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Care Home Residency and Its Association with Ambulance Service Workload

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A B S T R A C T

Objectives: Care home residents comprise a significant minority of ambulance patients, but little is known about how care homes impact ambulance service workload. This study aims to quantify differences in the workload of ambulance paramedics associated with patient residence (care home vs private).
Design: This was an observational study using routine ambulance service data and Clinical Frailty Scale scores from patients attended by 112 study paramedics between January 1, 2021, and June 30, 2021.
Setting and Participants: 3056 patients (459 in care homes) aged ≥50 attended by the North East Ambulance Service NHS Foundation Trust, England.
Methods: This study used 2 outcome measures of treatment: time spent at scene and conveyance to hospital. Anonymized patient data and incident time logs were collected from ambulance electronic patient care records. The relationships between care home residency, conveyance to hospital, and time spent at scene were investigated using ordinal logistic regression and quantile regression. Models were weighted to address potential sampling imbalance using anonymised call logs containing all eligible ambulance callouts.
Results: Care home residents were less likely to be conveyed to hospital [odds ratio: 0.75 (0.59-0.96)] and received shorter treatment time than community residents [median −7.0 (−12.0, −1.9) minutes for patients conveyed to hospital, −2.8 (−5.4, −0.3) minutes for patients discharged at scene].
Conclusions and Implications: Our results suggest that care homes provide support that reduces demand on the ambulance service and other "downstream" services in secondary care. This study also points to a need to enhance care for older people in private households to contain the demands on ambulance services. These findings have implications for countries like England, where ambulance services struggle to meet target response times, which may affect patient outcomes.

Residents of care homes have complex needs. Many are cognitively impaired, live with multiple long-term conditions, and require a range of support from primary and secondary health care.[1] In England, 361,000 people (0.6%) are care home residents,[2] and ambulance services are often their first point of contact with the Nation Health Service (NHS). Calls to the ambulance service are disproportionately high among older populations[3,4] and care home residents.[5] Previous research in England found that care home residents comprise 16% of callouts to people aged ≥75 years, and 35% of all ambulance calls are to people aged ≥75 years.[6] Utilization is expected to increase as populations age.[7]

The ambulance service in England rarely meets target response times.[8] Care provided in other settings, such as care homes, may help

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manage demand. In the United Kingdom, care homes encompass institutions with and without 24-hour registered nurses on site (formerly nursing and residential homes, respectively). Many homes are a mixture, with some beds covered by nursing staff. Residential homes provide support with personal care and activities of daily living, whereas nursing homes also support health care–related needs.

Two key measures of ambulance workload are time spent at scene with patients and the rate of conveyance to hospital for patients. This study aimed to measure the workload of ambulance paramedics associated with patients in care homes, compared to patients outside of care homes.

Methods

Data were collected over 6 months (January-June 2021) for callouts attended by 112 paramedics from the North East Ambulance Service (NEAS) NHS Foundation Trust, England. Eligible patients were ≥50 years old, had nonimpaired consciousness (Glasgow Coma Scale < 15[9]) and were not ambulance priority category 1 calls. Category 1 is limited to patients requiring immediate treatment for life-threatening conditions (eg, cardiac arrests).[10]

Anonymized patient data and incident time logs were collected remotely from ambulance electronic patient care record (ePCR) systems. ePCRs are completed by paramedics for each incident and contain standardized information related to each clinical episode. This information includes age, gender, whether the patient was located at a care home, ambulance arrival time, and 3 measures of patients' status: National Early Warning Score 2 (NEWS2), Clinical Frailty Scale (CFS) score, and ambulance priority category. NEWS2 is a measure of acute illness severity,[11] where a score of 5 is a threshold for triggering an urgent clinical review (although this is not reason alone to convey a patient to hospital).

All data analyzed in this study are routinely collected by paramedics as part of ePCRs, except for the CFS score. All paramedics working for NEAS were contacted to take part in this study; 112 of 498 volunteered to be trained to use the CFS, all of whom subsequently included patient CFS scores when completing their ePCRs. Training was conducted with an online course. Paramedics were assigned to patients on an approximately random basis, following the normal approach used by NHS emergency call handlers, which is related to ambulance availability and location.

