

ORIGINAL ARTICLE



Dental avoidance among adolescents – a retrospective case –control study based on dental records in the public dental service in a Swedish county

Anida Fägerstad^{a,b}, Jesper Lundgren^c, Jenny Windahl^b and Kristina Arnrup^{a,b}

^aPublic Dental Service, Dental research Department, Örebro, Sweden; ^bFaculty of Medicine and Health, School of Health Sciences, Örebro University, Örebro, Sweden;; ^cDepartment of Psychology, University of Gothenburg, Gothenburg, Sweden

ABSTRACT

Objective: This study aimed to investigate the occurrence of missed dental appointments among 16–19-year-old adolescents in a Swedish county. A second aim was to explore associations between background and concomitant factors and missed appointments and to investigate if these associations differed between areas with different sociodemographic profiles.

Materials and methods: A list of booked, and missed, appointments for 10,158 individuals during 2012 was used for assessments. Based on the total sample, 522 cases with, and 522 matched controls without, dental avoidance behavior in 2012 were identified. Data on previous missed and cancelled appointments, oral health status, dental treatment, fear or behavior problems, and medical, and, where available, psychosocial or lifestyle factors were extracted from the dental records using a preset protocol covering the period 2009–2012.

Results: In 2012, 13.1% of 23,522 booked appointments were missed, with a higher proportion of missed appointments among boys than girls. Cases with avoidance behavior more often had a record of sociodemographic load and dental fear or behavior management problems. They also had more oral health problems, more invasive dental treatments, and, in the past, more missed and canceled appointments.

Conclusion: To enable good oral health and continued regular dental care, we need to pay more attention to adolescents' individual situation and be observant of early signs of avoidance.

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Introduction

To ensure access to dental care regardless of socioeconomic or insurance status, all children and adolescents living in Sweden are offered free dental care (public or private) with regular check-ups at intervals determined by individual risk assessments [1]. Of these children and adolescents, approximately 95% get their dental care at public dental clinics (PDCs) [2]. However, despite the system of free dental care, not all adolescents regularly visit the dental office. For example, one study reports that among 15-year-olds in the city of Jönköping, 2.9% of girls and 1.7% of boys had no report of dental visits in 3–5 years or more [3].

Missed and canceled dental appointments have been associated with more caries disease [4–6], poorer oral health, and more emergency dental visits [7–10]. Furthermore, missed and canceled dental appointments also contribute to prolonged intervals between, and discontinuity in, dental treatments. Among adults with high dental fear (DF), long-standing avoidance of dental care has been associated with feelings of guilt and shame. This, in turn, may increase both avoidance and DF, and a vicious circle is established [11].

Missed or canceled appointments, as signs of dental avoidance among adolescents in a system of free dental

care, have been associated with a variety of environmental, situational, and individual factors [12]. For example, according to Fägerstad et al. [12], dental avoidance is more common among boys [4,6,13,14], older adolescents [4], adolescents living with a single parent [15], and families with low socioeconomic status (SES) [14,15]. Patterns of dental avoidance also differ when taking the geographic location of dental clinics into account. A Norwegian study [4] in 12–18-year-olds reported more missed or canceled dental appointments among those living in a rural area compared to those living in an urban area. Further, individual factors, such as DF or anxiety [6,13,15,16], attitudes and priority setting [13,14], and lifestyle factors, such as tobacco use and poor oral health behavior [14], have been associated with dental avoidance among youths. Experience of dental pain [5,16] is one of the situational factors reported as having a negative impact on dental attendance.

To reduce the number of missed dental appointments, different methods such as short message service (SMS) text reminders [17,18], voice messages [17,18], reminders by mail [17], and confirmation calls [19] have been tested, with positive effects. In Sweden, it is common routine that PDCs use SMS text reminders [20]. Still, missed and canceled appointments are not unusual.

To avoid a vicious cycle development in conjunction with entry into adult dental care, we first need to explore the occurrence of, and possible background factors behind, dental avoidance among adolescents still in a system of free dental care for youths. Therefore, the aim of this study was to investigate the occurrence and pattern of missed dental appointments among 16–19-year-old adolescents in a Swedish county. A second aim was to explore associations between background and concomitant factors (individual, situational, and environmental) and missed appointments, and, further, to investigate if these patterns of associations differed between areas with different sociodemographic profiles.

