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Finney, Owen, McClelland, Graham, Price, Christopher I and Shaw, Lisa (2023) Comparison of pre-hospital stroke care between private residences and care home settings: retrospective analysis of an ambulance clinical record dataset. *Journal of Paramedic Practice*, 15 (9). ISSN 1759-1376

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## **Title**

Comparison of pre-hospital stroke care between private residences and care home settings: retrospective analysis of an ambulance clinical record dataset

## **Keywords:**

Stroke, paramedic, ambulance, pre-hospital care, United Kingdom

## **Background**

Suspected stroke is a common scenario amongst care home residents, who are typically older and have more complex health needs than the general population.

## **Aims**

The aim of this study was to describe the care of suspected stroke patients according to their residential status.

## **Methods**

Retrospective secondary analysis of an existing ambulance clinical record dataset from a UK ambulance service, describing the care of patients labelled as suspected stroke between December 2021 and April 2022.

## **Findings**

Care home patients were older (median 86 (IQR 79-91) years versus 75 (IQR 63-83) years;  $p < 0.001$ ), with more comorbidities (median 5 (IQR 3-6) versus median 3 (IQR 2-5);  $p < 0.001$ ) and medications (median 6 (IQR 4-9) versus median 4 (IQR 1-7);  $p < 0.001$ ). They were more likely to have difficulties completing the Face Arms Speech Test (17/170 (10%) versus 39/1305 (3%);  $p < 0.001$ ) and present with facial droop (85/153 (55.6%) versus 506/1266 (40%);  $p < 0.001$ ). Ambulance on-scene time was longer at care homes (median 41 (IQR 32-49.5) minutes versus median 35 (IQR 27-45) minutes;  $p < 0.001$ ).

## **Conclusion**

Clinician awareness of characteristics associated with residential settings may be important for delivering emergency stroke care. Research is needed to optimise ambulance assessment for care home patients.

## **Conflict of interest**

No conflict of interest to declare.

## **Background**

Stroke is defined as a neurological deficit attributed to an acute focal injury of the central nervous system by a vascular cause. As a common time-sensitive medical emergency with a high mortality (Sacco et al., 2013; Sibson, 2017), pre-hospital care focuses upon early recognition and rapid transportation to an appropriate hospital for treatment (Sibson, 2017). A significant proportion of patients with stroke symptoms are later diagnosed with a non-stroke mimic condition (Winkler et al., 2009), whilst some spontaneously improve after initial assessment and are labelled as transient ischaemic attack (TIA) (McClelland et al., 2020). However, the emergency response should continue until stroke has been excluded.

There are approximately 340,000 older people in England living in care homes across the UK (Wolters, Lloyd, Lilburne, 2019), which are split into two main types: nursing homes providing 24-hour personalised nursing care and residential homes providing assistance with daily activities only (Wolters, Lloyd, Lilburne, 2019). It is well understood that care home patients will be older and have more complex health needs than the general population (Gordon et al., 2013; Shah et al., 2010; Wolters, Lloyd, Lilburne, 2019), and research has shown higher disease prevalence for conditions such as stroke, dementia, and mental health problems (Shah et al., 2010; Wolters, Lloyd, Lilburne, 2019). The presence of such co-morbidities and the care environment itself might make pre-hospital patient assessment and management more challenging (Voss et al., 2018), for example, dementia can affect recognition and communication of symptoms (Choonara and Williams 2021)

No previous research containing descriptions of acute stroke patient characteristics and emergency assessment processes amongst care home patients has been published. There is wider evidence showing that care home patients in general access emergency services more frequently than their non-care home counterparts (Dwyer et al., 2018), and that healthcare provision is often not tailored towards their needs (Gordon et al., 2013). It is therefore possible that differences between private and care home populations and settings might influence stroke identification and pre-hospital care, with implications for staff training and clinical guidelines, which currently do not differentiate between settings (Joint Royal Colleges Ambulance Liaison Committee & Association of Ambulance Chief Executives (JRCALC & AACE), 2022).

## **Aim**

This study aimed to describe the ambulance care of suspected adult stroke patients according to residential status of any care home versus private address (i.e., patients living in their own home).

## **Methods**

### **Objectives**

- To describe and compare demographic characteristics of suspected stroke patients from care homes and private addresses
- To describe and compare clinical care characteristics of suspected stroke patients from care homes and private addresses

### **Study design**

We undertook secondary analysis of an existing ambulance clinical record dataset, which had previously been used to describe pre-hospital stroke care in a single UK ambulance service.

