ASPECTS REGARDING THE IMPACT OF THE COVID-19 PANDEMIC ON PRIVATE DENTAL PRACTICES IN BUCHAREST, ROMANIA

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ABSTRACT

The aim of this paper is to analyze the influence that the COVID-19 pandemic had on certain economic aspects related to the activity of private dental practices in Bucharest, Romania, in order to identify relevant factors related to the pandemic's impact on dental health services. Relevant data was collected from the Romanian Finance Ministry website, covering three business years (2019, 2020, 2021). The COVID-19 pandemic had a negative impact on the economic performance of the observed dental practices. This paper highlights different elements that could explain (related to) the negative impact of the COVID-19 pandemic on the activity of private dental practices and indicates certain strategies which could enhance economic resilience of dental practices, should pandemic-like crises reoccur.

Key words: Dentistry; COVID-19; Pandemics; Oral health; Dental health services; Dental economics; Dental professionals; Infection control; SARS-CoV-2 infection

INTRODUCTION

At the end of 2019, the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) appears, a new strain of the Coronaviridae family, leading to the appearance of coronavirus disease 2019 (COVID-19), causing a Pandemic around the globe. On March 11, 2020, it was named by the World Health Organization (WHO) as the second pandemic of the 21st century. The virus was first identified in Wuhan City, Hubei Province, China, on December 12, 2019 [1].

The main form of human-to-human transmission is through respiratory droplets expelled from an infected individual, coughing and sneezing release the virus which is transported by the air to other humans in close proximity, exposing uninfected people at risk of contracting the disease [2]. Due to this type of human-to-human transmission, many dental practices were closed during 2020 in several countries around the globe [3-7].

Both, worldwide and in Romania, the COVID-19 pandemic has brought major challenges to the dental domain [8]. Dental professionals have been affected in many ways by the effects of this pandemic, including at the level of their economic and financial status, but the dentist-patient relationship was also indirectly, but profoundly influenced by diverse factors in this pandemic period [9,10,11]. However, with the outbreak of COVID-19, this relationship has changed significantly. Dental

practices were closed or had limited services as part of government regulations or recommendations aimed at slowing the spread of the virus; as a result, many patients have had to delay their regular check-ups and dental treatments [12,13,14]. Some dental practices have begun to offer virtual consultations to patients, allowing them to remotely communicate with their dental practitioners [12,13,14]. The COVID-19 pandemic added an unfavorable influence, another layer of stress on the both sides of the dentist-patient relationship: the anxiety, the fear of being infected; this additional layer of anxiety may have had an indirect impact on the economic burden on dental practices, but also on the long-term health of patients [15,16].

Moreover, the legal requirements imposed during the pandemic have influenced the way dentist provide medical dental services to the population; even if the enactment of these rules was justified, their consequence consisted in limiting the population's access to medical services (which, by the way, is a constitutional right) [11,12].

Regarding the overall economic impact of COVID-19 pandemic on the dental offices, it's important to note that the regulations regarding protective measures were frequently updated as the pandemic progressed, and that some states had more stringent requirements than others [6,17,18]. Hogan [17] reported that in the United States of America, revenues of the dental offices decreased by 6%, in 2020, according to analyzes based on the average revenues from the dental offices from 2019-2020[17]. Carvalho et al. (2021) [18] showed that the cost for treating a patient in Belgium increased with 10-30 EUR and an additional time spend from 10 to 30 minutes was reported for the treatment of each patient during the pandemic.

In accordance with the international measures against the pandemic, the Romanian authorities also developed guidelines and imposed specific measures to limit the effects of the pandemic. In Romania, on 18 March 2020, according to the 1st Military Ordinance issued by the Romanian government [19], the state of emergency began, and according to the 2nd Military Ordinance from 21 March 2020 [20], the dental practices were officially closed and only a handful of selected dental offices, per region, remained open for emergency purposes. On 18 May 2020, the state of emergency was transformed in a state of alert and the dental practices could resume their work, according to the Government Decision no. 394 [21]. Due to this measure, the Ministry of Health developed and published, in collaboration with the Romanian College of Dentists, a plan that provides a series of measures addressed to dental offices, doctors and auxiliary staff aimed at establishing procedures and preventive measures for this specific period. The decision was adopted by the National Executive Office of the College of Dentists [22, 23]. Lucaciu et al. [23] pointed out that in Romania only 7.7% of dental offices provided dental services during the emergency period and 27.2% of dentists increased their treatment fees; additionally, the authors indicate that for 50% of the assessed dental offices, the number of patients was lower in 2020 as opposed to 2019, and this number increased starting with January 2021 [23]. However, to our knowledge, dental scientific literature provides relatively few scientific studies dedicated to evolution of financial indicators corresponding to private dental practices during COVID-19 pandemic.