Materials and methods

Study population and design

This study was performed using data on individuals born between 1993 and 1996, who were therefore 16–19 years old in 2012. To be included, they had to have had at least one scheduled appointment for a dental examination or treatment at any of the PDCs ($n=23$) in Örebro County during 2012. Altogether, 10,158 individuals fulfilled this criterion. A list of booked and missed appointments for all these individuals during 2012 was used for assessments.

For the case–control design, a computer-based non-stratified random selection of 749 cases with at least one missed appointment according to the list of booked and missed appointments during 2012 was made. The initial sample size of 749 was based on assumptions of a prevalence rate of 15% versus 10% of DF or dental behavior management problems (DBMPs) as one of the explanatory factors expected to discriminate between cases and controls. With a power of 80% and a significance level of $\alpha=0.05$, 686 patients in each group would be required. Age-, gender-, and PDC-matched controls without missed appointments were identified from the same list. After identifying and matching the case–control pairs from the booking list of 2012, digital dental records were reviewed to confirm the inclusion. To be included in the case–control design, both cases and controls should have a history of booked dental appointments with at least one dental examination during the period 2009–2012. Two hundred and twenty-seven pairs failed to fulfil the inclusion criteria (missed appointment could not be confirmed, $n=166$; no history of booked appointments, $n=52$; no control available, $n=1$; and no access to digital records, $n=8$), leaving 522 case–control pairs for inclusion.

Further, based on the number and percentage of missed and/or canceled appointments during 2012, two subgroups of cases were defined. Those who had at least two missed appointments or one missed and at least two canceled appointments were categorized as serious avoiders if the rate of missed/canceled appointments exceeded 20% of their booked appointments for the year ($n=232$). All other cases ($n=290$) were classified as moderate avoiders.

Measures

The occurrence of missed dental appointments during 2012, at both booking and individual level, by gender, age, and clinic, was computed from the lists of booked and missed (i.e. no show) dental appointments.

Dental records

For the 522 plus 522 adolescents included in the case–control design, the dental records for the period 2009–2012 were reviewed. Data on number and type of dental visits and treatments, oral health status, records of general health problems or tobacco use, as well as missed (no show) and canceled (patient-initiated cancellations) appointments, were extracted. Further, when available in the dental records, data on family and everyday situation, recorded incidence of DF or DBMPs, and other circumstances of potential relevance were also registered. All extractions from the dental records were made by the first author (A. F.) according to a preset protocol.

Data on family (living with a single parent, alternating between parents, living with older siblings/relatives without parents, or living in a refugee camp) and everyday situation (home schooling or dropout from school) were merged into a variable of known sociodemographic load and then dichotomized as YES (any of the named circumstances) or NO (absence of the circumstances). Records of serious or chronic medical conditions including allergies, neuropsychiatric disorders, psychiatric diseases, or other disabilities (e.g. hearing impairment) were merged into a dichotomous variable of known medical load (YES/NO). Any incidence of documented DF/DBMPs, tobacco use (smoking or snuffing), and oral health problems (notes on dentin caries and gingivitis, registered by the dentist or dental hygienist according to clinical routine during a regular dental examination) between 2009 and 2012 was dichotomized as YES or NO.

The history of invasive dental treatments (emergency visits, extractions, drilling and filling) between 2009 and 2011 was likewise dichotomized as YES or NO. Previous signs of dental avoidance in terms of missed and cancelled appointments were reviewed for the period 2009–2011.

Sociodemographic profile

The 23 PDCs were grouped into three location categories (urban, $n=7$, all in the same mid-sized town with 138,952 inhabitants; small towns with 10,000–30,000 inhabitants, $n=6$; rural, $n=10$) based on the population density of 2012, according to Statistics Sweden [21]. The PDCs were also grouped into two socioeconomic categories (low SES, $n=4$; average/high SES, $n=19$) based on the distribution of different sociodemographic profiles in the areas where they were located [22]. The four PDCs classified in the category of low SES were all located in the urban area and were characterized by higher proportions of inhabitants born outside Sweden, of single-parent households, of households with a

low income, and of inhabitants whose level of education was upper secondary school or lower.

The study was approved by the Regional Ethical Review Board (Dnr: 2013/476) and was performed in accordance with the principles stated in the Declaration of Helsinki [23].

