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Access to oral healthcare for children during the COVID-19 pandemic: a mixed-methods study in the Aegean region of Türkiye

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Abstract

Background The COVID-19 pandemic significantly disrupted healthcare systems, particularly affecting vulnerable populations such as children and individuals with special needs, causing delays and reductions in routine dental services. The aim of this study was to evaluate level of access and identify determinants of access to oral healthcare for children aged 0–13 during COVID-19 restrictions.

Methods Mixed-methods research design was adopted. This cross-sectional study included 270 children aged 0 to 13 years who visited Ege University Pediatric Dental Clinics between August 2021 and February 2022. Interviewer-administered questionnaires collected information about sociodemographic and economic characteristics, as well as dental service utilization during the pandemic. "Access" to receive oral health care to address existing dental problems is defined separately for each application to the institution. Statistical analyses were conducted using IBM SPSS Statistics 23, with Pearson's Chi-Square, Fisher's Exact, and Binary Logistic Regression tests applied to examine variable relationships. A 95% confidence interval and a significance level of $p < 0.05$ were adopted, with model fit assessed using the Hosmer-Lemeshow test and Nagelkerke R^2. Qualitative data from 16 in-depth interviews were analysed using thematic analysis to explore the barriers to accessing oral healthcare during the COVID-19 pandemic.

Results During the pandemic, 62.3% of dental institutions' applications had limited access to care. Parental education, employment status, and household income significantly affected access ($p < 0.005$). Multiple logistic regression revealed that applying to university clinics (OR = 4.78; 95% CI 2.24–10.21) and private institutions (OR = 4.33; 95% CI 2.30–8.17) led to higher access rates when compared to public dental centres. The father's regular employment (OR = 3.39; 95% CI 1.37–8.34) and the child's previous dental contacts (OR = 2.37; 95% CI 1.21–4.62) increased the likelihood of accessing oral healthcare. The risk of contracting infections and income loss were pandemic related barriers. The most common barriers were those concerning the availability of services at public dental clinics. Children with disabilities faced further barriers due to the risk of infection, difficulty reaching institutions, and unmet dental needs for treatment under general anaesthesia.

Conclusion Higher socioeconomic status and past contact with dentists had a positive effect on oral healthcare access. Dental services provided by public institutions had a lower level of access. The COVID-19 pandemic

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highlighted oral healthcare inequalities, particularly for those children with disabilities in Türkiye. Policymakers should strengthen public health crisis plans in order to improve children's oral healthcare access.

Keywords Access, Oral healthcare, Health services, Pandemic, COVID-19, Paediatric dentistry

Background

The Coronavirus disease (COVID-19) pandemic significantly affected access to services, as it across all areas of the of the healthcare [1]. In early stages of the pandemic, the main focus was on the SARS-CoV-2, which led to disruptions in access to healthcare for patients suffering from non-COVID-19 diseases [1, 2]. Dental care was particularly affected, as many countries implemented policies restricting non-emergency dental procedures to minimize the risk of viral transmission [3, 4]. Consequently, preventive and routine dental treatments, including check-ups, fluoride applications, and restorative procedures, were postponed or canceled, exacerbating oral health disparities, particularly among populations. The interruption of routine dental services also contributed to an increased burden of untreated dental diseases, potentially leading to more severe oral health complications in the long term [5].

Access to healthcare has been widely studied through various frameworks. Aday and Andersen's (1974) model, one of the earliest frameworks on healthcare access, defines it as the actual use of health services and the factors that influence it [6]. Penchansky & Thomas (1981) refined this by introducing the five dimensions of access: Availability, Accessibility, Accommodation, Affordability, and Acceptability [7]. Gulliford et al. (2002) defines access with two distinct verbs: "having access" refers to the potential to utilize a service if needed, while "gaining access" refers to the initiation into the process of utilizing a service, highlighting barriers such as financial, organizational, and informational barriers [8]. Expanding on these models, Levesque et al. (2013) proposed a dynamic, patient-centered framework linking five dimensions of access (approachability, acceptability, availability/accommodation, affordability, and appropriateness) with five patient abilities (ability to perceive, seek, reach, pay, and engage) [9]. Thus, access is more than just service utilization; it also encompasses a variety of factors which can impede individuals from obtaining their required care. Utilization, on the other hand, focuses on whether individuals actually use the healthcare services which are available to them. The current concept of access encompasses all stages, from identifying healthcare needs, to seeking, reaching, obtaining, or using health care services, and ultimately fulfilling their needs for their required services [9].

One of the key determinants of access to oral healthcare is oral health literacy, which plays a crucial role in the utilization of dental services. It plays a significant role in oral health outcomes, influencing behaviors such as oral hygiene practices, frequency of dental visits, and adherence to preventive care measures. Low oral health literacy is associated with higher rates of dental caries, untreated oral conditions, and less frequent use of dental services, especially in children, whose oral health is largely influenced by their caregivers' literacy levels [10, 11]. Addressing oral health literacy could help mitigate some of the barriers to care access for all members of society, especially during times of healthcare disruption, such as the COVID-19 pandemic [12].

Children and people with special needs are among the groups most affected due to their unmet needs for and access to dental care even before the pandemic [13]. Due to the burden of oral diseases and the disruption of preventive care services, children across the world have a very high degree of dental care needs [14, 15]. According to an Organisation for Economic Co-Operation and Development (OECD) report for 2020, the COVID-19 pandemic seriously affected children [16]. The implementation of mitigation policies, such as lockdowns, school closures, and social distancing measures, had an impact on children's healthcare access, including their oral healthcare [17, 18]. Children's oral health was likely one of the most significantly impacted aspects of their overall health because of early access limitations to dental care, particularly because of restrictions on aerosol-generating procedures in dentistry, including dental cleanings, restorative and endodontic treatments [19–21]. These procedures were considered high-risk for virus spread, as they involve the use of dental instruments that can produce droplets or aerosols, which can linger in the air and increase the risk of infection [22]. As a result, children's access to essential dental care, including check-ups and necessary treatments, was significantly reduced, leading to delays in interventions that could result in a rise in dental caries, pain, and other oral health issues.

