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ORIGINAL ARTICLE

Analysis of violence-related ambulance call-outs in the North West of England to explore the impact of calendar events, public holidays, and COVID-19 restrictions

Nicholas Davies[1] · Zara Quigg[1,2] · Jennifer Germain[2] · Howard Reed[2] · James Woollacott[1] · Mark Whitfield[2] · Mark A Bellis[2]

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Abstract

Objective Healthcare data can provide key insights into the nature, extent, and trends in violence; however, few studies have analysed ambulance call-out data. We analysed ambulance call-out data to examine the extent of violence-related call outs, and how trends are influenced by calendar events (e.g. weekends, public holidays) and COVID-19 restrictions.

Methods Secondary data analysis of assault call-outs ($N = 52{,}052$) over a 6-year period (2018/19–2023/24) across a region of the United Kingdom. Generalised linear models analysed changes by weekend, holidays, and COVID-19 restrictions.

Results Assaults were higher on weekends, bank holidays, and during the Christmas/New Year period. Assaults were particularly higher on New Year's Eve [incident rate ratio (IRR) = 2.65 (95% CI = 2.38, 2.95), $p < .001$]. Celebration days without public holidays were not generally associated with increased violence, apart from Halloween and Valentine's Day. Assaults were generally higher during summer months, peaking in August [IRR=1.43 (95% CI = 1.37, 1.50), $p < .001$]. Assaults were lower during national COVID-19 restrictions, and higher during local-level COVID-19 restrictions.

Conclusions Ambulance call-out data provides useful information on the extent and nature of violence across the calendar year and other significant events such as COVID-19 restrictions. Ambulance data shows similarities with other data sources (e.g. police and healthcare), with increases on weekends and public holidays. There was some evidence that violence decreased during national COVID-19 restrictions and increased during local-level restrictions. Further work is needed to encourage data sharing between health, police, and wider partners to inform violence prevention.

Keywords Violence · Emergency · COVID · Health

Introduction

Violence prevention is a global public health priority, as stated by the World Health Organization (WHO) (World Health Organization n.d.). International estimates suggest violence rates remain unacceptably high; for instance, violence against women affects one in three women worldwide (World Health Organization 2024), and homicide rates have not decreased for around 15 years (between 400,000 to 450,000 victims annually) (United Nations Office on Drugs and Crime 2023). Collecting and comparing nationally representative data is important in order to understand the global prevalence of violence and to inform prevention efforts. Data collection for violence, however, varies across countries; for example, while 83% of countries surveyed in the WHO violence against children report had nationally representative survey data on violence, far fewer countries were able to supply violence data from either police or vital (i.e. government) registration sources (World Health Organization 2020). This suggests a lack of data available from facility-based administrative systems such as police or healthcare records to inform violence prevention priorities.

Estimates for the prevalence of violence in the United Kingdom (UK) come from national survey data such as the Police and Crime Survey for England and Wales

✉ Zara Quigg
z.a.quigg@ljmu.ac.uk

[1] School of Public and Allied Health, Liverpool John Moores University, Tithebarn Building, Liverpool L3 2ER, UK

[2] Faculty of Health, Innovation, Technology and Science, Public Health Institute, Liverpool John Moores University, Liverpool, Merseyside, UK

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(Office for National Statistics 2023) and police-recorded crime data routinely published by the Home Office (Home Office 2013). These statistics rely on crime victims being captured by the survey and willing to self-report their experiences of crime, or on crimes being reported to (and recorded by) the police. Whilst these data sources can provide a wealth of information on violence, self-report of sensitive topics can be affected by sampling and measurement characteristics in surveys, and a high proportion of violence is not reported to the police (Dufour et al. 2023). When comparing assault data between emergency departments (ED) with criminal justice system data, it suggests around 59% of assaults recorded in ED are not known to the police (Gray et al. 2017) and this can be higher again for certain types of violence such as sexual violence (Office for National Statistics 2017). Given the limitations in criminal justice data, the use of healthcare data such as ED attendances, hospital admissions data, and ambulance service data could provide a more comprehensive understanding of violence, given the associations between violence and accessing emergency care [Association of Ambulance Chief Executives (AACE) 2025; Bellis et al. 2012; Gray et al. 2017; Quigg et al. 2010, 2017]. Establishing routine collection and sharing of healthcare data between partners has been shown to provide important intelligence on violence prevention for a range of stakeholders including local authorities, non-government organisations and public health teams (Droste et al. 2014; Quigg et al. 2012a). This data sharing is now required through legislation introduced by the UK Government in 2022, known as the Serious Violence Duty statutory guidance (Home Office 2022). Furthermore, Home Office funded Violence Reduction Units across England and Wales are required to follow a whole system public health approach to violence reduction which is based on data and intelligence (Home Office 2020).