### **Study population**

The dataset described care parameters for patients transported to hospital by the North East Ambulance Service NHS Foundation Trust (NEAS), where a clinical impression of suspected stroke (including TIA, or any clinical scenario suggesting possible stroke) had been documented on the electronic patient record system between December 2021 and April 2022 (McClelland et al 2020). The region covered by NEAS contains six acute stroke units. Clinicians with varying grades and qualifications are employed, so in this report ambulance clinician is used as a generic term for any responding clinician. However, stroke patients are usually attended by a minimum of an emergency care technician.

Residential status is routinely recorded by ambulance clinicians attending any incident using pre-defined categories: private address, care home, public place, educational facility, other, unknown. The care homes category includes both residential home and nursing home settings, which cannot be further separated. Cases were excluded from the analysis if the residential status recorded was not a care home or private address (i.e., public incident, educational facility, workplace, other, or unknown) and where there were obvious nonsensical data reporting errors.

### **Data analysis**

Pre-hospital time intervals were calculated from routinely captured time stamps. The presence of polypharmacy and multimorbidity were derived from lists of medication and previous medical history recorded in the ambulance dataset using standard definitions: over five prescribed medications (Masnoon et al., 2017) and two or more medical conditions respectively (Johnston et al., 2018).

Patient demographics, ambulance response times, ambulance clinician assessment and ambulance clinician treatments provided were summarised according to residential status (i.e., private address or care home) using descriptive statistics.

Categorical data were compared using chi-square testing and continuous data were compared using Mann-Whitney U testing. For statistical analysis, SPSS 28.0 package (IBM SPSS Statistics for Windows, Armonk, NY, USA: IBM Corp.) was used.

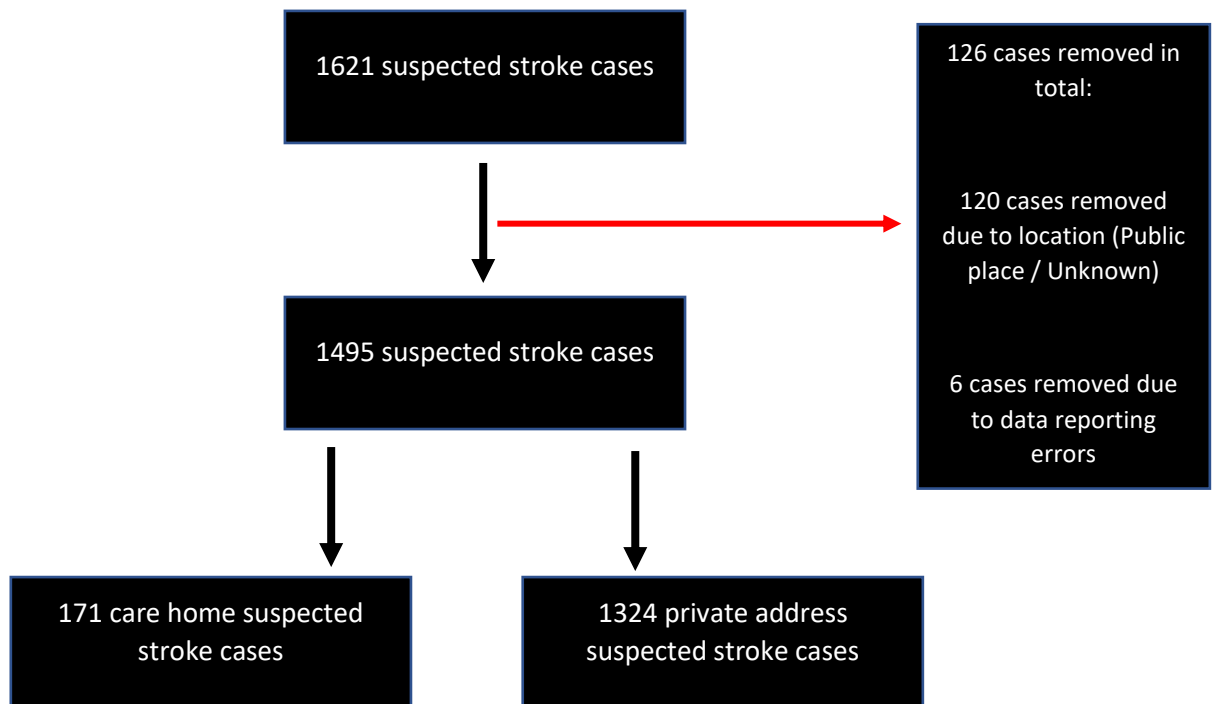
### **Ethical issues**

As a retrospective description of anonymised routine care provided by a single organisation, ethical approval was not required.