Both public and private health institutions in Türkiye provide oral health services. Individuals covered by social security can receive free or partially paid services in public dental institutions; however, in private institutions, people are responsible for paying all expenses themselves [23]. The provision of dental care shifted from private to public after the "Health Transformation Programme" launched in 2003 [24]. However, due to the performance-based payment system in public dental clinics, this program encouraged dental practitioners to prioritize quantity over quality by focusing on the number of patients seen and the number of treatments administered

each day [25]. For many years, inadequate access to oral healthcare has been a significant issue in Türkiye [26]. Consequently, the long-standing issue of access remains unresolved, and a serious issue of questionable service quality has also surfaced. Moreover, with the COVID-19 pandemic, this problem became more apparent, particularly in children [17, 18].

Health authorities issued recommendations to delay elective dental treatments at the beginning of the pandemic [19, 20]. Many dental offices closed or only provided urgent care in the spring of 2020 due to the possibility of viral transmission. According to the Turkish Health Statistics Yearbook 2020, the number of dental visits decreased by 51.4% in 2020, the year the pandemic began [30]. Not surprisingly, evidence emerged on substantial declines in children's utilization of oral healthcare services during the pandemic [22, 23]. Access is more complex than what can be understood solely from the number of dental visits or the use of oral healthcare services [9]. Aside from the measures taken, such as closing clinics and reducing patient capacity due to COVID-19, there are additional barriers to accessing oral healthcare like socioeconomic factors, geographic location, cost of treatment, fear of COVID-19, all of which contribute to disparities [28]. It is yet unknown how these characteristics affected children's access to oral healthcare and how these factors evolved during the pandemic period in Türkiye. A holistic assessment of patients, institutions and the interaction between them may provide a better understanding of this problem.

The aim of the study was to first assess the level of access and then to explore the determinants of access for those patients aged 0–13 years who were treated at Ege University Pediatric Dental Clinics during the period of the COVID-19 pandemic restrictions.

Methods

This study was conducted at Ege University Pediatric Dental Clinics between August 2021 and February 2022. The Ege University Ethics Committee reviewed and approved the study design and protocols (ref: 21-2T/11). Prior to the commencement of the study, participants and their parents/legal guardians were provided with information both orally and in writing. Informed consent forms were obtained from all participants and their legal guardians.

Research design

A mixed-method research design was used for this study, integrating both qualitative and quantitative approaches. The quantitative approach was designed as a cross-sectional study, and the reporting process adhered to the guidelines outlined in the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist. Levesque's framework for access to healthcare was adopted for the qualitative data approach [9]. The researchers reported the results using the COREQ (Consolidated Criteria for Reporting Qualitative Studies) criteria [33].

Study group

The study included children aged 0 to 13 who applied to Ege University Pediatric Dental Clinics between August 2021 and February 2022. The average number of patients admitted to Ege University's Department of Pedodontics in the two years before the pandemic was taken as the reference. Using 12,500 individuals as the target population, the sample size was calculated as being 270 with a 6% margin of error and 95% confidence interval. As the prevalence was unknown, we based our sample size calculation on a prevalence of 50%, which provides the maximum possible sample size. The inclusion criteria were being a child who applied to Ege University Pediatric Dental Clinics with an accompanying person familiar with all of their health problems experienced during the pandemic period. In total, 292 parents were invited to participate in this study, and 270 ultimately consented. The remaining parents declined to participate, citing reasons such as a lack of motivation or time constraints.

For the qualitative part, the first author (SA) invited parents who expressed significant experience with access to oral healthcare during the pandemic to an interview. The participants' diversity was taken into consideration based on their educational background, occupation, and the type of oral health problems (pain, trauma, etc.) which necessitated seeking care during the pandemic. We deemed the research complete upon reaching data saturation during in-depth interviews when further data collection did not yield any new information [24, 25]. This study achieved data saturation after conducting in-depth interviews with 16 patients (Fig. 1).

Variables and data collection

In this study, access to oral healthcare during the pandemic was the dependent variable. We considered "access" to be receiving dental treatment or temporary management of dental pain. We categorized the following conditions as "limited access": an inability to receive temporary pain management at the institution, physical inaccessibility to the institution, only receiving prescriptions without intervention, a referral to university dental clinics, or no treatment due to non-cooperation. Table 1 presents the categorization of access based on the situations encountered in the institutions.

The researchers developed a questionnaire in Turkish, based on existing concepts and literature related to access. This questionnaire is original and has not been published previously. Information regarding