Statistical analysis

Medians (range), means (standard deviation (SD)), and frequency tables were used to describe data (gender, age, and booked and missed dental appointments). Group differences were analyzed using non-parametric and parametric tests (chi square test, Student's *t*-test, one-way analysis of variance [ANOVA]). Multivariate comparisons of cases and controls were performed using a series of logistic regression analyses (using the enter and forward stepwise methods), with group as outcome variable and selected variables (see Results) as potentially discriminatory variables.

Odds ratios (ORs) with 95% confidence intervals (CIs) are given. All statistics were performed using IBM SPSS statistics version 22.0 (SPSS Inc., Chicago, IL). The level of significance was set at $p < .05$.

Results

Missed appointments in 2012 – total sample

In 2012, a total of 23,522 dental appointments were booked for 10,158 adolescents (16–19-year-olds) at 23 PDCs in the county. Of these booked dental appointments, 13.1% were missed, with a significantly higher proportion of missed appointments among boys than among girls (14.6% vs. 11.4%, $p < .001$) (Table 1). Missed appointments for different ages varied between 12.7% and 13.5% (not significant) (Table 1) and for the 23 PDCs ranged from 9.6% to 19.1%.

The mean number of booked appointments per individual was 2.3 (range 1–24). Among those with at least one missed appointment, the mean number of missed appointments was 1.4 (range 1–11). Altogether 21.3% ($n = 2162$) of the adolescents (23.4% of the boys and 18.9% of the girls, $p < .001$) had missed at least one dental appointment during 2012 (Table 1). When separated by age, the proportions of

adolescents with missed appointments were similar (Table 1). The proportions of adolescents with missed dental appointments per clinic varied between 5.3% and 11.7%.

Characteristics – case-control sample

As previously mentioned, the study included 522 case-control pairs. These consisted of 215 (41.2%) pairs of girls and 307 (58.8%) pairs of boys. In total, 219 (42.0%) case-control pairs were born in 1993, 112 (21.5%) in 1994, 92 (17.6%) in 1995, and 99 (19.0%) in 1996. Altogether, 262 (50.2%) case-control pairs came from PDCs located in the urban area, 167 (32.0%) came from PDCs located in small towns, and 93 (17.8%) came from clinics located in rural areas of the county. Based on the sociodemographic areas the PDCs were located in, in 2012 a total of 201 (38.5%) case-control pairs had their bookings at clinics located in areas with low SES, while 321 (61.5%) pairs had bookings at clinics in areas with average/high SES.

In 2012, adolescents identified as cases had a higher number of dental visits, as well as canceled dental appointments (both $p < .001$), compared to adolescents identified as controls (Table 2). The mean number of missed dental appointments in 2012 among cases was 1.5 (SD 0.94) (Table 2).

Background and concomitant factors – case-control sample

The proportion of adolescents with sociodemographic load was almost five times higher among cases than among controls (7.1% vs. 1.5%; $p < .001$) (Table 3), while no difference in medical load was found. DF or DBMPs were recorded significantly more often for cases, as was use of tobacco (Table 3). Cases also had more oral health problems (i.e. more often had caries disease and gingivitis) and more emergency visits, tooth extractions, and operative treatments compared to controls (Table 3).

As in 2012, the mean number of dental visits during the period 2009–2011 was higher for the cases and they had a higher mean number of previous missed and canceled appointments compared to controls (Table 3). During the same time period, the number of cases with at least one

Table 1. Booked and missed dental appointments among 10,158 adolescents at 23 public dental clinics (PDCs) in Örebro County during 2012, by gender and age.

	Dental appointments			Individuals		
	Booked N	Missed		With booked dental appointments N	With missed dental appointments	
		Count	%		Count	%
Gender						
Girls	10,903	1248	11.4	4798	906	18.9
Boys	12,619	1842	14.6	5360	1256	23.4
Year of birth (age in years)						
1993 (19 years)	7978	1076	13.5	3377	742	22.0
1994 (18 years)	5207	667	12.8	2258	472	20.9
1995 (17 years)	5431	723	13.3	2362	501	21.2
1996 (16 years)	4906	624	12.7	2161	447	20.7
All	23,522	3090	13.1	10,158	2162	21.3

Data are presented at the appointment (total $N = 23,522$) and individual (total $N = 10,158$) levels.

Table 2. Sample characteristics regarding number of dental visits, and missed and canceled dental appointments, during 2012, for the 522 cases (including subgroups) and 522 controls.

