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# A shared data approach more accurately represents the rates and patterns of violence with injury assaults

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## ABSTRACT

**Background** To investigate whether sharing and linking routinely collected violence data across health and criminal justice systems can provide a more comprehensive understanding of violence, establish patterns of under-reporting and better inform the development, implementation and evaluation of violence prevention initiatives.

**Methods** Police violence with injury (VWI) crimed data and emergency department (ED) assault attendee data for South Wales were collected between 1 April 2014 and 31 March 2016 to examine the rates and patterns of VWI. Person identifiable data (PID) were cross-referenced to establish if certain victims or events were less likely to be reported to criminal justice services.

**Results** A total of 18 316 police crimed VWI victims and 10 260 individual ED attendances with an assault-related injury were considered. The majority of ED assault attendances (59.0%) were unknown to police. The key demographic identified as under-reporting to police were young males aged 18–34 years, while a significant amount of non-reported assaults involved a stranger. The combined monthly age-standardised rates were recalculated and on average were 74.7 (95% CI 72.1 to 77.2) and 66.1 (95% CI 64.0 to 68.2) per 100 000 population for males and females, respectively. Consideration of the additional ED cases resulted in a 35.3% and 18.1% increase on the original police totals for male and female VWI victims.

**Conclusions** This study identified that violence is currently undermeasured, demonstrated the importance of continued sharing of routinely collected ED data and highlighted the benefits of using PID from a number of services in a linked way to provide a more comprehensive picture of violence.

## INTRODUCTION

Since 1996, violence has been recognised as a global public health challenge by WHO.[1] Worldwide, around 6 million people have been killed as a result of interpersonal violence since 2000 and many more are non-fatally injured.[2] It is these non-fatal injuries that have the most significant economic burden on public services and social and health resources.[2] Although the full costs of violence are difficult to quantify, in 2015, the cost of violence to the global economy was estimated to be US$13.6 trillion.[3 4] In 2012, in the UK alone, the impact of violence cost society an estimated £124 billion through direct and indirect costs and lost productivity.[5]

Evidence suggests that males are five times more likely than females to require emergency admission to hospital for violence,[6 7] while the age range, irrespective of gender, most frequently admitted are those aged between 18 and 30 years.[7 8] Previous research has also demonstrated that violence is strongly correlated to deprivation[6 7 9 10] and individuals from the highest areas of deprivation are at least three times more likely to be hospitalised from violence-related assaults than individuals resident in the most affluent areas.[7 9] Excessive alcohol consumption also doubles the likelihood of an individual being involved in a physical confrontation.[11 12] Furthermore, better weather conditions (higher temperatures, low rainfall) provide greater criminal opportunity with potential victims and perpetrators likely to be interacting together for a prolonged period of time[13]; it is therefore unsurprising that, in many countries, peak levels of violence are observed in the summer months.[8 13–15]

A multidisciplinary approach to violence prevention that reaches across organisational boundaries of social, health and policing, underpinned by comprehensive data on patterns of violence (both victims and perpetrators), can reduce the impact on population health.[1] Data sharing and linking across health and criminal justice systems has been recognised as an important tool to help inform the development, implementation and evaluation of violence prevention initiatives.[16–19] Previous efforts in the UK and Canada have used only single sources of health data[20 21] or ambulance pick-up location data[10] to complement police operations rather than using data from multiple sources. In South Wales, a novel approach sharing routinely collected data on victims of violence from the police, emergency department (ED) assault attendees from local health boards and violence-related call-outs from the ambulance service was implemented in 2014. This method was introduced with the overarching aim to improve prevention through better identification of areas at high risk of violence to target efficient use of criminal justice and health resources. Using the police and ED datasets, we examine variations in under-reporting of violence-related events, to better understand if certain victims or events are less likely to be reported to criminal justice services. These are important considerations for delivering a comprehensive assessment of violence at a local level to inform action.

