



Interpersonal Violence – The Leading Cause of Maxillofacial Fractures

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Abstract

Purpose: Accident Compensation Corporation statistics show maxillofacial fracture affects 11000 people with an approximate \$90 million annual cost in New Zealand (NZ). Previous studies have demonstrated Inter Personal Violence (IPV), Road Traffic Accidents (RTA), sports injury and falls being the common causes of maxillofacial fracture. This study investigated the causes and associated alcohol and/or drug use, and fracture patterns in patients presenting with maxillofacial fractures in the Wellington region.

Methodology: Demographic data of the patients, the cause of maxillofacial fracture and associated alcohol and/or drug use, and the fracture patterns were culled from our prospective maxillofacial fracture database at Hutt Hospital for a 5-year period from 1 January 2013 to 31 December 2017, and analyzed.

Results: 1535 patients were referred with maxillofacial fractures during the study period. 38% of the maxillofacial fractures were caused by IPV, followed by sports injury (24%), falls (24%) and RTA (6%), with 33.4% associated with alcohol and/or drug use. Males were six times more likely to present with IPV-related maxillofacial fractures, compared to females. The 16-30 age group was most prevalent in the IPV group with NZ Maori attributing to significantly more maxillofacial fractures compared to NZ European, 54.6% vs. 32.0% (p<0.0001).

Conclusion: IPV, especially involving alcohol and/or drug use, is the most common cause of maxillofacial fractures in the Wellington region especially in NZ Maori males aged 16-30. Public health strategies are needed to decrease IPV as a cause of maxillofacial fractures.

Keywords: Maxillofacial; Facial; Fractures; Interpersonal violence; Alcohol

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Introduction

Accident Compensation Corporation statistics show that the incidence of maxillofacial fractures and its associated costs have been increasing steadily over the last 11 years [1]. There were 6944 new claims for maxillofacial fractures in 2006, compared with 7965 in 2017, an increase of 14.7%. A total of all claims has risen similarly with 10124 active claims in 2006 compared with 11385 in 2017, an increase of 12.4% [1]. The cost of maxillofacial fractures for all active claims for 2017 was greater than \$90 million1 a substantial fiscal cost to the public health system.

Common causes of maxillofacial fractures include Inter Personal Violence (IPV), Road Traffic Accidents (RTA) and sports injuries 1-4 with IPV and RTA being the most common causes historically, both of which are preventable. Since 1979 IPV has been the leading cause of maxillofacial trauma in New Zealand (NZ) with alcohol also being implicated in those caused by IPV and RTA [1-5].

Concerted campaigns including public education and legislative changes such as compulsory seat belts and helmets, and enforcement of alcohol limits, have resulted in marked reduction of RTA as a cause of maxillofacial fractures over the last 40 years, while IPV has remained the leading cause [1-6]. Unlike RTA there has been no effective intervention to address IPV despite it being identified early this century [1-5].

Studies in NZ [1-5] including the Christchurch [5], Waikato [3,4] and Wellington regions

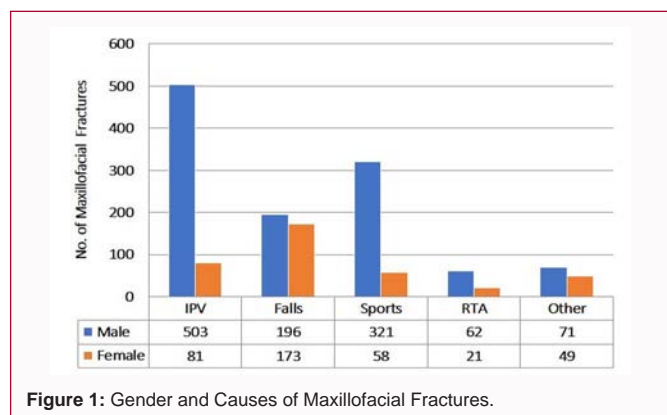


Figure 1: Gender and Causes of Maxillofacial Fractures.

between 1979 and 2013 have shown a steady increase in IPV as the cause of maxillofacial fractures. A NZ-wide study for the period 1979-1998 showed IPV as the most common cause of maxillofacial fractures, attributing to 34% of all maxillofacial fractures and that Maori were twice as likely to suffer a maxillofacial fracture compared to other ethnic groups [2]. A study of the Waikato region for the period 1989-2000 showed that IPV accounted for 36% of all maxillofacial fractures and this was associated with alcohol and drug use [3]. A follow-up study in the Waikato region for the period 2004-2013 showed that IPV was responsible for 54% of all maxillofacial fractures [4]. A study of the Christchurch region for the period 1996-2006 showed that alcohol was a significant risk factor associated with IPV and maxillofacial fractures [5]. A study in the Wellington region for a 2-year period 2006-2007 showed that IPV contributed to 42% of all maxillofacial fractures (Wood field MJ et al. Interpersonal violence is the leading cause of maxillofacial fractures. Presented at the New Zealand Association of Plastic Surgeons' Annual Scientific Meeting, Wellington, New Zealand, November 7, 2008).