Frailty measures a patient's loss of physical, cognitive, energy, and health reserves,[12] with well-established associations with poorer clinical outcomes, higher health care use and higher hospitalization rates.[13-15] The CFS is a commonly used measure of frailty in clinical settings, with ≥5 (on a 9-point scale) commonly considered the threshold for frailty.[16]

Ambulance priority categories are assigned based on a standard, national approach in England and indicate the urgency of a patient's condition.[10]

Time spent at scene was determined from incident time logs. For patients conveyed to hospital, time spent was measured from the ambulance's arrival at the patient's location until the ambulance departed for hospital. For patients not conveyed, time spent was measured until the ambulance crew became available for new incidents.

The time of an ambulance call may influence whether paramedics convey a patient to hospital or direct them to other health services (such as primary care), as these services may only be open during core hours. It may also influence the decision to call an ambulance in the first place, especially in a care home where staffing levels may be reduced outside of core hours. We define core hours as the ambulance arriving on scene 9 AM–5 PM but conducted a sensitivity analysis which included other time frames: 8 AM–4 PM and 8 AM–6 PM.

We assume eligible patients treated at care home locations are care home residents, and patients treated at other locations are not. ePCRs do not distinguish between residential and nursing care homes.

The relationship between care home residency and conveyance to hospital was investigated using ordinal logistic regression models. Time spent at scene was studied with quantile regression. Models were adjusted for age, gender, frailty, NEWS2 score, ambulance priority category, and time of attendance. Area deprivation and rurality status were not included in our main analysis, as these may not be representative of the patient's residency prior to moving to their care homes. However, a sensitivity analysis that included these area characteristics was conducted.

Anonymized emergency call logs for all potentially eligible patients treated by NEAS during the study period were used to calculate inverse probability weights for study patients. Weights were calculated using the model covariates plus area deprivation (Index of Multiple Deprivation quintile[17]) and rurality.[18] Missing data were imputed with multiple imputation by chained equation.

Analyses were performed using Stata, version 17 (StataCorp), and R, version 4.2.1 (R Foundation for Statistical Computing). This study was approved by the NHS Health Research Authority (HRA) (20/HRA/5278) and Newcastle University Ethics Committee (Ref: 18743/2022). A waiver of informed consent was obtained from the institutional review boards.

Results

We analyzed 3056 ambulance callouts, with 11.2% (95% CI 10.1%-12.3%) made to care homes (Table 1).

A larger proportion of female patients (12.5%, 95% CI 11.0%-14.0%) were in care homes than male patients (9.7%, 95% CI 8.1%-11.4%). Care home residents were more likely to be frail, and in lower ambulance priority categories than community-dwelling patients.

Table 1
Baseline Characteristics of Patients by Care Home Residency Status

	Total Number of Patients	Number of Care Home Residents	Weighted Percentage Care Home Residents (%, 95% CI)
Total	3056	459	11.2 (10.1, 12.3)
Gender			
Female	1748	300	12.5 (11.0, 14.0)
Male	1308	159	9.7 (8.1, 11.4)
Age			
50-54	115	5	3.8 (0.4, 7.2)
55-59	135	9	4.6 (0.9, 8.2)
60-64	204	5	2.3 (0.3, 4.3)
65-69	228	8	2.2 (0.4, 4.0)
70-74	299	27	8.1 (5.0, 11.1)
75-79	376	46	9.4 (6.6, 12.3)
80-84	463	94	15.6 (12.5, 18.7)
85-89	435	114	19.5 (16.1, 23.0)
≥90	342	151	28.9 (24.7, 33.1)
NEWS2 score ≥5			
No	2594	388	11.6 (10.4, 12.8)
Yes	404	54	9.0 (6.1, 11.9)
(Missing)	(58)	(17)	—
Frailty status			
Not frail	1049	46	3.7 (2.5, 4.9)
Frail	2007	413	16.6 (14.9, 18.2)
Core hours			
No	2096	352	12.6 (11.2, 14.0)
Yes	953	107	8.3 (6.6, 10.0)
(Missing)	(7)	(0)	—
Priority category			
2	1743	218	9.4 (8.1, 10.7)
3	957	182	15.2 (13.0, 17.3)
4	132	30	17.3 (11.2, 23.3)
(Missing)	(224)	(29)	—

Care home residency percentages account for weighting and missing data.