Studies have demonstrated the value of using healthcare data to gather intelligence on the prevalence and nature of violence. Comparisons between ED attendances for intentional versus unintentional injuries suggests that violence-related presentations are more common in young males from deprived communities (Quigg et al. 2012a). Research has also examined the temporal characteristics of violent incidents; violence-related ED attendances are more common overnight and at weekends (Quigg et al. 2012a), across certain public holidays (e.g. New Year's Eve) (Bellis et al. 2012), and during significant sporting events (e.g. the football World Cup) (Quigg et al. 2012b). Importantly, these studies provide insight into who is at higher risk of violence in terms of sociodemographic characteristics, as well as when violence might be expected to increase across the calendar year and in line with other regional/national events. This information is useful, as it can allow frontline services [e.g. police, health, third (charity) sector] to be proactive, rather than reacting to violence once it has occurred (Bellis et al. 2012).

While analyses with healthcare data have provided a useful insight into violence, most of these studies have used ED attendance or hospital admissions data. Fewer studies have explored the characteristics and trends of violence using ambulance call-out data (Critchley & Quigg 2019; Quigg et al. 2017). This is significant, as in December 2024, ambulance services across England answered 935,000 emergency calls, yet only 48% of call-outs resulted in conveyance to an emergency department [Association of Ambulance Chief Executives (AACE) 2025]. This is attributed to an increase in the proportion of 'hear and treat' services, when a patient does not require an ambulance but a clinician provides treatment or advice over the phone, and 'see and treat' services, when a patient is assessed and treated in the community, comprising a national average of 18% and 30% of responses respectively [Association of Ambulance Chief Executives (AACE) 2025]. The final 4% nationally can be attributed to patients who are not conveyed to ED but other healthcare services such as walk-in and urgent treatment centres [Association of Ambulance Chief Executives (AACE) 2025]. The implications of this suggest that previous analyses within ED or hospital admissions data may significantly underestimate the true level of violence, demonstrating the utility of using ambulance call-out data. Further consideration must also be given to the triage and categorisation of ambulance call-outs. The categorisation of a 999 call as involving violence is dependent on multiple factors, including the caller (potential victim) accurately reporting the situation, non-medically trained call handlers correctly interpreting the information, and the appropriate classification of the call within the triage system. At each stage, there is an inherent level of subjectivity which may contribute to the potential under or over reporting of violent incidents. Further, ambulance call-outs recorded as violence by the ambulance service may not be recorded as violence once the patient is transferred to hospital (Quigg et al. 2017). Analyses with ambulance data confirm similar sociodemographic profile of violence to research with other data sources, including higher prevalence amongst males and in more deprived areas (Quigg et al. 2017). Additionally, call-outs are more likely to occur at nighttime and at specific times of the calendar year (e.g. New Year's Eve) (Quigg et al. 2017). National trends in violence, however, are not stable over time. According to the Police and Crime Survey for England and Wales, violence with and without injury and domestic abuse have declined over the past decade (Office for National Statistics 2024). Other types of violence, however, such as sexual assault have been increasing (Office for National Statistics 2024). This suggests that regularly monitoring patterns of violence from a range of sources (including ambulance data) is important.

Furthermore, in recent years major events such as COVID-19 have also impacted a range of behaviours, including violence (Lightowlers et al. 2023). For example, analysis of police-recorded violence shows that violence decreased during lockdown restrictions but increased again following the easing of restrictions (Lightowlers et al. 2023). Given the limitations of relying on a single data source, however, further research is needed to confirm these patterns in violence.

The current study explores the sociodemographic and temporal characteristics of violence, using data from the North West Ambulance Service (NWAS). More specifically, the study analyses ambulance call-outs recorded as assault, and examines the temporal pattern of assaults across the calendar year (e.g. weekends, holidays, bank holidays etc.). Finally, we explore how COVID-19 restrictions may impact assaults, including national and regional level restrictions.