In this study we investigated the causes, and associated drug and/or alcohol use, fracture patterns and management of patients presenting with maxillofacial fractures in the Wellington region.

Materials and Methods

Consecutive patients referred to Hutt Hospital from 1 January 2013 to 31 December 2017 were culled from our prospective maxillofacial fracture registry, approved by the Central Health and Disability Ethics Committee (Ref. 16/CEN/173). Informed consent was obtained from the subjects. Demographic data of the patients including age, gender and ethnicity, cause of maxillofacial fracture, alcohol and/or drug use, fracture patterns and management, were collated and analyzed.

Statistical analysis

The 5-year sample yielded 1535 patients but contained only three

groups that were of large enough size to be compared meaningfully for that length of time-NZ Europeans 834, NZ Maori 339 and Pacific people 74. With groups of the size of the first two testing for significance of difference was not helpful as almost all differences will be significant and real differences would generally be self-evident. To illustrate this, testing between the ratios of IPV to Total Incidents for the NZ Maori and NZ European groups using χ^2 (Graph Pad Quick Calcs) produces a $p < 0.0001$ which is extremely significant.

Results and Discussion

1535 patients' aged 1-97 (mean, 35) years with 1951 maxillofacial fractures were identified. 75.1% of the patients were males. IPV accounted for 38% of the maxillofacial fractures, followed by sports injury (24%), falls (24%), and RTA (6%) (Figure 1).

Demographics and causes of maxillofacial fractures

The breakdown of the age groups and fracture patterns is shown in Table 1. The mean age for NZ Europeans and NZ Maori at presentation was 38.5 (range, 12-85) years and 28.6 (range, 8-67) years, respectively. The 16-30 age group was the most prevalent age group to sustain maxillofacial fractures caused by IPV (53.8%), sports injury (54.4%) and RTA (48.1%). Patients older than 60 years were the most prevalent age group to sustain maxillofacial fractures from falls (48.5%). IPV was responsible for 54.6% of Maori presentations in both males and females and was responsible for 32% of NZ European presentations (Table 2). This difference reached statistical significance (χ^2 , $p < 0.0001$). This showed that Maori are more likely to present with maxillofacial fractures at a younger age and from IPV, than NZ Europeans. Those older than 60 years were more likely to present with falls than other causes with 59% of maxillofacial fractures resulting from falls occurring in patients over 60 years compared with 11% for those aged 60 or younger ($p < 0.0001$) (Table 2).

Males are far more likely to sustain maxillofacial fractures from all causes except for falls where the difference is much modest (Figure 1). Males were six times more likely to present with maxillofacial fractures resulting from IPV, five times more likely from sports injury and 1.1 times more likely from falls, compared to females.

Ethnicity Breakdown vs. 2013 Census Figure 2 shows the ethnic representation of our regional population according to the 2013 Census, the proportion of maxillofacial fractures affecting different ethnic groups from all causes, and those caused by IPV in our study. According to the 2013 Census, NZ Maori represented 7% of our regional population. In our study, NZ Maori accounted for 22% of maxillofacial fractures from all causes and 31% of IPV-related maxillofacial fractures (Table 2). This shows a greater than 4-fold over-representation of NZ Maori in IPV. Pacific people were approximately 2-fold over-represented in our cohort than would have been expected from the census data. NZ European population

