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Covid-19 pandemic: the impact of Italian lockdown on maxillofacial trauma incidence in southern Tuscany

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The outbreak of the Covid-19 pandemic has seriously affected our society. Governments have difficult situations by adopting strict and severe mitigation measures in order to contain the pandemic spreading. These decisions influenced significatively people's behavior changing their habits and routines. This study offers a statistical analysis of the incidence of the Maxillo-Facial traumas in Tuscany southern area, during the pandemic lockdown. The statistical analyzed has been obtained comparing the maxillo-facial trauma occurrence during the Italian lockdown between the 9th of March and the 18th of May 2020 in comparison with same period of the five previous years.

KEY WORDS: Covid-19, Italian covid-19, Maxillofacial surgery, Maxillofacial trauma, Pandemic, Surgery management, Trauma incidence in Italy

Introduction

Novel disease caused by the highly infected virus named SARS-CoV-2, initially 2019-CoV, has been spreading worldwide since January-February 2020. Therefore, it was pathologically characterized by sever acute respiratory syndrome and was initially identified in Wuhan China in December 2019 [1] linked to a wholesale seafood market in Huanan [2] and led to a global pandemic that has not been seen for more than a century. The new coronavirus has been isolated in the early January 2020 [3], and the genome sequencing of the virus has been officially recognized by World Health Organization (WHO) in January 12th, 2020. Consequently, the new infection has been detected in many different countries [4] and due to its rapid increase has been classified by the WHO as a pandemic in March 11th, 2020.

COVID-19 has been labelled by the WHO as an emerging respiratory disease. Currently, clinical observations show that SARS-CoV2 infection can range from a non-symptomatic condition to a respiratory illness. Common symptoms were anosmia, fever, cough and myalgia or fatigue. Less common symptoms are sputum production, headache, hemoptysis and diarrhea, as well as lung oedema. Unfortunately, complications included acute respiratory distress syndrome, acute cardiac injury and secondary bacterial infections [5,6], developing into an atypical upper respiratory tract pneumonia[1]. However, even if the medical community is working restlessly to find a proper treatment and vaccine, at the moment none has been found.

Furthermore, an abnormal and uncontrolled cytokines production in critical ill Covid-19 patients [7] and the inflammatory storm is centrally involved in the exacerbation of the symptomatology and it contributes to COVID-19 mortality [8].

Chinese health authorities have employed rapid measures including intensive surveillance, epidemiological investigation and lockdown [9].

In Europe, Italy was the first country which had to deal with COVID-19 disease and considering the severity and spreading all over the country, it has been a threat for the public health system[10]. Moreover, the lethality of COVID-19 has been confirmed higher in Italy than China and worldwide (9% vs 4.3%) [10].

As the virus spread in Italy, similar measures were taken by the Italian government in order to contain the virus. Those measures followed a series of restrictions starting on Feb 23rd 2020, with the lockdown of the geographical area Codogno [11] in the North of Italy. During the following 24 h many other patients tested positive [12] and consequently any type of travel was forbidden with the exception of working if allowed, or for necessary situations.

After March 9th the lockdown measurements were extended to the whole country [11].

Despite the imposition of the restricting measures, the number of infected people and death rates kept growing, as represented in the figure 1 [12]. After several months the number of new cases is still, slowly, increasing with a total number of cases over 280,000 nationwide.

Among the restrictions, hospitals following the national guidelines decided to increase the intensive care ward with a specific section for treating Covid-19 positive patients.

Therefore, in order to face outspread of Covid-19 pandemic, hospitals have decided to reduce all non-essential treatments. Elective surgeries were cancelled, semi-elective postponed, and many wards were converted into ICUs (intense cure unit).

The complicated scenario has changed traumatological activities in the maxillofacial department and new allocation has been necessary to give the best treatment to the patients [14–17]. Patients in critical conditions were treated in specific operation rooms (OR) and the healthcare operators were provided with PPE (personal protective equipment). Oropharyngeal swaps were required to all patients, and in the eventuality of performing surgery before receiving results from the laboratory, the healthcare workers had to wait inside the OR until the definitive outcomes were ready [18].

