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# The effect of deprivation on the Incidence of Mandibular fractures in a British city

**Wilson MH, Robinson JP, Sisson RT, Revington PJ, Thomas SJ**  
*Department Oral and Maxillofacial Surgery, University Hospitals Bristol*

Mark H Wilson *MCh, MFDS RCSEd, MRCSEd*  
Specialty Registrar in Oral & Maxillofacial Surgery  
University Hospitals Bristol

Joshua P Robinson *BDS, MFDS*  
Senior House Officer in Oral & Maxillofacial Surgery  
University Hospitals Bristol

Richard T Sisson *MFDS, FRCS(OMFS)*  
Specialty Registrar in Oral & Maxillofacial Surgery  
University Hospitals Bristol

Peter J Revington *TD, BDS, MB, BS, MSc, FDSRCS, FRCS*  
Consultant Oral & Maxillofacial Surgeon  
University Hospitals Bristol

Professor Steven Thomas *BDS, MBBCh, PhD, FDSRCS, FRCS(Eng),  
FRCS(OMFS)*  
Professor in Oral & Maxillofacial Surgery  
School of Oral and Dental Sciences  
University of Bristol

## **Corresponding author:**

Mark Wilson  
Department of Oral & Maxillofacial Surgery  
University Hospitals Bristol  
Upper Maudlin Street, Bristol, BS2 8HW, United Kingdom.  
Tel: +44 117 342 4301 Fax: +44 117 342 4443  
Email: [Mark.Wilson@UHBristol.nhs.uk](mailto:Mark.Wilson@UHBristol.nhs.uk)

## **The effect of deprivation on the Incidence of Mandibular fractures in a British city**

### **Abstract**

#### **Aim**

To examine the relationship between social and material deprivation and mandibular fractures.

#### **Method**

Three hundred and forty three consecutive patients who underwent mandibular fracture fixation were selected for the study. After exclusions, 290 were divided into age groups and ranked according to their Index of Multiple Deprivation (IMD) score. Rankings were determined using postcodes, and divided into quintiles for statistical analysis.

#### **Results**

Ages ranged from 7- 82 with 146 (50%) patients aged between 20 and 29. Males accounted for 85% of cases. The most common site of fracture was the angle (n=195) and assault was shown to be the most common mechanism of injury (63.3%). A strong relationship was demonstrated between fractures of the mandible and worsening deprivation, with the most striking relationship seen with fractures sustained as a consequence of assault. Females were less likely than males to sustain a fracture of the mandible as a consequence of assault; however, when assault was the mechanism of injury they were also likely to be from a deprived background.

#### **Conclusion**

This study has demonstrated that a strong relationship exists between deprivation and the incidence of mandibular fractures in our catchment area. Fractures that resulted from interpersonal violence were shown to have a particularly strong correlation with deprivation.

## **Introduction**

The mandible is one of the most frequently fractured bones of the facial skeleton, accounting for up to three quarters of all facial fractures.(1-3) Males in the third decade are the most likely group to sustain a fracture of the mandible(1-4) and alcohol is a well-reported contributory factor.(5, 6) Assault is widely accepted to be the most common cause of mandibular fractures in the developed world - Rashid et al reported that Interpersonal violence was the cause for 72% of mandibular fractures in London(7), and this observation is supported by studies in other major urban areas.(1, 2, 8, 9).

A link between assault and increasing deprivation has been well documented.(10-12) Deprived communities tend to have poor social cohesion limiting social control and higher background levels of community violence. In addition, socially disadvantaged groups have a higher prevalence of a number of risk factors more specific for physical violence, such as alcohol and drug abuse.(13-15) Although an association between fractures of the mandible and deprivation is casually observed in the clinical setting, to our knowledge, no study specifically examines this. Consequently, this study aims to examine the relationship between mandibular fractures and combined material and social deprivation.

## **Methods**

Information regarding patient demographics, injuries sustained and procedures undertaken were ascertained through electronic records and patient notes and examined retrospectively. We included all mandibular fractures, which underwent Open Reduction and Internal Fixation (ORIF) across the two acute trusts in Bristol, United Kingdom between the years 2011- 2013. Only fractures that underwent ORIF were included in the study. The pre-determined catchment area comprised of the City of Bristol, South Gloucestershire, North Somerset, Bath and North East Somerset. This catchment area was used for analysis to avoid selection bias based on hospital location. Patients managed conservatively were excluded, as were patients from outside the predetermined catchment area.