	N	Dental visits				Missed appointments				Canceled appointments			
		Mean	SD	Median	Range	Mean	SD	Median	Range	Mean	SD	Median	Range
Cases	522	3.1	3.36	2	0–20	1.5	0.94	1	1–7	1.2	1.78	1	1–14
Serious avoiders	232	4.1	3.83	3	0–20	2.1	1.17	2	1–7	2.2	2.22	2	0–14
Moderate avoiders	290	2.4	2.73	2	0–19	1.0	0.13	1	1–3	0.4	0.45	0	0–2
Controls	522	2.4	2.32	2	1–14	0	0	0	0	0.6	0.95	0	0–6

SD: standard deviation.

Table 3. Findings from the dental records, grouped into environmental/medical, individual/lifestyle, and situational factors and reported by group (cases vs. controls) and case subgroups (serious and moderate avoiders).

	Controls (Valid <i>N</i> = 517–522)		Cases (Valid <i>N</i> = 517–522)		Cases vs. controls	Serious avoiders (Valid <i>N</i> = 230–232)		Moderate avoiders (Valid <i>N</i> = 282–290)		Serious vs. moderate avoiders	Serious vs. moderate avoiders vs. controls
	<i>n</i>	%	<i>n</i>	%	<i>p</i>	<i>n</i>	%	<i>n</i>	%	<i>p</i>	<i>p</i>
Environmental/medical factors											
Sociodemographic load	8	1.5	37	7.1	<.001	21	9.1	16	5.5	.12	<.001
Medical load	155	29.7	166	31.9	.45	82	35.3	84	29.1	.13	.228
Individual/lifestyle factors											
DF/DBMPs	34	6.5	75	14.4	<.001	48	20.7	27	9.3	<.001	<.001
Tobacco use	85	16.3	138	26.5	<.001	73	31.5	65	22.5	.021	<.001
Situational factors											
Oral health											
Caries disease	245	46.9	327	63.0	<.001	161	69.4	166	57.8	.007	<.001
Gingivitis	142	27.2	249	48.1	<.001	116	50.2	133	46.3	.38	<.001
Treatments											
Emergency visits	130	25.1	159	31.1	.035	83	36.1	76	27.0	.026	.008
Extractions	46	8.8	70	13.5	.016	37	16.0	33	11.5	.139	.015
Operative treatment	239	45.9	307	59.4	<.001	151	65.4	156	54.5	.013	<.001
Dental avoidance	Mean	SD	Mean	SD	<i>p</i>	Mean	SD	Mean	SD	<i>p</i>	<i>p</i>
Number of previous dental visits	7.2	7.21	9.0	7.79	<.001	11.4	8.77	7.2	6.32	<.001	<.001
Number of previous missed dental appointments	0.4	0.88	1.8	2.47	<.001	2.3	2.86	1.3	2.00	<.001	<.001
Number of previous canceled dental appointments	1.7	2.34	2.9	3.66	<.001	4.2	4.38	1.9	2.53	<.001	<.001

DF: dental fear; DBMP: dental behavior management problem.

missed dental appointment was 308 (59.0%) compared to 137 (26.2%) among controls.

Serious versus moderate avoiders – cases

Within the case group, serious avoiders had a higher number of dental visits ($p < .001$), as well as missed and canceled dental appointments (both $p < .001$), compared to adolescents identified as moderate avoiders (Table 2). The mean number of missed dental appointments in 2012 among serious avoiders was 2.1 (SD 1.17), whereas the mean number of canceled appointments among serious avoiders was 2.20 (SD 2.2) (Table 2).

Comparisons between the subgroups of serious and moderate avoiders revealed that a recorded history of DF/DBMPs, tobacco use, caries disease, emergency visits, and operative treatment was significantly higher for the group of serious avoiders than for moderate avoiders (Table 3).

Serious avoiders (as classified based on missed and canceled appointments in 2012) also had more previous dental visits and more previous missed and canceled appointments (during the period 2009–2011); the differences in other background factors were small and non-significant (Table 3).

Logistic regression analyses – case-control sample

Logistic regression analyses were performed in five (enter) plus one (forward stepwise) steps. Only variables with significant effects between cases and controls in the bivariate analyses (Table 3) were included. In the first step, separate analyses were performed for each of five groups of variables (Table 4). The second to fifth steps were performed adding one group of variables at every step. A final analysis was performed using the forward stepwise method and the same variables as in step 5.

