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What Is the Effect of COVID-19 Social Distancing on Oral and Maxillofacial Trauma Related to Domestic Violence?

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Purpose: To understand the impact of social distancing policies on the incidence and severity of oral and maxillofacial trauma (OMT) secondary to interpersonal violence (IPV) and domestic violence (DV).

Methods: The authors designed a retrospective cohort study enrolling subjects who presented to an urban Level 1 trauma center in Seattle, WA, for the evaluation and management of OMT between January 1 and December 31 in the years 2018 through 2020. The primary predictor variable was evaluation of OMT during periods with (2020: investigational group) or without (2018 or 2019: control group) social distancing policies in place. The primary outcome variables were the mechanism and severity of injury, defined as IPV, DV or neither, the abbreviated injury scale (AIS) and the injury severity score (ISS). Descriptive, univariate and bivariate analyses were performed with statistical significance at \( P < .05 \).

Results: Eight hundred twenty-eight subjects; 737 (89%) IPV and 91 (11%) IPV due to DV. The incidence of OMT secondary to IPV or DV was unchanged \(( P = .81, P = .57 \) respectively). There was a nonsignificant increase in ISS for IPV \(( P = .07)\) and no change for DV \(( P = .46)\). AIS scores were unchanged for IPV \(( P = .36)\). For DV, AIS scores were lower in 2020 when compared to 2019 \(( P = .04)\) but unchanged from 2018 \(( P = .58)\).

At least half of the DV victims were male \((50\% \text{ in } 2018, 59\% \text{ in } 2019, \text{ and } 53\% \text{ in } 2020)\). Of these, 65\% were under 18, and represented the pediatric majority \((62\%)\). A nonsignificant increase in non-white subjects presenting with DV in 2020 \(( P = .15)\) was seen.

Conclusions: The COVID-19 pandemic did not change the number or severity of OMT cases secondary to IPV or DV in this region of Washington. Pediatric males were more likely to be victims of DV.

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J Oral Maxillofac Surg 79:2319.e1–2319.e8, 2021

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Funding: This project was supported in part by the University of Washington Dr Douglass L. Morell Dentistry Research Fund.

Conflict of Interest Disclosures: Dr Dillon is the recipient of an Oral and Maxillofacial Surgery Foundation Grant and an Osteo-science Foundation Grant. There are no conflicts of interest for this study.

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Received May 24, 2021
Accepted July 19, 2021.

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0278-2391
https://doi.org/10.1016/j.joms.2021.07.020

2319.e1
Communities around the world have experienced an unprecedented crisis in the COVID-19 pandemic. In the United States, policies have been enacted to mitigate the transmission of the disease, but these policies have varied by jurisdiction (eg, city, county, state). In Washington State, for example, during the early stages of the pandemic social distancing policies such as a stay-at-home order (3/23/2020) were enacted. Since then, these policies have gone through numerous iterations; having been adjusted based on disease spread and the availability of healthcare resources. While these measures have been effective in slowing the spread of COVID-19, there is evidence of adverse psychological impact. Individuals under social distancing policies have been found to experience higher levels of stress, confusion and anger.

In the setting of widespread mandatory lockdown during the COVID-19 pandemic, domestic violence (DV) has increased significantly. DV is a broad term that includes partner violence, child and elder abuse. An increase in household stress can increase the likelihood of DV. Social distancing policies can also disrupt the social and protective networks of DV victims, making them more susceptible victims. Furthermore, the American Psychological Association has reported other factors that have led to increased stress not directly related to the COVID-19 pandemic such as social movements and political uncertainty and unrest.

Among victims of DV, trauma to the oral and maxillofacial region is 1 of the most common injury patterns. Up to 50% of victims who present for evaluation of injuries secondary to DV have trauma to the oral and maxillofacial region. Given the reported increase in DV during the COVID-19 pandemic and the propensity for oral and maxillofacial trauma (OMT) in these victims, the investigators sought to investigate this subject focusing on their geographical region. The purpose of this study was to understand the impact of social distancing policies on the incidence of OMT secondary to DV and interpersonal violence (IPV). The authors hypothesized that the frequency and severity of OMT secondary to DV or IPV would increase as a result of social distancing policies. The specific aims were to 1) measure and compare the incidence of OMT secondary to DV and IPV during a period with social distancing policies in place versus without, and 2) estimate and compare the severity of OMT during periods with or without social distancing policies in place.