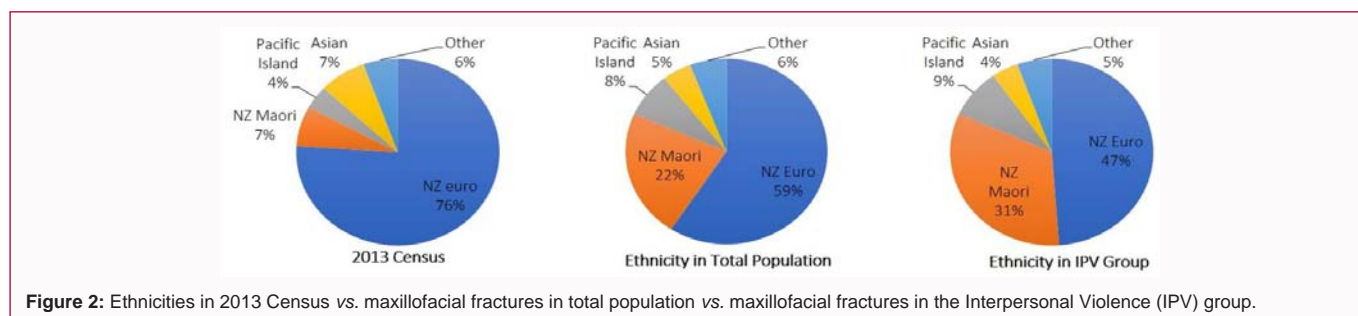


Figure 2: Ethnicities in 2013 Census vs. maxillofacial fractures in total population vs. maxillofacial fractures in the Interpersonal Violence (IPV) group.

Table 1: Age Groups and Causes of Maxillofacial Fractures.

Age Range (years)	IPV (%)	Falls	Sports	RTA	Other
<16	10 (1.7)	47 (12.7)	66 (16.6)	7 (8.4)	21 (17.5)
16-30	314 (53.8)	52 (14.1)	216 (54.4)	40 (48.1)	45 (37.5)
31-45	159 (27.2)	42 (11.4)	67 (16.9)	16 (19.2)	28 (23.3)
46-60	86 (14.7)	49 (13.3)	28 (7.1)	11 (13.3)	17 (14.2)
>60	13 (2.2)	179 (48.5)	2 (0.5)	9 (10.8)	9 (7.5)
Total	584	369	397	83	120

Table 2: Ethnicities and Causes of Maxillofacial Fractures.

Ethnicity	IPV (%)	Falls (%)	Sports (%)	RTA (%)	Other (%)	Total (%)
NZ European	275 (47.1)	264 (71.5)	222 (55.9)	52(62.7)	84 (70.0)	897 (59.2)
NZ Maori	185 (31.7)	54 (14.6)	68 (17.1)	15(18.1)	17 (14.2)	339 (22.4)
Pacific People	48 (8.2)	11 (3.0)	49 (12.3)	4(4.8)	6 (0.1)	118 (7.8)
Asian	24 (4.1)	14 (3.8)	21 (5.3)	4(4.8)	8 (6.7)	71 (4.7)
Other	31 (5.3)	26 (7.1)	19 (4.8)	8(9.6)	5 (4.2)	89 (5.9)

Table 3: Causes and Fracture Patterns.

Causes	Fracture Patterns					Total
	Orbital (%)	Maxillary (%)	Nasal (%)	Mandibular (%)	Cranial/Skull Base (%)	
IPV	215 (28.2)	179 (23.5)	176 (23.1)	168 (22.0)	24 (3.1)	762
Sports	110 (24.8)	92 (20.7)	170 (38.3)	58 (13.1)	14 (3.2)	444
Falls	120 (25.9)	112 (24.1)	158 (34.1)	44 (9.5)	30 (6.5)	464
RTA	38 (31.7)	29 (23.6)	29 (23.6)	12 (9.8)	15 (12.2)	123
Other	36 (22.9)	33 (21.0)	68 (43.3)	10 (6.4)	10 (6.4)	157

Table 4: Management and Aetiology of Maxillofacial Fractures.

Management	IPV (%)	Falls (%)	Sports (%)	RTA (%)	Other (%)
Conservative	331 (43.4)	312 (67.8)	187 (42.1)	71 (59.7)	66 (42.0)
Operative	431 (56.6)	148 (32.2)	257 (57.9)	48 (40.3)	91 (58.0)
Total	762	460	444	119	157

was majorly under-represented.

Alcohol and/Drug use

Alcohol, drugs or both contributed to 37.3%, 14.6% and 13.6% of maxillofacial fractures resulting from IPV, RTA and falls, respectively. IPV-related maxillofacial fractures involving alcohol, drugs and both, affected ethnicities differentially. Of the total IPV cohort affected by alcohol, drugs or both were involved in 46.8%, 35.8% and 9.17% of NZ Europeans, NZ Maori and Pacific people, respectively. Alcohol alone was associated with maxillofacial fractures in 46.7%, 35.8% and 9.2% in NZ European, NZ Maori and Pacific people, respectively.

In males aged 16-30, alcohol, drugs or both attributed to 50.6% of maxillofacial fractures resulting from IPV. Alcohol and/or drugs played a very small role in injuries occurring during sports (0.003%).

