%), ECPs 539 (2.3%) and other crew types 48 (0.2%). Raw transport proportions by crew type were 33.4% for ECPs (180/539), 84.6% for ICPs (4279/5055), 84.3% for standard paramedic crews (14,896/17,675) and 64.6% for other crews (31/48). ECPs accounted for 9.1% of non-transported attendances (359/3931) and 0.9% (180/19,386) of transported attendances.

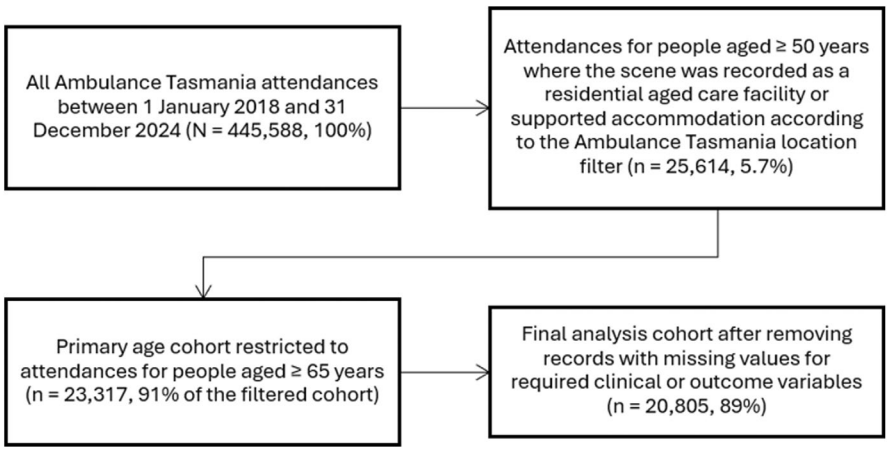

FIGURE 1 | Selection of ambulance attendances included in the study.

TABLE 1 | Characteristics of ambulance attendances for residents aged 65 years or older, by transport status.[a]

Characteristic	Total ($n = 23,317$)	Transported ($n = 19,386$)	Not transported ($n = 3931$)
Age, years (median [IQR])	85 [78–90]	85 [78–90]	85 [78–91]
Female sex	13,695 (58.7%)	11,385 (58.7%)	2310 (58.8%)
Region			
Greater Hobart	10,761 (46.2%)	8970 (46.3%)	1791 (45.6%)
Launceston and Northeast	6106 (26.2%)	4755 (24.5%)	1351 (34.4%)
Southeast	372 (1.6%)	335 (1.7%)	37 (0.9%)
West and Northwest	6076 (26.1%)	5324 (27.5%)	752 (19.1%)
Other/unknown	2 (0.01%)	2 (0.01%)	0 (0.0%)
SEIFA IRSD (median [IQR])[b]	973.0 [914.2–1029.5]	973.0 [914.2–1029.5]	981.5 [929.0–1029.5]
SEIFA decile[b]			
1–3 (most disadvantaged)	7098 (30.4%)	5973 (30.8%)	1125 (28.6%)
4–7	9577 (41.1%)	7916 (40.8%)	1661 (42.3%)
8–10 (least disadvantaged)	6626 (28.4%)	5485 (28.3%)	1141 (29.0%)
Paramedic skill set			
Extended care paramedic	539 (2.3%)	180 (0.9%)	359 (9.1%)
Intensive care paramedic	5055 (21.7%)	4279 (22.1%)	776 (19.7%)
Paramedic	17,675 (75.8%)	14,896 (76.8%)	2779 (70.7%)
Other	48 (0.2%)	31 (0.2%)	17 (0.4%)

Abbreviations: IQR, interquartile range; IRSD, Index of Relative Socio-economic Disadvantage; SEIFA, Socio-Economic Indexes for Areas.
[a]Values are number (percentage) unless otherwise stated.
[b]SEIFA data were unavailable for 16 attendances.

Clinical status at first assessment is summarised in Table 2. Among the 23,317 attendances, the median NEWS2 score was 3 (interquartile range, 1–5), with 16,529 (70.9%) attendances classified as low risk (0 to 4), 2706 (11.6%) as medium risk (5 to 6) and 4082 (17.5%) as high risk (7 or more). Transport increased with NEWS2 category, from 79.8% (13,195/16,529) among low-risk attendances to 92.5% among high-risk attendances (3776/4082), calculated from the counts in Table 2. The distribution of final primary assessment categories is shown in Table S1. Pain was the most common final primary assessment category. Treatment and intervention patterns are summarised in Tables S2 and S3. Analgesia most commonly involved opioids, with frequent use of non-opioid agents.

