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Impact of COVID-19 on dental students in Brazil

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Abstract The aim of the present study was to analyze the effects of the COVID-19 pandemic on the academic performance of dental students in Brazil. A descriptive cross-sectional study was conducted using a questionnaire available on the Google Forms application and shared via social networks, such as WhatsApp, Instagram and Facebook, as well as electronic addresses (e-mails) to 383 students. This number was defined by the sample size calculation. After conducting a pilot study, the "virtual snowball" technique was used to collect responses. Descriptive and inferential analyses of the data were performed using frequencies and multinomial logistic regression, with a 5% significance level. Most students (72%) were female and studied at private dental schools (81.5%). Dissatisfaction was found for both remote classes (42.1% completely and 25.4% partially) and academic training (44.1% completely and 25.6% partially), with a reported drop in performance among 70.7% of the students and thoughts of abandoning their studies (40.5% answered "yes" and 10.2% answered "maybe"). Region of residence and device used to follow classes exerted an influence on thoughts of abandoning studies ($p < 0.05$ and $p = 0.031$, respectively). Moreover, the level of computer knowledge exerted an influence on academic performance during the pandemic ($p = 0.009$). In conclusion, a drop in academic performance occurred among dental students during the pandemic. The lack of preparedness for the remote model and difficulties related to learning demonstrate that "Emergency Remote Education" was insufficient to cover the range of skills to be developed during training.
Descriptors: Education, Distance. COVID-19. Students, Dental.

Impactos del COVID-19 en estudiantes de Odontología en Brasil

Resumen El presente estudio tuvo como objetivo analizar los efectos de la pandemia COVID-19 en el rendimiento y logro académico de los estudiantes de odontología en Brasil. El estudio descriptivo transversal se realizó mediante la aplicación de un cuestionario utilizando la aplicación Google Forms, compartido a través de redes sociales. redes como WhatsApp, Instagram, Facebook y direcciones electrónicas (e-mails) de 383 estudiantes, número definido mediante cálculo muestral. Tras realizar un estudio piloto, se utilizó la técnica de la "bola de nieve virtual" para recoger respuestas. Se realizó análisis descriptivo e inferencial de los datos mediante frecuencias y regresiones logísticas multinomiales con un nivel de significancia del 5%. La mayoría de los estudiantes (72%) eran mujeres, el 81,5% de instituciones privadas. Hubo insatisfacción tanto con las clases remotas (42,1% total y 25,4% parcialmente) como con la formación académica (44,1% total y 25,6% parcial), reportándose una caída en el rendimiento del 70,7% de los estudiantes que pensaron en abandonar sus estudios (40,5% dijo sí y el 10,2% dijo "tal vez"). La región de residencia y el dispositivo utilizado para seguir clases influyeron en el pensamiento de abandonar los estudios ($p<0,05$ y $p=0,031$ respectivamente), así como el nivel de conocimientos de informática influyó en el rendimiento académico durante la pandemia ($p=0,009$). Se concluye que hubo una caída en el rendimiento académico de los estudiantes durante la pandemia. La falta de preparación de los estudiantes para el modelo remoto y las dificultades relacionadas con el aprendizaje demuestran que la Educación Remota de Emergencia no fue suficiente para cubrir el conjunto de habilidades a desarrollar durante la formación.
Descriptores: Educación a Distancia. COVID-19. Estudiantes de Odontología.