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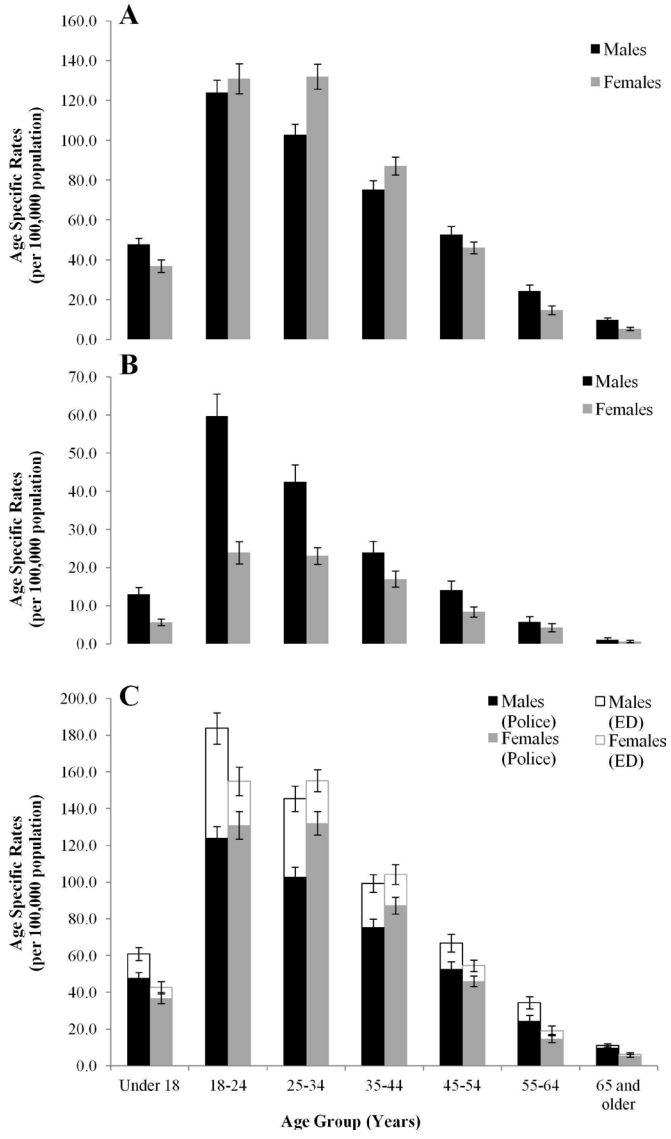



**Figure 1** Average age-specific rates (per 100 000 population) over the 24-month period between April 2014 and March 2016 for (A) police data, (B) unknown to police emergency department data and (C) combination of police and unknown emergency department attendance data. ED, emergency department.

## METHODS

### Data sources

The data in this study were collected over a 24-month period between 1 April 2014 and 31 March 2016.

### Police crimed dataset

This study looked to examine violence with injury (VWI) incidents, crimed by South Wales Police (SWP) as one of the following; (1) assault with injury, (2) assault with intent to cause serious injury, (3) murder, (4) manslaughter or (5) racially or religiously aggravated assault with injury. Variables collected included crimed date, offence group, victim name (full first name and surname initial), victim age at time of assault, victim gender and victim residence postcode. 'Crimed date' refers to the date the police deemed the incident a crime for investigatory purposes; this has to take place within 72 hours of the day the occurrence took place (in the majority of cases, this is the same day of the occurrence).

### ED dataset

ED assault attendance data were collected from all three South Wales local health boards plus a local alcohol treatment centre established in an inner city area to respond to incidents of assault that occur specifically within the night time economy. Records of assaults were recorded by ED reception staff on patient arrival. Variables collected included ED attended, date of arrival, patient name (first name and surname initial), patient age at time of attendance, patient gender, patient residence postcode, assault location ('site description' such as own home, street, licensed premise and 'site text'-specific named location) and assailant relationship to patient.

Data sharing agreements were established across police, local health boards and Public Health Wales (PHW) to allow PHW to act as the central partner to collate and analyse the data. Services provided person identifiable data (PID) on assault victims to PHW via National Health Service (NHS) secure file-sharing platforms. All data were incorporated into a violence surveillance database held on a secure NHS file server developed by PHW.

### Population and deprivation data

The population of the SWP region was calculated using The Office for National Statistics 2014 mid-year population estimates[22] for Cardiff, Swansea, Neath Port Talbot, Bridgend, The Vale of Glamorgan, Merthyr Tydfil and Rhondda Cynon Taf. The 2013 European Standard Population[23] was used to subsequently age-standardise the population data. Lower Super Output Areas (LSOAs) were determined from victim and patient postcodes using the 2014 version of the Welsh Index of Multiple Deprivation.[24] There are 1909 LSOAs in Wales, each with a population of approximately 1600 individuals, and these LSOAs are categorised equally into deprivation quintiles (or fifths[24]).