Given this context, the main purpose of this paper is to evaluate the influence the COVID-19 pandemic had on certain economic aspects related to the activity of private dental practices in Bucharest, Romania, through an analysis of certain indicators between 2019 – 2021.

MATERIAL AND METHODS

2.1. Data collection

Data was collected from the Romanian Finance Ministry website (Agenţi economici şi instituţii publice - date de identificare, informaţii fiscale, bilanţuri - Acasa - MFP (gov.ro)), which allows any economic agent (company) to be identified from its unique identification number. This website is exclusively available in the

Romanian language, with accessibility afforded to all users. In order to get the unique identification number, we used company aggregation websites, that possess advanced search tools and one can search for dental offices based on the code corresponding to the Classification of Activities in the National Economy (CAEN). The CAEN code for dental practice activities is 8623. We extracted the overview data for all of Romania's 41 counties plus Bucharest for 2021. We included the city of Bucharest in this study; we observed that 25% of all Romanian private dental clinics are registered there. Moreover, in 2021, the revenue of all the private dental practices in Bucharest represented 34% of the revenue of all Romanian dental practices, with a total of 259,8 million euro, as mentioned on the Romanian Ministry of Finance website. We used a specific Romanian aggregation platform (https://www.topfirme.com/), we listed all the companies in Bucharest with CAEN 8623, and extracted the reported financial data from the pre-pandemic year 2019, pandemic year 2020 and year 2021. The indicators which were analyzed in this study are the following: turnover, profit, number of employees (No. Emp.), debts, revenue, and expenses. In order to estimate the performance for each company, the ratio between turnover and number of employee was also calculated as a relevant coefficient (T/E) – corresponding to companies with financial activity and with both turnover and the number of employees above 0, for the mentioned three business years - 2019, 2020 and 2021.

2.2 Statistical analysis

All the data gathered from the study was analyzed using IBM SPSS Statistics 25 and illustrated using Microsoft Office Excel 2013. The qualitative variables were mentioned as counts or percentages. The quantitative variables were tested for normal distribution using the Shapiro-Wilk Test, were written as averages with standard deviations or medians with interquartile ranges. Quantitative variables measured between related groups (according to years) were tested using Friedman's tests along with Dunn-Bonferroni post-hoc tests and estimation of differences between years using medians with interquartile ranges. Quantitative variables measured between independent groups were tested using Mann-Whitney U tests. For box-plot figures that were used in comparisons of quantitative data where the measure of dispersion was extremely high, rescaling was used for highlighting the interquartile ranges and for easing the interpretation. Any association where the statistical probability was less than $\alpha=0.05$ was considered to be significant.

RESULTS AND DISCUSSIONS

We have organized the results of our research in the following six categories:
3.1. General data of the observed dental practices
3.2. The evolution of the observed dental practices between 2019-2021

3.1. General data of the observed dental practices

Data from **Table 1** show the descriptive characteristics of the observed dental practices. The results are the following:

- The analyzed dental practices that reported financial activity during the 2019 year was 1735, while the number lowered in 2020 (1704) and 2021 (1644);

Table 1. Descriptive characteristics of the observed private dental practices

Parameter	Value
Period of activity (No.)	
2019	1735
2020	1704
2021	1644
Company age (Average ± SD, Median (IQR))	11.9 ± 8.25, 9 (5-18)
Company age – Categories – 2019 Period of Activity (No., %)	
< 5 years	329 (19.0%)
5-10 years	613 (35.3%)
> 10 years	793 (45.7%)

- In accordance with Bucharest sectors, most of the dental practices with activity in 2019 were localized in Sector 1 (22.6%), Sector 2 (21.6%) and Sector 3 (21.0%).
- The average age of dental practices with activity in 2019 was 11.9 ± 8.25 years with a median of 9 years (interquartile range: 5-18 years), most of the dental practices having a company age higher than 10 years (45.7%), or between 5 to 10 years (35.3%).