Methods

Data were obtained from the Trauma and Injury Intelligence Group Injury Surveillance System (TIIG ISS) (Quigg et al. 2012a) hosted by the Public Health Institute (LJMU — Liverpool John Moores University). The system collates call-out data from the NWAS for monitoring and intelligence purposes. The North West of England consists of ten upper-tier/combined authorities with a total population of 7.4 million (Office for National Statistics n.d.). NWAS respond to urgent and emergency call-outs in the North West, providing acute medical assessment, treatment, referral, and (when clinically indicated) transport (e.g. to EDs) 24 hours per day, 365 days per year. When a 999 call is made, BT (British Telecom) operators identify the emergency service the caller requires and connects the caller. NWAS call handlers are non-clinical staff who identify the nature of the call, triage and provide pre-arrival advice. This information is processed electronically using triage systems to identify the acuity of the patient and provide the most appropriate response. NWAS moved from AMPDS (Advanced Medical Priority Dispatch System) onto the NHS Pathways telephone triage system in April 2022 and this system was gradually rolled out across the region between April and September 2022. NHS Pathways is a clinical tool used for assessing, triaging and directing the public to urgent and emergency care services. The data received from Pathways reduced the ability to identify core injury groups such as assaults. Therefore, NWAS now provide TIIG with additional data from the electronic patient record (EPR) to enable better identification of the causes of injuries.

Data are stored in the Ambulance Command and Control System in a reporting database. A subset of required fields are extracted on behalf of the TIIG ISS, to gather intelligence on violence and injury prevention across the North West of England. The TIIG ISS collates data on a quarterly basis, with data shared via a secure drop box. Information routinely shared with TIIG include time/date of the call, incident type (e.g. assault), patient age/gender (where known), and outcome of the call-out (e.g. transferred to another health service). NWAS also automatically places the geographic location of each call-out (i.e. where the ambulance stopped to assess/treat the patient) within a lower layer super output area (LSOA). LSOAs are geographic areas with between 1,000 to 3,000 persons, developed to allow for comparison across different parts of the UK. Call-out LSOA is merged with English Indices of Deprivation (IMD) (2019) data, to provide a national IMD score for each call out, to operationalise deprivation.

We extracted all NWAS call-outs coded as assault between 1 April 2018 and 31 March 2024 from the TIIG ISS (N = 65,424). Assault flags are added by NWAS prior to the data being shared to TIIG. Whilst it is possible to identify different types of assaults, e.g. sexual, involving a weapon, this subcategorisation can be unreliable as it often relies on examination of free text data fields. Call-out data included call date/time, patient sex, age, and IMD quintile, which were recoded into discrete categories. Days were coded as 24-h periods beginning at 6am to account for call-outs occurring in the early hours of the morning (i.e. 12am until 5.59am), as call-outs at this time are likely to be associated with nightlife activity on the previous day (i.e. call-outs in the early hours of Sunday morning are probably associated with nightlife activity on Saturday night). This is in line with previous comparable analyses using ambulance call-out data (Quigg et al. 2017). Due to the date manipulation, cases occurring on 31 March were excluded (n=19). Variables entered as not known, other, or not specified were coded as missing. In addition, age above 100 years old were coded as missing, as these appeared to be data entry errors (e.g. 126 years old) (see Table S1). The final sample, therefore, included N = 52,052 call-outs.

Additional variables were derived to indicate the day of the week and month in which call-outs occurred. In addition, we considered assaults which took place on special events in the year (e.g. bank holidays, Christmas Day, etc). Finally, we considered whether call-outs occurred during COVID-19 lockdowns (including local-level restrictions and national lockdown measures). COVID-19 restriction definitions and dates were determined through information published by the House of Commons Library (House of Commons Library 2021). Event variables are summarised in Table 1.

Data were analysed using SPSS V.29. Descriptive statistics were computed describing the number of events included in the analysis, and the unadjusted mean number of assaults (and 95% CIs) occurring on each event. Poisson loglinear generalised linear modelling (GLM) was used to model count data (assaults per day) examining the independent impacts of events on assaults.

Table 1 Events included in the analysis

Event	Details
Calendar events	
Day of week	Monday to Sunday
Month of year	January to December
Special days	
Non-special day	None of the below
New Year's Eve	31 December
New Year's Day	1 January
Christmas Eve	24 December
Boxing Day	26 December
St George's Day	23 April
St. Patrick's Day	17 March
Valentine's Day	14 February
Guy Fawke's Night	5 November
Halloween	31 October
Other bank holiday eves	Any bank holiday eve not included above (i.e. not Christmas day, New Year's day etc.)
Other bank holiday days	Any bank holiday not included above
COVID-19 restrictions	
Local or national level restrictions	Periods when the UK was under national lockdown or local-level restrictions

Results

Over the 6-year period, there were 52,052 assault-related ambulance call-outs (with complete data). Most call-out patients were men (68.4%), and approximately half were aged between 30 to 59 years (53.9%). The majority of call-outs (62.7%) were to deprived areas (IMD quintile 1) (see Table S2). Table S3 shows the unadjusted mean number of assaults occurring on each event. For example, the table shows that average assaults are higher on New Year's Eve.