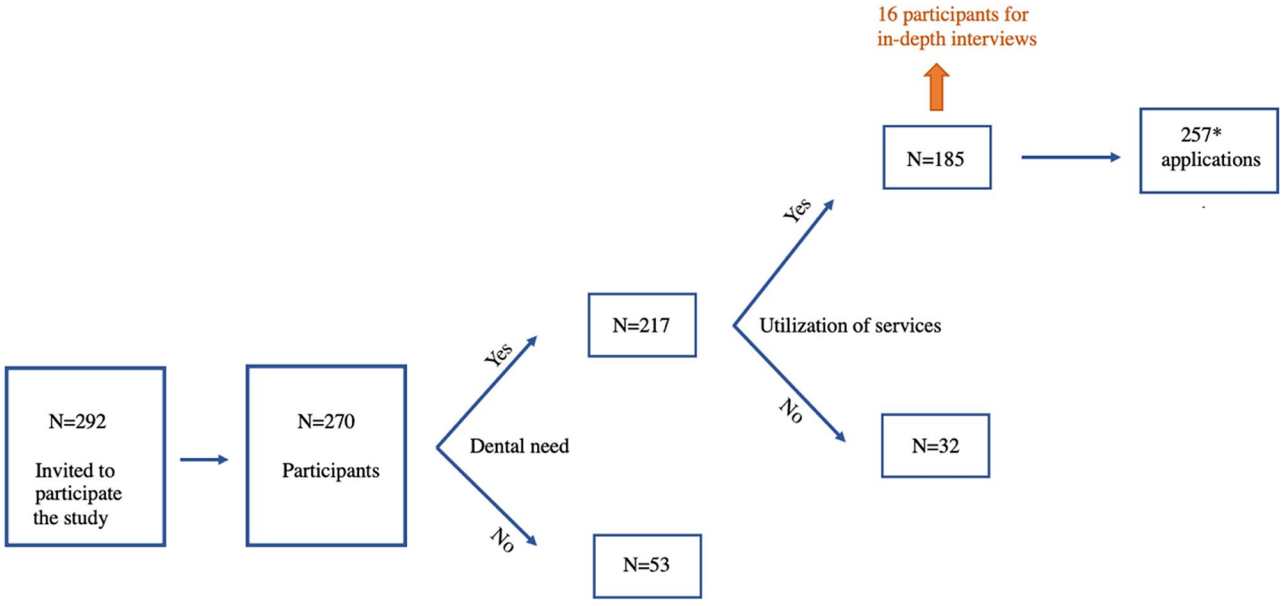

Fig. 1 Flow chart of this study

Table 1 Classification of access to oral healthcare based on the situations experienced in the relevant institutions

Access	Dental treatment was provided
	Temporary management of dental pain
Limited Access	No treatment, only consultation
	No treatment, no consultation
	The institution was physically inaccessible
	Medication was prescribed without any intervention
	Referral to university dental clinics
	No treatment due to a lack of cooperation

sociodemographic and economic characteristics (age, gender, mother's/father's education, employment, household income) and oral health service utilization during the pandemic were collected using interviewer-administered questionnaires (see Appendix).

Parental education levels were classified into six categories: illiterate, literate but did not complete primary school, primary school, secondary school, high school, and university or higher. For data analysis, these categories were categorized into three groups: secondary school graduate or lower education, high school graduate and university graduate or higher. Occupations were categorized into seven groups: unemployed, wage worker, salaried employee, self-employed, retired, and other. For data analysis, these categories were consolidated into two groups: those with a stable job and regular income and those without. Household monthly income was defined as the total earnings of all income-generating family members, including wages, rental income, and government assistance when applicable. Income levels were divided into four categories based on Türkiye's minimum wage at the time of data collection.

Regarding oral health service utilization, participants were asked whether they have a healthcare institution or dentist that they visit regularly for their child. Their responses were classified into four categories: university hospitals, public dental centres, private clinics, or no regular dental care provider. In the final section of the survey, participants who indicated that their child required dental care during the pandemic were asked whether they had sought treatment from any other institution. Their responses were grouped into three categories: university hospitals, public dental centres, and private clinics.

A person may apply to multiple institutions but may not access oral healthcare in all of them. Defining 'access' based solely on the number of applicants may lead to some confusion. Therefore, access is defined by considering the number of individual applications to each institution separately, rather than the number of participants.

A single researcher (SA) collected the data face-to-face for the qualitative part of this study. The interviewer (SA) was trained by an experienced researcher (ZÖ) through three preliminary interviews conducted and analyzed together. The interviews were transcribed verbatim by the interviewer (SA), and the data analysis was conducted manually by the interviewer (SA) without using any analysis software. In-depth interviews were conducted using semi-structured questions, which provided the respondent with the opportunity to express their thoughts and opinions with a focus on a specific, pre-defined problem. Six open-ended questions were defined and agreed upon with three specialists in the field. The interviews were audio-recorded. Each interview lasted about 30 min.

Data analysis

Quantitative data were analysed using IBM SPSS Statistics 23 (IBM SPSS Statistics for Windows, Version 23.0 Armonk, NY: IBM Corp). Pearson Chi-Square and Fisher's Exact Tests were conducted to investigate associations between the independent variables and the dependent variables. Based on the significance of the Chi-Square test, the association between access to dental services and the independent variables was assessed using binary logistic regression analysis. Logistic regression analysis was utilized in order to develop a model which examines the relationship between access to dental services and various variables of interest. Prior to being incorporated into the model, the independent variables were regrouped. The determinants included in the model were "*regular source of dental care*," "*institution applied to*," "*employment status of mother and father*," "*education level of mother and father*," "*monthly income of the household*," "*number of siblings*," and "*having been to a dentist before the pandemic*." The Hosmer-Lemeshow test was used to measure the goodness of fit of the regression model, and Nagelkerke R2 was used for the model explanation ratio. The confidence interval was 95%, and the statistical significance level was accepted as $p < 0.05$ in all analyses.

In the qualitative part, each interview was transcribed verbatim and coded soon after it was completed. Multiple consensus meetings and continuous improvement refined the categories, domains, and access framework design. SA and ZÖ evaluated the dataset and reached a consensus on selecting open codes and data related to oral healthcare. Following this, SA enhanced the list of codes and generated sub-codes. Following a consultation with ZÖ, the codes and sub-codes were subsequently restructured. The researchers then used Levesque's access framework to examine the categories and classify them into domains related to the determinants of access to oral healthcare.

Results

Quantitative findings

A total of 270 parents participated. The majority (48.5%) of the respondents were mothers. The mean age of the children was 8.08 ± 2.24 years. A total of 54.8% had one sibling and 30% had two or more siblings. When the parents were classified based on their educational levels, 59.2% of the mothers and 61.9% of the fathers had a high school diploma or higher.