In 2019, 1735 private dental practices reported economic activity, but of these, in 2020, 36 stopped their activity (they faced business interruption), leaving only 1699 in activity; to the latter were added another 5 companies that opened their activity in 2020, resulting in a total number of 1704 companies with activity in 2020 (as seen in Table 1). Later, out of these 1704 companies, 73 closed their activity in 2021, resulting in a number of 1631 companies that had activity in 2021; also in 2021, a number of 13 new companies opened their activity, resulting in a total number of 1644 companies with economic activity (as seen in Table 1).

3.2. The evolution of the observed dental practices between 2019-2021

Data from **Table 2** shows the comparison of financial indicators between 2019-2020-2021. The results show that all indicators were significantly different between the years according to Friedman's tests ($p<0.05$):

Turnover was lower in 2020 (median = 130238, IQR = 46048.75-354709.5, mean rank = 1.65) than in 2019 (median = 130930.5, IQR = 39936.5-331530.25, mean rank = 1.85) (median difference = 965, IQR = -29425.75 – 36501.5) ($p<0.001$) or in 2021 (median = 179162, IQR = 63263.75-490486.75, mean rank = 2.50) (median difference = -41537, IQR = -134330.25 - -2824.5) ($p<0.001$). Also, turnover was lower in 2019 than in 2021 (median difference = -34423.5, IQR = -134162.5 – 4651.25) ($p<0.001$).

Profit was higher in 2021 (median = 41503, IQR = 1739.75-164174.75, mean rank = 2.33) than in 2019 (median = 22593.5, IQR = -293.25 – 94917.5, mean rank = 1.83) (median difference = -14813, IQR = -76498 – 9681.5) ($p<0.001$) or in 2020 (median = 24653.5, IQR = 0-106721.25, mean rank = 1.85) (median difference = -15046.5, IQR = -62652.75 – 3726.25) ($p<0.001$). Differences of profit between 2019 and 2020 were not significant ($p=1.000$).

Differences for the number of employees

between years were not significant ac-cording to post-hoc tests (p>0.05), because of the high number of ties between years (many companies had 0 or 1 employee and remained with 0 or 1 employee during the investigated years).

Debts were lower in 2019 (median = 34571, IQR = 5200.25-143544.75, mean rank = 1.94) than in 2020 (median = 36899.5, IQR = 6295-148262.25, mean rank = 2.04) (median difference = -150.5, IQR = -9999.25 - 9486) (p=0.008) or in 2021 (median = 37474, IQR = 5983-154672, mean rank = 2.02) (median difference = -300, IQR = -22907.25 – 15617.25) (p=0.042). Differences of debts between 2020 and 2021 were not significant (p=1.000).

Revenue was lower in 2020 (median = 133641.5, IQR = 40721.5-338458, mean rank = 1.68) than in 2019 (median = 133641.5, IQR = 40721.5-338458, mean rank = 1.83) (median difference = 0, IQR = -34536.25 – 35179.75) (p<0.001) or in 2021 (median = 183538, IQR = 66914-503023.25, mean rank = 2.49) (median difference = -40475, IQR = -133749.75 - -1118.75) (p<0.001). Also, revenue was lower in 2019 than in 2021 (median difference = -35644.5, IQR = -142632.75 - 4817) (p<0.001).

Expenses were lower in 2020 (median = 90964, IQR = 31246.5-247676.75, mean rank = 1.73) than in 2019 (median = 91719.5, IQR = 27403-232722, mean rank = 1.89) (median difference = 740, IQR = -19676 – 21119.25) (p<0.001) or in 2021 (median = 111862, IQR = 38256.5-333446.5, mean rank = 2.37) (median difference = -15544.5, IQR = -77382.5-143.25) (p<0.001). Also, expenses were lower in 2019 than in 2021 (median difference = -13488.5, IQR = -83111.75 – 6735.25) (p<0.001).

The performance of the companies measured in turnover/no. employees (T/E) was higher in 2021 (median = 161680, IQR = 82034.62-299940.16, mean rank = 2.52) than in 2019 (median = 115387, IQR = 61024-209678, mean rank = 1.78) (median difference = -30482.5, IQR = -98123.41 – 3116.5) (p<0.001) or in 2020 (median = 122205, IQR = 64457.5-225198.16, mean rank = 1.70) (median difference = -31427, IQR = -78143.75 - -4655.75) (p<0.001). Differences of T/E between 2020 and 2019 were not significant (p=0.220).