The pre-decision GBM showed moderate discrimination for transported versus non-transported (area under the receiver operating characteristic curve, 0.77); the most influential variables were crew skill set, month of case, initial pain score, respiratory rate and NEWS2 category (Figure S2). Adding treatments, procedures and final primary assessment category improved discrimination to 0.86, with final primary assessment category and crew skill set ranked highest.

Because crew skill set was the highest ranked potentially modifiable predictor, we estimated its adjusted association with transport using multivariable logistic regression. Compared with standard paramedic crews, ECP attendances had much lower odds of transport (adjusted odds ratio [aOR], 0.09 [95% CI, 0.07–0.12]), while ICP crews were similar (aOR, 0.96 [95% CI, 0.86–1.07]); other crews also had lower odds (aOR, 0.27 [95% CI, 0.11–0.68]) (Table 3; Table S4). Marginal predictions gave adjusted transport probabilities of 0.50 (95% CI, 0.45–0.54) for ECPs, 0.85 (95% CI, 0.84–0.86) for ICPs, 0.86 (95% CI, 0.85–0.86) for standard paramedic crews and 0.69 (95% CI, 0.54–0.84) for other crews (Figure 2).

To assess overlap between ECP and non-ECP attendances in key clinical strata, we examined the number of clinically similar non-ECP attendances available for comparison with each ECP attendance. For each ECP attendance, the comparator pool was defined as the number of non-ECP attendances with the same final primary assessment category, NEWS2 risk category, 5-year age band and sex. Comparator pools were typically sizeable (median, 26 [interquartile range, 7–75]) rather than single comparators: 433/539 (80.3%) ECP attendances had at least five comparators and 375/539 (69.6%) had at least 10 comparators. Only 24/539 (4.5%) had none; overall 515/539 (95.5%) had at least one comparator. Comparator pools were generally large for common ECP presentations (Table S5; Figure S3).

TABLE 2 | Clinical status at first assessment and time intervals for residents aged 65 years or older, by transport status.[a]

Characteristic	Total ($n = 23,317$)	Transported ($n = 19,386$)	Not transported ($n = 3931$)
NEWS2 score	3 [1–5]	3 [1–6]	1 [0–3]
NEWS2 category (number (%))			
Low (0–4)	16,529 (70.9%)	13,195 (68.1%)	3334 (84.8%)
Medium (5–6)	2706 (11.6%)	2415 (12.5%)	291 (7.4%)
High (≥ 7)	4082 (17.5%)	3776 (19.5%)	306 (7.8%)
Shock Index score (initial)	0.59 [0.48–0.73]	0.59 [0.48–0.74]	0.57 [0.48–0.67]
Initial pain score (0–10 scale)	0 [0–2]	0 [0–2]	0 [0–0]
Initial vital signs[b]			
Heart rate, beats/min	82 [72–95]	83 [72–97]	80 [70–89]
Systolic BP, mmHg	140 [121–161]	140 [121–162]	140 [123–159]
Respiratory rate, breaths/min	18 [16–20]	18 [16–20]	16 [16–18]
Oxygen saturation, %	96 [94–98]	96 [94–98]	97 [95–98]
Glasgow Coma Scale score	15 [14–15]	15 [14–15]	15 [14–15]
Time intervals, min			
Response duration	17 [10–33]	16 [10–36]	18 [10–36]
Scene duration	29 [21–39]	27 [20–35]	41 [30–59]
Transport duration	16 [11–25]	16 [11–25]	NA

Abbreviations: NA, not applicable; NEWS2, National Early Warning Score 2.
[a]Values are median [interquartile range] unless otherwise stated.
[b]Physiological measures are from the first recorded assessment.

TABLE 3 | Adjusted association between crew skill set and transport to hospital for residents aged 65 years or older.