Impactos da COVID-19 aos acadêmicos de Odontologia no Brasil
Resumo O presente estudo teve por objetivo analisar os efeitos da pandemia da COVID-19 sobre o rendimento e aproveitamento acadêmico dos estudantes de Odontologia no Brasil. O estudo transversal descritivo foi realizado por meio da aplicação de questionário usando o aplicativo Google Forms, compartilhado via redes sociais como WhatsApp, Instagram, Facebook e endereços eletrônicos (e-mails) para 383 estudantes, número definido por cálculo amostral. Após a realização de estudo piloto, utilizou-se a técnica da "bola de neve virtual" para a coleta das respostas. Realizou-se análise descritiva e inferencial dos dados por meio de frequências e regressões logísticas multinominais com nível de significância de 5%. A maioria dos estudantes (72%) eram do sexo feminino, 81,5% oriundos de instituições privadas. Houve insatisfação tanto para com as aulas remotas (42,1% totalmente e 25,4% parcialmente) quanto para a formação acadêmica (44,1% totalmente e 25,6% parcialmente), relatou-se queda de rendimento em 70,7% dos estudantes e pensamento em abandonar os estudos (40,5% afirmam que sim e 10,2% relatam "talvez"). Região de residência e dispositivo utilizado para acompanhar as aulas influenciaram no pensamento em desistir dos estudos ($p<0,05$ e $p=0,031$ respectivamente), assim como o nível de conhecimento em informática influenciou no rendimento acadêmico durante a pandemia ($p=0,009$). Conclui-se que houve queda no rendimento acadêmico dos alunos durante a pandemia. O despreparo dos estudantes frente ao modelo remoto e as dificuldades relacionadas à aprendizagem demonstram que o Ensino Remoto Emergencial não foi suficiente para contemplar a gama de habilidades a serem desenvolvidas durante a formação.
Descritores: Educação a Distância. COVID-19. Estudantes de Odontologia.

INTRODUCTION

In December of 2019, the Chinese government reported an outbreak initiated by a virus belonging to the *Coronaviridae* family, which had not yet affected humans[1]. This was SARS-CoV-2, the etiological agent of COVID-19[2]. On March 11, 2020, the World Health Organization (WHO) declared COVID-19 to be a pandemic[3]. The restrictive measures adopted by public authorities in response to the spread of the virus had significant impacts on the economy, politics, education and, especially, health, as it highlighted "gaps" in terms of preparedness for emergency calamity situations[4,5].

Education was seriously affected by the pandemic[6-13]. Amid the interruption of in-person activities at higher education institutions, several schools had to opt for migration to the online environment as an alternative to the complete cancellation of the annual academic calendar, adapting activities previously carried out in person to remote learning technologies through videoconferencing, denominated "Emergency Remote Teaching". The abrupt transition from one teaching modality to a considerably different modality exerted an impact on both students and teachers[14].

In the specific case of dental schools, the abrupt interruption of in-person activities in an essentially in-person course and the replacement with the remote teaching modality tends to be quite challenging for teachers and students[8,9,15]. The dental course is based on the combination of theoretical activities and clinical/laboratory practices. This combination is fundamental to the students' progress, given the need to develop the knowledge and skills inherent to professional practice. The interruption of this form of learning and its replacement with the remote teaching modality implies the need for students to adapt to a new scenario and poses new obstacles to training[16-18]. Therefore, the question arises with regards to the perceptions of dental students about the measures adopted by their schools and the implications of the scenario for issues such as academic performance, training and thoughts of abandoning the studies.

Considering the importance of assessing how dental students experienced this atypical period in their training, the aim of the present study was to analyze the effects of the COVID-19 pandemic on the academic performance of

dental students in Brazil, addressing satisfaction and adaptation to Emergency Remote Teaching.

METHOD

A descriptive cross-sectional study was conducted. This study design was chosen due to the collection of data limited to a short space of time, which enables the creation of a "snapshot" of the variables of interest. The study provides a detailed, organized description of the answers given by students with regards to academic training in dentistry during the pandemic, enabling the clarification of the effects of the pandemic on learning in this population[19].

The target population was students of dental schools in Brazil. The sample size was determined based on data provided by the 2018 Higher Education Statistical Synopsis available from the website of the Anísio Teixeira National Institute of Educational Studies and Research (INEP)[20]. Based on the number of students enrolled in undergraduate dental courses in Brazil (125,585), the sample size was calculated adopting a 95% confidence level and 5% margin of error, determining a non-probabilistic sample of 383 students.

Data were obtained using a questionnaire, which, after validation, was disseminated via social networks. The instrument consisted of 28 questions divided into closed-ended questions with response options both on a Likert scale and with several alternatives (e.g., 'yes', 'no', 'maybe') as well as open-ended questions with a short answer. The questions were categorized into three different groups: Group 1 – sociodemographic characteristics and academic profile; Group 2 – perception of Emergency Remote Teaching, satisfaction with training and technologies used; Group 3 – learning, performance, abandoning studies and return to classes. The questions were based on previous surveys published during the pandemic that addressed the impact of the period on the academic career of students in the health field and their satisfaction with the measures adopted by higher education institutions, with the questions adapted for dental courses[7-12]. The platform used to develop the questionnaire was the Google Forms® research management application, following a previously validated method[11,21-23].