One in every two mothers was a homemaker (52.6%), while 40.7% of the fathers were salaried workers. According to the results, 46.3% of the families had a monthly income between the minimum wage and double the minimum wage, while 18.9% had a monthly income below the minimum wage. Of the participants, 9.6% had systemic diseases, 1.5% had disabilities (autism, cerebral palsy, Down syndrome), and 6.3% regularly took medication.

Most children (66.3%) had visited a dentist before the COVID-19. When asked if they had a regular dentist or dental institution, 38.9% of the participants stated that they routinely applied to university dental clinics, 13.3% to public dental centres, and 7.4% to private dental clinics while 33.7% answered that they did not have any regular dentists or dental institutions.

Out of a total of 217 children who needed oral healthcare during the pandemic, 185 of them applied to dental institutions. The total number of applications was 257 (Fig. 1). Of the 257 applications, 62.3% had limited access to service, while 37.7% were able to access. Table 2 displays the applicants' socioeconomic information and access status.

There was a statistically significant difference in the access levels for those children whose parents had graduated from high school or higher. Despite the lack of significant findings on the impact of the mother's employment status, the analysis revealed a significantly higher likelihood of access for those children whose fathers held a steady job with a regular income. A positive relation was observed between the monthly income level of the household and the percentage of access to dental services. This relationship was found to be statistically significant.

The institutions to which individuals applied and their access were significantly associated. While applications to private institutions and university hospitals were successful in accessing dental services (58%), a considerably higher percentage of applications to public dental centres did not result in access (77.5%) (Table 3).

In the logistic regression model, the "limited access" group served as the reference (Table 4). The model's goodness of fit was assessed using the Hosmer-Lemeshow test, and the results showed that the model and the data were compatible ($p = 0.947$). The model explanation rate was calculated using Nagelkerke R2 and found to be 23.6%.

The model accurately predicted 70.4% of the data when preparing the classification table. Regression analysis revealed that there was a statistically significant link between access and the institution applied to, the father's employment status, and having seen a dentist before the pandemic. The findings showed that patients who applied to a university hospital had a 4.788 times higher chance of accessing the service compared to those who applied to a public dental hospital. Similarly, those patients who applied to a private institution had a 4.336 times greater chance of receiving dental care than those who applied to a public dental hospital. The presence of a parent with a steady job significantly enhanced the probability of their child accessing dental services by a factor of 3.391.

Table 2 The percentages of applications which resulted in access based on patients' sociodemographic characteristics

Patients' characteristics		Limited Access		Access		Total	*p*-value
		n	%	*n*	%		
Gender	Female	85	64.0	50	37.0	135	0.898
	Male	75	61.5	47	38.5	122	
Age group	0–6 years	38	63.3	22	36.7	60	0.771
	7–9 years	68	64.2	38	35.8	106	
	Above 10 years	54	59.3	37	40.7	91	
Number of siblings	0	27	60.0	18	40.0	45	0.067
	1	88	57.9	64	42.10	152	
	2 or more	45	75.0	15	25.0	60	
Education level of mother	Secondary school graduate or lower education	71	67.6	34	32.4	105	0.017
	High school graduate	61	66.3	31	33.7	92	
	University graduate or higher	28	46.7	32	53.3	60	
Education level of father	Secondary school graduate or lower education	72	72.7	27	27.3	99	0.022
	High school graduate	48	57.1	36	42.9	84	
	University graduate or higher	40	54.1	34	45.9	84	
Having a steady job with regular income (mother)	No	130	64.7	71	35.3	201	0.160
	Yes	30	53.6	26	46.4	56	
Having a steady job with regular income (father)	No	36	83.7	7	16.3	43	0.002
	Yes	124	57.9	90	42.1	214	
Monthly income of the family	Lower than one National Minimum Wage	48	72.7	18	27.3	66	0.043
	Between one and two National Minimum Wages	71	64.0	40	36.0	111	
	Between two and three National Minimum Wages	25	55.6	20	44.4	45	
	More than three National Minimum Wages	16	45.7	19	54.3	35	
Total		160	62.3	97	37.7	257	

Table 3 The institutions being applied to and status of access

Dental clinic	Limited Access	Access	Test statistics
	n (%)	*n* (%)	
Private dental clinics	29 (42.0)	40 (58.0)	34.373
Public dental centres	114 (77.5)	33 (22.5)	$p < 0.05$
University dental clinics	17 (41.5)	24 (58.5)	
Total	160 (62.3)	97 (37.7)	

Those children who had previously seen a dentist before the pandemic showed a 2.371-fold increase in their probability of accessing dental services during the pandemic in comparison to those who had not had any prior dental visits. The confidence intervals of the odds ratios for all variables which exhibited significance in the model were found to exceed the value of 1, thereby providing evidence for their statistical significance.

Table 4 Multivariable analysis of determinants of access to oral healthcare for children during the pandemic

	Beta	S.E.	Wald	*p*	O.*R.*	95% C.I.	
Variable (Reference)						**Lower bound**	**Upper bound**
Institutions that applied to (Public dental centres)			27.936	0.000*			
University dental clinics	1.566	0.386	16.422	0.000*	4.788	2.245	10.211
Private dental clinics	1.467	0.323	20.579	0.000*	4.336	2.300	8.171
Father having a steady job with regular income							
No							
Yes	1.221	0.460	7.057	0.008*	3.391	1.377	8.349
Child had been to dentist before the pandemic							
No							
Yes	0.863	0.341	6.415	0.011*	2.371	1.216	4.623
Constant	-2.913	0.542	28.888	0.000*	0.054		

Hosmer-Lemeshow; X2 = 1.675 and $p = 0.947$

Cox and Snell R2 = 0.174 and Nagelkerke R2 = 0.236

Correct classification rate = 70.4

*$p < 0.05$, S.E.=Standard Error, O.R.=Odds Ratio, Ref.=Reference, C.I.=Confidence Interval

Qualitative findings

Based on the analysed interviews, the determinants of access to oral healthcare were categorized into seven dimensions.