### Data linkage

Victim data for assault-related attendances at ED were linked with police data by patient name, age and either date of ED arrival or VWI 'crimed date'. Internal validity was carried out through manual checks of a sample of records from 3 months, which identified inconsistencies in name spelling across the two datasets. Therefore, a matching algorithm using first two letters of the first name+surname initial+age (±1 year)+date of ED visit/reported crimed date (±1 day) was adopted. The algorithm also allowed for late-night assaults, which may have taken place where an individual reported the crime to the police and then arrived at the ED in the early hours of the following morning or vice versa. Data quality was monitored with quarterly data audits performed by PHW researchers from September 2014.

### Data analysis

Data represented in figures are expressed as either age-standardised or age-specific rates (per 100 000 population) and 95% CIs. Logistic regression models were applied to investigate the patterns between assault location and gender, age and deprivation (SPSS V.23).

## RESULTS

In total, there were 18 316 victims (9128 males) recorded on the police database for VWI crimes during the 24-month period. In males, the monthly average victim rates were 55.2 (95% CI 53.0 to 57.3) per 100 000 population, while the monthly average victim rates for females were slightly higher at 55.9 (95% CI 54.0 to 57.9) per 100 000 population. Seasonality was evident with increases in victims during June to August and again in



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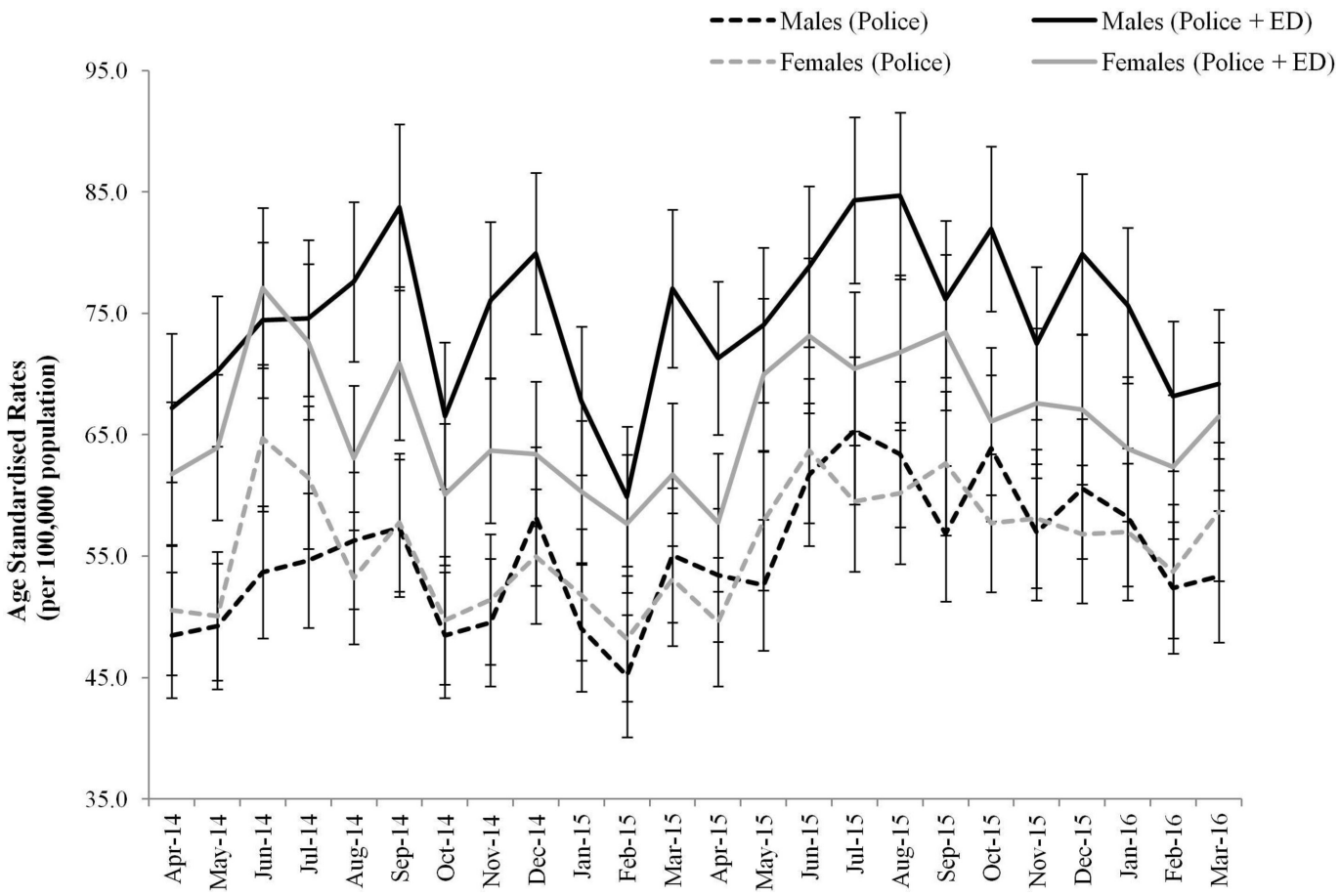