### *Deprivation Status*

The Index of Multiple Deprivation (IMD) 2010 is used as the indicator for deprivation.<sup>(16)</sup> This index is a measure of the material deprivation of small areas of England termed Lower Layer Super Output Areas (LSOAs) and enables comparisons to be made between like sized areas across the country. There are 32,482 LSOAs across England each containing approximately 1,500 residents. The index is based on 7 domains of deprivation: Income Deprivation; Employment Deprivation; Health and Disability Deprivation; Education, Skills and Training Deprivation; Barriers to Housing and Services; Crime Deprivation; Living Environment Deprivation. The domains are then combined with different weightings to give an overall IMD. Each individual LSOA is given an IMD score, which enables them to be ranked from most deprived (Rank 1) to least deprived (Rank 32,482) to give an IMD ranking. Our catchment area is divided into 653 LSOAs, these were ranked 1 to 653 based on their raw IMD scores. Individual LSOAs were placed into Quintiles based on their IMD ranking. Each patient in the study was allocated to an individual LSOA based on

his or her postcode. The South West of England is relatively undeprived compared to the rest of the country and although Bristol has deprivation 'hot spots', which are amongst some of the most deprived areas in the country, it also has a large number of the least deprived areas in the country.(17) As such, Bristol would be regarded as a comparatively undeprived area of England.

### *Statistical Analysis*

Index of Multiple Deprivation (IMD) ranking were divided into quintiles to allow statistical analysis by means of a chi-squared test using SPSS software.

### **Results**

Information was obtained for 426 patients from coding data. Eighty-two patients had been inappropriately coded as fractures and therefore excluded. Forty-six were from outside of the pre-determined catchment area and 8 patients had postcodes that were not recognised, or did not live in England. These patients were excluded. Following these exclusions there were 290 patients that had undergone primary treatment of a mandibular fracture and met our inclusion criteria.

Among the 290 validated fractures with IMD scores there were a total of 466 fractures of the mandible treated. The most common sites of fracture were the angle (n=195) and parasymphysis (n=160). The IMD scores of the 290 patients analysed ranged from 1.85 to 70.36 (median IMD score 17.37, IQR: 10.73-30.52). These were ranked within the 653 LSOAs ranging from 1 to 653 with a median rank of 242 (IQR: 103-383). IMD rankings were distributed into Quintiles: 1 – most deprived - (30.5%), 2 (22.5%), 3 (23.5%), 4(15.2%) and 5 – least deprived (8.7%) (table 1). These show a significant link between deprivation and incidence using a Chi Squared Test ( $p=3.86 \times 10^{-8}$ ).

Ages ranged from 7 to 82 with a median of 25 (IQR: 21-33). The largest proportion of patients, 50.3% (n=146) were in their third decade and 85.2% (n=247) of the patients were male and 14.8% (n=43) female. Assault is the most common cause of mandibular fractures across both hospitals accounting for 193 injuries in the 290 patients (66.6%). Falls account for 7.9% of injuries, sports 5.9% and RTAs 9.3%. Information was unavailable for a total of 25 patients, or 8.6% (table 1).

**Table 1. Percentage of patients categorised in deprivation quintile, age, aetiology and gender**

	Number of Patients	% Total (95% CI)
<b>Deprivation Quintile</b>		
1	88	30.2 (25.2 - 35.8)
2	65	22.4 (17.9 - 27.4)
3	68	23.4 (18.81 - 28.5)
4	44	15.2 (11.4 - 19.6)
5	25	8.62 (5.8 - 12.2)
<b>Age of Patient</b>		
0-19	46	15.9 (11.9 - 20.4)
20-29	146	50.3 (50.3 - 56.1)
30-39	53	18.3 (14.1 - 22.9)
40+	45	15.5 (11.7 - 19.9)
<b>Aetiology</b>		
Assault	193	66.6 (61.0 - 71.8)
RTA	27	9.3 (6.3 - 13.0)
Fall	23	7.9 (5.2 - 11.4)
Sports	17	5.9 (3.5 - 8.9)
Iatrogenic	4	1.4 (0.4 - 3.2)
Pathological	1	0.3 (0.02 - 1.5)
Unknown	25	8.6 (5.8 - 12.2)
<b>Gender</b>		
Male	247	85.2 (80.8 - 90.0)
Female	43	14.8 (11.1 - 19.2)

Assault was shown to have a very strong correlation of increasing incidence with deprivation score, with 60 of the 193 patients falling into the most deprived quintile (table 2). There is a significant trend of increasing frequency of assault with worsening deprivation ( $p < 0.0001$ )

and a 6-fold increase in the risk of assault in the most deprived quintile compared with the least deprived (OR 6.2 95% CI 3.4 – 12.3)

**Table 2. The proportion of injuries attributed to assault in each deprivation quintile**

<b>Deprivation Quintile</b>	<b>Number of assaults (% Total assaults)</b>	<b>Odds Ratio</b>	<b>CI</b>
5 ( <i>Least Deprived</i> )	13 (6.7)		
4	34 (17.6)	3	1.5-6
3	41 (21.2)	3.7	2-7.5
2	45 (23.3)	4.2	2.2-8.4
1 ( <i>Most Deprived</i> )	60 (31.1)	6.2	3.4-12.3

*P* = <0.0001

Fractures attributed to assault were less common in females (41.9%, n= 18) when compared with males (70.85%, n=175) with a much larger proportion being caused by falls (18.6%, n=8), and cycling (14%, n=6). Female patients, who sustained a fractured mandible as a consequence of assault, were also likely to be from deprived areas.