Table 2. Comparison of financial indicators between 2019-2020-2021

Turnover/Year (N=1626)	**Average ± SD**	**Median (IQR)**	**Mean Rank**	**p**
2019	484261.88 ± 2013006.65	130930.5 (39936.5-331530.25)	1.85	**<0.001***
2020	489053.02 ± 1990332.21	130238 (46048.75-354709.5)	1.65	
2021	686268.98 ± 2820892.41	179162 (63263.75-490486.75)	2.50	
Profit/Year (N=1626)	**Average ± SD**	**Median (IQR)**	**Mean Rank**	**p**
2019	100520.78 ± 275218.10	22593.5 (-293.25 – 94917.5)	1.83	**<0.001***
2020	105052.55 ± 275718.03	24653.5 (0-106721.25)	1.85	
2021	161030.13 ± 416185.60	41503 (1739.75 – 164174.75)	2.33	
No. Emp./Year (N=1626)	**Average ± SD**	**Median (IQR)**	**Mean Rank**	**p**
2019	2.381 ± 6.548	1 (0-3)	2.03	**0.007***
2020	2.339 ± 6.665	1 (0-2)	1.96	
2021	2.413 ± 6.745	1 (0-2)	2.01	
Debts/Year	**Average ± SD**	**Median (IQR)**	**Mean Rank**	**p**

(N=1626)				
2019	178836.01 ± 985066.53	34571 (5200.25-143544.75)	1.94	**0.005***
2020	192393.11 ± 1072822.92	36899.5 (6295-148262.25)	2.04	
2021	224751.13 ± 1354607.17	37474 (5983-154672)	2.02	
Revenue/Year (N=1626)	**Average ± SD**	**Median (IQR)**	**Mean Rank**	**p**
2019	491428.45 ± 2042822.38	133641.5 (40721.5-338458)	1.83	**<0.001***
2020	502155.34 ± 2059239.49	136041.5 (48181.5-366562.25)	1.68	
2021	700445.16 ± 2873856.46	183538 (66914-503023.25)	2.49	
Expenses/Year (N=1626)	**Average ± SD**	**Median (IQR)**	**Mean Rank**	**p**
2019	384279.22 ± 1830909.61	91719.5 (27403-232722)	1.89	**<0.001***
2020	391360.89 ± 1903208.12	90964 (31246.5-247676.75)	1.73	
2021	530878.5 ± 2601069.35	111862 (38256.5-333446.5)	2.37	
T/E /Year (N=997)	**Average ± SD**	**Median (IQR)**	**Mean Rank**	**p**
2019	161495.13 ± 156943.74	115387 (61024-209678)	1.78	**<0.001***
2020	171884.01 ± 165395.18	122205 (64457.5-225198.16)	1.70	
2021	227806.85 ± 223409.92	161680 (82034.62-299940.16)	2.52	

*Related-Samples Friedman's Two-Way Analysis of Variance by Ranks Test,
**Shapiro-Wilk Test, ***Post-Hoc Dunn-Bonferroni Test

DISCUSSION

The aim of our study was to analyze the economic impact of COVID-19 pandemic on private dental practices in Bucharest, Romania. In accordance to Bucharest sectors, most of the companies included in this study were localized in Sector 1 (the central area of the city). During the years 2019, 2020, and 2021, there was a reduction in the number of private dental practices that demonstrated financial activity: in 2019, the recorded number of such practices was 1735, which decreased to 1704 in 2020, and further reduced to 1644 in 2021. Hereunder, we present, along with a synthesis of the main results of our study, certain remarks and possible explanations of the observed indicators' dynamics, correlated with relevant results of other studies collected from scientific literature. Various suggestions for the (re-)organization of dental practices that could help enhance their economic resilience and overcome the effects of future possible crises are also advanced.

The results of our study indicated that, for the private dental practices in Bucharest, two of the analyzed indicators - turnover and revenue - were significantly lower in 2020, when compared to 2019 ($p<0.001$).