At the time of writing (Sept 2020), the current estimate of global disease burden is over 27 million infections and over 898,000 deaths worldwide (Johns Hopkins University - https://coronavirus.jhu.edu/map.html).

Regarding Tuscany which has a population of 3.72 million dividend by the health system into 3 macro-areas: Centre, North-West and South-Est.

The total number of Hospital beds in the region is 12,958 including public and private institutions, with 4 major Public Hospitals (A.O) and 46 public minor health institutions (Az. Usl).

The University Hospital of Siena is one of the 4 A.O with 794 beds and the most important health center of the South-Est Area which includes the province of Siena, Arezzo, and Grosseto with a total number of inhabitants of 828,789. Regarding the South-Est Area the University Hospital of Siena is the only one that has a department of maxillo-facial surgery.

Therefore, the current estimate of the Covid-19 infection in Tuscany is of 12558 with 9334 patients fully recovered and 1145 deceased. Regarding to the South-Est Area the total number of cases was 1956 as reported by the Minister of Health (Fig. 3).

The aim of the present work is to produce a statistical analysis comparing the main differences in the traumatological activities of the Maxillo-Facial Surgery department of the University Hospital "Santa Maria alle Scotte" of Siena, Italy during the lockdown of March 2020 -May 2020 Vs. March 2019 -May 2019 before the COVID-19 epidemic.

Materials and methods

A statistical analysis was performed comparing the trauma treated by the maxillofacial department of the University Hospital of Siena.

Criteria of inclusions: The maxillo-facial trauma which received surgical treatment between the years 2016-2019 and 2020. The analysis performed, compared the trauma incidences between 2016-2019 with the 2020 ones. In order to investigate the cumulative dynamic growth over weeks, we fitted a generalized linear model in R version 4.0.1 (R Core Development Team 2020) using the function glm().
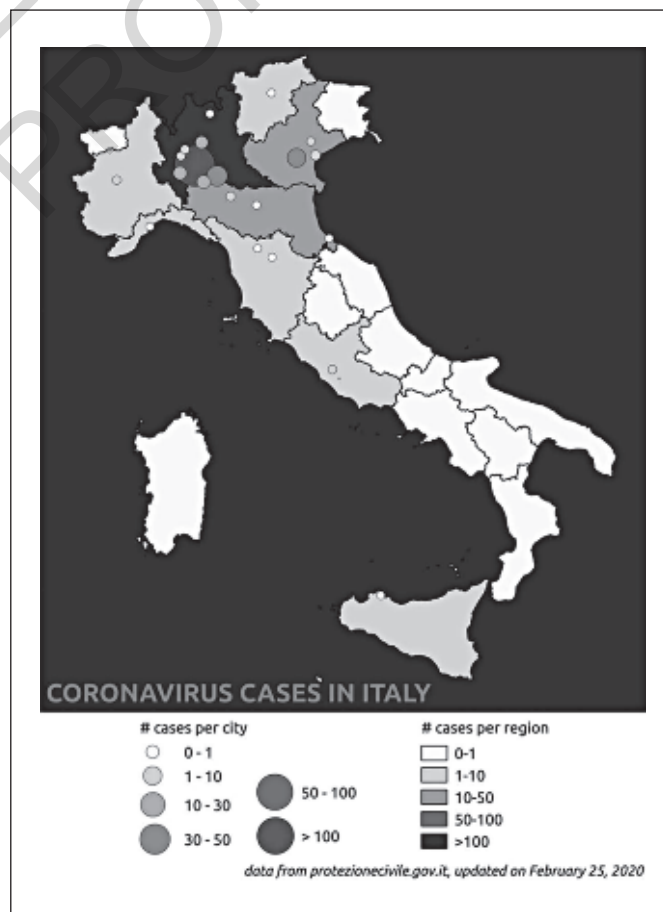

Fig. 1: Representing the more affected areas in Italy, described by Porcheddu et al. 13.

