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POLICY

A Retrospective Analysis of the Nature, Extent and Cost of Alcohol-Related Emergency Calls to the Ambulance Service in an English Region

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Abstract — **Aims:** To measure the prevalence, pattern and associated financial cost of alcohol-related ambulance call outs in the North East of England using routinely collected data from the North East Ambulance Service (NEAS). **Methods:** A retrospective cohort study over a 1-year time period (1 April 2009 to 31 March 2010) using NEAS patient record forms. **Results:** In the North East, 10% of ambulance call outs were alcohol-related. Males were 2.5 times more likely than females to be attended by an ambulance on the street rather than at home. People aged 10–19 had the highest relative risk ratio (3.4) of an ambulance pick up being on the street compare with those aged over 60. These call outs and subsequent accident and emergency (A&E) attendances cost over £9 million in a 1-year period. When extrapolated to the whole country the cost could be as much as £152 million per year. **Conclusion:** In a 1-year period, we estimated that over 31,000 ambulance call outs were alcohol-related. A large discrepancy was found between manual and electronic recording of alcohol-related ambulance attendances to A&E. The workload and cost of alcohol-related call outs is high and mostly preventable. Ambulance visits may present a teachable moment for brief intervention to reduce alcohol-related risk and harm.

INTRODUCTION

The annual cost of alcohol-related harm in the UK is estimated to be between £17.7 and £25.1 billion (Department of Health, 2008) with healthcare costs alone reaching £2.7 billion (Health Improvement Analytical Team, 2008) and alcohol-related crime and disorder accounting for £9–£15 billion (Department of Health, Home Office, Department of Media Culture and Sport, 2007). In 2009, the North East had the highest average weekly alcohol consumption in England at 14.4 units per week (Office for National Statistics, 2010) and the North East and South East of England were the only areas that had increased in average weekly alcohol consumption from the previous year (Office for National Statistics, 2010). Furthermore, the North East of England has the second highest national rates of alcohol-related deaths per 100,000 for males and females at 20.6 and 10.6, respectively compared with 17.4 for males and 8.4 for females nationally (Office for National Statistics, 2011). Indeed, between 2000 and 2009, the North East had a 159% increase in the number of alcohol-related male deaths per year (from 111 to 287) and a 176% females deaths (from 59 to 163) (Office for National Statistics, 2011).

Over 15 million people are treated in Accident and Emergency Departments (A&E) in England each year (NHS The information Centre, 2011a) of whom 35% of attendances have been estimated to be alcohol-related at a cost of over £0.5 billion per year (Drummond *et al*., 2003). Furthermore, a recent survey of 32 A&Es in England found that up to 40% of admissions at weekends and up to 70% at peak times were alcohol-related (Drummond *et al*., 2003). In this work, alcohol-related was defined as either being too intoxicated to give consent, having a positive breath alcohol test, reporting the current attendance was alcohol-related or having consumed more than 8 units in men or 6 units in women in the previous 24 h (Drummond *et al*., 2003). The high levels of attendances can be explained by the link between excessive drinking and a greater risk of being involved in accidents, assaults, fights and other traumatic events requiring hospital care (Green *et al*., 1993; Waller *et al*., 1998; Thom *et al*., 1999). Since a quarter of all people attending A&Es in England arrive by ambulance or helicopter (NHS The information Centre, 2011a), alcohol-related problems clearly have the capacity to create a large amount of work for ambulance services (Lynagh *et al*., 2009; London Ambulance Service, 2011). Moreover, given the limited amount of ambulance resources (people, time or transport), dealing with alcohol-related call outs is likely to have an opportunity cost of reducing the capacity to deal with other emergency work. Lastly, not all ambulance call outs result in a hospital attendance. Some patients with minor injuries are treated at the point of the ambulance pick up. Consequently, the full NHS cost of alcohol-related work needs to include this *in situ* work plus the transportation of patients to hospital by the paramedic service.