These objective observations indicate the negative economic impact that the COVID-19 pandemic had on private dental practices in Bucharest, which corelates with the multitude of volatile elements specific to the pandemic that disturb the activity of dental private

practices and dentists' relationships with their patients and suppliers. Our findings could be related to certain legal regulations that were imposed during the COVID-19 pandemic. The results of our study are generally in line with the information found in the scientific dental literature [8,14,26-28]. World Health Organization (WHO) recommended at the beginning of the coronavirus pandemic that only emergency dental procedures should be performed in dental offices [26]. Moraes et al. (2020) [8] pointed out that the COVID-19 pandemic impact on dental clinical daily routine has been certainly high, generating varied changes to patient screening and scheduling, clinic infrastructure, and personal protective equipment usage [8].

The application of new clinical routines, of rigorous preventive measures and new patient management guidelines were associated with an economic burden for dentists, as various studies indicate; the pandemic period was characterized by large amounts of information made uncertain through lack of coherence and irregular periods during which normative acts were applied [8,14,26-28]. A relatively recent study showed that telephone triages in dental offices have been widely used by dentists, and training routines on how to use, remove, and dispose PPE, were organized by 80% of the Italian dental clinics included in the study [14]. Another study conducted on 287 clinics in Saudi Arabia indicated that 65% of these clinics had a distinct workflow for COVID-19 patient screening and new management routines [27]. During the pandemic period, it was reported the reduction of the number of appointments with patients in dental clinics [8,29]. A nationwide survey carried out in Brazil, indicated that this reduction in patients seen weekly was significantly greater in public dental clinics (38.7±18.6) than in private ones (22.5±17.8) [8]. Chamorro-Petronacci et al. [29] showed in their study regarding the economic and health-care impact of COVID-19 on public and private dental practices in Spain that 86% of participants reported seeing up to five patients per week considering the existing recommendations to treat only urgent situations during the national state of alarm.

In Romania, as per the 2nd Military Ordinance of 21st March 2022 [20], all dental practices were forced to close their activity and only a select few offices, in each region, were kept open for emergency cases. On the 18th May 2020, the state of emergency was altered to a state of alert and the dental practices were allowed to resume operations, in accordance with the Romanian Government Decision no. 394 [21]. All the above mentioned contextual pandemic changes that appeared in dental practices' activity have indirectly left their mark on their economic status; as other authors have pointed out, the revenue stream was a significant predictor of burnout during the COVID-19 pandemic [10]. In line with these previous statements, our statistical analysis' results indicate that turnover and revenue were significantly lower in 2020 when compared with 2019, for the private dental practices in Bucharest.

However, turnover and revenue stream were significantly lower in 2020 compared to 2021, ($p<0.001$), the profit was higher in 2021 when compared with 2020 ($p<0.001$) and the performance of the companies measured in Turnover/Number of Employees (T/E) was higher in 2021 when compared to 2020. Therefore, the private dental practices in Bucharest have revived their activity starting with 2021. The dental practices closed in 2020 were the ones that had no sustainability even in the pre-pandemic period, having low turnover and small number of employees. The ones that were better financially prepared from 2019,

managed to survive in 2020. Hence, a strong indication of good practice is the readiness to face a crisis afore one takes place. Those who survived crises gained the know-how of increasing the turnover of their dental practice with fewer employees, resulting in higher T/E rates in the aftermath of that crisis and in improved management skills. Resilience thus reveals as the key factor to successfully overcoming the crisis, a conclusion applicable to dental practices, too.

SUGGESTIONS TO OVERCOME THE NEGATIVE EFFECTS OF FUTURE POSSIBLE CRISIS SITUATIONS

The COVID-19 pandemic and its consequences have thought us that building an antifragile, strong, resilient and constructive attitude could help us overcome the effects of future crises. Protecting health care workers and patients is of up-most importance, and we must focus on preventing future outbreaks [11,12,41,42].

To our understanding, the dental health-care sector should be placed in a better state of preparedness (in case such crises reoccur), by adopting certain attitudes in the (re-)organization of dental practices, as follows: enhancement of the adherence to IPC practices and guidelines, and refinement of IPC-related procedures [43]; ensuring permanent emergency stocks for dental materials and equipment; proper management for medical personnel fluctuation; implementation or development of teledentistry and digital dentistry; development of an isolated emergency dental care center (area); re-organization of dental practices to reduce costs and maintain minimum profitability [36]; preventive development of an immediate interventional strategy in case of imminent crisis situations (preventive management); improvement of the ability to better recognize the initial signs and contexts of crisis situations; enhancement of the ability to estimate and properly use key-resources; progression of knowledge management practices among dental clinic administrators. Additionally, healthcare decision makers should consider financially supporting “dental practices while organizing dental care along infection control policies” [36].