**Methods**

**STUDY DESIGN AND SAMPLE**

To answer the research question, the authors designed a retrospective cohort study. The study sample was composed of subjects who presented to Harborview Medical Center (HMC), an urban Level 1 trauma center in Seattle, WA, for the evaluation and management of OMT and were enrolled in the Institutional Trauma Registry. This study was approved by the University of Washington Institutional Review Board (UW IRB: STUDY00011831).

Inclusion criteria were: 1) subjects who presented between January 1 and December 31 in the years 2018, 2019, or 2020 with OMT and 2) subjects who presented with OMT coded as S00 through S09 as defined by the International Classification of Disease, 10th Edition (ICD-10) (Table 1) during this time period. Exclusion criteria were: cause of OMT not documented or inadequate/unclear documentation otherwise.

Among those who met the inclusion criteria for the study, those who were victims of DV or IPV were then identified:

**IPV Group:** Subjects who presented with OMT secondary to assault were categorized into the IPV group. OMT was identified by the presence of ICD-10 codes S00 through S09 and was identified by the presence of ICD-10 codes X92 through X99 or Y00 through Y09 (Table 1). Subjects meeting both criteria (1. oral and maxillofacial trauma, 2. assault as the mechanism) were therefore categorized in the IPV group.

**DV Group:** Subjects who presented with OMT secondary to DV were categorized into the DV group. DV subjects were identified from within the IPV group if, in addition, they were also coded as Y07.0 through Y07.5 (Table 1), or by identifying evidence of DV in the injury details provided by the trauma registry or clinical documentation.

The incidence of OMT secondary to DV and IPV was compared to the incidence secondary to other mechanisms for each year.

**STUDY VARIABLES**

**Predictor Variables**

The primary predictor variable was the date of evaluation of OMT. The control group included those who presented between January 1 and December 31 in the years 2018 and 2019. The investigational group included those who presented between January 1, 2020 and December 31, 2020. The entirety of the year 2020 was selected as the investigational group because the senior author and literature noted social behavioral changes earlier on in the year as uncertainties around the disease intensified. Social distancing policies officially began March 23, 2020 in Washington State.
To address the first aim, the primary outcome variable was the mechanism of injury. The mechanism of injury was defined in our study as IPV, DV, or neither. IPV and DV are defined above. “Neither” includes those subjects who sustained OMT injuries not secondary to DV or IPV.

To address the second aim, the primary outcome variables were the severity of trauma quantified through the abbreviated injury scale (AIS) and the injury severity score (ISS). The AIS and ISS are internationally validated trauma scores and they have been used to outline epidemiology of craniofacial trauma as explained in prior literature.18-20 The AIS and ISS values were taken directly from the trauma registry.

OTHER STUDY VARIABLES

Demographic variables included age at injury (pediatric was defined as younger than 18 years of age), sex, and race/ethnicity. Race was categorized in the trauma registry as Black or African American, Asian, White, Native American, Native Hawaiian/Pacific Islander, Other or Not Documented. Ethnicity was reported as Hispanic, Non-Hispanic, or Not Documented.

Other variables included hospital admission status (outpatient, inpatient, intensive care unit), intensive care unit (ICU) length of stay (defined as # of days), total length of hospitalization (defined as # of days), alcohol level (positive, negative, or not tested), toxicology screen (positive for substance, negative, or not tested), reimbursement/payment source (Medicaid, Medicare, charity, commercial, healthcare service corporation (HCSC)), referral to Seattle Children’s Safe Child and Adolescent Network (SCAN) (yes, no, not recorded), abuse reported (yes or no), and abuse investigated (yes or no). SCAN is a program through Seattle Children’s Hospital to assure children who are suspected of having been abused receive care and protection.21

DATA COLLECTION AND ANALYSIS

Data was retrieved directly from HMC’s Institutional Trauma Registry. Any other or missing variables were abstracted from the subject’s medical record. All data was de-identified and kept in a secure spreadsheet accessible only by members of the research team. Classification and organization of data was accomplished independently by 2 members of the research team (A.M., S.G.). At the conclusion of data organization each member re-reviewed patient charts for classification and inclusion accuracy. If discrepancies were noted between data collectors, then they were resolved by the senior author for final decision. Descriptive statistics (mean, frequency, range, standard deviations) were computed for each study variable. Univariate and bivariate analyses were computed to measure the association between the variables of interest. Statistical significance was set at $P \leq .05$.