**Figure 2** Month-by-month age-standardised rates (per 100 000 population) and 95% CIs for police-recorded data only and the combination of police-recorded data and unknown ED attendances for violence-related attendances. ED, emergency department.

December, especially among males. Age-standardised victim rates were threefold and fourfold greater in the most compared with the least deprived areas in males (97.7 (95% CI 91.3 to 104.0) vs 33.2 (95% CI 31.8 to 34.7) per 100 000 population) and females (106.8 (95% CI 100.7 to 113.0) vs 27.0 (95% CI 25.4 to 28.6) per 100 000 population), respectively. In males, the victim rate was highest among those aged 18–24 years (124.0 (95% CI 117.7 to 130.3) per 100 000 population; figure 1A) and declined in each of the subsequent older age groups. Among females, victim rates were highest in the 18–24 (131.0 (95% CI 123.5 to 138.5) per 100 000 population) and 25–34 years (132.1 (95% CI 125.8 to 138.4) per 100 000 population) age groups, and comparable with the males, rates declined with increasing age (figure 1A).

A total of 10 260 attendees (6954 males) visited EDs as a result of being a victim of a violence-related assault. Of these ED attendees, two-fifths (41.0%) were matched between databases using our algorithm, which suggests that the vast majority of ED attendances (59.0%) for a violence-related injury are potentially unknown to police. Overall, the proportion of unknown ED assault attendances was similar between genders, although differences across age groups were evident. The proportion unknown to police was significantly higher among young males (aged 18–34 years) (figure 1B). There were also a considerable number of females between 18 and 44 years that attended EDs without their injuries being reported to the police (figure 1B). In every age group, there were some ED attendances that were unreported to police (figure 1B).

The addition of the unknown ED attendances to the police-recorded victims (figure 1C) changed the relationship previously observed (figure 1A). The combined totals revealed that, rather than the female rates being greater than males in the ages between 25 and 44 years, the gender rates were now similar (figure 1C). On a month-by-month basis, there was an average 135 (95% CI 127 to 144) male and 69 (95% CI 64 to 74) female ED attendees unknown to police. These new cases resulted in a 35.3% and 18.1% increase on the original totals for males and females, respectively. The combined totals' monthly age-standardised rates were recalculated and on average were 74.7 (95% CI 72.1 to 77.2) and 66.1 (95% CI 64.0 to 68.2) per 100 000 population for males and females, respectively. The age-standardised rates for males and females were recalculated and compared against the original police data age-standardised rates (figure 2). The seasonable peaks in violence-related assaults around the summer months and the festive period are more apparent in the combined monthly totals.

When considering ED data, males were most likely to be a victim of an assault requiring medical treatment where the reported assault location was either the street or a licensed premise and usually involving a stranger (table 1). The majority of these cases were unknown to police; 945 (57.4%) street assaults and 60.3% of assaults in licensed premises involving male victims recorded in the ED database were not recorded in the police records (data not shown), whereas females were most frequently a victim in their own home and in these cases the vast majority of the alleged assailants were



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**Table 1** Emergency department attendees cross-tabulated by proportion of alleged assailant relationship to victim and assault location