Table 2
Assessment of Patients Being Conveyed to Hospital and Time Paramedics Spend at Scene

	Conveyance (OR, 95% CI)	Time Spent at Scene (min, 95% CI)
Male (ref: female)	1.01 (0.83, 1.23)	−3.9 (−5.5, −2.2)
Age category (ref: 50-54)		
55-59	1.00 (0.52, 1.93)	−0.7 (−6.7, 5.3)
60-64	0.75 (0.42, 1.35)	0.7 (−5.8, 7.2)
65-69	1.18 (0.65, 2.16)	5.2 (−1.40, 11.8)
70-74	0.75 (0.43, 1.30)	3.8 (−2.2, 9.7)
75-79	0.84 (0.49, 1.45)	4.3 (−1.7, 10.4)
80-84	0.84 (0.49, 1.44)	6.9 (0.9, 12.9)
85-89	1.00 (0.58, 1.73)	5.0 (−0.8, 10.9)
≥90	0.90 (0.52, 1.55)	6.3 (0.1, 12.5)
Frail (ref: not frail)	0.80 (0.63, 1.00)	6.4 (4.4, 8.4)
NEWS2 score ≥5 (ref: <5)	4.72 (2.80, 7.93)	3.0 (0.5, 5.6)
Priority category (ref: 2)		
3	0.52 (0.43, 0.64)	1.6 (−0.3, 3.4)
4	0.64 (0.43, 0.95)	−1.8 (−6.7, 3.2)
Attended in core hours (ref: out of core hours)	1.54 (1.25, 1.91)	−1.3 (−3.0, 0.4)
Care home resident (ref: not)	0.75 (0.59, 0.96)	−7.0 (−12.0, −1.9)
Conveyed (ref: not)	—	−38.5 (−41.1, −35.8)
Care home resident × conveyed	—	4.1 (−1.5, 9.7)
Baseline	3.81 (2.31, 6.26)	73.0 (66.8, 79.2)

× Signifies an interaction effect. The baseline row provides the odds of conveyance and time spent at scene for a patient in all reference categories.

Care home residents were less likely to be conveyed to hospital than patients in the community [odds ratio (OR), 0.75, 95% CI 0.59-0.96] (Table 2).

Time spent at scene was approximately double for patients discharged on scene compared with patients conveyed to hospital, independent of patient location. The interaction of care home residency and conveyance shows that paramedics spent less time treating care home residents than community residents: 7.0 (1.9-12.0) minutes less for patients not conveyed and 2.8 (0.3-5.4) minutes less for patients conveyed.

Among all patients, frailty was associated with increased time spent at scene [6.4 (4.4-8.4) minutes], but not decreased conveyance at the 95% CI (OR 0.8, 95% CI 0.6-1.0). NEWS2 score ≥5 markedly increased the odds of conveyance (OR 4.7, 95% CI 2.8-7.9) and increased the time spent at scene (3.0, 95% CI 0.5-5.6) minutes. Lower-priority ambulance categories decreased the odds of conveyance but were not associated with changes in time spent at scene. Time spent at scene was 3.9 (95% CI 2.2-5.5) minutes shorter for males compared to females, but there was no difference in conveyance rates.

Interaction effects between care home residency and frailty, conveyance, and core hours were each tested and found to be not significant for either conveyance or time spent at scene. The data show a high level of collinearity between conveyance and NEWS2 score ≥5 for care home residents. Consequently, this interaction was not tested.