Due to the different alternatives adopted by universities during the pandemic, which is a relevant factor in the students' perceptions of their training, we sought to use Branching Logic, which is a resource contained in the research platform used, whose function is to change the next question to which the participant is directed based on the answer given to the current question[24]. Therefore, students who reported the cancellation of the academic calendar or who indicated that in-person classes had already resumed were not presented the second group of questions (satisfaction with Emergency Remote Teaching).

A pilot study was conducted for the validation of the questionnaire based on criteria defined in the literature[25], which states that the number of participants in this type of study does not need to exceed 10% of the desired sample. Thus, as the sample for the main study was 383 students, 38 students participated in the pilot study. After submitting the form, the volunteers were asked about their understanding of the questions, level of difficulty and discomfort with the questions. These questionnaires were not included in the final sample. The main study was initiated after validation and adjustments to the questionnaire based on the results of this pilot study.

The questionnaire was shared with students at more than 100 dental schools in the period from December 18, 2020 to January 17, 2021. The method used to acquire the sample was based on the premise of sampling by reference chains[26], which was adapted to the means of dissemination through social networks. This method is denominated the "virtual snowball" technique, whose premise is to obtain the sample size as participants share the link to their network of contacts compatible with the study profile[27].

The questionnaire was disseminated on social media, as WhatsApp®, Instagram® and Facebook®. Additionally, survey invitations were sent via electronic addresses (e-mails). As various means were used to reach the study population, cataloging was performed using a spreadsheet in Microsoft Excel® (2019) of all active dental courses recognized by the Brazilian Ministry of Education contained in the National Registry of Courses and Institutions of Higher Education (e-MEC Registration). Based on this list, contacts with coordinators and students of these schools were sought through the following channels: direct contact (Instagram chat mechanism) of profiles of academic

leagues belonging to dental courses of different schools; message sending via WhatsApp to academic groups and private profiles; and the distribution of invitations via email to the administrative boards of the dental courses at various schools requesting disclosure to the students of the course. The distribution of questionnaires via social networks was a valid strategy during the pandemic[11,21,23].

The inclusion criteria were dental students at public or private schools in Brazil enrolled in day or night classes with active enrollment during the data collection period. Students under 18 years of age and volunteers who did not answer all the questions on the questionnaire were excluded. Duplicate response stipulated at the end of the collection process were removed.

The responses were organized on a Microsoft Excel® (2019) spreadsheet and subsequently formatted for statistical analysis with the aid of the Jamovi® software (version 1.6). Descriptive analysis was performed, with the determination of frequencies. Inferential analysis involved multinomial logistic regression analyses with a significance level of 5% ($p < 0.05$). The outcome variable of the first logistic regression was the question "did you think about abandoning your studies during the pandemic?". The reference answer for the question was "yes" and the following were used as explanatory variables: region of residence; internet quality; devices used to attend classes; type of dental school (public or private), and level of computer knowledge. This regression was conducted to determine the strength of associations and highlight variables that explained the answers regarding the thought of abandoning studies.

The outcome variable of the second logistic regression was the question "did your academic performance drop a lot during the pandemic?", with the "no" option as reference. This statistical test sought associations between the outcome and same explanatory variables as in the first regression analysis.

This study received approval from the Human Research Ethics Committee of the University of Cuiabá (CEP-UNIC) (protocol number: 4,559,922, CAAE: 40051920.0.0000.5165). A statement of informed consent was made available for reading and consent in the first section of the questionnaire.

RESULTS

A total of 383 students from 70 dental schools participated in the study. All respondents marked the option "yes, I agree to participate in the study" in the first section, where the statement of informed consent was provided (refusal rate: 0%). The results are presented according to the groups of questions on the questionnaire.