Although the recent UK Spending Review (HM Treasury, 2010) did not result in funding cuts to the NHS, the very small increase of 0.1% per year until 2014 will leave health services struggling to meet the rising demand and inflationary costs (Timmins, 2010). Consequently, ambulance services need to identify areas where costs can be saved and unnecessary activity reduced. For many, heavy drinking is volitional and so its harms are preventable. This study aimed to measure the prevalence and patterns of call outs and the associated financial costs of alcohol-related call outs in the North East of England using routinely collected data from the North East Ambulance Service (NEAS). Secondly, we aimed to investigate the accuracy of electronic recording of alcohol-related call out data compared with written records.

METHODS

Design

The study was a retrospective patient cohort study over a 1-year time period (1 April 2009 to 31 March 2010). All NEAS patient record forms completed in this time frame were included in the analysis.

Setting

NEAS provides services to the counties of Northumberland, Tyne and Wear, Durham and Teesside and serves a population of 2.6 million (North East Ambulance Service, 2011).

Data collection

The NEAS Control database, 'Cleric', holds information relating to all 999 calls, Patient Transport Service and subsequent journey information. Every incident is allocated a unique number which is provided by the Control Centre and the crew record this number on the patient record form. The patient record form contains comprehensive clinical and non-clinical information and, in the bottom left hand corner, is a box which is used to record if an incident was alcohol-related. Paramedics were directed to shade this box if they judged that the patient's current presentation was obviously either directly or indirectly related to the consumption of alcohol. A free-text box was also available to record further details of the call out including any disclosed information about alcohol or other substances used prior to the call out.

All patient record forms were scanned at the NEAS Headquarters and the data extracted and stored electronically. These data were exported onto a Microsoft excel spreadsheet (Microsoft Office, 2007) including the following fields: 'alcohol-related'; substance abused (alcohol, drug type etc.); incident postcode; date; time; incident location type (home, street, other place—the latter included public drinking venues as well as schools, workplaces, nursing homes, medical centre etc.); receiving destination (hospital); abuse to staff; age and gender. Duplicate patient record forms were excluded from the data set. A confirmed alcohol-related call out was based on either the 'alcohol-related' box on the patient record having been completed, or free-text recording of alcohol use or linkage to the presenting condition or both.

To check the accuracy of electronic data scanning, we manually checked a random sample of 2150 patient record forms from the whole 2009/2010 NEAS database. The sample was stratified by age and gender to ensure accurate representation of the local demographic profile of ambulance users. Based on an expected prevalence rate of 6% , reported in a previous survey carried out by the London Ambulance Service , this sample size allowed us to estimate the prevalence with a 95% confidence interval of plus or minus 1% (London Ambulance Service, 2011).

Descriptive statistics were used for analysis. Chi-square statistics were reported to compare responses to categorical data. A $P < 0.05$ was considered to be statistically significant. Econometric modelling was performed to identify the characteristics of patients that predicted alcohol-related ambulance call outs, namely whether the person in the incident is treated at the scene or taken to the hospital, and whether the call out incident occurred on the street, at home or at other locations (for example leisure places). The independent predictor variables included gender and age of the person in the incident, location of the incident, time and days of the week of the incident.

The cost of an ambulance call out and A&E attendance came from the Unit Costs of Health and Social Care 2010 (Curtis, 2010). The average cost for paramedic services was used, which included the overall running cost of the ambulance and crew which is currently £223 with an interquartile range (IQR) of £192–£246. Where a call out resulted in a visit to hospital, the average cost of an attendance at A&E (not including admission to a hospital ward) was calculated at an average cost of £97 (IQR £76–£112) per treatment episode.

Caldicott approval was granted from NEAS for the project in order for the researcher (N.M.) to gain access to the full patient records at NEAS headquarters.

RESULTS

From a total of 309,714 ambulance call outs in the 1-year time period, electronic record scans identified 3.2% as alcohol-related (10,063). Just under two-thirds of the alcohol-related call outs involved male patients (64%). Almost a quarter of alcohol-related call outs were for patients aged 20–29 with significantly more males in this age group (26% of males and 22% females; χ^2 618; df = 1; $P < 0.0001$) (Table 1). However, there was a relatively high prevalence of alcohol-related call outs continuing into middle age for men (18% aged 30–39; 19% aged 40–49) and women (20% aged 30–39 and 19% aged 40–49). In contrast, a fifth of the female attendances occurred in the youngest age group (age 10–19) (see Table 1).

