Title: Variation in ambulance call rates for care homes in Torbay, UK

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Abstract:

Emergency ambulance calls represent one of the routes of emergency hospital admissions from care homes. We aimed to describe the pattern of ambulance call rates from care homes and identify factors predicting those homes calling for an ambulance most frequently. We obtained data from South Western Ambulance Service NHS Foundation Trust on 3138 ambulance calls relating to people aged 65 and over from care homes in the Torbay region between 1/4/12 and 31/7/13. We supplemented this with data from the Care Quality Commission (CQC) website on home characteristics and outcomes of CQC inspections. We used descriptive statistics to identify variation in ambulance call rates for residential and nursing homes and fitted negative binomial regression models to determine if call rates were predicted by home type (nursing versus residential), the five standards in the CQC reports, dementia care status or travel time to hospital. One hundred and forty-six homes (119 residential and 27 nursing) were included in the analysis. The number of calls made ranged from 1 to 99. The median number (IQR; range) of calls per resident per year was 0.51 (0.21 to 0.89; 0.03 to 2.45). Nursing homes had a lower call rate than residential homes (adjusted rate ratio (ARR) 0.29; 95% CI: 0.22 to 0.40 ; p<0.001); care homes failing the quality and suitability of management standard had a lower call rate compared to those who passed (ARR 0.67; 95% CI: 0.50 to 0.90; p=0.006); and homes specialising in dementia had a higher call rate compared to those not specialising (ARR 1.56; 95% CI: 1.23 to 1.96; p<0.001). These findings require replication in other regions to establish their generalisability and further investigation is required to determine the extent to which call-rate variability reflects the different needs of resident populations or differences in care home policies and practice.

What is already known about the subject:

- The number of calls received by ambulance services are increasing, as are the number of emergency hospital admissions.

- Residents living in an area with a care home have a higher chance of being admitted to hospital as an emergency compared to an age-matched population.

What this paper adds:

- This is the first study to investigate factors associated with variation in ambulance call rates from care homes.

- We found marked variation in the number of emergency ambulance calls made by care homes.

- More ambulance calls were made by residential homes, dementia specialist homes, and homes passing the Care Quality Commission 'quality and management' standard.

Introduction

Recent increases in the number of emergency hospital admissions have led to substantial effort to reverse this trend (Bardot *et al* 2013, The Kings Fund 2013). Residents living in an area with a care home have a higher chance of being admitted to hospital as an emergency compared to an age-matched population (Smith et al 2015). Since 400,000 people currently live in a care home in the UK (Age UK 2015), reducing the number of emergency hospital admissions from this setting is a priority but we know little about the drivers of emergency admission from care homes. One route to admission is via an emergency ambulance and understanding the variation and factors driving ambulance call rates from care homes is important.

Our aims in this study were to describe the pattern and variation of ambulance call-outs for people aged 65 and over living in residential or nursing homes in the Torbay area of south-west England and to identify home-level factors associated with higher ambulance call-out rates.

Methods

We obtained data from the South Western Ambulance Service NHS Foundation Trust (SWAST) for all calls from care homes in the Torbay region for people aged 65 and over, over a 16 month period between 1st April 2012 and 31st July 2013. Torbay is a largely urban area with a population of 130,000. There are a significant number of care homes in the region, reflecting the high proportion of older people in the region. Torbay has a higher proportion of people over 50 than the UK average (Torbay council 2011). The Care Quality Commission (CQC) recognises two different types of care homes, residential and nursing. While both offer care and support for residents, nursing homes also have 24 hour medical care from a qualified nurse (Care Quality Commission 2015). We considered both types of home in this analysis.

Data were available on date and time of call, reason for the call, care home name, and postcode. These data were summarised at the level of the home and supplemented by data we obtained

from the CQC website on whether the home was a residential or nursing home, whether the home was registered as specialising in dementia, the maximum number of beds for each home (size), and details on outcomes of CQC inspections in relation to five standards. These standards include: treating people with respect and involving them in their care; providing care, treatment and support that meets people's needs; caring for people safely and protecting them from harm; staffing; and quality and suitability of management (Care Quality Commission 2014). We also calculated an estimate of the journey time by road to the nearest hospital for each home using 'Google maps'. As this is a secondary analysis of anonymised service use data, collected by SWAST, ethical permission to conduct this study was not necessary.