Weekday, month, and special days

In the GLM analyses, compared to Sunday, assaults were significantly higher on Friday and Saturday, and lower on all other days. Compared to January, assaults were higher across all other months, and more so during summer months, particularly in August. Compared to non-special days, assaults were higher during the Christmas/New Year period, especially on New Year's Eve; and on bank holidays and bank holiday eves. Other special days which do not include a public holiday (e.g. St George's Day), were generally not associated with increased assaults, apart from Halloween and Valentine's Day which showed increases (see Table 2).

Table 2 GLM model examining independent impacts of events on mean number of assault-related call-outs

Variable*	Estimated marginal means	Slope (exp B)	95% CIs		*P*
Day of week					
Monday	23.8	0.77	0.75	0.80	<.001
Tuesday	24.5	0.80	0.77	0.82	<.001
Wednesday	24.9	0.81	0.78	0.84	<.001
Thursday	26.6	0.86	0.83	0.89	<.001
Friday	41.2	1.34	1.30	1.38	<.001
Saturday	50.5	1.64	1.59	1.69	<.001
Month					
February	29.9	1.16	1.10	1.21	<.001
March	29.1	1.13	1.08	1.18	<.001
April	27.9	1.08	1.03	1.13	.002
May	31.6	1.22	1.17	1.28	<.001
June	33.1	1.28	1.23	1.34	<.001
July	33.9	1.31	1.25	1.37	<.001
August	37.1	1.43	1.37	1.50	<.001
September	32.7	1.27	1.21	1.32	<.001
October	28.6	1.11	1.06	1.16	<.001
November	29.5	1.14	1.09	1.19	<.001
December	29.0	1.12	1.07	1.17	<.001
Special days					
New Year's Eve	59.7	2.65	2.38	2.95	<.001
New Year's Day	34.0	1.51	1.30	1.75	<.001
Christmas Eve	31.7	1.41	1.22	1.63	<.001
Christmas Day	37.3	1.66	1.45	1.89	<.001
Boxing Day	36.2	1.61	1.40	1.85	<.001
St George's Day	24.6	1.09	0.93	1.29	.293
St Patrick's Day	25.7	1.14	0.96	1.35	.124
Valentine's Day	28.5	1.26	1.08	1.49	.004
Guy Fawkes' Day	21.0	0.93	0.78	1.11	.444
Halloween	29.4	1.30	1.12	1.52	<.001
Other bank holiday eves	31.1	1.38	1.29	1.47	<.001
Other bank holiday days	29.8	1.32	1.24	1.41	<.001
COVID restrictions					
Local restrictions	33.2	1.10	1.07	1.14	<.001
National restrictions	28.6	0.95	0.92	0.99	.005

**Reference categories have been omitted (e.g. Month reference category = January)*

COVID-19 restrictions

Assaults were significantly lower during periods when the UK was under national lockdown restrictions (see Table 2). However, assaults were significantly higher when national

lockdown restrictions stopped but there were at least some level of local COVID-19 restrictions in place (see Table 2).

Discussion

This study showed that ambulance call-out data can provide useful insights into events within the calendar year (such as public holidays and weekends) where violence is likely to increase. Additionally, this study explored how COVID-19 restrictions influenced violence, as violence appeared lower than usual during national restrictions and higher than average during local restrictions. This information can help to inform violence prevention strategies and service-level responses to violence.

Similar to research with ED attendances, this study found that violence increased on weekends and public holidays (Bellis et al. 2012). This suggests that periods preceding typically work-free days impact upon violence, and this could be linked to alcohol consumption. Alcohol consumption is associated with interpersonal violence (Kilian et al. 2024) and consumption peaks on Friday and Saturdays (Lac et al. 2016). In the current study, a similar effect was demonstrated for public holidays which include a day off work (i.e. bank holidays) but not for other celebrations which did not include a day off work (e.g. St George's Day). This is except for Halloween and Valentines Day, both of which may be associated with increased alcohol consumption. This suggests periods where people are typically not working (including weekends and bank holidays) are associated with higher prevalence of violence. While the strain alcohol-related incidents place on healthcare services is well documented, this research confirms that this burden is not limited solely to EDs, with alcohol-related violence also probably placing a significant strain on ambulance services. Understanding this is important, given the significant fluctuation in demand observed in the current study; for example, at New Year's Eve demand for ambulances increased by 72.6%. While this finding may not seem particularly novel, operationalising the increases in violence at certain times of the year could be used to justify funding for extra resources to improve responses to violence whilst preserving resources for those with the most urgent health needs in the community. The research also found increased levels of violence during summer months, particularly August. This mirrors trends observed in a previous study examining nighttime assault presentations to EDs (Bellis et al. 2012). Many of the calendar events examined were British/Christian events and can therefore not be considered inclusive of all populations. However, the findings do have relevance to a non-British audience, through the inclusion of widespread shared holidays, e.g. weekends, New Year celebrations.