**Table 3: Injuries caused by assaults with gender and deprivation analysis**

<b>Deprivation Quintile</b>	<b>Assaults Male (%)</b>	<b>Odds Ratio (CI)</b>	<b>Assaults Female (%)</b>	<b>Odds Ratio (CI)</b>
5 (Least Deprived)	13 (7.4)	1	0 (0)	1
4	31 (17.7)	2.7 (1.4-5.5)	3 (16.7)	3.4 (0.4-72.9)
3	39 (22.3)	3.6 (1.9-7.2)	2 (11.1)	2.1 (0.2-48.3)
2	41 (23.4)	3.8 (2-7.7)	4 (22.2)	4.9 (0.6-100.9)
1 (Most Deprived)	51 (29.1)	5.1 (2.7-10.2)	9 (50)	17 (2.6-339.9)

*Male* *p* < 0.001

*Female* *p* < 0.001

The proportion of fractures attributed to assault was consistent across the years: 65.3% - 2011, 69.2% - 2012 and 65% - 2013 (table 4.)

*Table 4. The proportion of fractures attributed to assault across the study years*

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<b>Year</b>	<b>Total fractures</b>	<b>Fractures related to assault</b>	<b>% Fractures related to assault (95% CI)</b>
2011	92	61	66.3 (56.3 - 75.4)
2012	78	54	69.2 (58.5 - 78.7)
2013	120	78	65.0 (56.2 - 73.2)

## **Discussion**

This study demonstrates that the incidence of mandibular fractures has a strong relationship with deprivation in our defined catchment area. Interpersonal violence was shown to be the most common cause for fractures of the mandible, and this is consistent with findings from many other studies conducted in urban areas. There was a significant trend of increasing frequency of assault with worsening deprivation demonstrated. Patients from the most deprived areas of the catchment had a 6-fold increased risk of sustaining a fracture of the mandible as consequence of assault when compared to those of less deprived areas.

This is the first study to our knowledge to examine the often casually observed relationship between mandibular fractures and deprivation. However, the study was a retrospective analysis and consequently some important factors, notably the role of alcohol was not always clearly documented in patient notes. It is appreciated that this study is looking at “Group Level” deprivation not “Individual Level” deprivation. Despite the relatively small areas identified when using the Index of multiple deprivation – narrowing to an area of approximately 1500 people it cannot ultimately be known whether everybody within an individual LSOA is in fact deprived. Furthermore, there is no information available to us on where the assault occurred and it is possible that a place of assault-based analysis

would yield a different deprivation profile. The catchment area studied was fully representative of the local area but it would be desirable to broaden the study to cover a fully representative sample of the United Kingdom.

The relationship between increased levels of assault and deprivation is well known but is complex - deprived communities tend to have poor social cohesion limiting social control and higher background levels of community violence. In addition, socially disadvantaged groups have a higher prevalence of a number of risk factors more specific for physical violence, such as alcohol and drug abuse.(13-15). The majority of patients sustaining a fracture of the mandible were male and in the 20 – 29 age group. This finding is not surprising as males and those aged 18–30 years demonstrate higher rates of delinquency, adult criminality and violent behaviour. Across a range of studies, males are consistently over-represented as both victims and perpetrators of violence. Males were responsible for 88% of indictable offences (including violence against persons) and accounted for 83% of emergency hospital admissions relating to violence in England in 2013.(18)

A larger proportion of fractures in women are caused by falls and cycling. However, female patients, who sustained a fractured mandible as a consequence of assault, were also likely to be from deprived areas. A study looking at Intimate Partner Violence (IPV) and Socioeconomic Deprivation in England showed that physical violence against women by a male partner appears to be strongly associated with social deprivation.(19) An explanation for this association may be that women living in lower socioeconomic areas may have higher exposure to domestic violence and this may reflect risk factors in their male partners. Domestic violence has been shown to account for nearly half of violence-related maxillofacial injuries in females, with women in the 20s and 30s being the highest risk groups.(20)

The most recent Crime Survey for England and Wales (CSEW) has demonstrated a long-

term reduction in the incidence of violent crime since the mid-1990s.(21) This finding is supported by a study examining the incidence of violence related attendances to Emergency Departments throughout England and Wales.(22) However, the same study showed that the South West region was one of only three nationally that showed a year-on-year increase in violence over the 10-year period (2000–2009). This was quite surprising given the areas socioeconomic profile. Our study showed that the proportion of fractures attributed to assault was unchanged across the years (65.30% - 2011, 69.23%. - 2012 and 65% - 2013) and this suggests that violent crime in the South West is not in decline unlike most other regions throughout England and Wales.

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3	39 (22.3)	3.6 (1.9-7.2)	2 (11.1)	2.1 (0.2-48.3)
2	41 (23.4)	3.8 (2-7.7)	4 (22.2)	4.9 (0.6-100.9)
1 (Most Deprived)	51 (29.1)	5.1 (2.7-10.2)	9 (50)	17 (2.6-339.9)

*Male*  $p < 0.001$   
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