| Table 1. DETAILS OF INTERNATIONAL CLASSIFICATION OF DISEASES (ICD) 10 CODES |
|-----------------------------------------------|
| Diagnosis Codes | Description |
| S00 | Superficial injury of head |
| S01 | Open wound of head |
| S02 | Fracture of skull and facial bones |
| S03 | Dislocation and sprain of joints and ligaments of head |
| S04 | Injury of cranial nerve |
| S05 | Injury of eye and orbit |
| S06 | Intracranial injury |
| S07 | Crushing injury of head |
| S08 | Avulsion and traumatic amputation of part of head |
| S09 | Other and unspecified injuries of head |
| X92 | Assault by drowning and submersion |
| X93 | Assault by handgun discharge |
| X94 | Assault by rifle, shotgun and larger firearm discharge |
| X95 | Assault by other and unspecified firearm and gun discharge |
| X96 | Assault by explosive material |
| X97 | Assault by smoke, fire, and flames |
| X98 | Assault by steam, hot vapors and hot objects |
| X99 | Assault by sharp object |
| Y00 | Assault by blunt object |
| Y01 | Assault by pushing from high place |
| Y02 | Assault by pushing or placing victim in front of moving object |
| Y03 | Assault by crashing of motor vehicle |
| Y04 | Assault by bodily force |
| Y07 | Perpetrator of assault, maltreatment and neglect |
| Y07.0 | Spouse or partner, perpetrator of maltreatment and neglect |
| Y07.1 | Parent (adoptive) (Biological perpetrator of maltreatment and neglect |
| Y07.4 | Other family member, perpetrator of maltreatment and neglect |
| Y07.5 | Non-family member, perpetrator of maltreatment and neglect |
| Y08 | Assault by other specified means |
| Y09 | Assault by unspecified means |

Injuries to the head.

Interpersonal violence (assault).
Domestic violence.

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Primary Outcome Variables

To address the first aim, the primary outcome variable was the mechanism of injury. The mechanism of injury was defined in our study as IPV, DV, or neither. IPV and DV are defined above. “Neither” includes those subjects who sustained OMT injuries not secondary to DV or IPV.
OVERVIEW

Eight thousand two hundred sixty-three subjects presented to HMC for the evaluation and management of OMT from January 1 to December 31 in the years 2018 through 2020. From this group, 828 subjects met the inclusion criteria with assault representing 10% of all OMT. Of these 828, 737 (89%) presented with IPV alone, and 91 (11%) presented with IPV secondary to DV.

STUDY DEMOGRAPHICS

Table 2 describes the subjects' demographics. Most victims of IPV were male (84% in 2018, 86% in 2019, and 90% in 2020) while individuals subject to DV had a more even male to female ratio. At least half the victims of DV were male (50% in 2018, 59% in 2019, and 53% in 2020). Of these male DV victims, 65% were under 18, and represented the pediatric majority (62%). Most victims of IPV were between the age of 18 and 65 (89% in 2018, 90% in 2019, and 89% in 2020) while those of DV were predominantly <18 years of age (46% in 2018, 62% in 2019, and 62% in 2020).

The majority of IPV (57%) and DV (70%) victims were white. While not significant, there was a decrease in the percentage of white victims of DV in 2020 (82%, 72%, and 59% in 2018, 2019, and 2020, respectively) and an increase in non-white victims of DV in 2020 (P = .15). Most subjects had Medicaid (IPV = 57% and DV = 70%).

Of the IPV victims 35.6% (n = 195/548) and 12.8% of DV victims (n = 5/39) recorded a positive blood alcohol level, among those tested, and there was no significant difference between the investigational and control groups for either (P = .86 and P = .82, respectively).

Of the IPV victims 68.9% (n = 235/341) and 31.6% of DV victims (n = 6/19) recorded a positive toxicology screening, among those tested, and there was no significant difference between the investigational and control groups for either (P = .25 and P = .98, respectively).