A sensitivity analysis that included area deprivation and rurality did not significantly alter the results, nor did adjusting the core hours. Data missingness was low (1.9% NEWS2 score, 0.2% core hours, 7.3% priority category).

Discussion

Residents of care homes were less likely to be conveyed to hospital and received less on-site treatment time from paramedics compared to people living in the community. These findings suggest that care homes provide an appropriate level of care that may reduce demands on paramedics and hospitals.

Averting conveyance has multiple benefits for patients, including improved patient satisfaction, and reduced emergency department overcrowding.[19–21] Previous research found that 95% of care home residents in UK emergency departments arrived by ambulance,[22] implying that patients who are not conveyed are unlikely to arrive by another route. Reduced time spent at scene and conveyance rates also allow paramedics to treat more patients per shift, improving ambulance response times.

Care home staff may call ambulances for less serious complaints than older people in private residences. This would lower the expected conveyance rate and time spent at scene for care home residents. However, our model adjusts for 3 measures of patient status: ambulance priority category, NEWS2 score, and frailty. This suggests that similarly ill patients are indeed less likely to be conveyed to hospital and receive less treatment time if they are care home residents. Paramedics may trust care home staff to monitor patients in some instances and consequently do not convey them to hospital. However, paramedics may be more cautious in the community setting and convey patients to hospital for monitoring.

Higher rates of conveyance among community-dwelling older people compared with care home residents emphasizes that well-resourced community services have a key role in reducing the overall demand on ambulance services and hospitals. To enhance resident care, the next challenge is to reduce callouts that do not result in hospital conveyance. A better understanding of the situations that prompt an ambulance request, and alternative ways of addressing residents' needs, are likely to be helpful.

Patients with NEWS2 score ≥5 were at much greater risk of conveyance than those with NEWS2 score <5. This may be because paramedics believe the most acutely ill patients, which NEWS2 measures, are best treated in hospital. Although our results did not find frailty to be associated with decreased conveyance at the 95% CI, frailty was associated with increased time spent at scene, possibly because of frail patients having more complex needs or increased mobility problems.

Paramedics typically spent 4 minutes less treating male than female patients. The reason is unclear; however, previous studies have found higher rates of ambulance use among male care home residents than female[5] and gender differences in reported symptoms away from an emergency setting,[23] both of which may contribute to the disparity. It is also possible that biases in the perception and treatment of symptoms by paramedics or care home staff may influence treatment duration.

Limitations

The CFS is a subjective measure, and inconsistent use between paramedics is possible. The paramedics were trained using an online course because of the COVID-19 pandemic, preventing dialogue that may have consolidated and improved understanding. However, online delivery of frailty training can be effective and feasible.[24]

Data collection in the ambulance setting is necessarily limited by the need to offer emergency treatment to patients. This compelled a pragmatic approach to obtaining information on patient frailty, which is not routinely collected in the ambulance setting. Paramedics were randomly assigned to patients, but the decision to record frailty status was not, as paramedics volunteered to join this study. To mitigate any biases, we reweighted the study data based on all calls to NEAS for eligible patients during the study period, whether they were treated by a study paramedic or not.

Data collection occurred during the COVID-19 pandemic. Both COVID-19 infections and social distancing may have influenced patient behavior. However, the total number of emergency calls to NEAS during the study period (January-June 2021) was similar to the equivalent 6-month period from before the pandemic (January-June 2019),[25] suggesting changes in ambulance use may have been limited.

Despite accounting for care home residence, frailty, ambulance priority category, and NEWS2 score, some patients may have presented medical needs not fully captured by these metrics and required more treatment. ePCRs did not distinguish between care homes with and without nursing staff, so we were unable to compare results across these settings.

Conclusions and Implications

Care home residents were less likely to be conveyed to hospital and have a shorter duration of treatment than community-dwelling patients, suggesting care homes provide a safety net for their residents and assurance for paramedics regarding onward care. Care home residents comprise a significant minority of ambulance patients but are seldom studied. Improving future data collection will be essential to understand how to optimize their use of ambulance services and identify situations where care home staff can use other pathways to treat patients.

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