CONCLUSIONS

Following the assessment of the results obtained, and given the limitations of the present study, we reached the following conclusions:

1. The COVID-19 pandemic had a detrimental effect on the economic performance of private dental practices in Bucharest, Romania. This aspect is supported by the unfavorable dynamic of the observed indicators (including turnover, profit, revenue, expenses, debts, number of employees, and the T/E ratio) corresponding with three consecutive years: 2019, 2020, and 2021;

2. The pandemic legislation (which included restrictions or pauses on routine dental care, extensive and costly preventive measures that had to be implemented in dental practices), and the reduction of dental services, combined with factors such as fluctuations in medical personnel and fear of contagion among patients, dental staff, and dentists, contributed to this unfavorable economic situation;

3. This paper highlights certain

suggestions (such as adopting a preventive management, implementing teledentistry and digital dentistry, developing of an isolated emergency dental care area, adjusting medical personnel fluctuation), that could be extended and beneficial to other dental practices. These suggestions could increase the chances of effectively navigating a pandemic and achieving economic stability once it concludes.

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Abbreviations

SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2
COVID-19: Corona-virus disease 2019
WHO: World Health Organization
KFIs: key financial indicators
T/E: ratio between turnover and number of employees
IPC: measures Infection prevention and control (measures)
PPE: Personal protective equipment

REFERENCES

1. Mallah SI, Ghorab OK, Al-Salmi S, Abdellatif OS, Tharmaratnam T, Iskandar MA, Sefen JAN, Sidhu P, Atallah B, El-Lababidi R, Al-Qahtani M. COVID-19: breaking down a global health crisis. Ann Clin Microbiol Antimicrob. 2021;20(1):1-36 https://doi.org/10.1186/s12941-021-00438-7
2. Sharma A, Ahmad Farouk I, Lal SK. COVID-19: A review on the novel coronavirus disease evolution, transmission, detection, control and prevention. Viruses 2021;13(2):202
3. Robert Koch Institut. COVID-19 in Germany. Available online: https://www.rki.de/EN/Home/homepage_node.html. Accessed 01 Jun 2022.
4. Tysiąc-Miśta M, Dziedzic A. The Attitudes and Professional Approaches of Dental Practitioners during the COVID-19 Outbreak in Poland: A Cross-Sectional Survey. Int J Environ Res Public Health. 2020;17:4703.
5. Wolf TG, Zeyer O, Campus G. COVID-19 in Switzerland and Liechtenstein: A Cross-Sectional Survey among Dentists' Awareness, Protective Measures and Economic Effects. Int J Environ Res Public Health. 2020;17:9051.
6. COVIDental Collaboration Group. The COVID-19 pandemic and its global effects on dental practice. An International survey. J Dent. 2021:114, doi:10.1016/j.jdent.2021.103749
7. Stangvaltaite-Mouhat L, Uhlen MM, Skudutyte-Rysstad R, Szyszko Hovden EA, Shabestari M, Ansteinsson VE. Dental Health Services Response to COVID-19 in Norway. Int J Environ Res Public Health. 2020;17:5843. https://doi.org/10.3390/ijerph17165843.
8. Moraes RR, Correa MB, QueirozAB, Daneris Â, Lopes JP, Pereira-Cenci T, D'Avila OP, Cenci MS, Lima GS, Demarco FF. COVID-19 challenges to dentistry in the new pandemic epicenter: Brazil. PLoS One. 2020;15(11): e0242251.
9. Pituru SM, Imre M, Totan A, Pantea M, Țâncu AMC, Amza O, Bencze A, Ionescu E. Study on the ethical and safety aspects among romanian dental healthcare professionals during COVID-19 pandemic, Rom J Leg Med. 2020;28(3):322-330, DOI:10.4323/rjlm.2020.322
10. Antoniadou M. Estimation of Factors Affecting Burnout in Greek Dentists before and during the COVID-19 Pandemic. Dent. J. 2022;10:108. https://doi.org/10.3390/dj10060108
11. Coulthard P, Thomson P, Dave M, Coulthard FP, Seoudi N, Hill M. The COVID-19 pandemic and dentistry: the clinical, legal and economic consequences-part 1: clinical. Br Dent J.