The peak time for all ambulance call outs was 2.00 p.m. to 3.00 p.m.; however, alcohol-related call outs peaked between midnight and 1.00 a.m. (Figs. 1 and 2). Alcohol-related call outs also peaked around the weekend particularly Friday and Saturday nights.

In relation to where the call out came from, a higher percentage of 10–19 year olds were reported as being picked up from the 'street' (44%) rather than their home (32%) (χ^2 44.4; df = 1; $P < 0.0001$) or from other places (24%) (χ^2 143.2; df = 1; $P < 0.0001$).

Table 1. Age and gender of alcohol-related call outs

	Male		Female			Total	
Age group	Number	%	Number	%	Not stated	Number	%
Age not stated	301		136	—	29	466	—
10–19	834	13.6	706	20.3	1	1541	16.1
20–29	1608	26.3	754	21.7	5	2367	24.7
30–39	1124	18.4	682	19.6	1	1807	18.8
40–49	1181	19.3	664	19.1	1	1846	19.2
50–59	789	12.9	406	11.7	2	1197	12.5
60–69	366	6.0	176	5.1	0	542	5.6
70+	211	3.5	86	2.5	0	297	3.1
Total	6414		3610		39	10,063	

Percentages based on known ages.

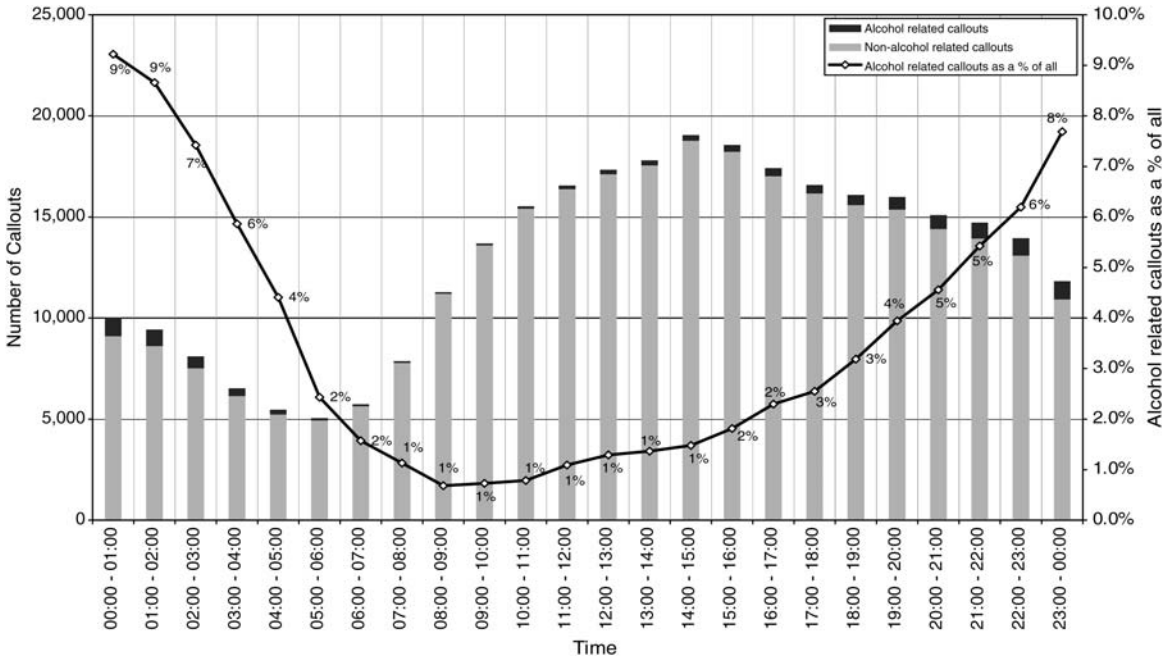

Fig. 1. Percentage of alcohol-related call outs in relation to all ambulance call outs.