TRAUMA CHARACTERISTICS

Table 3 describes the subjects' trauma characteristics. Most victims of IPV (67%) and DV (82%) presented with blunt trauma. Most victims of IPV (66%) and DV (79%) were admitted to the hospital. Interestingly, a higher percentage of subjects in the 2020 cohort (88%) in the DV group were admitted to the hospital.
**Table 3. TRAUMA CHARACTERISTICS**

| Characteristic | 2018 Cohort, n (%) | 2019 Cohort, n (%) | 2020 Cohort, n (%) |
|----------------|--------------------|--------------------|--------------------|
| **Trauma type** |                    |                    |                    |
| Blunt          | 178 (71)           | 22 (79)            | 2,379 (92)         |
| Penetrating    | 69 (28)            | 4 (14)             | 124 (5)            |
| Other          | 2 (1)              | 2 (7)              | 70 (3)             |
| **Admission status** |                |                    |                    |
| Admitted       | 169 (68)           | 19 (68)            | 2,103 (82)         |
| ICU            | 91 (37)            | 16 (56)            | 1,326 (52)         |
| Outpatient     | 80 (32)            | 9 (32)             | 470 (18)           |
| **Length of hospitalization** |               |                    |                    |
| Total LOS      | mean = 7.53 ± 2.47 | Mean = 6.16 ± 1.57 | Mean = 9.49 ± 1.18 |
| ICU LOS        | Mean = 3.20 ± 5.44 | Mean = 4.13 ± 6.67 | Mean = 4.98 ± 9.65 |
| Alcohol level  | Negative           | 112 (45)           | 9 (32)             |
|               | Positive           | 69 (28)            | 2 (7)              |
|               | N/A                | 68 (27)            | 17 (61)            |
| Toxicology screen | Negative           | 37 (15)            | 1 (4)              |
|               | Positive           | 72 (29)            | 2 (7)              |
|               | N/A                | 140 (56)           | 25 (89)            |
| **Payment source** | Charity            | 2 (1)              | 1 (4)              |
|               | Commercial insurance | 0 (0)             | 1 (4)              |
|               | Healthcare service | 31 (12)            | 4 (14)             |
|               | Corporation        |                    |                    |
|               | Labor and industries | 12 (5)            | 0 (0)              |
|               | Medicaid           | 148 (59)           | 18 (64)            |
|               | Medicare           | 54 (14)            | 5 (11)             |
|               | Other (other, other government) | 10 (4) | 0 (0) |
|               | Self-pay           | 8 (3)              | 1 (4)              |
|               | Unknown            | 4 (2)              | 0 (0)              |
| **Referral to Seattle Children's Network** |                |                    |                    |
| Yes            | 0 (0)              | 9 (32)             | 1 (43)             |
| No             | 10 (4)             | 14 (50)            | 12 (48)            |
| N/A            | 239 (96)           | 15 (54)            | 2,328 (91)         |
| **Abuse reported** |                |                    |                    |
| Yes            | 0 (0)              | 14 (50)            | 16 (55)            |
| No             | 249 (100)          | 14 (50)            | 2,575 (100)        |
| **Abuse investigated** |              |                    |                    |
| Yes            | 0 (0)              | 13 (46)            | 16 (55)            |
| No             | 249 (100)          | 15 (54)            | 2,575 (100)        |

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hospital compared to 2018 (68%) and 2019 (79%), although this was not statistically significant \((P = .14)\). The average total length of stay and intensive care unit (ICU) length of stay did not change for either the IPV or DV groups.

There was no significant difference in the amount of abuse reported in the DV group (50% in 2018, 55% in 2019, 62% in 2020, \(P = .64\)) or referral to Seattle Children’s Adolescent Network (32% in 2018, 55% in 2019, 41% in 2020, \(P = .21\)). Abuse investigated likewise did not change significantly in the DV group between the investigational years (46% in 2018, 55% in 2019, 59% in 2020, \(P = .61\)).

**Aim 1 Results**

Table 4 describes the incidence of OMT secondary to DV and IPV. The number of subjects presenting with OMT secondary to IPV in the 2020 cohort \((n = 246)\) was unchanged compared to the number in the 2018 and 2019 cohorts \((n = 249 \text{ and } 242 \text{ respectively, } P = .81)\). The number of subjects presenting with OMT secondary to DV in the 2020 cohort \((n = 34)\) was unchanged compared to the number in the 2018 and 2019 cohorts \((n = 28 \text{ and } 29 \text{ respectively, } P = .57)\).