Additionally, this research examined the effect of COVID-19 restrictions on violence including periods of national lockdown and local lockdowns. Violence was lower than usual during national lockdown restrictions; however, during periods of local restrictions, violence was higher than usual. This finding is consistent with a previous study which analysed police-recorded violence (Lightowlers et al. 2023). This could provide tentative evidence that as public spaces (i.e. bars and restaurants) began to reopen following restrictions, there was a slight increase in violence, beyond the pre-COVID norm. Importantly, however, estimates from police data show significant fluctuation in levels of violence, making it difficult to conclude whether these changes are due to the pandemic or due to general variation in violence levels (Lightowlers et al. 2023). In addition, some research has suggested that the lockdown restrictions had unintended consequences on specific types of violence such as domestic abuse, child abuse, and family violence (Haddadou et al. 2025; Whiteman et al. 2023). The evidence to support this in the UK, however, is mixed; police data shows that while domestic abuse increased during the pandemic, this could reflect better police-recording practices rather than the effect of lockdown restrictions (Office for National Statistics 2023). The current study, however, did not subcategorise by type of violence, so it was not possible to see how individual types of violence increased/decreased during the COVID-19 lockdown periods. Future research should consider linking police, ambulance, and hospital data to assess changes in subtypes of violence, particularly for domestic violence, which may be less likely to reported to police but may lead to healthcare treatment.

This research demonstrates the utility of analysing ambulance data, (Sutherland et al. 2021), and the importance of using multiple data sources is echoed by calls to link ambulance and ED data, which rarely happens in practice despite evidence that this is feasible (Clark et al. 2019). Including ambulance data alongside police and emergency department data, therefore, can provide a more complete picture of violence, and future work is needed to link between these datasets. The need for collaboration and information sharing between services has also been highlighted (Home Office 2022). Further work, therefore, is needed to identify barriers to data sharing between services and improve collaboration between these services to inform violence prevention strategies.

Limitations

A limitation of this research, however, is that while it shows that violence increases at certain periods, the data includes a range of subcategories. This means it was not possible to see which specific types of violence increased at certain times. In

addition, ambulance data relies on the incident being recorded as violence, and therefore may underestimate the true prevalence of violence where injuries are not reported or recorded as violence. This again reinforces the need for data sharing between services, as recommended by the Serious Violence Duty guidelines (Home Office 2022). During our study period, NWAS used two different data collection processes, AMPDS (Advanced Medical Priority Dispatch System) and Pathways, which may have impacted on data recording. A further limitation of this research is its focus on calendar events rooted in Christianity, the Gregorian calendar and British cultural traditions. By selecting events such as Christmas Day, New Year's Day and St. Georges Day, the study potentially overlooks significant dates from other religions, faiths, and ethnic communities, which may also influence patterns of violence. Events which hold social and celebratory significance for diverse populations are not considered, potentially leading to an incomplete understanding on how violence fluctuates across different communities. A more inclusive approach that incorporates a broader range of calendar events would provide a more comprehensive and representative analysis of the relationship between specific dates and violence. Furthermore, the geographical area in which this research was based is predominately White British, meaning the findings may not also be transferable to other ethnicities and cultures. Further analyses which explore the impact of ethnicity would also be beneficial.

Conclusion

This study used ambulance data to explore the proportions of violence during calendar events, public holidays, celebration days, and COVID-19 restrictions. Violence increased at weekends and public holidays, and the largest increase was seen on New Year's Day. Generally, violence did not increase on celebration days which did not include a public holiday. Finally, violence decreased during national COVID-19 restrictions and increased during local-level restrictions. This research confirms trends in violence as described by other data sources such as emergency department and police data, suggesting an association between time off work and violence. The research demonstrates the feasibility of using ambulance data to monitor violence, and future work should consider how to encourage collaboration between key services (e.g. healthcare providers and police forces) in order to provide a more complete picture of violence, in line with Government policy in the UK.

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Data availability Data are available upon reasonable request from the corresponding author.

Declarations

Conflict interest/Competing interests Authors declare no financial or non-financial interests that are directly or indirectly related to the work submitted for publication.

Ethical approval This article comprises secondary data analysis of data shared by the North West Ambulance Service to the Trauma and Injury Intelligence Group. All data protection guidance was adhered to, and no ethical approval was required

As this is secondary analyses of an anonymised dataset, no ethical approval was required.

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