Statistical analysis

We summarized the size of care homes, the number of ambulance calls made, the proportion of calls made outside of office hours, and the reason for ambulance calls by residential and nursing homes using descriptive statistics. There were a high number of different reasons for an ambulance call recorded (119) and a high proportion of calls (over 20%) had incomplete data. We felt that if an ambulance call was made following a fall or injury then this would have been likely to have been clearly recorded at the point that the call was made and we describe the proportion of calls following a 'fall or injury' for residential and nursing homes. However when a call was made for a medical, surgical or social reason this may have been less likely to have been accurately recorded. Therefore we took the decision not to report this data. The log-survivor plots indicated that the number of calls within each home followed a Poisson model but a goodness-of-fit test for the Poisson model indicated extra variability (overdispersion). We used negative binomial regression to analyse the call rate rather than Poisson regression because this allows us to take into account the extra variability and results in appropriately wider confidence intervals (Kirkwood & Sterne 2003). Models were fitted to the number of ambulance calls (outcome) using eight predictors: home type (residential or nursing), home

dementia status (whether the home specialises in dementia care), whether the homes failed each of the CQC five standards and the log of predicted journey time to hospital by road. The number of person-years was specified as denominator (offset). We fitted crude models in which one predictor was used at a time and an adjusted (multivariable) model including all predictors that were significant in the crude models. In the models we included only care homes for which we had complete data. We reported McFadden's pseudo R^2 value (Dobson & Barnett 2008) to quantify the model's goodness-of-fit. We used the statistics package R3.1

Results

During the 16 month study period 3138 ambulance calls were made by 164 care homes. Of these 164 homes in the SWAST database, three were replicated records, two were included in the original dataset as a postcode only and did not correspond to a care home address, four had no available data on home size, and in nine cases data were not available for the outcomes of all five CQC standards. We removed 18 records and used data on the remaining 146 homes in our analysis.

Seventy-four of the 119 (62%) residential homes and 16 of the 27 (59%) nursing homes were registered as specialising in dementia. Table 1 reports the descriptive statistics for home size, ambulance call rates, and estimated journey time to hospital for residential and nursing homes.

(Please insert table 1 about here)

The range of calls made by residential homes was 1 to 99 and the range of calls made by nursing homes was 1 to 32. The median number (IQR; range) of ambulance calls per resident per year was 0.58 (0.34 to 0.99; 0.05 to 2.45) for residential homes and 0.12 (0.08 to 0.25; 0.03 to 1.00) for nursing homes.

Both residential and nursing homes made a similar proportion of ambulance calls outside of 09.00 – 17.00 office hours: 60% (1748) of the calls from residential homes, and 60% (140) of the calls from nursing homes. Calls following a fall or injury accounted for 40% (1163) of all calls from residential homes and 22% (52) of all calls from nursing homes.

Results of the crude and adjusted negative binomial regression models are shown in Table 2, where we report the estimated rate ratio with 95% confidence limits and p-values. In the adjusted results nursing homes had a lower call rate than residential homes with an ambulance call rate ratio of 0.29 (95% CI: 0.22 to 0.40; p<0.001). Of the CQC standards only quality and suitability of management was a significant predictor of call rate: homes that failed this standard made fewer calls than those that passed (rate ratio 0.67; 95% CI: 0.50 to 0.90; p=0.006). Homes that specialised in dementia had a higher call rate than those that did not (rate ratio 1.56; 95% CI: 1.23 to 1.96; p<0.001). Predicted travel time to hospital was not related to the ambulance call rate of the home. When the variables that were non-significant in the crude analyses were included in a full multivariable model with all variables they remained non-significant. Those that were significant at the 5% level remained so.

(Please insert table 2 about here)

The pseudo R^2 value of the multivariable negative binomial model is 0.57. Some homes appear to be making markedly more calls than predicted by the model – see Figure 1.

(Please insert figure 1 about here)

Discussion

Our analysis indicates that there is marked variation in the number of calls made by care homes in the region studied. Residential homes and homes specialising in dementia care made more

calls per resident and homes that failed CQC Standard 5 (quality and suitability of management) made fewer ambulance calls than homes that passed this standard.

The characteristics of homes on which we had data explain around 60% of the overall variation in observed call rates between homes, but certain homes deviate considerably from their predicted rates (Figure 1). There are additional potentially predictive characteristics on which we did not have information including differences in populations within homes, the policies and practices of individual homes, their relationships with General Practitioners (GPs) and primary care, and the home's funding source.

There has been previous research into predictors of hospital transfers and admissions from care homes. One previous study investigated ambulance use for residential home residents with dementia and found a large number of calls related to trauma or an ambulatory care sensitive (ACS) condition (Amador *et al* 2014).

Previous research has also suggested that living closer to an emergency department may increase the risk of an emergency hospital admission, particularly for chronic health conditions, common in the care home population (Purdy *et al* 2011a, Purdy *et al* 2011b, Huntley *et al* 2014). In contrast to this we did not find an association between estimated travel time to hospital and the ambulance call rate. It should be noted that this estimate was made using 'Google maps' and was for a car, not an ambulance. Nevertheless we can presume that the relative travel times are similar. The reasons for the lack of association are unclear, but may be because previous studies have focussed on the impact of distance on admission rate, rather than the ambulance call rate. This may also reflect the limited impact travel time to hospital has on care home staff's decision of whether or not to call an ambulance. The proportion of calls being made by residential and nursing homes outside of office hours were similar, with 60% of all ambulance calls being made outside of office hours in both settings.