Sociodemographic and academic profile of participants

Among the 383 participants, most were female (72.0%), between 18 and 25 years of age (86.4%) and distributed mainly in the South (30.8%), Central-West (24 .3%) and Southeast (21.4%) regions of the country. Nearly all (90.8%) students reported that in-person activities were canceled and partially replaced with Emergency Remote Teaching. Most (57.4%) were gradually returning to practical activities and around 33.4% were strictly in Emergency Remote Teaching. At the time, more than half (59.3%) of the participants agreed with the interruption of in-person activities in response to COVID-19 (Table 1).

Perception regarding Emergency Remote Teaching, satisfaction with training and technologies used

A total of 234 students expressed dissatisfaction with remote classes during the pandemic. Among all participants, 69.7% expressed some degree of dissatisfaction with their academic training during the pandemic. Only 29.6% disagreed that flexible study times was one of the advantages of remote learning (Table 2).

Quality of the internet, which is a fundamental factor for remote classes, was characterized as good by 78.2% of participants. Additionally, 75.7% of students agreed that they could attend remote classes with good quality and no problems with the internet. Computer knowledge was largely between basic and intermediate levels. The computer was the predominant device used to follow remote classes (74.4%). A significant percentage of the students (74.1%) disagreed that studying at home is more beneficial (Table 2).

Table 1. Distribution of students according to sociodemographic characteristics and academic profile.

Category | Questions | Statements	n	%
Gender		
Female	275	72
Male	108	28
Age		
18 - 25 years	331	86.4
26 - 40 years	45	11.7
> 40 years	7	1.9
Region of residence		
Central-West	93	24.3
Northeast	43	11.2
North	47	12.3
Southeast	82	21.4
South	118	30.8
Place of residence		
Rural zone	40	10.4
Urban zone	343	89.6
Type of dental school		
Private	312	81.5
Public	71	18.5
Period of classes		
Day	317	84.8
Night	57	15.2
Has the school where you study canceled in-person activities?		
Yes, the academic calendar was canceled	12	3.1
Yes, but in-person classes have already returned	23	6.0
Yes, partially remote	128	33.4
Yes, partially remote, restarting again	220	57.4
Do you agree with the interruption of in-person activities at educational institutions in response to the spread of COVID-19?		
Yes	227	59.3
No	58	15.1
Maybe	98	25.6

Table 2. Distribution of students according perception of emergency remote teaching and satisfaction with training and technologies used during pandemic.

Questions | Statements	n	%
I am very satisfied with remote classes.		
Fully agree	27	7.8
Partially agree	52	15.0
Neither agree nor disagree	34	9.8
Partially disagree	88	25.4
Fully disagree	146	42.1
I am very satisfied with my academic training during the pandemic		
Fully agree	14	3.7
Partially agree	67	17.5
Neither agree nor disagree	35	9.1
Partially disagree	98	25.6
Fully disagree	169	44.1
For me, one of the advantages of remote classes is the flexibility of study times.		
Fully agree	100	28.7
Partially agree	87	25.0
Neither agree nor disagree	58	16.7
Partially disagree	37	10.6
Fully disagree	66	19.0
Internet quality		
Good quality	298	78.2
Bad quality	83	21.8
I can attend remote classes with good quality and without internet problems		
Fully agree	73	21.1
Partially agree	189	54.6
Neither agree nor disagree	28	8.1
Partially disagree	36	10.4
Fully disagree	20	5.8
What is your level of computer knowledge?		
Basic	151	43.4
Intermediate	159	45.7
Advanced	38	10.9
What electronic device(s) have you been using to attend remote classes?		
Cellphone/Tablet	89	25.6
Computer	259	74.4
For me, studying at home is more beneficial		
Fully agree	20	5.8
Partially agree	45	13.0
Neither agree nor disagree	25	7.2
Partially disagree	78	22.5
Fully disagree	179	51.6

Learning, performance, abandoning studies and return to classes

A total of 76.5% of the respondents agreed to some extent that using computers or other electronic devices for learning makes them restless and confused. Among the 383 students, 88 were unable to learn by studying remotely, while 151 reported having learning difficulties with Emergency Remote Teaching. Around 90.3% of the students reported a drop in their academic performance. Furthermore, 82.1% remoted that the lack of in-person interaction with the teacher was a negative factor for learning. Most students agreed that the quality of the course was negatively affected by the

interruption of in-person activities and the adoption of remote teaching strategies. Nearly half of the students (40.5%) said they had thought about abandoning their studies in the pandemic scenario. During the data collection period, 28.5% were against returning to in-person activities until vaccinations took place (Table 3).