| Assault location type | Own home | Someone else's home | Licensed premises | Street | Other* | All |
|---|---|---|---|---|---|---|
| Males (n=5626) | | | | | | |
| Partner | 59 (10.2) | 19 (6.3) | <5 (0.2) | 11 (0.5) | <10 (0.5) | 98 (1.7) |
| Ex-partner | 23 (4.0) | <5 (1.0) | <5 (0.2) | 15 (0.7) | <5 (0.2) | 46 (0.8) |
| Family member | 145 (25.0) | 42 (13.9) | 11 (1.2) | 39 (1.7) | 16 (1.0) | 253 (4.5) |
| Acquaintance/friend | **213 (36.7)** | **144 (47.7)** | 167 (18.0) | 529 (23.2) | 385 (25.0) | 1438 (25.6) |
| Stranger | 139 (23.9) | 88 (29.1) | **652 (70.4)** | **1647 (72.4)** | **946 (61.4)** | **3472 (61.7)** |
| Work-related individual† | <5 (0.3) | <10 (2.0) | 92 (9.9) | 35 (1.5) | 184 (11.9) | 319 (5.7) |
| Females (n=2815) | | | | | | |
| Partner | **430 (49.4)** | **78 (25.7)** | 7 (2.3) | 43 (7.1) | 69 (9.4) | 627 (22.3) |
| Ex-partner | 151 (17.3) | 61 (20.1) | 10 (3.3) | 49 (8.1) | 41 (5.6) | 312 (11.1) |
| Family member | 115 (13.2) | 52 (17.2) | 7 (2.3) | 29 (4.8) | 27 (3.7) | 230 (8.2) |
| Acquaintance/friend | 111 (12.7) | 69 (22.8) | 98 (32.2) | 214 (35.3) | 175 (23.9) | 667 (23.7) |
| Stranger | 63 (7.2) | 40 (13.2) | **171 (56.3)** | **264 (43.6)** | 209 (28.6) | **747 (26.5)** |
| Work-related individual† | <5 (0.1) | <5 (1.0) | 11 (3.6) | 7 (1.2) | **210 (28.7)** | 232 (8.2) |

Data reported as number of emergency department attendances and relationship proportions by location. Bold figures denote the most frequent alleged assailant relationship to victim in each of the six location types.
*Other locations include but not exhaustive of workplace, residential homes and educational establishments.
†Work-related Individuals are the combination of work colleagues, work clients and bouncers/workers at licensed premises. Bold data denote the highest proportion of alleged assailant relationship for the different assault locations.

either current or ex-partners (66.7%; table 1). A substantial number of these female 'domestic' cases (244; 42.0%) were not known to police, and a high proportion (47.5%) of males victims assaulted in their own home by current or ex-partners were also unknown to police (data not shown). At a population level, the highest rates observed for females were for assaults occurring in their own home (table 2). These rates were 0.5 times greater than those for males in this location, while the rates for males were three and four times higher than females for assaults occurring either in a licensed premise or on the street, respectively (table 2). Generally, the rates were observed to decline for each location with an increase in deprivation. Applying logistic regression models and adjusting these location relationships for age, gender and deprivation revealed that females were four times more likely than males to be a victim in their own home (table 3). The odds that the individual was a victim in their own home increased with age, where the reverse relationship was observed for licensed premises or the street with the likelihood declining with increasing age (table 3).

**Table 2** Age-standardised rates (per 100 000 population) of assault gender by assault location compared by all ages, adults and deprivation quintiles (adults only)