Ability to perceive dental needs

All parents stated that their children had been experiencing oral health problems since before the pandemic. Most of them said that their children did not brush their teeth often and pointed to the excessive consumption of junk food during the pandemic.

> *"It was very challenging for them to stay at home during the pandemic. As they stayed at home, their oral health got worse as they constantly ate junk food. Dental problems have increased throughout this pandemic..." (Mother of two children with poor oral hygiene habits).*

Ability to seek oral health care

Eleven parents stated that they had applied to various institutions prior to the start of the pandemic. Among these patients, the majority were those who regularly applied to public dental centres and university dental clinics. Three parents stated that they postponed applying to these institutions due to the risk of COVID-19 transmission, while three parents stated that they tried to continue their dental treatment even though pandemic was ongoing. The parents of children with disabilities stated that they faced greater challenges due to their children's susceptibility to infections and their inability to seek treatment, resulting in an exacerbation of their pre-existing dental problems.

> *"I couldn't take my child anywhere since she had a fever and seizures shortly after the infection. It was extremely difficult to take her out in such a period." (Homemaker, mother of a child with an intellectual disability).*

Several parents expressed their lack of trust in private dental institutions, primarily due to their profit-orientation and inadequate hygiene measures during the pandemic. However, one parent claimed that they considered private institutions to be safer in terms of hygiene practices and pandemic measures. Some parents claimed that being able to communicate with their regular dentist facilitated access during the lockdown period. Parents claimed that being unable to access their regular dentist had a negative impact on their children's motivation towards the dentist and the treatment process.

> *"My children kept asking why our regular dentist was absent.... They draw pictures for her, it is very important to see someone familiar there." (Highly educated mother of two children who have regular dentists).*

Ability to reach oral healthcare

Long travel times, long distances, and the challenges of using public transportation were the most commonly expressed transportation problems. Two parents considered public transportation to be risky in terms of infections, particularly during the time of the pandemic, while one parent stated that they had problems due to the public transportation restrictions during the pandemic period. The parents of those children with disabilities spoke about the difficulties they faced when using public transportation for their child's special needs.

> *"It takes 1.5 hours to get here.... Think about traveling alone in the dark as a woman with two children." (Single parent, working mother with two children, living in a suburban area).*
>
> *" I struggled a lot yesterday on my way to the dental clinic with the wheelchair. We didn't have any private car.... You'd cry if you saw me." (Mother of a child with an intellectual disability having dental pain from a low socioeconomic background).*

Availability & accommodation of dental services

According to the parents, the absence of dentists caused disruptions in the delivery of oral healthcare. The constant absence of their regular dentists forced parents to seek care from other dentists or institutions. This was determined to be due to the inclusion of dentists in the filiation teams which were responsible for testing and tracing COVID-19 cases during the pandemic.

The most frequently addressed problem with appointments was the inability to get one. During the pandemic period, the appointment quota quickly filled up. Despite physically reaching the institution, many parents expressed their dissatisfaction at not receiving any curative treatment. Seven of them experienced that situation in public dental centres, two in university hospitals, and one in private institutions. The inadequate number of dentists, a lack of interest among healthcare professionals, and the fact that elective dental procedures were not performed within the scope of pandemic measures were among the reasons given in public dental centres.

> *"Why did they leave public dental clinics abandoned?.... Children are neglected by the oral healthcare system... I am frustrated in every way, from scheduling an appointment to receiving treatment. We have yet to access care " (Mother of four children,*

income loss due to the pandemic, applied to multiple public dental centres).
"Public dental centres have been useless since the pandemic started… The doctor said, open your mouth, he glanced at it from the doorway, without allowing my child to sit in the dental chair. He gave the prescription and sent us away" (Mother of 7-year-old girl experiencing dental pain, applied to multiple public dental centres).
"Why are public dental centres open if we can't get any service?" (Father of a child who had dental pain, living in another city).

The parents of those children with disabilities stated that, despite applying to various institutions, they were unable to receive dental treatment under general anaesthesia from public dental centres or university hospitals. Long waiting times and inadequate facilities forced then to apply to different institutions.

Affordability and the parents' ability to pay for oral healthcare

Eight of the parents mentioned that they had financial difficulties in paying for dental treatment at private institutions. Three parents said that they had lost financial income because of the pandemic. One parent said that they were struggling to cover additional expenses (transportation, material fees) in public dental centres.

" The problem I have right now is the constant purchases (mask and gloves). When I bring both of my children together, I must pay double. It is difficult for a family with a low income like mine." (Mother of three children with early childhood caries, regularly visiting university clinics, low socioeconomic level).

The parent of a special needs child, facing income loss due to the pandemic, discussed their child's unmet dental need for treatment under general anaesthesia.

Despite seeking assistance from public dental centres and universities, they were rejected. However, they could not afford the expenses associated with private clinics.

"We live in a house with a wood stove, no gas supply. My husband works alone, and we have three children.… My husband applied for a loan to take our son to private clinics; we have a lot of debt because of the pandemic. We could not receive the loan. I was desperate." (Homemaker, mother of a child with a disability, income loss due to the pandemic).

Appropriateness of services

A total of eight parents reported experiencing a range of communication problems. Five participants reported experiencing difficulties when engaging in dialogues with dentists and facing aggressive behaviour from healthcare professionals.

" 'Don't give me any paediatric patients; do I have to yell?' said the doctor to the secretary next to him. He had an unusual demeanour." (Father of a child who had dental pain, living in another city).