Table 3. Distribution of students according to remote learning, performance, abandoning studies and return to classes.

Questions | Statements	n	%
Using a computer or other electronic device for learning makes me restless and confused.		
Fully disagree	32	9.2
Partially disagree	26	7.5
Neither agree nor disagree	24	6.9
Partially agree	112	32.2
Fully agree	154	44.3
I can't learn by studying remotely.		
Fully agree	88	25.4
Partially agree	151	43.5
Neither agree nor disagree	48	13.8
Partially disagree	45	13.0
Fully disagree	15	4.3
Has your academic performance dropped significantly during the pandemic?		
Yes	216	56.4
No	37	9.7
A little	130	33.9
The lack of in-person interaction with the teacher makes it difficult for me to learn.		
Fully disagree	16	4.6
Partially disagree	20	5.7
Neither agree nor disagree	26	7.5
Partially agree	107	30.7
Fully agree	179	51.4
I feel that the quality of the course was negatively affected by the remote modality.		
Fully agree	169	48.6
Partially agree	77	22.1
Neither agree nor disagree	23	6.6
Partially disagree	47	13.5
Fully disagree	32	9.2
Have you considered abandoning your studies during the pandemic?		
Yes	155	40.5
No	189	49.3
Maybe	39	10.2
In your opinion, is the pandemic under control enough to return to in-person activities?		
No, wait for vaccination	109	28.5
Yes, just for practices	211	55.2
Yes, for all activities	62	16.2

Two multinominal logistic regressions were preformed to determine variables associated with thoughts of abandoning studies and the drop in academic performance during the pandemic. The reference answer was "yes" in the first case and "no" in the second. In both regressions, the following explanatory variables were adopted: region of residence, internet access, device used to attend classes, place of residence and level of computer knowledge.

For the first regression related to the thought of abandoning studies, the variables of interest explained only 9.67% of the variation in the outcome, with $p < 0.001$ and an adjustment value (Aika Information Criterion) of 632.7. From the interactions obtained, students from the Northeast Region were 3.5 times more likely not to think about abandoning their studies compared to students from the Central-West Region ($p = 0.020$) and students from the Southeast Region were 2.6 times more likely not to think about abandoning their studies compared to those of the

Central-West region (p = 0.015). Students with good internet quality were 4.8 times more likely not to think about abandoning their studies compared to students with poor internet quality (p <0.001). Students who attended classes on a cellphone or tablet were 1.9 times not to think about abandoning their studies compared to those who used a computer (p = 0.031). No significant interaction was found between "maybe" and "yes" answers (Table 4).

Table 4. Multinominal logistic regression with outcome variable "thinking about abandoning studies".