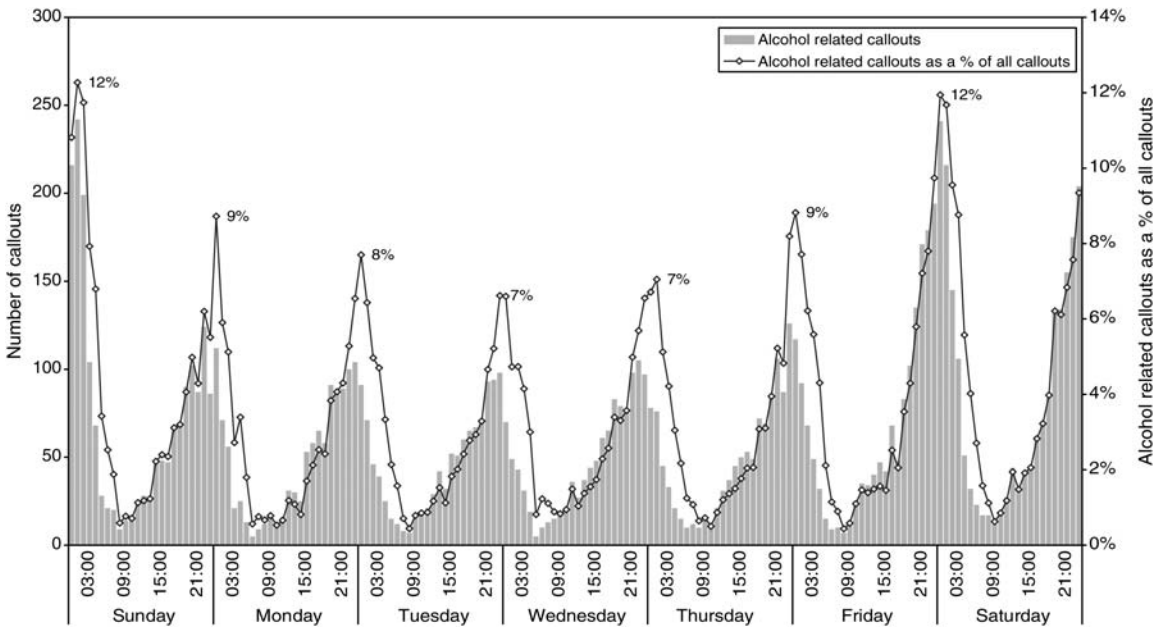

Fig. 2. Alcohol-related call outs by day of the week and time.

For individuals aged 20–29, 41% had home rather than 38% 'street' call outs (χ^2 3.40; df = 1; P 0.065) or other places (21%) (χ^2 201.9; df = 1; $P < 0.0001$). However, in the 30+ age groups, there were more home (57%) call outs than street (27%) (χ^2 930; df = 1; $P < 0.0001$) or other places (χ^2 2192.5; df = 1; $P < 0.0001$ (Fig. 3).

The majority (71%) of ambulance call outs resulted in the patient being taken to hospital. The remainder of patients (29%) were treated at the scene or refused to be transferred to hospital.

Logistic regression was used to model whether the person in the incident was treated on scene or taken to hospital. The reference population was female, aged 60 and over, having an incident at home on Monday between 8 a.m. and 12 a.m. Among the factors tested, only age and location were statistically significant. Compared with the reference group, those aged between 30 and 39 were 30% most likely to be taken to hospital; incidents that happened at other locations (such as, leisure places) were 16% more likely to result in hospital treatment than call outs from home. Gender, days of the