Predictor	Adjusted odds ratio (95% confidence interval)	*p*	Adjusted probability of transport (95% confidence interval)
Crew skill set			
Extended care paramedic	0.09 (0.07–0.12)	< 0.001	0.50 (0.45–0.54)
Intensive care paramedic	0.96 (0.86–1.07)	0.45	0.85 (0.84–0.86)
Paramedic	1.0 (Reference category)		0.86 (0.85–0.86)
Other	0.27 (0.11–0.68)	0.005	0.69 (0.54–0.84)

Higher initial pain score and higher NEWS2 category were associated with greater odds of transport. Fractional polynomial terms supported non-linear relationships for NEWS2 category and Shock Index score; after adjustment, the independent association of Shock Index score was smaller. Odds of transport declined in later calendar years. Relative to Greater Hobart, odds were lower in Launceston and the Northeast and higher in the West and Northwest; many final assessment categories had substantially lower adjusted odds of transport than pain (Table S4).

Using marginal predicted probabilities (0.50 for ECPs vs. 0.86 for standard paramedics), the E-value was 2.8. Under a conservative comorbidity-based modelling scenario, the ECP odds ratio increased from 0.09 (95% CI, 0.07–0.12) to 0.12 (95% CI, 0.09–0.16). In a second sensitivity analysis allowing for medically directed or pre-arranged transfers, the ECP aOR increased to 0.14 (95% CI, 0.11–0.19).

4 | Discussion

In this statewide cohort of 23,317 ambulance attendances to RACFs, about five in six encounters resulted in transport to hospital, and transport remained common across clinical presentations. ECP attendance was strongly associated with non-transport, although ECPs attended relatively few cases overall.