2020;229(11):743-747
12. Coulthard P, Thomson P, Dave M, Coulthard FP, Seoudi N, Hill M. The COVID-19 pandemic and dentistry: the clinical, legal and economic consequences-part 2: consequences of withholding dental care. Br Dent J. 2020;229(12):801-805.
13. Sycinska-Dziarnowska M, Maglitto M, Wozniak K, Spagnuolo G. Oral Health and Teledentistry Interest during the COVID-19 Pandemic. J. Clin. Med. 2021;10:3532. https://doi.org/10.3390/jcm10163532
14. Sinjari B, Rexhepi, I, Santilli M, D′Addazio G, Chiacchiaretta P, Di Carlo P, Caputi S. The Impact of COVID-19 Related Lockdown on Dental Practice in Central Italy—Outcomes of A Survey. Int J Environ Res Public Health. 2020;17:5780. https://doi.org/10.3390/ijerph17165780
15. Iorga M, Iurcov R, Pop LM. The relationship between fear of infection and insomnia among dentists from Oradea metropolitan area during the outbreak of Sars-CoV-2 pandemic. Journal of Clinical Medicine. 2021;10(11):2494.
16. Schepers M, Schmidtmann I, Zahn D, Wild P, Beutel, M, Schuster, AK, et al. Medical appointments and provision of medical care during the COVID-19 pandemic in Mainz, Germany. PLoS ONE. 2023;18(1):e0280292.
17. Hogan B. In 2020, dental practice revenue declined 6%; Available online : https://www.dentistryiq.com/practice-management/industry/article/14200344/in-2020-dental-practice-revenue-declined-6. Accessed 01 June 2022.
18. Carvalho JC, Declerck D, Jacquet W, Bottenberg P. Dentist Related Factors Associated with Implementation of COVID-19 Protective Measures: A National Survey. Int J Environ Res Public Health. 2021*;18*:8381. https://doi.org/10.3390/ijerph18168381
19. Romanian Government, Military Ordinance no 1, 17.03.2022, Available online:
20. https://legislatie.just.ro/Public/DetaliiDocument/223888, (Romanian only) Accessed 10 Jan 2023.
21. Romanian Government, 2nd Military Ordinance of 21.03.2022, Available online: https://legislatie.just.ro/Public/DetaliiDocument/224284 (Romanian only) Accessed 10 Jan 2023.
22. Romanian Government, DECISION no. 394 of May 18, 2020 regarding the declaration of the state of alert and the measures that apply during it to prevent and combat the effects of the COVID-19 pandemic. Available online: https://legislatie.just.ro/Public/DetaliiDocument/225876 (Romanian only) Accessed on 10 Jan 2023.
23. Colegiul Medicilor Stomatologi din România. Recomandări privind reluarea activității în cabinetele stomatologice. 2020; (Romanian only) Available online: https://cmdr.ro/download-zone-file/0/1674143525/3549/c4ed0560af8e93988f817dc0c6ec73bb. Accessed 10 Jan 2023.
24. Lucaciu O, Boca A, Mesaros AS, Petrescu N, Aghiorghiesei O, Mirica IC, Hosu I, Armencea G, Bran S, Dinu CM. Assessing SARS-CoV-2 Infection Rate among Romanian Dental Practitioners. *Int J Environ Res Public Health.* 2021;18,4897. https://doi.org/10.3390/ijerph18094897.
25. Agenţi economici şi instituţii publice - date de identificare, informaţii fiscale, bilanţuri - Acasa - MFP (gov.ro) (Romanian only). Accessed 01 Sep 2022.
26. https://www.topfirme.com/ (Romanian only). Accessed 01 Sep 2022.
27. Lo Giudice R. The severe acute respiratory syndrome coronavirus-2 (SARS CoV-2) in dentistry. Management of biological risk in dental practice. *Int. J. Environ. Res. Public Health*. 2020;17(9):3067.
28. Al-Khalifa KS, AlSheikh R, Al-Swuailem AS, Alkhalifa MS, Al-Johani MH, Al-Moumen SA, et al. Pandemic preparedness of dentists against coronavirus disease: A Saudi Arabian experience. PLoS One. 2020;15(8):e0237630. pmid:32813692.
29. Lo Nigro G, Bizzoca ME, Lo Muzio L, Campisi G. The Management of Dental Practices in the Post-COVID 19 Era: An Economic and Operational Perspective. *Int J Environ Res Public Health.* 2020;17:8905. https://doi.org/10.3390/ijerph17238905.
30. Chamorro-Petronacci C, Martin Carreras-Presas C, Sanz-Marchena AA, Rodríguez-Fernández M, María Suárez-Quintanilla J, Rivas-Mundiña B, et al. Assessment of the economic and health-care impact of COVID-19 (SARS-CoV-2) on public and private dental surgeries in Spain: A pilot study. *Int J Environ Res Public Health.* 2020;17(14):5139. pmid:32708838.
31. Spagnuolo G, De Vito D, Rengo S, Tatullo M. COVID-19 outbreak: An overview on dentistry. *Int J*