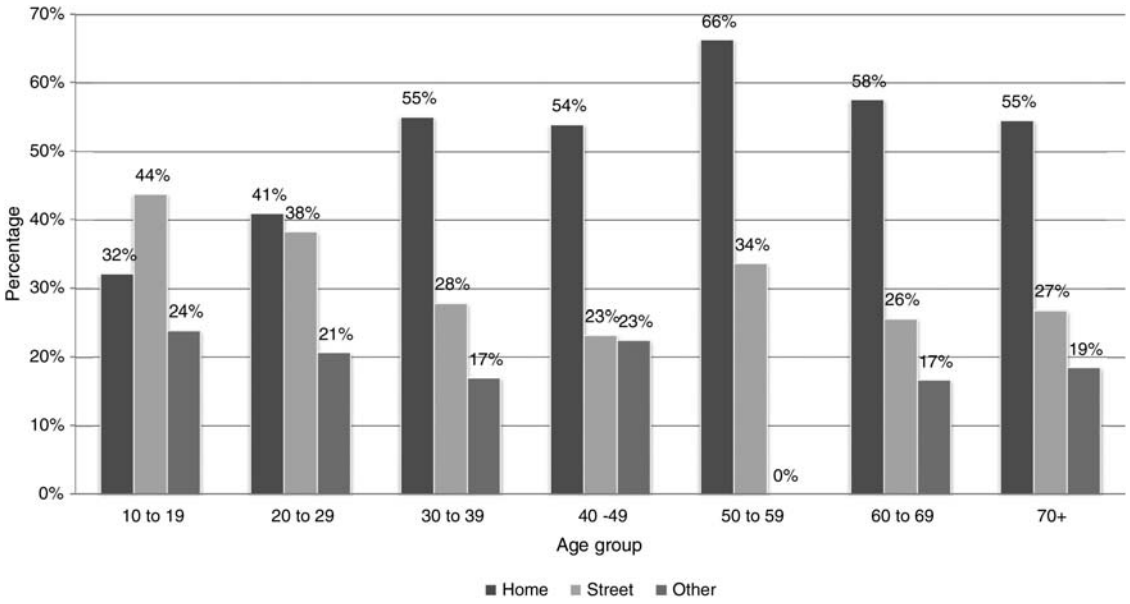

Fig. 3. Percentages of call outs by location and age.

week and time of the day did not appear to explain the severity of the injuries, assuming that incidents requiring hospital treatment were more severe (Table 2).

Multinomial logit model was used to explore the determinants of incident locations with incidents that occurred at home chosen as the reference group. Males are 2.5 times more likely than females to have an incident on the street rather than at home. Those aged 10–19 had the highest relative risk ratio, being 3.4 times more likely to have an ambulance call out from the street setting than people over 60. Being aged 20–29 was also significantly more likely to result in a street call out with a relative risk ratio of 2.1. A street call out was significantly more likely on a Friday (40% more likely) or Saturday (47% more likely) compared with a Monday. Time of the day also mattered—the relative risk of having a street call out was 68% higher between 4 p.m. and 8 p.m., and 34% higher between 8 p.m. and midnight than between 8 a.m. and 12 a.m., whereas the time period of 4 a.m. to 8 a.m. is 32% less likely for a street call out.

Call outs to other settings followed the same trend as street incidents; being male and aged between 10 and 29 were the high-risk groups, incidents occurring on a Friday or Saturday also increased this call out risk significantly. Time of the day, however, was not a significant predictor of incidents occurring in other locations (Table 2).

Abuse to ambulance staff

Recorded abuse directed at ambulance staff (verbal, physical or both) from patients was low, with 2.1% of all ambulance call outs noting abuse by a patient recorded on the patient record form. However, 7.6% of alcohol-related ambulance call outs had abuse to staff by patients recorded on the patient record form. This was more than a 3-fold increase.

Cost

The cost of alcohol-related ambulance call outs in this sample was estimated as £2.24 million in the 1-year time period (IQR £1.93 million–£2.58 million). Individuals in the 20–29 year age group were responsible for nearly a quarter of all the total cost (£527,841) (IQR £454,464–£605,952). The cost of alcohol-related ambulance call outs between 10 p.m. and 3 a.m. on a Friday and Saturday night inclusive accounted for almost 20% of the estimated costs (£448,453) (IQR £386,112–£514,816).