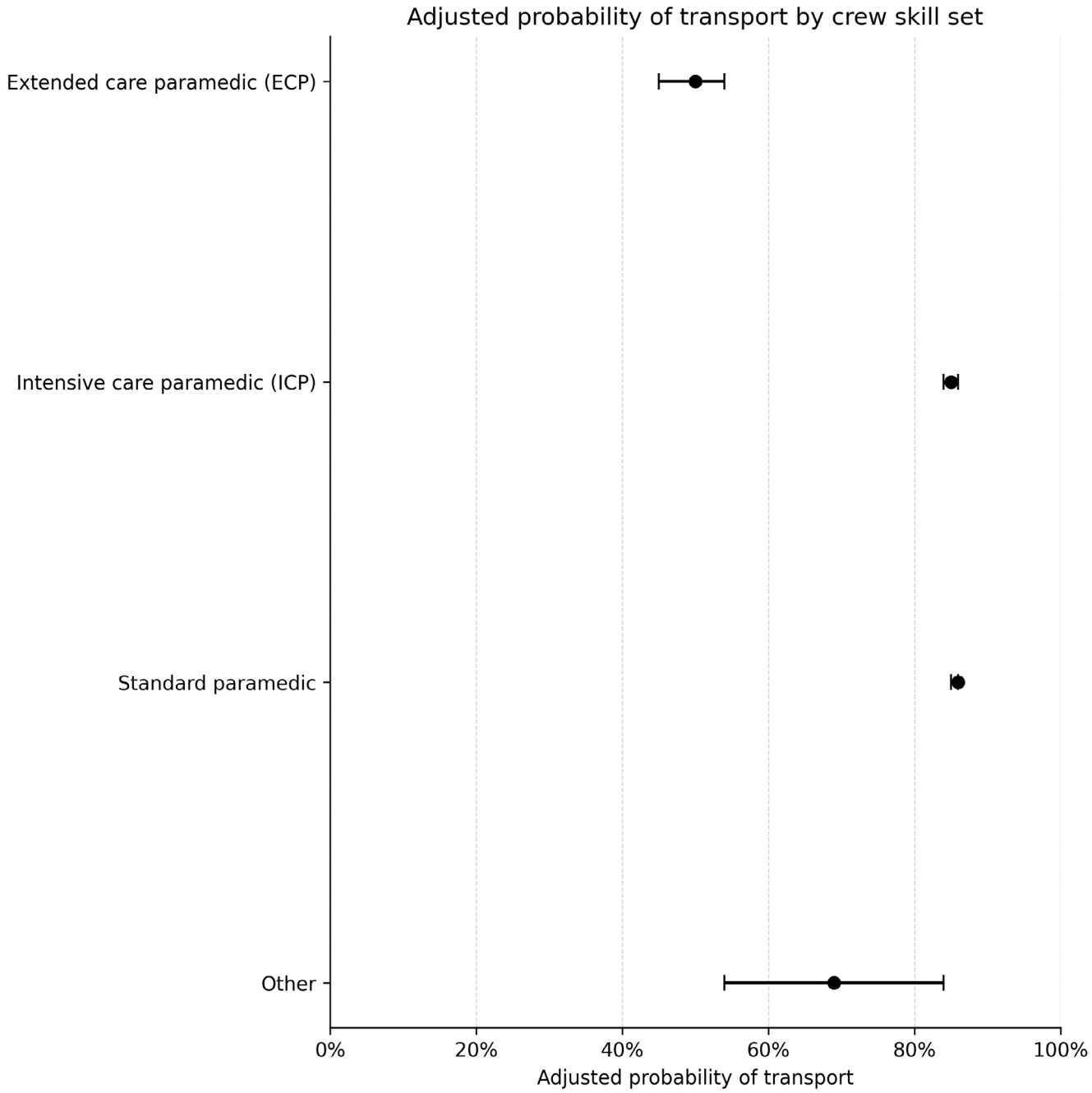

FIGURE 2 | Adjusted probability of transport by crew skill set.

Our transport proportion aligns with prior Australian research that reported that the vast majority of ambulance call-outs for aged care residents result in hospital transfer [4, 14, 19]. Clinical status emerged as a prominent driver of conveyance in our analysis. Dwyer et al. also demonstrated that residents with greater clinical complexity, higher comorbidity or high acuity had increased odds of transport, whereas low-acuity trauma was less likely to result in conveyance [4]. In our study, transport rates increased steadily with higher NEWS2 scores. Overseas, similar associations have been observed, with higher NEWS2 scores and other indicators of physiological deterioration strongly predicting transport decisions [20]. These findings suggest that paramedics appropriately prioritise physiological risk when deciding on hospital transfer.

In our cohort, most RACFs and supported accommodation presentations were physiologically low acuity yet still resulted in transport. This is not contradictory; NEWS2 captures acute physiological instability. Chronic or subacute conditions such as wounds, persistent pain, catheter problems or functional decline may not elevate NEWS2 or Shock Index scores. However, these conditions often require further medical or multidisciplinary assessment which may not be readily available in RACFs and supported accommodation or which may be outside the scope of standard paramedic practice. Within this context, the markedly lower probability of transport associated with ECP attendance is noteworthy. ECPs fall under a broader banner of community paramedicine, which reflects efforts to extend the scope and flexibility of out-of-hospital care [28, 29]. The expanded paramedic skill sets aim to reduce pressure on overwhelmed health

services, supplement primary care workforce shortages and improve patient experience by serving as a bridge between primary and emergency care [28]. While our findings cannot establish that one service model is superior to another (e.g., ECP crew vs. standard crew), they do point to the potential value of empowering paramedics to provide treatment on scene rather than transfer, together with service redesign that better supports non-transport decision-making in this setting. The key implication is that workforce skill mix and scope of practice may shape conveyance decisions for RACF and supported accommodation residents whose needs are not primarily driven by acute physiological instability.

Other contextual factors also shaped transport decisions. Attendances from facilities located in the West and Northwest of the state had higher adjusted odds of transport than those from Greater Hobart. These regions include many rural and remote communities under the Australian Statistical Geography Standard [30]. Our finding is broadly consistent with Australian evidence that geographic context influences conveyance decisions [19]. This pattern may reflect service availability, travel distance and paramedic risk thresholds, underscoring the need to interpret transport rates with respect to geographic context.

Even after adjustment for clinical severity, case mix and context, attendances seen by ECPs had a markedly lower adjusted probability of transport than those seen by standard paramedics. This pattern is consistent with ECPs using a broader range of non-hospital options, such as treatment in place or community follow-up. However, this finding should not be interpreted causally because ECP dispatch was not random and patients seen by ECPs may differ because of dispatcher judgement, perceived case suitability, crew availability, scope of practice and local pathways. Nonetheless, the comparator-pool analysis suggests that ECPs were not attending a completely separate patient group, and the sensitivity analyses reduced but did not eliminate concern about unmeasured confounding (e.g., frailty, staffing, policy and local pathways [12]). Our finding extends international evidence [31, 32] by demonstrating strong association between expanded paramedic scope of practice and lower transport rates from nursing homes. It also extends support for prospective evaluation of extended-scope paramedic models.