	Estimate	Std. Error	P-Value	
Intercept	0.7544	0.1569	1.53e-06	***
2016 (ref:2020)	0.4904	0.1429	0.000598	***
2017(ref:2020)	0.2155	0.1512	0.154051	
2018(ref:2020)	0.3755	0.1461	0.010184	*
2019(ref:2020)	0.5505	0.1413	9.74e-05	***
Week	0.1530	0.0133	< 2e-16	***

Proportion of deviance explained: 0.88; Prob > chi2= 0.00002

The cumulative count by week of craniofacial trauma follows the Poisson distribution thus we performed the Poisson regression model for a count Y where Y ~ Pois (μ) where written as:

$$\log(\mu_i) = \beta_0 + \beta_1 X_1 + \beta_2 X_2$$

β_0 = is the intercept;
β_1; β_2 = coefficients of predictors respectively for the variable **years** (X_1) and **weeks** (X_2)

Result

Regression model was performed over the number of cases as the dependent variable and respectively weeks and years as predictors.
Overall, the estimated model provides good level of statistical significance.
For years 2016, 2018, 2019, we obtained a high significance level (p-value < 0.01) compared to the reference years 2020, except for the year 2017, which exhibits a higher p-value level (p-value > 0.1). All coefficients are positive, meaning an excess of craniofacial traumas for each year compared to the same period in 2020. Specifically, for a better interpretability using exponential transformation of regression coefficients we observe an increase of 63%; 24%; 45% and 73%; respectively in 2016; 2017; 2018; and 2019 compared to the refe-

TABLE I - *Total number of traumas occurred during weeks for the years considered.*

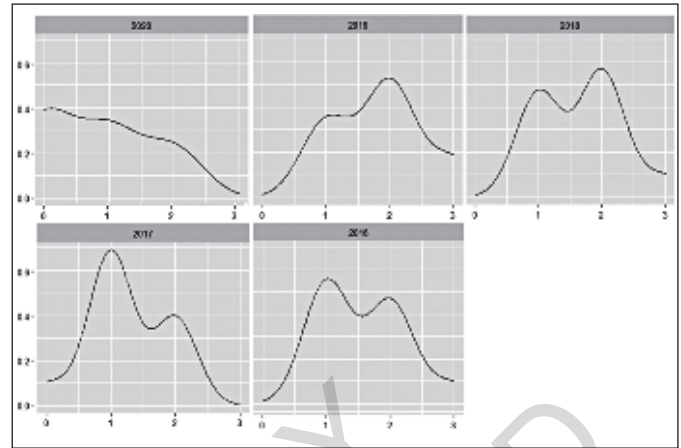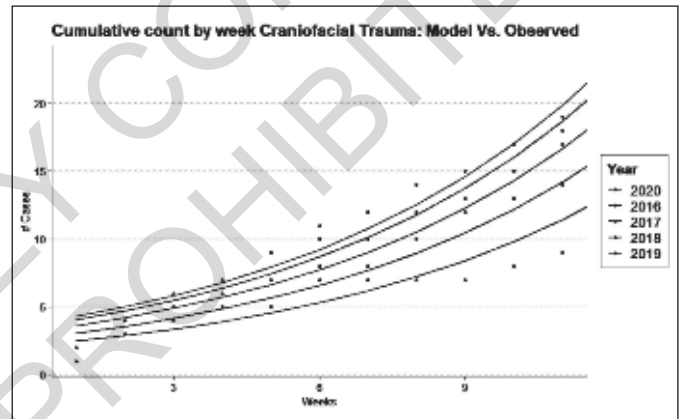| weeks/year	2020	2019	2018	2017	2016
1	2	1	2	2	1
2	1	3	1	1	2
3	2	2	1	1	2
4	2	1	2	1	1
5	0	2	1	0	3
6	0	2	1	2	1
7	0	1	2	1	2
8	0	2	2	2	2
9	0	1	1	2	1
10	1	2	2	1	2
11	1	2	2	1	1
12	1	3	3	1	1
Totale	10	22	18	18	18

Fig. 2: Density estimation

Fig. 3: craniofacial report comparing the number of cases Vs. the time observed.

rence year (2020), supporting the growth function estimated in the plot below. However, even if the total number of traumas treated seem to be lower comparing with the other years considered, we can appreciate a constant trend. Following which, appears clear that for the time considered there is a lower number of cases during for example the 6th and 7th week of the 2020 in relation to the other weeks considered. Therefore, the tendency is also detectable during the years 2019-2016, which suggests that there is a predictable reduction of traumas during specific weeks of the year, as we can appreciate in Table I and Fig. 2.
The total number of traumas occurred during the timeframe considered has been analyzed and divided week by week, in order to better represent the incidence oscillation and predictability, as described by the Table I.