### **Results**

The original dataset contained 1621 suspected stroke patients attended by ambulance clinicians between December 2021 and April 2022. Exclusion criteria removed 126 cases (119 public incidents, 1 unknown location and 6 private address cases with obvious nonsensical errors in data recording). Of the remaining 1495 cases, 171 were from care homes and 1324 were from private addresses (Figure 1).

**Figure 1 – Study flow chart**



The median age of patients in care homes was 11 years older than private addresses. Care home patients had on average 2 more medications prescribed and 2 more co-morbidities than the private address patients. Rates of atrial fibrillation and dementia were higher in the care home group. The private address group had a higher systolic blood pressure reading whereas the care home group had a lower Glasgow Coma Score (GCS), lower AcVPU score and higher NEWS2 score (Table 1).

Both groups received similar assessment content from ambulance clinicians, including documentation of the Face Arm Speech Test (FAST) and a 12-lead ECG. When looking at NHS Ambulance Care Quality stroke assessment bundle (Ambulance quality indicators, 2020) of FAST, BP, and capillary blood glucose (CBG) assessments, the private address group was more likely to have a blood pressure assessment completed. However, other physiological observation recordings were similar. In terms of the FAST items, a higher proportion of care home patients were unable to participate in assessment, but when assessment was possible, a facial droop was recorded more often. Other components of the FAST assessment were similar across both groups (Table 2).

The ambulance response time and transfer time to hospital were similar in both groups. However, the on-scene time (OST) was significantly longer by a median of 6 minutes in the care home group. Private address patients were more likely to have IV cannulation attempted by paramedics, but other interventions provided by ambulance clinicians such as using a hospital pre-alert call and administering drugs were similar in both groups (Table 3).

**Table 1 – Population characteristics**

\*Statistically significant result (p&lt;0.05)

	Care home (n=171)	Private address (n=1324)	P-value
Age (years) <i>Median (IQR)</i>	86 (79-91)	75 (63-83)	<0.001*
Sex <i>Female (%)</i> <i>Male (%)</i>	94 (55.0%) 77 (45.0%)	672 (50.8%) 652 (49.2%)	0.29
Polypharmacy (%)	116 (67.8%)	625 (47.2%)	<0.001*
Number of prescribed medications <i>Median (IQR)</i>	6 (4-9)	4 (1-7)	<0.001*
Multimorbidity (%)	163 (95.3%)	1065 (80.4%)	<0.001*
Number of comorbidities <i>Median (IQR)</i>	5 (3-6)	3 (2-5)	<0.001*
Atrial fibrillation listed (%)	40 (23.4%)	181 (13.7%)	<0.001*
Dementia and/or Alzheimer's listed (%)	58 (33.9%)	62 (4.7%)	<0.001*
Previous stroke listed (%)	27 (15.8%)	192 (14.5%)	0.65
Diabetes (Type 1 and 2 grouped) listed (%)	28 (16.4%)	229 (17.3%)	0.76
Heart rate (HR) <i>Median (IQR)</i>	n=170 80 (71-92)	n=1319 83 (72-96)	0.164
Blood pressure (BP) (Systolic) <i>Median (IQR)</i>	n=167 141 (121-158)	n=1315 157 (136-179)	<0.001*
Capillary blood glucose (CBG) <i>Median (IQR)</i>	n=164 6.9 (5.2-7.9)	n=1289 7.2 (5.2-8.0)	0.409
Body temperature <i>Median (IQR)</i>	n=162 36.7 (36.2-37.2)	n=1267 36.6 (36.2-37.0)	0.340
Glasgow coma score (GCS) <i>Median (IQR)</i>	n=170 14 (11-15)	n=1316 15 (14-15)	<0.001*
AcVPU assessment (Alert = 5 Confused = 4 Verbal = 3 Pain = 2 Unresponsive = 1)	n=156	n=1246	<0.001*



<i>Median (IQR)</i>	5 (Alert) (4-5 (c-A))	5 (Alert) (5-5 (A-A))	
NEWS2 score <i>Median (IQR)</i>	n=118 3 (1-5)	n=944 1 (0-3)	<0.001*

**Table 2 – Patient assessment results by ambulance clinicians**

\*Statistically significant result (p=<0.05)