**Aim 2 Results**

Table 5 describes the mean AIS of OMT secondary to DV and IPV. A difference in severity of OMT in the DV group was shown between the groups: mean AIS \(=1.6 \pm 1.5, 2.6 \pm 1.5, \text{ and } 1.8 \pm 1.7 \text{ in } 2018, 2019, \text{ and } 2020, \text{ respectively } (P = .04)\). Those who presented in 2020 with DV had a significant decrease in severity of OMT compared to the 2019 \((P = .04)\) and no difference with 2018 \((P = .58)\). There was no significant difference in mean AIS score comparing the 2018, 2019 and 2020 cohorts in the IPV group \((P = .36)\).

Table 6 describes the mean ISS of OMT secondary to DV and IPV. No difference presented in the overall

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**Table 4. INCIDENCE OF ORAL AND MAXILLOFACIAL TRAUMA**

| Mechanism           | 2018 Cohort: n (%) | 2019 Cohort: n (%) | 2020 Cohort: n (%) | \(P\) Value |
|---------------------|--------------------|--------------------|--------------------|-------------|
| Domestic violence   | 28 (1.0)           | 29 (1.1)           | 34 (1.3)           | .57         |
| Interpersonal violence | 249 (8.7)      | 242 (8.8)           | 246 (9.2)           | .81         |
| Neither             | 2,573 (90.3)       | 2,470 (90.1)       | 2,392 (89.5)       | .62         |
| Total               | 2,850              | 2,741              | 2,672              |             |

**Table 5. ABBREVIATED INJURY SCALE (AIS) OF ORAL AND MAXILLOFACIAL TRAUMA**

| Mechanism           | 2018 Cohort | 2019 Cohort | 2020 Cohort | \(P\) Value |
|---------------------|-------------|-------------|-------------|-------------|
| Domestic violence   | 1.64 (1.49) | 2.62 (1.49) | 1.76 (1.72) | .04         |
| Interpersonal violence | 1.92 (1.46) | 1.92 (1.52) | 2.09 (1.52) | .36         |
| Neither             | 2.03 (1.65) | 2.02 (1.61) | 2.07 (1.63) | .80         |

**Table 6. INJURY SEVERITY SCALE (ISS) OF ORAL AND MAXILLOFACIAL TRAUMA**

| Mechanism           | 2018 Cohort | 2019 Cohort | 2020 Cohort | \(P\) Value |
|---------------------|-------------|-------------|-------------|-------------|
| Domestic violence   | 9.67 (6.91) | 12.64 (7.96) | 11.15 (10.87) | .46         |
| Interpersonal violence | 10.66 (8.31) | 11.77 (10.19) | 12.69 (10.62) | .07         |
| Neither             | 16.04 (12.53) | 15.95 (12.07) | 16.15 (12.79) | .83         |
ISS between the cohorts in the DV group \( (P = .46) \). The mean ISS in the IPV group was shown to be increased in the 2020 cohort compared to the 2018 and 2019 cohorts, but not significantly (10.66 in 2018, 11.77 in 2019, and 12.69 in 2020 \( P = .07 \)).

**Discussion**

The purpose of this study was to understand the impact of social distancing policies on the incidence of OMT secondary to IPV and DV. The authors hypothesized that the frequency and severity of OMT secondary to IPV and DV would increase as a result of social distancing policies.

Contrary to our hypothesis, our study found that OMT from IPV during the COVID-19 pandemic did not change \( (P = .81) \) and that while there was a small increase in DV, it was not significant \( (P = .57) \). This was unexpected, as prior literature indicates a dramatic increase in the susceptibility of IPV and DV victims during COVID-19 and other disasters or emergencies.\(^6,7,22-25\) Several factors may explain this finding. Our sample was limited to an urban level 1 trauma center, which treats the most severe trauma cases and as such may not be indicative of the general population of IPV and DV victims. These victims may present at lower level trauma centers, to other health care providers, or chose not to seek medical care.\(^26,27\) Additionally, DV is well known to be underreported by victims and is often underdiagnosed by providers.\(^8,28\)

Irrespective of the year, the percentage of males with OMT secondary to DV was higher than expected (50% in 2018, 59% in 2019, and 53% in 2020). This was surprising, as the literature on DV in adult populations describes victims as predominantly female.\(^8,13-15\) However, our study included pediatric patients (younger than 18 years of age). Of the males presenting, the majority (65%) were pediatric and represented the pediatric gender majority (62%). Literature examining DV in pediatric victims suggest pediatric males are more likely to present for DV, coinciding with our observation.\(^12\) The higher percentage of pediatric males presenting with OMT secondary to DV suggests this group to be particularly vulnerable.