| Assault location type | Own home | Someone else's home | Licensed premises | Street | Other | All |
|---|---|---|---|---|---|---|
| Males | | | | | | |
| All ages | 90.6 (83.4 to 97.8) | 45.2 (40.2 to 50.2) | 127.2 (119.0 to 135.3) | 345.0 (331.4 to 358.6) | 227.0 (215.8 to 238.1) | 834.9 (813.6 to 856.1) |
| Adults (aged ≥18 years) | 105.7 (97.1 to 114.4) | 52.2 (46.2 to 58.2) | 154.1 (144.0 to 164.1) | 379.2 (363.4 to 395.0) | 231.9 (219.3 to 244.5) | 923.1 (898.2 to 948.0) |
| WIMD 1 (adults) | 191.1 (167.9 to 214.2) | 90.4 (74.6 to 106.1) | 183.1 (160.8 to 205.5) | 595.5 (555.7 to 635.3) | 338.7 (308.2 to 369.1) | 1398.7 (1337.1 to 1460.3) |
| WIMD 2 (adults) | 132.3 (111.0 to 153.6) | 51.0 (38.2 to 63.7) | 164.5 (141.6 to 187.5) | 369.1 (335.0 to 403.2) | 225.7 (198.7 to 252.6) | 942.6 (887.5 to 997.6) |
| WIMD 3 (adults) | 88.0 (68.1 to 108.0) | 42.7 (28.6 to 56.9) | 142.3 (118.7 to 165.9) | 340.7 (302.5 to 378.9) | 227.1 (195.5 to 258.7) | 840.9 (780.9 to 900.9) |
| WIMD 4 (adults) | 52.9 (37.3 to 68.5) | 25.2 (14.9 to 35.6) | 105.4 (85.5 to 125.3) | 212.0 (182.4 to 241.6) | 171.5 (143.8 to 199.2) | 567.0 (518.3 to 615.8) |
| WIMD 5 (adults) | 23.9 (15.2 to 32.6) | 23.1 (14.7 to 31.6) | 107.4 (89.5 to 125.3) | 179.5 (156.5 to 202.7) | 125.0 (105.5 to 144.5) | 459.1 (421.9 to 496.2) |
| Females | | | | | | |
| All ages | 131.0 (122.4 to 139.7) | 44.1 (39.2 to 49.0) | 42.5 (37.7 to 47.3) | 92.6 (85.5 to 99.8) | 114.3 (106.2 to 122.3) | 424.5 (409.1 to 439.9) |
| Adults (aged ≥18 years) | 156.8 (146.3 to 167.4) | 48.5 (42.8 to 54.2) | 49.3 (43.6 to 55.1) | 95.8 (87.8 to 103.9) | 119.3 (110.1 to 128.5) | 469.8 (451.8 to 487.9) |
| WIMD 1 (adults) | 288.3 (260.4 to 316.2) | 87.4 (72.5 to 102.3) | 69.2 (55.7 to 82.6) | 168.3 (147.4 to 189.1) | 145.2 (125.4 to 165.0) | 758.3 (713.5 to 803.1) |
| WIMD 2 (adults) | 175.4 (151.3 to 199.5) | 54.1 (40.9 to 67.2) | 57.8 (43.9 to 71.6) | 105.2 (86.5 to 123.9) | 144.1 (122.2 to 166.1) | 536.6 (494.5 to 578.8) |
| WIMD 3 (adults) | 143.4 (117.5 to 169.2) | 38.1 (24.7 to 51.5) | 35.6 (23.6 to 47.6) | 79.5 (61.3 to 97.7) | 132.5 (107.6 to 157.4) | 429.1 (385.1 to 473.1) |
| WIMD 4 (adults) | 80.9 (59.9 to 101.9) | 16.2 (7.7 to 24.6) | 31.4 (20.0 to 42.8) | 50.6 (35.1 to 66.1) | 89.0 (67.0 to 111.0) | 268.0 (231.3 to 304.8) |
| WIMD 5 (adults) | 43.8 (32.1 to 55.4) | 16.7 (9.4 to 24.1) | 32.4 (22.5 to 42.4) | 28.5 (19.2 to 37.9) | 68.5 (54.1 to 82.9) | 190.0 (165.8 to 214.1) |

Data represented as age-standardised rates and 95% CIs. Bold data denote the location with the highest rates for each category (all ages, adults and deprivation quintiles).
WIMD, Welsh Index of Multiple Deprivation.



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**Table 3** Logistic regression model for assault location and age, gender and deprivation (all adults aged ≥18 years)