Have you considered abandoning your studies because of COVID-19?	*Predictor***	*Estimate*	SE	Z	P***	*Odds ratio*	95% IC †	
							Lower	*Upper*
No x Yes*	Region:							
	Northeast x Central-West	1.252	0.536	2.334	0.020	3.496	1.2223	10.000
	North x Central-West	-0.183	0.430	-0.427	0.669	0.832	0.3585	1.933
	Southeast x Central-West	0.982	0.405	2.424	0.015	2.671	1.2071	5.910
	South x Central-West	0.335	0.323	1.036	0.300	1.398	0.7415	2.635
No x Yes	Internet Quality: Good quality x Bad quality	1.584	0.348	4.559	< .001	4.876	2.4676	9.635
No x Yes	Device(s) used to attend classes: Cellphone/Tablet x Computer	0.661	0.307	2.155	0.031	1.937	1.0615	3.533
No x Yes	Type of dental school:							
	Public x Private	-0.137	0.386	-0.354	0.723	0.872	0.4093	1.859
No x Yes	Level of computer knowledge:							
	Intermediate x Basic	0.484	0.264	1.834	0.067	1.623	0.9673	2.723
	Advanced x Basic	-0.222	0.398	-0.558	0.577	0.801	0.3673	1.746
Maybe x Yes	Region:							
	Northeast x Central-West	1.455	0.830	1.753	0.080	4.284	0.0664	0.569
	North x Central-West	-0.441	0.853	-0.517	0.605	0.643	0.8418	21.797
	Southeast x Central-West	0.994	0.630	1.579	0.114	2.703	0.1208	3.425
	South x Central-West	0.456	0.514	0.888	0.375	1.578	0.7867	9.286
Maybe x Yes	Internet Quality:							
	Good quality x Bad quality	-0.474	0.428	-1.107	0.268	0.622	0.2689	1.441
Maybe x Yes	Device(s) used to attend classes: Cellphone/Tablet x Computer	0.532	0.449	1.185	0.236	1.703	0.7058	4.107
Maybe x Yes	Type of dental school: Public x Private	-0.152	0.580	-0.262	0.793	0.859	0.2755	2.677
Maybe x Yes	Level of computer knowledge:							
	Intermediate x Basic	0.321	0.397	0.810	0.418	1.379	0.6336	3.001
	Advanced x Basic	-1.418	1.070	-1.326	0.185	0.242	0.0298	1.971

* Reference answer. ** Explanatory variable. ***Significance level p <0.05. † Confidence interval.

For the second regression related to the drop in academic performance during the pandemic, the variables of interest explained only 5.44% of the variation in the outcome variable, with p = 0.011 and an adjustment value (Aike Information Criterion) of 636.7. Only one of the interactions was significant: students with advanced computer knowledge were 6.0 times more likely to answer "a little" compared to those with basic knowledge (p = 0.009) (Table 5).

Table 5. Multinomial logistic regression with outcome variable "drop in performance during the pandemic".

Has your academic performance dropped significantly during the pandemic?	*Predictor***	*Estimate*	SE	Z	P***	*Odds ratio*	95% CI †	
							Lower	*Upper*
Yes x No*	Device(s) used to attend classes: Cellphone/Tablet x Computer	-0.54012	0.581	-0.9292	0.353	0.583	0.186	1.821
	Place of residence: Urban zone x rural zone	-0.29387	0.790	-0.3719	0.710	0.745	0.158	3.508
Yes x No	Region: Northeast x Central-West	-0.64139	0.675	-0.9500	0.342	0.527	0.140	1.978
	North x Central-West	-0.28547	0.755	-0.3781	0.705	0.752	0.171	3.301
	Southeast x Central-West	-0.52189	0.578	-0.9027	0.367	0.593	0.191	1.843
	South x Central-West	-0.00858	0.548	-0.0157	0.988	0.991	0.338	2.903
Yes x No	Level of computer knowledge:							
	Intermediate x Advanced	0.23714	0.543	0.4365	0.662	1.268	0.437	3.677
	Basic x Advanced	0.82116	0.606	1.3541	0.176	2.273	0.692	7.461
Yes x No	Internet Quality: Bad quality x Good quality	1.31818	0.771	1.7086	0.088	3.737	0.823	16.950
A little x No	Device(s) used to attend classes: Computer x Cellphone/Tablet	-0.92701	0.593	-1.5625	0.118	0.396	0.123	1.266
A little x No	Place of residence: Urban zone x rural zone	-0.13655	0.829	-0.1646	0.869	0.872	0.171	4.433
A little x No	Region:							
	Northeast x Central-West	0.42032	0.710	0.5922	0.554	1.522	0.378	6.119
	North x Central-West	0.63557	0.784	0.8105	0.418	1.888	0.406	8.791
	Southeast x Central-West	0.41853	0.612	0.6835	0.494	1.520	0.457	5.047
	South x Central-West	0.40796	0.595	0.6855	0.493	1.504	0.468	4.828
A little x No	Level of computer knowledge:							
	Intermediate x Advanced	0.85740	0.640	1.3407	0.180	2.357	0.673	8.255
	Basic x Advanced	1.78864	0.689	2.5958	0.009	5.981	1.549	23.085
A little x No	Internet Quality: Bad quality x Good quality	0.88571	0.795	1.1142	0.265	2.425	0.410	11.516

* Reference answer. ** Explanatory variable. ***Significance level p <0.05.