Environ Res Public Health. 2020;17:2094. https://doi.org/10.3390/ijerph17062094.
32. Simms A, Fear NT, Greenberg N. The impact of having inadequate safety equipment on mental health. Occup Med (Lond). 2020;70(4):278-281.
33. Wolf TG, Barth A, Hüttmann J, Lennartz M, Otterbach E-J, Brendel C, Cagetti MG, Deschner J, Campus G. Economic Impact of COVID-19 Pandemic on Dental Practices in Germany: A Cross-Sectional Survey. *Int J Environ Res Public Health.* 2022;*19*:6593. https://doi.org/10.3390/ijerph19116593.
34. Ahmed MA, Jouhar R, Ahmed N, Adnan S, Aftab M, Zafar MS, et al. Fear and practice modifications among dentists to combat novel coronavirus disease (COVID-19) outbreak. Int J Environ Res Public Health. 2020;17:2821. pmid:32325888.
35. Nguyen NT, Boyd LD, Oh U, Vineyard J. Patients' Fear, Stress, and Anxiety Toward Attending Dental Visits During the COVID-19 Pandemic. Journal of dental hygiene: JDH. 2022;96(6):15–23.
36. González-Olmo MJ, Ortega-Martínez AR, Delgado-Ramos B, Romero-Maroto M, Carrillo-Diaz M. Perceived vulnerability to Coronavirus infection: impact on dental practice. Braz Oral Res. 2020;34, pmid:32401934
37. Schwendicke F, Krois J, Gomez J. Impact of SARS-CoV2 (Covid-19) on dental practices: Economic analysis. J Dent. 2020;99:103387.
38. Barabari P, Moharamzadeh K. Novel Coronavirus (COVID-19) and Dentistry–A Comprehensive Review of Literature. J Dent. 2020;8:53. https://doi.org/10.3390/dj8020053.
39. Almotairi KH, Hussein AM, Abualigah L, Abujayyab SK, Mahmoud EH, Ghanem BO, Gandomi AH. Impact of Artificial Intelligence on COVID-19 Pandemic: A Survey of Image Processing, Tracking of Disease, Prediction of Outcomes, and Computational Medicine. Big Data and Cognitive Computing. 2023;7(1):11.
40. Shamsoddin E, DeTora LM, Tovani-Palone MR, Bierer BE. Dental Care in Times of the COVID-19 Pandemic: A Review Med Sci. 2021;9:13. https://doi.org/10.3390/medsci9010013.
41. Levit M, Levit L. Infection Risk of COVID-19 in Dentistry Remains Unknown: A Preliminary Systematic Review. Infect Dis Clin Pract (Baltim Md). 2021;29(2):70-77. doi: 10.1097/IPC.0000000000000939.
42. Halepas S, Ferneini EM. A pinch of prevention is worth a pound of cure: proactive dentistry in the wake of COVID-19. J Oral Maxillofac Surg. 2020;78(6):860-861.
43. Koyama S, Aida J, Mori Y, Okawa S, Odani S, Miyashiro I. COVID-19 Effects on Income and Dental Visits: A Cross-sectional Study. JDR Clinical & Translational Research. 2022;7(3):307-314.
44. Nahidi S, Li C, Sotomayor-Castillo C, Kaufman-Francis K, Shaban RZ. "We will have to learn to live with it": Australian dentists' experiences during the COVID-19 pandemic. Infection, Disease & Health. 2022;27(2):96-104.