| | Assault location type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Own home | | Someone else's home | | Licensed premises | | Street | | Other | |
| | AOR (95% CI) | p Value | AOR (95% CI) | p Value | AOR (95% CI) | p Value | AOR (95% CI) | p Value | AOR (95% CI) | p Value |
| Age (years)* | | | | | | | | | | |
| 25–34 | 1.773 (1.504 to 2.091) | <0.001 | 1.005 (0.809 to 1.249) | 0.962 | 0.717 (0.613 to 0.839) | <0.001 | 0.829 (0.735 to 0.935) | 0.002 | 1.109 (0.968 to 1.270) | 0.136 |
| 35–44 | 2.011 (1.679 to 2.410) | <0.001 | 0.893 (0.692 to 1.153) | 0.386 | 0.668 (0.554 to 0.806) | <0.001 | 0.713 (0.619 to 0.823) | <0.001 | 1.291 (1.108 to 1.504) | 0.001 |
| 45–54 | 2.003 (1.624 to 2.472) | <0.001 | 0.785 (0.571 to 1.078) | 0.134 | 0.561 (0.445 to 0.707) | <0.001 | 0.634 (0.536 to 0.751) | <0.001 | 1.688 (1.423 to 2.002) | <0.001 |
| 55–64 | 2.649 (1.965 to 3.572) | <0.001 | 0.644 (0.374 to 1.109) | 0.113 | 0.529 (0.361 to 0.776) | 0.001 | 0.460 (0.344 to 0.613) | <0.001 | 1.891 (1.462 to 2.449) | <0.001 |
| 65 and older | 7.041 (4.628 to 10.711) | <0.001 | 1.104 (0.547 to 2.229) | 0.783 | 0.380 (0.190 to 0.760) | 0.006 | 0.275 (0.162 to 0.467) | <0.001 | 1.040 (0.659 to 1.643) | 0.866 |
| Gender† | | | | | | | | | | |
| Female | 3.874 (3.426 to 4.381) | <0.001 | 1.961 (1.642 to 2.342) | <0.001 | 0.620 (0.535 to 0.718) | <0.001 | 0.371 (0.332 to 0.416) | <0.001 | 0.992 (0.887 to 1.109) | 0.884 |
| Deprivation‡ | | | | | | | | | | |
| WIMD 1 | 2.394 (1.862 to 3.078) | <0.001 | 1.381 (1.006 to 1.896) | 0.046 | 0.495 (0.405 to 0.605) | <0.001 | 1.261 (1.066 to 1.491) | 0.007 | 0.670 (0.564 to 0.797) | <0.001 |
| WIMD 2 | 2.115 (1.624 to 2.756) | <0.001 | 1.173 (0.833 to 1.651) | 0.361 | 0.672 (0.543 to 0.831) | <0.001 | 1.086 (0.906 to 1.302) | 0.372 | 0.778 (0.646 to 0.937) | 0.008 |
| WIMD 3 | 1.800 (1.353 to 2.393) | <0.001 | 0.965 (0.658 to 1.404) | 0.855 | 0.683 (0.541 to 0.862) | 0.001 | 1.106 (0.909 to 1.345) | 0.315 | 0.900 (0.737 to 1.099) | 0.303 |
| WIMD 4 | 1.512 (1.096 to 2.085) | 0.012 | 0.857 (0.552 to 1.332) | 0.493 | 0.820 (0.638 to 1.054) | 0.121 | 0.994 (0.799 to 1.236) | 0.955 | 0.978 (0.784 to 1.219) | 0.842 |

*Reference category: 18–24 years.
†Reference category: male gender.
‡Reference category: WIMD 5 (least deprived).
AOR, adjusted OR; WIMD, Welsh Index of Multiple Deprivation.

## DISCUSSION

To our knowledge, this is the first time a study has used linked (person identifiable) data in an attempt to create a more accurate picture of local patterns of violence with an additional emphasis on those individuals not reporting violence. The benefits of this will enable violence interventions to be evidence based and tailored to suit the demographics of those presenting to services within specific communities. Many studies in the literature examining trends in violence use anonymised health data and/or crime statistics.[8 9 20 21] One previous UK-based study reported using violence-related injury patient data derived from EDs combined with police intelligence to generate areas of 'violence hotspots' to inform the deployment of targeted violence prevention resources.[21] However, as this current study demonstrates, the real picture of violence across communities is only revealed when including both PID from health services and police data to allow for cross-referencing to establish those individuals reporting serious assaults resulting in a violence-related injury to EDs not known/reported to police. This helps us to identify, more precisely, violence hotspot areas and to profile communities more accurately to target violence prevention initiatives and also to address the potential factors behind under-reporting. For example, adding the 'unknown to police' violence-related ED assault attendances to the police-recorded VWI victims data (figure 1C) reveals that, rather than female rates being greater than males between the ages of 25 and 44 years, the gender rates were actually similar. Additionally, these added cases resulted in a 35.3% and 18.1% increase on the original police totals for male and females, respectively (figure 2). These findings are of particular interest, especially given that the rate of violent crime across the UK can often be up to 60% higher than official statistics suggest.[25] This is an important consideration given that trends in violence from one source alone may not accurately represent the true reflection of violence.[26]