Beyond crew skill set, higher pain score at initial assessment was the most prominent potentially modifiable clinical factor associated with transport. Pain was the most common final primary assessment category. Given evidence of high pain prevalence, and under-recognition and undertreatment of pain in RACFs, improving pain assessment and treatment may support more in-place care and reduce avoidable transport [33–35]. Region, month and day of week also remained influential after clinical adjustment, consistent with non-medical drivers such as general practitioner access, community pathways and facility staffing. Systematic reviews show that paramedic confidence, protocols, access to alternatives and legal or organisational pressure shape transport decisions for RACF residents [36]. Qualitative work adds staffing constraints, risk aversion, limited primary care access and unclear follow-up pathways [37], plus safety concerns and professional norms that bias clinicians towards hospital transfer [38]. This aligns with our finding that non-transported cases had longer scene times, likely reflecting the extra assessment, negotiation and coordination needed to manage residents safely in place.

These findings have several implications for practice and policy. First, they support prospective evaluation of expanded-scope paramedic models in RACFs, with explicit attention to case selection, communication, shared decision-making and follow-up arrangements. Second, the use of NEWS2 and other early warning scores in this population should be framed as one input into a broader geriatric assessment rather than a standalone trigger for transport. Third, interventions to strengthen aged care service capacity, including advanced care planning, clearer 'treat-in-place' protocols and reliable access to medical or nurse practitioner advice, are likely to be necessary partners for any prehospital reforms. These findings may also inform broader workforce and pathway redesign. Paramedic scope of practice emerges from our analysis as a promising modifiable target for further investment and rigorous evaluation.

5 | Limitations

This retrospective study used routinely collected ambulance data, so the findings are associative rather than causal and cannot determine whether transport or non-transport decisions were appropriate, safe or aligned with residents' goals of care. The analytic cohort was defined as ambulance-attended RACF and supported accommodation episodes, not all RACF residents or all RACF clinical deteriorations, so the reported transport proportions are episode-based estimates within ambulance-attended events and should not be interpreted as population-based rates.

Crew allocation was not random, and unmeasured factors such as frailty, comorbidity, facility staffing, general practitioner availability, local policy, dispatcher processes and medically directed or pre-arranged transfers may have influenced both crew allocation and transport decisions. No comorbidity measure was available, so residual confounding is likely, particularly in analyses by crew skill set.

Because the deidentified dataset was episode-based, repeat attendances by the same resident could not be linked and resident-level clustering could not be addressed. The cohort definition relied on ambulance scene coding and a curated facility list, so some facility or residency misclassification is possible. Routine records may also contain recording error and missingness; we used prespecified range checks and complete-case analysis, which may have influenced estimates. Generalisability beyond similar Australian ambulance systems is uncertain.

6 | Conclusion

In this episode-based cohort of ambulance attendances to RACFs and supported accommodation, transport was strongly associated with acute illness severity, and crew skill set was also independently associated with transport. Episodes

attended by ECPs had lower adjusted probabilities of hospital transport, but because crew allocation was not random and residual confounding may remain, this finding should be interpreted cautiously. These results support prospective evaluation and outcome monitoring of extended-scope paramedic models in RACFs.

Author Contributions

Sharon Andrews and Pieter F Fouche contributed equally to this manuscript. **Sharon Andrews:** conceptualisation, investigation, project administration, supervision, writing – original draft, writing – review and editing. **Pieter F. Fouche:** conceptualisation, data curation, investigation, methodology, visualisation, formal analysis, writing – original draft, writing – review and editing. **Belinda Flanagan:** writing – review and editing. **Michael McDermott:** resources, writing – review and editing. **Melanie Greenwood:** writing – original draft, writing – review and editing.

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Disclosure

Not commissioned, externally peer reviewed.

Conflicts of Interest

Michael McDermott is the Senior Manager of Governance, Innovation and Research at Ambulance Tasmania. All other authors have no relevant disclosures.

Data Availability Statement

The ambulance and dispatch datasets are not publicly available because of privacy and contractual restrictions with the data custodian. Deidentified data may be available from the corresponding author on reasonable request and subject to approval by Ambulance Tasmania and the relevant ethics committee.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Data S1:** mja270211-sup-0001-supinfo.pdf.