The caregivers of children with disabilities said that they experienced additional challenges due to their children's inability to express their complaints independently. Most institutions exhibited a dentist's reluctance to care for children with disabilities, resulting in the postponement or delay of essential dental interventions. One parent expressed the psychological crisis she experienced because of her child's unmet dental needs.

"Many of the doctors said that she had too many concurrent medical problems, so they postponed their dental treatment. I even met a doctor who slapped my child's hand.… Then you come home, you feel desperate. You are experiencing a breakdown and grappling with familial issues." (Homemaker, mother of a child with a disability, applied to multiple clinics).

Outcomes of inadequate access to oral healthcare

Applying to multiple institutions Parents stated that they applied to different institutions because they could not gain access to care. The main reasons for this were not being able to reach their regular dentist, not being able to make an appointment, and not receiving the proper treatment. The reasons for referrals to university hospitals were having children with special needs, healthy children who needed pharmacologic behaviour guidance techniques, or the need for root canal treatment. Parents expressed their grievances by applying to multiple institutions.

" 'You should go to university hospitals for root canal treatment' they said. This is ridiculous. Are the dentists in public health centres only trained to do fillings? They graduated from the same school, they had the same education." (Highly educated mother of 2 children who had root canal treatment needs).

The lack of access to dental services in public dental centres compelled parents to seek care in private clinics. The most common reasons for choosing private clinics were the need of emergency treatment, the inability to make an appointment in public dental centres, and not having any treatment carried out when visiting public institutions.

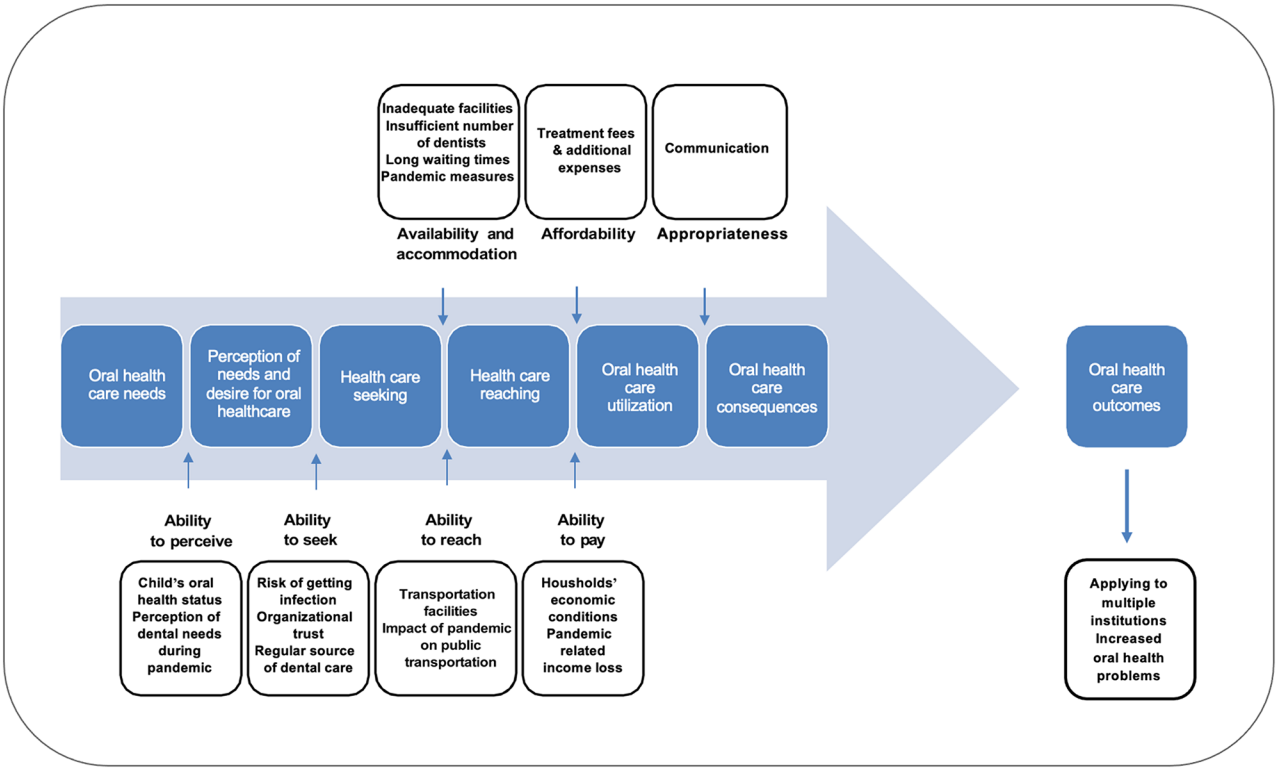

Fig. 2 Conceptual framework of access to oral healthcare during the pandemic (adopted by Levesque et al.)

"People visit private clinics out of necessity." (Mother of four children experiencing dental caries, income loss due to the pandemic).

Increase in oral health related problems and the search for solutions Parents reported an increase in dental complaints in their children, particularly dental pain and abscesses, due to poor access during the pandemic. They tried to relieve the pain at home using various herbal methods. Seven parents reported an increase in the use of antibiotics and painkillers due to worsening oral health problems. One of them said, *"Painkillers became a part of our lives."* Some parents stated that they did not have enough information about the medicines, doses, and regimens.

"We tried everything we could at home, including applying garlic." (Mother of three children, low socio-economic background).

The parents of those children with disabilities expressed their frustration at being unable to pinpoint the source of their child's pain, conveying feelings of deep depression and helplessness in the face of this challenge.

"…. My child was crying out of pain. We were crying together." (Mother of a child with autism).