There was no change in abuse reported among DV patients \( (P = .64) \) or in abuse investigated by authorities \( (P = .61) \). This correlates with the non-significant increase in DV in our study. The proportion of subjects referred to SCAN increased slightly but not significantly \( (P = .21) \). Given the high rate of pediatric victims in all years (57%) presenting with OMT as a result of DV, communities should continue to provide resources to both recognize and protect pediatric victims of DV.

IPV subjects were predominantly male (87%), as expected.\(^29\) While the majority of DV patients were white (70%), there was a non-significant increase in the proportion of non-white patients during social distancing; (18, 28, and 41% in 2018, 2019, and 2020, respectively \( P = .15 \)). This increase in presentation of non-white subjects may reflect socioeconomic variations in the impact of the pandemic, as minorities were disproportionately out of work for longer periods of time.\(^30\) Furthermore, this demographic may also suffer from more crowded living conditions, contributing to stress and risk of infection.\(^31\) This change was not seen in IPV patients where the proportion of white subjects went unchanged (57, 60, and 55% in 2018, 2019, and 2020, respectively \( P = .64 \)). The difference in proportion of white subjects presenting for either IPV or DV could potentially be explained by the small sample size, or a higher likelihood of white DV victims to seek care at a level 1 trauma center versus other ethnic groups. When 2018, 2019, and 2020 counts of white DV victims are averaged (mean = 70%), it closely represents the proportion of white individuals living in Seattle as of July 1, 2019 (67.5%).\(^12\)

The severity of injury of OMT during the COVID-19 pandemic did not change and trended toward a decrease for DV. The mean AIS score was found to be significant \( (P = .04) \) when comparing all years together and when comparing the 2020 and 2019 cohorts alone \( (P = .04) \); mean AIS =1.6 ± 1.5, 2.6 ± 1.5, 1.8 ± 1.7 in 2018, 2019, 2020, respectively. However, there was no difference comparing 2020 and 2018 cohorts alone \( (P = .58) \). The overall injury severity (ISS) was unchanged in the DV group \( (P = .46) \). While there was no change in the severity of injury, a higher proportion of DV patients were admitted during the period with COVID-19 social distancing policies in place, although this was non-significant \( (P = .14) \). There was no significant difference in mean AIS score among the IPV cohorts \( (P = .36) \), while there was a noticeable, but non-significant increase in ISS \( (P = .07) \). This finding may be related to social distancing policies and the public turmoil/riots (from the ‘Black Lives Matter’ movement) during the year of 2020, leading to more severe injuries for those involved in IPV.

There are some limitations to the study. The trauma registry will only capture patients who are admitted or transferred from another facility. It is unclear if there were patients who met our criteria for OMT and DV but were not entered into the trauma registry. Additionally, as with any level I trauma center, transfer to a higher acuity center may not have occurred in this patient population so we would not be capturing all the data for our region. Subsequent studies, with the inclusion of lower level-of-care facilities, are
warranted to avoid potential sampling bias in the current study.

The entirety of the year 2020 was selected as the investigational group as the senior author and subsequent literature noted social behavioral changes earlier on in the year as uncertainties around the disease intensified. However, to ensure accuracy, this data was closely studied; there was no difference in the presentation of OMT secondary to DV or IPV between January, February or March of 2020 compared to the rest of 2020 (P = .79, P = .19 respectively).

In conclusion, the COVID-19 pandemic did not change the number or severity of OMT cases secondary to IPV or DV in this region of Washington. Pediatric males were more likely to be victims of DV. Further collaborative studies are recommended.

At the time of writing, there had been 427,494 COVID-19 cases and 5,702 deaths secondary to COVID-19 in Washington State, 33.1 million cases and 589,891 deaths in the United States, and 167 million cases and 3.4 million deaths worldwide.33,34

Acknowledgments

The authors would like to thank Shauna L. Carson, Program Support Supervisor, Harborview Medical Center – Trauma Program, for helping us obtain the data from Institutional Trauma Registry

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