DISCUSSION

This study analyzed the effects of the COVID-19 pandemic on the academic performance of dental students in Brazil, addressing satisfaction and adaptation to Emergency Remote Teaching. At the time of data collection, most schools had interrupted in-person activities, partially replacing them with classes taught remotely using the online model. More than two-thirds of students demonstrated some degree of dissatisfaction with Emergency Remote Teaching and academic training during the pandemic, despite more than three-quarters of students having good quality internet access and being able to attend remote classes without problems. The computer was the most used device to follow remote classes and most students agreed that using it for learning made them restless and confused to some degree. Two out of three students had difficulty or were unable to learn through Emergency Remote Teaching. Nine out of ten students reported a drop in academic performance and the lack of in-person interaction with the teacher was a negative factor in learning for eight out of ten. Most students agreed that the quality of the course was negatively affected by the interruption of in-person activities and the adoption of remote teaching strategies. Geographic region of residence and the device used to follow classes influenced thoughts of abandoning studies. Moreover, the level of computer knowledge influenced academic performance during the pandemic.

Replacing in-person attendance with Emergency Remote Teaching was the most appropriate means during the pandemic. However, the consequences arising from a change in the teaching model in terms of adaptability and the mental health of students must be considered[6,12,14,28].

The sample of the present study had a similar profile as that of the total population adopted as reference. As reported in previous studies, most dental students were female and studied full-time and a large part was between 18 and 25 years of age[29,30]. Similarities were also found in terms of the proportion of public and private schools offering dental courses in Brazil, with private institutions prevailing over public universities[30].

Most dental schools replaced theoretical in-person activities with remote activities. However, due to the reduction in the number of cases in some states in the second half of 2020[31], some institutions were gradually returning to in-person practical classes.

Although most agreed with the interruption of in-person classes in response to the pandemic, a considerable percentage of disagreement was found in terms of satisfaction with remote classes. Dissatisfaction with Emergency Remote Teaching and academic education may be related not only to the unfeasibility of carrying out clinical and laboratory activities, which implies an impossibility of developing the psychomotor skills necessary for the profession, but also to a drop in performance likely resulting from a reduction in concentration capacity, the absence of student/teacher interactions and inadaptability to Emergency Remote Teaching. Studies conducted with undergraduate students in different fields demonstrated the lack of autonomy to carry out activities adequately in a remote learning environment, with difficulty concentrating when attending classes; such studies also highlighted the lack of engagement on the part of students as a result of the structure of classes being tiring and unattractive, which are factors that promote resistance to remote teaching[6,10]. These deficits indicate that, for the most part, students are accustomed to the traditional teaching method, which places them as passive agents in the learning process, as previously reported in the literature[32], creating difficulty in adapting to Emergency Remote Teaching, the structuring of which is based on the premise of learning through virtual resources, making it necessary to develop autonomy in relation to studies.

The good quality of the internet reported and the agreement with being able to attend remote classes with no internet problems differ from studies that analyzed courses in other fields, which highlighted the instability of the internet connection and the inadequate home office infrastructure for online learning as the main problems reported by students[33-36].

The majority (74.4%) of students used the computer as their main electronic device for studies. The results of the type of electronic devices used by dental students are similar to data described in a previous survey conducted with students in other courses[11].

Three out of every four students totally or partially agreed with the statement “the use of a computer or other electronic

means for learning makes me restless and confused." This significant portion of the sample and those who reported an inability to learn while studying remotely could be strongly associated with the difficulty in adapting to the use of virtual resources[6,11]. However, student contact with subjects offered online has been a growing practice in undergraduate dental courses[33,35]. In theory, contact with the material would provide prior experience with disciplines adapted to Emergency Remote Teaching and, therefore, difficulties related to the use of the virtual resources should be reported little, which is contrary to what was observed.