	Care home (n=171)	Private address (n=1324)	P-value
Blood pressure assessment completed (%)	167 (97.7%)	1315 (99.3%)	0.028*
Capillary blood glucose assessment completed (%)	164(95.9%)	1291 (97.5%)	0.22
12-lead ECG assessment completed (%)	63(36.8%)	570 (43.1%)	0.12
Clinician attempted FAST assessment (%)	170 (99.4%)	1305 (98.6%)	0.36
Clinician attempted FAST, but patient unable to participate in FAST test (%)	n=170 17† (10%)	n=1305 39 †† (3%)	<0.001*
FAST positive result (%)	n=153 134 (87.6%)	n=1266 1043 (82.4%)	0.11
Facial weakness symptom recorded present (%)	n=153 85 (55.6%)	n=1266 506 (40.0%)	<0.001*
Arm weakness symptom recorded present (%)	n=153 70 (45.8%)	n=1266 595 (47.0%)	0.77
Speech abnormality symptom recorded present (%)	n=153 90 (58.8%)	n=1266 741 (58.5%)	0.94
Time of onset recorded by ambulance clinician (%) §	n=170 166 (97.6%)	n=1305 1269 (97.2%)	0.76
Leg weakness symptom recorded present (%)	n=153 49 (32.0%)	n=1266 462 (36.5%)	0.28

Number of stroke symptoms recorded (Face, arms, speech, and/or leg) (1-4) (%)	n=13	n=1043	
1	1= 48 (35.8%)	1= 375 (36.0%)	0.98
2	2= 38 (28.4%)	2= 274 (26.3%)	0.60
3	3=22 (16.4%)	3= 188 (18.0%)	0.64
4	4=26 (19.4%)	4= 206 (19.8%)	0.92

Footnote:  
† 12 = Due to reduced GCS  
5 = Due to patient being unconscious

†† 20 = Due to reduced GCS  
15 = Due to patient being unconscious  
1 = Noted as difficult to assess with no reason stated  
1 = Clinicians unable to access arms or legs  
1 = Patient non-compliant with assessment (Not GCS related)  
1 = exception (No reason stated)

§ n=170 and n=1305 as time was able to be collected without patient ability to complete FAST

**Table 3 – Ambulance treatment results**

\*Statistically significant result (p=<0.05)

	Care home (n=171)	Private address (n=1324)	P-value
999 call to on-scene time <i>Median (IQR)</i>	23 minutes (13-35.5)	25 minutes (15-41)	0.19
On-scene time <i>Median (IQR)</i>	41 minutes (32-49.5)	35 minutes (27-45)	<0.001*
Leave scene to hospital arrival time <i>Median (IQR)</i>	15 minutes (9-21)	16 minutes (11-23)	0.19
Overall time of pre-hospital phase (999 call to hospital arrival) <i>Median (IQR)</i>	83 minutes (75-106)	80 minutes (63-107)	0.60
Patient destination types <i>Stroke unit (%)</i> <i>Non-stroke unit (%)</i>	33 (19.3%) 138 (80.7%)	330 (24.9%) 994 (75.1%)	0.11
Hospital pre-alert call documented (%)	67 (39.2%)	584 (44.1%)	0.22
IV cannulation attempted (%)	41 (24.0%)	423 (31.9%)	0.03*
IV cannulation success (%)	n=41 30 (73.2%)	n=423 357 (84.4%)	0.06

Number of cases where IV drugs were given by paramedics (If cannulated successfully) (%)	n=30 4 (13.3%)	n=357 40 (11.2%)	0.72
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## **Discussion**

This retrospective examination of ambulance records demonstrated that there are potentially important differences between suspected stroke patient characteristics and the care received according to the setting where they live.

Care home patients with suspected stroke were older than their private address counterparts by 9 years, with a median age of 86 years. Consistent with these results, a large European study has previously reported a mean age of 83 years amongst 4156 care home residents presenting to emergency medical services (EMS) (Onder et al., 2012), but we are not aware of any previous detailed descriptions about suspected stroke admissions. It has, however, previously been reported in cross-sectional community studies that care home patients are typically older and have more complex care needs (Shah et al., 2010; Wolters, Lloyd, Lilburne, 2019), as reflected by the higher age, rates of polypharmacy and rates of multi-morbidity shown in our results.

Approximately 1 in 9 (11.4%) suspected stroke patients in our dataset were transported from care homes, which means that ambulance clinicians encounter this scenario regularly. Publicly available Sentinel Stroke National Audit Programme (SSNAP) data shows that approximately 2.2% (1945/89014) of all NHS confirmed hospital stroke admissions in England and Wales came from care homes during April 2021- March 2022 (SSNAP, 2023), however the national total includes patients who were not admitted by emergency ambulance, such as self-presentation and inpatient stroke. If the North East is typical of other regions, the large difference between the frequency of care home patients with suspected stroke in our ambulance data (11.2%) versus those confirmed stroke admissions from care homes in SSNAP (2.2%) implies that there may be a high proportion of stroke mimic cases coming from these settings, possibly reflecting the challenge of performing accurate clinical assessments in this context.