The cost for alcohol-related ambulance call outs where the patient was not transferred to hospital was £655,174 (IQR £564,096–£752,198). A quarter of this cost related to ambulance call outs between 10 p.m. and 3 a.m. on both a Friday and Saturday night (£167,696; IQR £144,384–£192,512).

Seventy-one percent of call outs in this study resulted in the patient being taken to an A&E Department. The average cost of these call outs with the associated A&E attendance (without admittance) was £691,125 (IQR £541,500–£798,000). It was not possible to establish the number or proportion of attendances that led to hospital admittance and so we could not calculate this further cost.

The average cost of the alcohol-related ambulance call outs and the linked A&E work was £2.93 million (IQR £2.47 million–£3.38 million).

Accuracy of ambulance data

The manual check of the records found that 10.1% of call outs were alcohol-related compared with 3.2% detected via electronic scanning of the data, an increase of 6.9%. When this more accurate percentage for alcohol-related call out was applied to the whole sample it was estimated that the actual number of alcohol-related call outs in the North East was 31,280 per year at a cost of £6.98 million (IQR £6.00 million–£7.69 million). When the relevant A&E costs were included, this figure rose to £9.13 million per annum (IQR £7.69 million–£10.16 million).

DISCUSSION

Electronic records indicated that 10,063 ambulance call outs in the North East of England were linked to alcohol-

Table 2. Econometric modelling of the characteristics of the patterns of alcohol-related incidents requiring ambulance call outs

Treat at hospital	Odds ratio	SE	*z*	*P* (*z*)	95% CI	
Logit model: whether the person involved in the incident is taken to the hospital						
Male	0.96	0.05	−0.83	0.409	0.86	1.06
Aged 10–19	0.99	0.11	−0.06	0.956	0.80	1.23
Aged 20–29	1.21	0.12	1.85	0.065*	0.99	1.47
Aged 30–39	1.30	0.14	2.52	0.012**	1.06	1.60
Aged 40–49	1.19	0.12	1.71	0.088*	0.97	1.46
Aged 50–59	1.09	0.12	0.79	0.427	0.88	1.36
Tuesday	1.03	0.11	0.22	0.823	0.83	1.27
Wednesday	0.91	0.10	−0.87	0.382	0.73	1.13
Thursday	0.86	0.09	−1.40	0.161	0.70	1.06
Friday	1.07	0.11	0.64	0.525	0.87	1.31
Saturday	0.87	0.08	−1.50	0.133	0.72	1.05
Sunday	0.98	0.10	−0.21	0.838	0.80	1.19
Incident at other location	1.16	0.09	2.04	0.042**	1.01	1.34
Incident in street	1.05	0.06	0.74	0.460	0.93	1.18
Midnight to 4 a.m.	1.08	0.14	0.58	0.560	0.84	1.39
4 a.m.–8 a.m.	1.17	0.20	0.94	0.345	0.84	1.63
12 noon to 4 p.m.	1.10	0.16	0.64	0.522	0.83	1.45
4 p.m.–8 p.m.	1.01	0.13	0.05	0.962	0.78	1.30
8 p.m.–midnight	0.91	0.12	−0.73	0.465	0.71	1.17
_Cons	2.67	0.43	6.05	0.000***	1.94	3.68
Multinomial logit model: whether the person is picked up from home, street or other locations						
Location of the incidents[a]						
Incident in street	Relative risk ratios	SE	*z*	*P* (*z*)	95% CI	
Male	2.47	0.14	15.57	0.000***	2.21	2.77
Aged 10–19	3.39	0.39	10.52	0.000***	2.70	4.26
Aged 20–29	2.14	0.23	7.09	0.000***	1.73	2.63
Aged 30–39	1.17	0.13	1.39	0.163	0.94	1.45
Aged 40–49	0.97	0.11	−0.32	0.748	0.78	1.20
Aged 50–59	1.12	0.13	0.93	0.351	0.89	1.40
Tuesday	0.95	0.11	−0.50	0.619	0.76	1.18
Wednesday	0.99	0.11	−0.10	0.920	0.79	1.23
Thursday	1.15	0.13	1.28	0.200	0.93	1.43
Friday	1.40	0.14	3.26	0.001***	1.14	1.71
Saturday	1.47	0.15	3.94	0.000***	1.21	1.79
Sunday	1.08	0.11	0.77	0.442	0.89	1.32
Treated at the scene	1.05	0.06	0.73	0.463	0.93	1.18
Midnight to 4 a.m.	1.31	0.18	1.95	0.052*	1.00	1.71
4 a.m.–8 a.m.	0.68	0.12	−2.18	0.029**	0.48	0.96
12 noon to 4 p.m.	1.33	0.20	1.87	0.061*	0.99	1.78
4 p.m.–8 p.m.	1.68	0.23	3.75	0.000***	1.28	2.20
8 p.m.–midnight	1.34	0.18	2.17	0.030**	1.03	1.74
Constant	0.15	0.03	−10.56	0.000***	0.10	0.21
Incident at other location (e.g. leisure place, work place)						
Male	1.26	0.08	3.63	0.000***	1.11	1.43
Aged 10–19	2.46	0.33	6.79	0.000***	1.90	3.19
Aged 20–29	1.65	0.20	4.05	0.000***	1.29	2.10
Aged 30–39	1.02	0.13	0.12	0.905	0.79	1.30
Aged 40–49	0.85	0.11	−1.29	0.198	0.66	1.09
Aged 50–59	0.81	0.11	−1.47	0.141	0.62	1.07
Tuesday	1.08	0.14	0.56	0.574	0.83	1.39
Wednesday	1.00	0.13	0.01	0.991	0.77	1.30
Thursday	0.95	0.13	−0.36	0.722	0.73	1.24
Friday	1.28	0.16	1.98	0.048**	1.00	1.62
Saturday	1.60	0.19	4.09	0.000***	1.28	2.01
Sunday	1.14	0.14	1.07	0.286	0.90	1.44
Treated at the scene	1.16	0.08	1.99	0.047**	1.00	1.34
Midnight to 4 a.m.	0.98	0.15	−0.14	0.887	0.72	1.32
4 a.m.–8 a.m.	0.76	0.15	−1.41	0.158	0.52	1.11
12 noon to 4 p.m.	1.08	0.18	0.46	0.642	0.78	1.51
4 p.m.–8 p.m.	1.13	0.18	0.80	0.425	0.83	1.54
8 p.m.–midnight	1.00	0.15	−0.03	0.975	0.74	1.34
_Cons	0.20	0.04	−7.95	0.000***	0.13	0.30