Discussion

The COVID-19 pandemic has been the worst health emergency of modern times and has significantly chan-

ged our life, limiting the daily social interactions, work and sport activities worldwide. Considering the pandemic incidence in our region and in particular the South-Est Area, with a total number of cases of 1956 over a population of 828798 as reported by ISTAT (National Institute of Statistics), the containment was possible only to the actualization of the strict measures decided by the Govern.

These limitations were necessary and in many areas are still mandatory, in order to avoid a wider spread of COVID-19 and to contrast its morbidity [14,17].

In Italy, containment has been possible due to the great job and sacrifice of many health care professionals and citizens who respect day-by-day the government rules and regulations.

The lockdown measures included: movement restrictions within the region, and limitations on an everyday basis. These limitations leaded to the impossibility to leave your home except for emergency and grocery shopping (only one member for family was authorized to do so). The measures decided by the Govern and applied in every region and area last between March 9th and May 3rd, which represent the so called "phase 1", were necessary to slow down the pandemic outbreak and contain the infection. Subsequently, in order to avoid further diffusion of the Covid-19, the Govern opted for a different application of the same rules and regulations, allowing free transit between regions and deciding to open all the commercial and non-essential shops. Maintaining, however, social distancing and mandatory face mask wearing inside of every shop or building.

The direct consequences of these regulations were the irremediably changing of our lifestyle, and interaction with each other, even if the effects on mental health are far to be determined [19]. If we consider the previous outbreak, like MERS, we noticed that post-traumatic stress disorder and other psychiatric symptoms were related to self-isolation [20,21].

From the present study we can appreciate a clear reduction of the number of cases during the 2020 comparing it with the number of cases during the other years taken into consideration. This reduction is due to the limitation introduced and to the impossibility in spending a sensitive quantity of time outdoors [22]. Moreover, the statistical analysis shows a significant difference in the number of cases with a p-value <0.01 for the years 2016, 2017 and 2019 comparing to the 2020.

Nevertheless, the study highlighted a statical trend in every year analyzed, despite the difference in the trauma's incidence.

Even if the number of total cases in 2020 expresses a decrement in comparison to the other years, the trend seems constant. This tendency, in particular for the 6th and 7th weeks, almost overlap with the other years' cases during the same weeks.

The results of our study show a constant pattern highlight the lack of strong correlation between maxillo-facial traumas and outdoor activities which were not allowed during the lockdown. Moreover, the pattern identified in our study could be used to predict the maxilla-facial traumas incidence during the years and this also indicates that even in a restricted reality the trauma incidence constant is still predictable.

Conclusion

The present epidemiological study evidences that the incidence of maxillofacial traumas follows a specific behavior over time even if quantitative variations can be observed for every year, especially for 2020. Interestingly, the statistical trend seems to remain constant over the weeks in every year.

Nevertheless, the data describe a precise decrease regardless to the lockdown related limitations. However, the same behavior can be detected not only for the 2020, but also for the years 2019 to 2016. Consequently, the tendency highlighted can increase the predictability of the weekly average number of maxillofacial traumas in the area.

Riassunto

Lo scoppio della pandemia Covid-19 ha gravemente colpito la nostra società. I governi si trovano in situazioni difficili adottando misure di mitigazione rigorose e severe al fine di contenere la diffusione della pandemia. Queste decisioni hanno influenzato in modo significativo il comportamento delle persone cambiando le loro abitudini e routine. Questo studio offre un'analisi statistica dell'incidenza dei traumi maxillo-facciali nell'area meridionale della Toscana, durante il blocco della pandemia. La statistica analizzata è stata ottenuta confrontando il verificarsi del trauma maxillo-facciale durante il lockdown italiano tra il 9 marzo e il 18 maggio 2020 rispetto allo stesso periodo dei cinque anni precedenti.