It is well understood in both practice and research that successful pre-hospital stroke care is defined by early recognition and timely conveyance to a stroke-receiving hospital due to the potential impact on patient outcomes (JRCALC & AACE, 2022) e.g., when ischaemic stroke is eligible for thrombolysis, each 15-minute reduction in time-to-treatment is associated with one additional month of disability-free life (Meretoja et al., 2014). Our care process data showed that both the ambulance

response time and transfer time to hospital were similar in all settings, however, the median on-scene time (OST) was longer in the care home group by 6 minutes. This could reflect that care home patients are more challenging to assess or require a more complex manoeuvre to board the ambulance due to reduced mobility and/or location in larger buildings, but further research would be required to understand whether this difference is amenable to intervention.

Our analysis was reassuring in demonstrating that patients in care homes with stroke symptoms receive a similar clinical assessment process to those seen at private addresses. Over 95% received the NHS Ambulance Care Quality stroke assessment bundle (Ambulance quality indicators, 2020) of FAST, BP, and capillary blood glucose (CBG) assessments. A new finding was that the care home group had higher rates of being unable to complete the FAST, which appeared to be due to their reduced level of responsiveness. Additionally, since care home patients typically have more complex health needs, the presence of pre-existing communication and movement difficulties due to conditions like dementia and Parkinson's disease could interfere with assessment (Shah et al., 2010; Wolters, Lloyd, Lilburne, 2019). However, it was observed that when FAST assessment was possible, care home patients were more likely than private address patients to present with facial weakness. This might also relate to challenges in assessment or be present already because of common co-morbidities such as previous stroke.

### **Recommendations for research and practice**

Although the median increase in OST amongst the care home group was quite small, at a population level the resulting delay in admission to hospital could impact negatively on patient outcomes. Future research to explore the factors contributing towards OST in care home patients could be done using a similar research design to Li et al., (2018), who retrospectively separated and analysed each part of the ambulance care process to understand the components that delayed OST, such as patient extrication. Ambulance clinicians should be made aware that reducing OST is particularly important for care home patients, some of whom are eligible for emergency stroke treatments in hospital despite the higher levels of co-morbidities and dependency.

Further research should explore how pre-hospital stroke assessment is affected by increasing age and specific common conditions such as dementia. By linking to hospital data, it would be possible to examine the predictive accuracy of different assessment approaches across different settings and understand how to improve clinical guidelines and training for clinicians.

### **Limitations**

It is important to acknowledge that the data represented emergency contacts in a single service over a short timeframe, and caution should be used when generalising the results to wider populations. It was not possible to distinguish between nursing and residential care populations, which could provide further insights into reasons for differences in assessment and treatment compared to private addresses. The study only included patients with a suspected stroke or TIA by ambulance clinicians, we did not have data to confirm a stroke or other diagnosis in hospital. Furthermore, the clinical information was obtained through electronic patient report forms completed by ambulance clinicians during routine care, which can contain errors or omissions, especially under the additional stress of time-critical situations (LeBlanc et al., 2012).

### **Conclusion**

In this first study to specifically investigate pre-hospital emergency stroke care in different residential settings it was found that care home patients had more complex background health needs and variations in assessment and care processes. Clinician awareness of differences between residential settings may be important for improving the delivery of emergency stroke care. Further research is needed to optimise ambulance assessment of care home patients presenting with suspected stroke.

### **Acknowledgements**

The author received financial support during the duration of this study from Health Data Research (HDR UK) Better Care North Partnership. The data used in this study came from a fellowship funded by the Stroke Association UK.

### **Key points**

- Suspected stroke patients at care homes are typically older, have a greater number of co-morbidities, and more prescribed medications than private address patients
- Care home patients with suspected stroke can present differently to those at private addresses and are more likely to be unable to complete the Face Arm Speech Test
- Ambulance clinicians typically spend longer on-scene with suspected stroke patients in care homes compared to patients in private addresses
- Future research should explore influences upon the pre-hospital care of suspected stroke patients in care homes in order to improve assessment processes and training

### **Reflective questions**

- Think about your last suspected stroke case with a patient living in a care home, did you have any challenges during patient assessment?
- Thinking about your experiences, do you notice any differences between the pre-hospital stroke care of care home patients in comparison to patients in their own home?
- What are the key parts of your pre-hospital stroke assessment, and how does that compare to current best practice?
- What are the challenges in your EMS system to be able to deliver rapid pre-hospital stroke care?

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