[a]Base outcome—incidents occurred at home.
*Significant at 90%.
**Significant at 95%.
***Significant at 99%.

related causes in a 1-year period. However, a manual check of patient records indicated that the more likely number of alcohol-related call outs was 31,280. The cost of this ambulance work and associated A&E attendances was over £9 million, representing an expenditure of ~£3.50 per head of population per year (total population head count is 2.6 million people). While the modal (24%) age group for an alcohol-related presentation was 20–29, around half of the alcohol-related attendances occurred in individuals aged 30–59. Thus alcohol-related acute harm is not merely a feature of youth but is relatively common in middle aged drinkers as reported elsewhere (Jefferis *et al*., 2005). Unsurprisingly, street call outs were significantly more likely to happen on Fridays and Saturdays from 4 p.m. to midnight, since most people tend to socialize after the working week and in the evenings (NHS The Information Centre, 2011b).

Although high, our findings may underestimate the full impact of alcohol-related work in this area of emergency care. Firstly, paramedics are likely to focus on patients' presenting symptoms and may not be able to assess less overt cases of alcohol-related problems. These could include situations where they are dealing with victims of alcohol-related physical or sexual violence, where the patient may not have been drinking. Also, patients with a flare-up of a chronic problem linked to drinking behaviour may not be detected (Academy of Medical Sciences, 2004). In 2003, a Cabinet Office commissioned MORI poll asked A&E staff to estimate the percentage of attendances that were related to alcohol consumption (Leontaridi, 2003). The resulting central estimate was 35% (Leontaridi, 2003). This figure is over three times higher than our estimate of alcohol-related ambulance work. The discrepancy could be due to the fact that many patients present themselves directly to A&E or are brought by family and friends rather than via ambulance. A more likely explanation is the fact that blood alcohol concentrations are not usually taken by paramedic staff and this clinical information would add less overt cases to our current prevalence estimate. More accurate estimation of the alcohol-related caseload in ambulance work would require the use of a validated screening tool or physiological tests in this setting. However, the feasibility of this work in a busy emergency context needs further investigation.