References

1. Li Q, Guan X, Wu P, et al.: *Early transmission dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia*. N Engl J Med, 2020; 382:1199-1207.

2. Chen Y, Liu Q, Guo D: *Emerging coronaviruses: Genome structure, replication, and pathogenesis*. J Med Virol, 2020; 92:418-23.

3. Lu H, Stratton CW, Tang Y-W: *Outbreak of pneumonia of unknown etiology in Wuhan, China: The mystery and the miracle*. J Med Virol, 2020; 92:401-02.

4. Corman VM, Landt O, Kaiser M, et al.: *Detection of 2019 novel coronavirus (2019-nCoV) by real-time RT-PCR*. Euro Surveill 25, Epub ahead of print 2020. DOI: 10.2807/1560-7917.ES.2020.25.3.2000045.

5. Li L, Huang Q, Wang DC, et al.: *Acute lung injury in patients*

with COVID-19 infection. Clin Transl Med, 2020; 10:20-27.

6. Su S, Wong G, Shi W, et al.: *Epidemiology, Genetic Recombination, and Pathogenesis of Coronaviruses*. Trends Microbiol, 2016; 24:490-02.

7. Wu JT, Leung K, Leung GM: *Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: A modelling study*. Lancet, 2020; 395:689-97.

8. Sun X, Wang T, Cai D, et al.: *Cytokine storm intervention in the early stages of COVID-19 pneumonia*. Cytokine & Growth Factor Reviews. 2020; 53:38-42.

9. Chen N, Zhou M, Dong X, et al.: *Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: A descriptive study*. Lancet, 2020; 395:507-13.

10. Indini A, Aschele C, Cavanna L, et al.: *Reorganisation of medical oncology departments during the novel coronavirus disease-19 pandemic: a nationwide Italian survey*. Eur J Cancer, 2020; 132:17–23.

11. Lazzerini M, Putoto G: COVID-*19 in Italy: Momentous decisions and many uncertainties*. Lancet Glob Health, 2020;8:e641–e642.

12. Motta Zanin G, Gentile E, Parisi A, et al.: *A preliminary evaluation of the public risk perception related to the COVID-19 Health Emergency in Italy*. Int J Environ Res Public Health; 17 Epub ahead of print May 2020. DOI: 10.3390/ijerph17093024.

13. Porcheddu R, Serra C, Kelvin D, et al.: *Similarity in Case Fatality Rates (CFR) of COVID-19/SARS-COV-2 in Italy and China*. The Journal of Infection in Developing Countries, 2020; 14:125-28.

14. Placella G, Salvato D, Delmastro E, et al.: *CoViD-19 and ortho and trauma surgery: The Italian experience*. Injury, 2020; 51:1403-405.

15. Bettinelli G, Delmastro E, Salvato D, et al. :*Orthopaedic patient workflow in CoViD-19 pandemic in Italy*. J Orthop, 2020; 22:158-59.

16. Randelli PS, Compagnoni R: *Management of orthopaedic and traumatology patients during the Coronavirus disease (COVID-19) pandemic in northern Italy*. Knee Surg Sports Traumatol Arthrosc, 2020; 1-7.

17. Jain VK, Vaishya R: *COVID-19 and orthopaedic surgeons: The Indian scenario*. Trop Doct, 2020; 50:108-10.

18. Placella G, Salvato D, Delmastro E, et al.: *CoViD-19 and ortho and trauma surgery: The Italian experience*. Injury, 2020; 51:1403-405.

19. Torales J, O'Higgins M, Castaldelli-Maia JM, et al: *The outbreak of COVID-19 coronavirus and its impact on global mental health*. Int J Soc Psychiatry, 2020; 66:317-20.

20. Lee SM, Kang WS, Cho A-R, et al.: *Psychological impact of the 2015 MERS outbreak on hospital workers and quarantined hemodialysis patients*. Compr Psychiatry, 2018; 87:123-27.

21. Srivatsa S, Stewart KA: *How should clinicians integrate mental health into epidemic responses?* AMA J Ethics, 2020; 22:E10-15.

22. Cascino F, Pini N, Giovannoni ME, et al.: *Our experience managing difficult accidental chainsaw trauma*. J Craniofac Surg, 2019; 30:2207-210.