One of the further benefits to using ED data alongside police data is the extra information it can provide on violence-related assaults. ED data detail both the reported assault location type and the assailant relationship to the victim, allowing for a more complete picture of violence to emerge. When considering ED linked data and the 'police unknowns', ED data can provide a more complete profile of the demographics of those that do not report to police to include assault location types and potential relationship to assailant and highlight potential areas that would benefit from more targeted violence interventions. The key demographic identified as under-reported to police were young males, and a substantial number (~60%) of male incidents unknown to police were assaults in streets or licensed premises involving a stranger. A Norwegian study looking at ED registrations of violence-related assaults also showed that victims were mostly males experiencing street attacks.[27] Females, on the other hand, are four times more likely than males to be a victim of assault in their own homes, a traditional proxy measure for domestic violence,[28] and the majority of these females know their alleged attacker (partner or ex-partner). Nearly half of ED-recorded own home incidents involving current or ex-partners as the assailant, for both male and female victims (47.6% and 42.0% respectively), were not known to the police, an important finding that could have strategic importance in addressing incidents of domestic violence. Accounting for assailant relationship gives a more accurate picture of patterns around assault location and the potential rates of domestic violence across communities. In addition, an increase in age revealed a rise in the proportion of cases that took place in an individual's own home across all age categories; when compared with those aged 18–24, those aged ≥65 years were six times more likely to report being assaulted in their own home. Interestingly, a recent study undertaken in China revealed similar findings, where 28.5% of all hospital-recorded domestic violence incidents over an 8-year period (2006–2013) were in those individuals aged 65 years and older.[29] These observations suggest that domestic abuse among the elderly population is an emerging global public health challenge.

Our study also showed results comparable with existing literature. In agreement with previous studies,[7 8 30] a greater number of males were observed to attend EDs for violence-related assaults than females. Both the ED and police data illustrated a higher incidence of victims in the most deprived areas, and the relationship between deprivation and an increase in violence has been widely reported.[6 7 9 10] However, a novel aspect to our study is that the results also demonstrated that relationships between



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violence and deprivation were consistent among a range of assault locations for both males and females. The majority of alcohol-related incidents in Australia requiring ED attendance were recorded to have taken place in a location described as 'other', a location not 'own home', 'street' or 'licensed premises'.[31] This is consistent with our findings, where a substantial number of males and females reported the location of their incident as 'Other', somewhat suggesting that reporting patterns by 'victims' are similar globally. Comparable trends in seasonality[8 13–15] and peak levels of violence in those aged 18–34 years[7 8] were also observed in our results.

The strengths of this study have been explained in detail; however, we acknowledge the following limitations. When using ED data to explore patterns of violence, data will not include violence where medical treatment was not sought; furthermore, individuals may be reluctant to report the injury occurring as the result of a violence-related assault. Additionally, there is currently no standardised data collection system across local health boards in South Wales; this means that some field responses can have more categories than others. For example, for the purpose of this study, the assault location for one health board had to be narrowed to fall into the same categories as the remaining two health boards (own home, someone else's home, licensed premises, street and other). This could therefore contribute to the underestimation of what is happening within the named categories. One further limitation to the study is that our matching algorithm would not be able to identify an individual who deliberately provided false details to either the police or EDs. However, although this may happen in some cases, it is likely to be infrequent and would not have a significant impact on our findings.

Nevertheless, in conclusion and in agreement with a systematic review[16] looking at the effectiveness of community-level interventions to reduce alcohol-related violence based on ED data sharing, this study demonstrates the importance of continued sharing of routinely collected ED data. This shared approach enhances the current picture or even changes existing profiles of violence, thus allowing services to develop and target more specifically violence prevention activities by providing additional information on patient demographics and types of violence to inform broader violence prevention work. Our study demonstrates that using PID from both police and EDs in a linked way can change the landscape of violence in terms of 'what is known' at a local level, providing a more comprehensive picture of violence, and therefore can more accurately inform targeted violence prevention approaches. Furthermore, it raises the question of policy and data sharing and highlights a need for more comprehensive datasets within services and the development of secure but accessible mechanisms to allow data sharing across agencies.

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**Competing interests** None declared.

**Ethics approval** The data presented in this manuscript are part of a routine surveillance dataset; the relevant permissions to use this data were sought through data disclosure agreements. As an additional security measure, files that contain PID were password protected, and accessed only by named project researchers.

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## What is already known on this subject

Evidence demonstrates that a multidisciplinary approach to violence prevention that reaches across organisational boundaries of social, health and policing, underpinned by comprehensive data on patterns of violence (both victims and perpetrators), can reduce the impact on population health. This study introduces a novel approach sharing routinely collected data on victims of violence from the police, emergency department assault attendees from local health boards and violence-related call-outs from the ambulance service, which was implemented in the South Wales region in 2014.

## What this study adds

From this study, we now know that sharing data between agencies such as the police and emergency departments enhances the current picture or even changes existing profiles of violence especially when considering the characteristics of those individuals who do not report their injuries to police. From a practical perspective, this shared data approach would then allow services to develop and target more specifically violence prevention activities by providing additional information on patient demographics and types of violence to inform broader violence prevention work.

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