One may infer that the difficulties experienced by the students point to an inherent characteristic of the generation, which was also recorded in years prior to the pandemic[37,38]. The majority (86.4%) of participants had been born between the mid-1990s and early 2000s, belonging to the so-called Z generation[39]. Young people of this generation are, for the most part, capable of performing multiple tasks at the same time as a result of their "digital nativism". However, they carry out these tasks with little ability to concentrate in addition to having greater risks of isolation, insecurity, anxiety and depression as well as a low tendency to persist, which leads to difficulties in the execution of long-term processes[39]. Due to their immediate and technological profile, teaching activities formulated essentially through expository classes tend to be unattractive to such individuals[37,38]. Based on this generation-learning relationship combined with the concept of Emergency Remote Teaching defined by Hodges (2020)[40], the dissatisfaction reported may be a strong indication that the teaching used in remote classes, which resembles the long expository classes taught during in-person teaching, does not correspond to the students' profile, resulting in deficient learning.

The reported possibility of abandoning studies may be linked to the drop in academic performance and dissatisfaction with Emergency Remote Teaching as well as issues such as behavioral self-regulation, performance anxiety, interpersonal relationships, social integration and the influence of financial aspects[41,42]. Significant agreement was found with regards to the desire to return to practices. Such responses are possibly due to the fact that training in dentistry requires laboratory and clinical practices for the development of manual and cognitive skills, which are fundamental to the exercise of the profession[16,17]. Dental students tend to have higher levels of stress compared to the general population, which is mainly associated with the high training requirements of dental procedures[18]. As these students advance through the semesters, there is a greater need for clinical practice and internships, which, when interrupted, lead to a lower level of student satisfaction. The interruption of this learning modality as a result of the COVID-19 pandemic served as a predisposing factor for the deficits reported by dental students in addition to being relevant to the decision to abandon one's studies. It is noteworthy that 28.5% of students defended the continuation of the Emergency Remote Teaching until their vaccination. Among the possible explanations for this would be the fear of contracting the virus and/or the possibility of transmitting it to family members and people close to them[13].

A poor internet connection makes access to remote classes difficult, hindering the possibility of understanding the content taught and, consequently, influencing both the performance and satisfaction of students and the thought of abandoning studies[43-45]. This was found through the regression test, which showed a significant interaction between the decision not to abandon studies and internet quality.

Significant associations ($p < 0.05$) were found between the outcome variable "thinking about abandoning studies because of COVID-19" and region of residence. These results are similar to data reported in the literature, demonstrating that the Central-West Region has considerably higher university dropout rates from courses in different fields compared to other regions of Brazil and often oscillates above the national average[43]. However, the non-probabilistic nature of the sample and the lack of studies that analyze variations among regions related to specific dropout rates from dental schools make it impossible to provide details on the influence of the explanatory variable "region of residence" and dropping out of dental school during the pandemic.

Another limitation of the study was the non-use of validated instruments related to psychosocial aspects, stress, anxiety and depression, which limits the association of these factors with the drop in performance, dissatisfaction and thoughts of abandoning studies reported by students. The possible sharing of devices, the students' previous experience with virtual resources or even their possible difficulty in participating in the study due to limited access to computers, tablets, cellphones and the internet as a result of insufficient income were not addressed in this investigation and should be discussed in future studies.

On the other hand, this research has the merit of highlighting students' perceptions with regards to Emergency Remote Teaching during the pandemic. As a survey based on the self-reports of students, a significant contribution is made in terms of clarifying the viewpoint of students in terms of the teaching of dentistry during the pandemic in Brazil, offering an overview of their perceptions of the changes experienced in the academic routine.

CONCLUSION

The pandemic caused by the coronavirus significantly impacted the teaching of dentistry, especially in terms of the students' academic performance and satisfaction with training. A significant drop was reported in the academic performance of students during Emergency Remote Teaching, especially among students with difficulties accessing the internet and those with a low level of computer knowledge. Such findings, along with the region of residence and the device used to follow classes influenced the desire to abandon studies during the period. The need for greater interaction with the teacher, the unpreparedness of students in terms of the remote teaching modality and difficulties related to learning in this context demonstrate that Emergency Remote Teaching was insufficient to cover the range of skills to be developed during training in dentistry. This study also contributes to the debate on the inclusion of online subjects in undergraduate dental courses, given that this is not viable in courses that require extensive practical hours to develop the skills necessary to professional practice.

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