A number of commentaries have expressed the view that admissions to hospitals from care homes are the direct result of poor patient care or poor staff training (Partridge 2008, McDermott *et al* 2012). Our findings are consistent with previous research that has shown that having dementia increases the risk of admission to hospital for ACS conditions (Carter & Porell 2005). In contrast to the views expressed by Partridge and McDermott et al. we found that those homes failing CQC Standard 5 (quality and suitability of management) made fewer ambulance calls than those homes passing this standard. This result was unexpected and the reasons behind it are not clear. It may be that homes deemed to have a higher quality of management have a lower threshold for calling an ambulance. This may reflect differences in the style of management within these homes or polices that they have in place. While much emphasis is often placed on the need to reduce the number of ambulance calls and emergency hospital admissions (Bardot et al 2013, The Kings Fund 2013) this study suggests that those homes with higher call rates may have a higher quality of management.

Ours is the first study to investigate the variation in calls for an ambulance from care homes, and the factors that predict calls, and it has several strengths. We investigated all ambulance calls from a large number of care homes in a clearly defined geographical region made over a 16-month study period and were able to link care homes to CQC inspection reports. However using the binary pass-fail outcomes from five CQC standards of care following a CQC inspection visit is only a gross measure of service quality. It was not possible to extract further data from individual CQC reports on the specific reasons for, or specific home characteristics associated with, homes failing each of these standards. Clearly future studies would benefit from a more detailed analysis of the reasons why homes failed each of the CQC standards. In addition whilst our results present a comprehensive picture of call rates from care homes in the Torbay region, it is not clear whether our findings are generalizable to other parts of the country.

Further work across the UK is needed to understand the extent to which call-rate variability reflects the different needs of resident populations or differences in care home policies and practice. An improved understanding of the factors leading to differences in call rates will inform NHS policy and care home staff practices to minimise unnecessary ambulance calls.

Acknowledgement

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Table 1: Descriptive statistics for home size and ambulance calls from residential and nursing homes

Characteristic	All homes N = 146	Residential homes N = 119	Nursing homes N = 27
Home size, median (IQR; range)	24 (19 to 34; 7 to 90)	24 (17 to 30; 7 to 50)	31 (25 to 46; 9 to 90)
Specialises in dementia, n (%)	90 (62)	74 (62)	16 (59)
Fail CQC 1 – treating people with respect and involving them in their care, n (%)	20 (14)	13 (11)	7 (26)
Fail CQC 2 – providing care, treatment and support that meets people's needs, n (%)	17 (12)	13 (11)	4 (15)
Fail CQC 3 – caring for people safely and protecting them from harm, n (%)	19 (13)	16 (13)	3 (11)
Fail CQC 4 - staffing, n (%)	26 (18)	18 (15)	8 (30)
Fail CQC 5 - quality and suitability of management, n (%)	31 (21)	20 (17)	11 (41)
Number of ambulance calls per person per year			
Mean (SD)	0.60 (0.48)	0.69 (0.48)	0.19 (0.21)
Median (IQR)	0.51 (0.21 to 0.89)	0.58 (0.34 to 0.99)	0.12 (0.08 to 0.25)
Range	0.03 to 2.45	0.05 to 2.45	0.03 to 1.00
Predicted travel time to hospital (minutes)			
Mean (SD)	15.1 (7.3)	14.9 (6.9)	15.8 (8.8)

Median (IQR)	13 (10 to 20)	13 (9 to 20)	13 (11 to 21)
Range	4 to 45	5 to 42	4 to 45

Table 2: Results from negative binomial regression models of number of calls

Predictor	Crude estimates		Multivariable model[1] estimates	
	rate ratio (95% CI)	p	rate ratio (95% CI)	p
Home type (nursing vs residential)	0.26 (0.19 to 0.36)	<0.001	0.29 (0.22 to 0.40)	<0.001
Fail CQC 1 – treating people with respect and involving them in their care	0.91 (0.62 to 1.37)	0.63		
Fail CQC 2 – providing care, treatment and support that meets people's needs	1.01 (0.68 to 1.57)	0.96		
Fail CQC 3 – caring for people safely and protecting them from harm	0.84 (0.57 to 1.28)	0.39		
Fail CQC 4 - staffing	0.80 (0.57 to 1.15)	0.22		
Fail CQC 5 - quality and suitability of management	0.58 (0.43 to 0.81)	0.002	0.67 (0.50 to 0.90)	0.006
Specialises in dementia	1.51 (1.15 to 1.99)	0.001	1.56 (1.23 to 1.96)	<0.001
log(time to hospital)	1.12 (0.83 to 1.53)	0.42		

[1]Multivariable model includes home type, failing CQC standard 5 and dementia status

Figure 1: Observed vs predicted number calls over the 16 month period by home