"The world appeared completely dark to me. I crumbled as I attempted to fight. My child was suffering in front of my eyes, and I was powerless to stop it." (Mother of a 7-year-old child with an intellectual disability).

Discussion

The COVID-19 pandemic caused disruptions in preventive measures, delayed diagnoses, and caused the suspension of routine treatments, which all exacerbated inequalities in access to healthcare, particularly affecting disadvantaged groups [12, 26]. This study highlighted the differences in access to oral healthcare, the challenges, and the barriers to accessing oral healthcare for those children under 13 years of age in Izmir and its neighbouring provinces during the COVID-19 pandemic. Measuring access is a difficult task which necessitates a multidimensional evaluation. Through a mixed-methods approach, we provided an in-depth understanding of the barriers and facilitators to access in times of pandemics. We classified Levesque et al.'s conceptual framework [9] into seven aspects from both the patient side and the provider side (Fig. 2). From the perspective of those seeking oral healthcare, our model identifies important barriers which need to be addressed in order to improve children's oral healthcare access. Additionally, our model provides valuable insights into the necessity of crisis

response plans for future pandemics, which may also be beneficial for other countries.

Even though our study was conducted in a metropolitan city in the Aegean region of Türkiye, which shows a slightly better profile compared to the national level [37], the prevalence of oral health problems among children was significant even before the pandemic [38].

Additionally, according to one study conducted in Türkiye, oral healthcare was the second most common unmet need during the pandemic for those children aged 6 to 12 years of age [28]. Our qualitative findings are consistent with the literature, indicating that the pandemic exacerbated dental complaints among the paediatric population, resulting in increased demand for dental treatment [22, 29].

The 'ability to perceive needs' is the first step in initiating the access process, and oral health literacy plays a pivotal role in determining access to and utilization of dental services. Our study highlights the importance of these factors, revealing that children whose parents had a higher level of education had a significantly higher percentage of access to dental care. These results can be interpreted as indicating that higher parental education levels are associated with increased oral health literacy, which facilitates access to dental care. This aligns with existing literature, which suggests that low oral health literacy is associated with delayed or unmet dental needs, often due to a lack of awareness regarding the importance of preventive care and regular dental visits [40, 41]. Although the majority of our participants sought care during the pandemic, among those who did not, some expressed that they did not know where to go or what to do during an emergency in COVID times, which highlights the importance oral health literacy.

Although many institutions remained open during the pandemic, many researchers attribute people's delays in seeking services to a high perception of infection risk [30, 31]. A study conducted in a university clinic in Türkiye found a significant reduction in dental service utilization among children during the lockdown and normalization periods [31]. Another study in Türkiye found that around half of the participants had dental problems during the pandemic, yet three-quarters of these parents did not take their child to the dentist [44]. In contrast to the other studies, 4 out of 5 children who participated in our study experienced dental problems during the pandemic and 85% of them applied to an institution. In our interviews, more than half of the participants said that they would seek care for their child by taking risks if necessary. The inclusion of longer time periods in this study's timeline may have contributed to the perception of higher dental needs compared to other studies. Furthermore, as a tertiary healthcare facility, Ege University Pediatric Dental Clinics provide various treatments to a wide range of patients from different socio-economic backgrounds and geographical locations, as well as serving a general population which already has a demand to seek such services.

The risk factors which impact oral healthcare access are more likely to affect individuals from lower socio-economic backgrounds, thereby influencing their oral health, habits, and lifestyle [45–47]. Even with the help of public insurance, many children experience difficulty receiving dental treatment, while cost remains the greatest barrier [48]. Moreover, social disparities played a crucial role in shaping the demand for services throughout the COVID-19 pandemic, as financial instability, unemployment, and economic crises among many parents indirectly affected access to healthcare [49–51]. A cross-sectional household survey in a high income country discovered a substantial link between unmet treatment needs in paediatric patients and pandemic-related job loss or reduced income among parents and reported that financial barriers to dental care had become more prominent during the COVID-19 pandemic period [52]. Similarly, those parents employed in the private sector are more likely to have a financial burden for their child's dental visits during the pandemic due to reduced incomes [53]. As a middle-income country, households in Türkiye were disproportionately affected by the halting of numerous sectors due to the COVID-19 pandemic [54]. A nationwide study in Türkiye revealed that 10% of unmet dental needs were attributed to barriers relating to the affordability of dental treatment and a lack of social security coverage [28]. Despite our study group comprising children with social coverage, our findings align with the literature, indicating that access to oral healthcare is significantly associated with the monthly income of the household. Moreover, fluctuations in household incomes may have made high out-of-pocket healthcare costs unaffordable for disadvantaged families, leaving children's dental needs unmet. Socio-economic disparities, including those relating to health and access to care, are well-documented [43, 44]. Other studies have also revealed that socio-behavioural factors affected access to and outcomes of child oral health issues during the pandemic [41, 45]. Similarly, in our study, parental education and employment status significantly affected access to oral healthcare. These findings are consistent with the literature, which suggests that the social and economic dimensions of the pandemic exacerbate existing social inequalities in access to oral healthcare [12, 30].

Other researchers have recognized that underlying socio-economic inequalities, including reduced access to healthcare services, put individuals with disabilities at higher risk of COVID-19 [57–59]. Our study revealed a significant impact on the 'care-seeking' stage of access, especially for children with disabilities who were more susceptible to COVID-19. Several studies revealed that

children with disabilities experienced a reduction in access to general anaesthesia and sedation services, particularly during the lockdown [49, 50]. Even before the pandemic, people with disabilities in Türkiye experienced individual and institutional barriers to oral healthcare [62]. Many public dental clinics lack the necessary technical equipment and staff to provide general anaesthesia and sedation services. University clinics with multidisciplinary teams offer more comprehensive care to individuals with disabilities who require complex therapies. Our study highlighted that restricted access during the pandemic set additional barriers relating to the 'availability' of the institutions, significantly affecting those families who have children with disabilities and also those from a low socioeconomic background.