Our data indicated that alcohol-related ambulance call outs were three times more likely to involve verbal or physical abuse of staff compared with general ambulance work. Other evidence shows that there are around 33 assaults per 1000 staff among ambulance staff nationally compared with 14 per 1000 within Primary Care (NHS Security Management Service, 2010a). Furthermore, A&E nurses are more than twice as likely as other frontline NHS staff (including doctors, ward nurses and receptionists) to experience verbal or physical abuse (78% compared with the UK average of 37%) (NHS Security Management Service, 2010b) with the main reason given for the being the patient being under the influence of alcohol (NHS Security Management Service, 2010b). In more extreme incidents, it is possible that staff treatment costs (including possible time of work after an incident) would need to be added to patient costs to generate the full economic impact of alcohol-related emergency care.

The strength of this study is that it used a non-intrusive approach (routinely collected service data) that considered all ambulance cases in a period of a year to generate an up to date assessment of the size, nature and cost of alcohol-related ambulance call outs in the North East of England. Hence, the study had good ecological validity. However, the retrospective nature of this study presented some limitations to the work which may affect the interpretation of our findings.

Firstly, our data were limited to one geographical area of England which may not be representative of other areas. Indeed, NEAS only deals with around 6% of the total number of ambulance call outs in England (The Information Centre, 2010). Moreover, the North East of England is well known to be a heavy drinking area and so our data may overestimate problems in other parts of the country. Our study also relied on paramedics' subjective assessment that a call out was alcohol-related and it was not possible to verify this against an objective measurement of alcohol use. However, it has been established that emergency care practitioners are able to accurately distinguish between non-intoxicated and intoxicated patients (World Health Organization, 2007). We found that there were system recording errors (inconsistencies in electronic and manual records) linked to the patient record forms. Our manual check of a random sample of cases enabled us to generate a more accurate estimate of the extent of alcohol-related work across the entire sample. However, we were not able to account for situations when paramedics may have forgotten, or were too busy, to record the alcohol-related detail. Nevertheless, a patient record is required for every ambulance episode and having two methods of recording alcohol-related detail (including a simple shaded box) was likely to have reduced the likelihood of missed events. While we were unable to show how much specific time was spent with individual patients, our use of average costs plus an IQR enabled an estimation of the upper and lower costs into which the majority of cases are likely to fall. Finally, econometric modelling was limited to only the routinely recorded characteristics of the incidents (time, day of the week and location of call out) and the person involved the incident (age and gender). Moreover, the current study did not have the resources to carry out a content analysis of the written comments on the patient record form which may have provided more contextual detail regarding the call outs. Future prospective work is required to establish the accuracy of clinical recording *per se* and the extent to which the full detail of managing alcohol-related problems can be captured in busy 'real-time' clinical situations.

Nevertheless, the data generated as a result of this study have provided empirical evidence of the high toll of alcohol-related problems in a typically understudied area of the National Health Service. This information is currently being used across the North East by Primary Care Teams and Local Authorities to inform local needs assessments and strategic plans. If the annual cost for the alcohol-related ambulance work in our area is extrapolated to the whole of England, the national average estimate is ~£152 million. The IQR of £128–£169 provides a guide to likely costs in areas with lower and higher alcohol drinking profiles. The majority of this alcohol-related work is preventable and future research should focus on the feasibility of diversionary work in less acute cases and the use of the ambulance setting as a possible teachable moment to link drinking behaviour to its adverse consequences, as part of a brief intervention, to reduce future alcohol-related risk and harm.

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