Causes, fracture patterns and management

IPV contributed to the majority of maxillofacial fractures in our population and was the most common cause for all fracture patterns. Orbital fractures were the most common fracture pattern from IPV (Table 3). More than half of the maxillofacial fractures resulting from IPV (56.6%), sports injury (57.9%) and other causes (58.9%) were managed operatively (Table 4). Within the sports injury group, these were mainly manipulations as nasal fractures that represented 38.3% of all fractures (Table 3). 67.8% of the maxillofacial fractures resulting

from falls were managed conservatively.

Analysis of New Zealand published data

There have been a number of NZ studies 2-5 on maxillofacial fractures and its causes dating to 1979. Over the last 40 years, maxillofacial fractures caused by RTA have dramatically decreased, to 6% in the last five years as demonstrated in our study, while IPV-related injuries have remained at 34% to 55% (Table 5). The ratio of IPV: RTA related maxillofacial fractures over the last five years is 6:1, compared to 2:1, 20 years ago [2]. The contributions from falls and sports-related injuries have also relatively increased which could reflect the increasing number of CT scans being performed in the emergency department [7].

Analysis of data from our maxillofacial fracture registry for the Wellington region for the period 2013-2017 demonstrated IPV as the leading cause of maxillofacial fractures contributing 38% of all cases, 33.4% of which were associated with alcohol and/or drugs. Falls has emerged to be the major cause of maxillofacial fractures affecting those aged 60 and over.

IPV has remained the leading cause of maxillofacial fractures in NZ for over the last 40 years with no effective intervention being implemented. RTA has dramatically decreased as a major cause of maxillofacial fractures over this period, reflecting the success of

Table 5: New Zealand Publications on Causes of Maxillofacial Fracture over the Last 40 Years.

Publications	Populations	Period	No. of pts	IPV (%)	RTA (%)	Falls (%)	Sports (%)
Kieser <i>et al.</i> [2]	NZ	1979-1998	27732	34.1	17.1	-	-
Lee <i>et al.</i> [5]	Christchurch	1996-2006	2581	44	11	14	19
Moore <i>et al.</i> [4]	Waikato	2004-2013	1975	54.5	14.5	11.6	11.9
York <i>et al.</i> [6]	Wellington	2013-2018	1535	38	6	24	24

the implementation of public health campaigns and changes in legislation. Urgent measures are needed to address IPV.

The incidence of maxillofacial fracture is disproportionately higher in certain ethnic groups, especially in the context of IPV and drug and/or alcohol use. The situation is likely to be worse, as reporting the cause and alcohol and/or drug use in this study was voluntary. Comparison of our data with the 2013 Census, Maori and Pacific populations are over-represented in maxillofacial fractures especially those caused by IPV, compared to NZ Europeans.

Our data also shows that males aged 16-30 in NZ contributes to over 50% of the IPV-related maxillofacial fractures, over 50% of which involved alcohol and/or drug use. NZ Maori suffering from maxillofacial fractures had a much lower mean age and are significantly more likely to be caused by IPV, when compared to NZ Europeans.

Orbital fractures were the most common fracture pattern from IPV. Operative management was needed in over 50% of the maxillofacial fractures resulting from IPV mostly mandibular and orbital fractures. Operative intervention was administered to 57.9% of maxillofacial fractures caused by sport injuries with a large proportion being manipulation of nasal fractures. Conversely 67.8% of the maxillofacial fractures caused by falls were managed conservatively, mainly because of less severe displacement of the fractures and the presence of medical comorbidities in this cohort.

Concerted public health campaigns along with legislative changes over the last 40 years have decreased the incidence of RTAs in NZ [6] which has resulted in a dramatic reduction of RTA as a cause of maxillofacial fractures 4,5, contributing to only 6% in our study. This underscores the effectiveness of concerted large-scale public health campaigns in concert with legislative changes to reduce the incidence of injuries. A similar campaign is urgently needed to deal with IPV as a leading cause of maxillofacial fractures that has significant personal, social and economic implications.

Currently in NZ, campaigns against violence are mainly directed towards domestic violence targeting violence against women such as

“White Ribbon Day” and “It’s Not OK”. Our data included injuries resulting mainly from street violence and demonstrates that the most affected group is NZ Maori aged 16-30 years. This emphasises a need for a more targeted campaign towards this demographic group.

Conclusion

IPV has remained the leading cause of maxillofacial fracture in NZ over the last 40 years while RTA now only contributes to 6%. Maxillofacial fracture caused by IPV is highly statistically significantly more prevalent in the 16-30-year age group and is disproportionately over-represented by NZ Maori, and to a lesser extent, by Pacific population. Urgent concerted public health campaigns are needed to prevent this costly and unnecessary harm on NZ society.

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