Public dental institutions' availability issues affect not only those individuals with disabilities but also healthy patients, posing a larger public health issue for the paediatric population. Despite the high utilization of public dental services [63], parents have observed a decline in the quality of public dental care, driving up demand for private institutions. This decline particularly impacts children needing root canal treatment or those with disabilities requiring general anaesthesia. Research has highlighted structural and functional problems in Türkiye's oral and dental health system, with no prioritized programs for disadvantaged groups [23]. This decrease in dental service quality is due to the rising number of patients, the limited amount of time per patient, shortages in the workforce and equipment, and a performance-based payment system [64]. Our study found that during the pandemic, access to oral healthcare in public dental centres decreased compared to private or university clinics. Inadequate facilities, the dentists' reluctance, and the reassignment of many dentists to COVID-19 contact tracing teams posed significant barriers.

Qualified health professionals are crucial for dental service utilization [65]. The pandemic exacerbated pre-existing issues in public dental centres. We can improve access to regular dental services by rotating filiation teams and ensuring the continuity of care at public institutions.

A cross sectional survey showed that those individuals who had not previously visited a dentist were less likely to seek emergency dental care during the pandemic when compared with those who had previously visited one [66]. Our study supports this claim, revealing that having a regular dentist increases the likelihood of access. Our in-depth interviews also supported this claim. Unfortunately, in Türkiye, more than 80% of the children visit a dentist only when they have a complaint [37]. The results of our study underscore the significance of regular dental care from a young age, and we recommend implementing a health policy which requires every child to see a dentist regularly for enhanced accessibility.

Study limitations

Our study focused solely on the patient's perspective, limiting the analysis to their viewpoint. Additionally, conducting the interviews at Ege University Faculty of Dentistry might have caused hesitation in expressing honest opinions, despite assurances of confidentiality. Furthermore, the study's location at a university dental clinic limited the sample group primarily to those paediatric patients with social security. This excluded immigrants and a broader representation of society. While the quantitative data lacked statistical significance due to low participation, the qualitative findings provided valuable insights into the access experiences of children with disabilities during the pandemic.

Recommendations

This study's main recommendation is to organize health policies in order to address the social inequalities exacerbated at times of crisis and to ensure access to services for children across all segments of society. In light of our study's framework, we recommend enhancing the quality of public dental health services, which includes initiatives to improve the physical infrastructure and overall service provisions within these facilities. Additionally, there is an urgent need to allocate resources to equip operating rooms with the necessary technical equipment and to ensure an adequate workforce of healthcare personnel capable of administering dental treatments, especially for children with disabilities who may require general anaesthesia.

Efforts should focus on integrating oral health education into existing public health initiatives, ensuring that information is accessible. Caregivers need to be equipped with practical knowledge about the importance of early dental visits, where and when to seek care during the crisis times. Educational campaigns through schools, community centers, and healthcare facilities could raise awareness and encourage proactive behaviors. During crises, when access to routine dental care may be disrupted, providing caregivers with the tools and knowledge to maintain their children's oral health becomes even more critical.

The COVID-19 pandemic underscored the importance of telehealth services, particularly for vulnerable populations or those with limited access to dental services. Integrating tele-dentistry into routine dental practice would allow for the reduction in the risk of pandemic-induced infections and address some service delivery inequalities [56, 57]. Thus, embracing and promoting tele-dentistry is not just a technological advancement but a crucial strategy to ensure equitable access to dental care during emergencies such as the COVID-19 pandemic. By establishing dedicated tele-dentistry services, we should pay special attention to disadvantaged groups, including

those individuals with disabilities and those with low incomes.

Conclusion

Our findings indicate that the COVID-19 pandemic exacerbated oral healthcare inequalities, particularly affecting those children with disabilities in Türkiye. Social determinants of health had a major impact on access, with service availability being the most common barrier. Moreover, dental service utilization is not enough to ensure access to oral healthcare.

Public dental clinics, which have the lowest access rates, need to be improved in order to reduce barriers in delivering dental care to paediatric patients, and so ensuring equitable access for those children with disabilities. The pandemic highlighted gaps in access to oral healthcare, emphasizing the need for improved preparedness. Prioritizing public health programs, promoting equal access to services, and developing emergency action plans are crucial in ensuring the continuous provision of essential oral health care services to all community members during pandemic situations. Policymakers should implement measures to refine the current strategies and break down barriers in order to improve children's access to oral healthcare during the height of public health crises.

Abbreviations

COREQ	Consolidated criteria for reporting qualitative studies
COVID-19	Coronavirus disease 2019
OECD	The organization for economic cooperation and development
STROBE	Strengthening the reporting of observational studies in epidemiology

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Author contributions

SA, ZAÖ and RÖÖ conceived the study and contributed to the acquisition of data. SA and ZAÖ analysed and interpreted the data and drafted the article. SA, ZAÖ and RÖÖ critically revised the article for important intellectual content. All members have read, offered feedback, and approved the version of this manuscript to be published.

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Data availability

The data that support the findings of this study are available on request from the corresponding author.

Declarations

Ethics approval and consent to participate

Ethical approval to conduct this study has been approved by the Ege University Faculty of Medicine Ethics Committee in 04.02.2021, Ref. No. 21-2T/11. This study was conducted in accordance with the Declaration of Helsinki. Written informed consent to participate in study activities was gathered from the parents/legal guardians of all study participants. Clinical trial registration is not applicable, as the study does not involve any interventions.

Consent for publication

Written and verbal consent for publication was obtained from all participants in the in-depth interviews and from those who completed the questionnaire. They were informed about the study's objectives and the use of their data in the research.

Competing interests

The authors declare no competing interests.

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