In the first step with separate models per variable group, the only variables without discriminatory capacity between the cases and controls were emergency visits and previous dental visits. When adding groups of variables including environmental/medical factors and individual/lifestyle factors (DF/DBMPs, tobacco use) (Model 2) and some of the situational factors (oral health; Model 3), all of the variables were stable as discriminators between the cases and controls. In the fourth step, the treatment variables were added, showing no impact on dental avoidance (i.e. for the cases); all other variables remained as stable discriminators. In the fifth step, when the history of dental visits and missed and canceled appointments was entered into the model, the impact of

Table 4. Models used in the logistic regression analysis (using the enter and forward stepwise methods), with group (cases =1 vs. controls =0) as the dependent variable and factors (environmental/medical, individual/lifestyle, and situational factors) of potential discriminatory value as independent variables.

	ENTER														Forward stepwise				
	Separate models (Model 1)				Model 2			Model 3			Model 4			Model 5			Final model		
	OR	95% CI	p	Nagelkerke R ²	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
Environmental/medical factors																			
Sociodemographic load (0 = no, 1 = yes)	4.90	2.26–10.63	<.001	0.03	3.98	1.82–8.73	<.001	3.30	1.49–7.32	.003	3.25	1.46–7.23	.004	2.69	1.17–6.23	.021	2.84 ^d	1.24–6.49	.013
Individual/lifestyle factors																			
DF/DBMPs (0 = no, 1 = yes)	2.29	1.49–3.52	<.001	0.04	2.12	1.37–3.27	<.001	1.75	1.12–2.74	.014	1.69	1.07–2.69	.025	1.03	0.59–1.80	.905			
Tobacco use (0 = no, 1 = yes)	1.83	1.34–2.48	<.001		1.75	1.28–2.38	<.001	1.52	1.11–2.09	.010	1.50	1.08–2.08	.015	1.24	0.86–1.76	.227			
Situational factors																			
Oral health																			
Caries disease (0 = no, 1 = yes)	1.72	1.33–2.22	<.001	0.08				1.53	1.18–1.99	<.001	1.41	1.01–1.96	.041	1.40	0.99–1.97	.059	1.38 ^e	1.05–1.82	.022
Gingivitis (0 = no, 1 = yes)	2.29	1.76–2.98	<.001					2.11	1.61–2.76	<.001	2.07	1.58–2.72	<.001	1.70	1.28–2.28	<.001	1.72 ^b	1.30–2.30	<.001
Treatments																			
Emergency visits (0 = no, 1 = yes)	1.18	0.89–1.56	.263	0.03							1.19	0.88–1.60	.254	0.88	0.63–1.23	.450			
Extractions (0 = no, 1 = yes)	1.52	1.02–2.29	.041								1.41	0.92–2.16	.113	1.26	0.78–2.04	.337			
Operative treatment (0 = no, 1 = yes)	1.70	1.32–2.18	<.001								1.13	0.81–1.57	.481	0–96	0.67–1.36	.800			
Dental avoidance																			
Number of previous dental visits	1.00	0.98–1.02	.894	0.21										0.99	0.98–1.02	.785			
Number of previous missed dental appointments	1.79	1.58–2.03	<.001											1.68	1.48–1.91	<.001	1.68 ^a	1.48–1.90	<.001
Number of previous canceled dental appointments	1.09	1.03–1.15	.002											1.09	1.03–1.15	.004	1.08 ^c	1.03–1.14	.004
Nagelkerke R ²				0.06			0.11			0.12			0.24			0.24			

^aEntered in step 1.

^bEntered in step 2.

^cEntered in step 3.

^dEntered in step 4.

^eEntered in step 5.

DF: dental fear; DBMP: dental behavior management problem.

Significant odds ratios (ORs) and confidence intervals (CIs) are given in bold.

DF/DBMPs, tobacco use, caries disease, treatment variables, and previous dental visits was no longer significant. The final (forward stepwise) analysis showed that sociodemographic load, poor oral health, and previous signs of dental avoidance were stable discriminators between the cases and controls, all other available aspects taken into account (Table 4). The final model explained 24% of the variance (Nagelkerke $R^2 = 0.24$).

When separate logistic regression analyses were performed for the different PDC categories based on location (urban/small towns/rural) and sociodemographic profile, poor oral health, previous emergency visits, and previous missed and canceled dental appointments discriminated between cases and controls (data not shown).

Discussion

The present study aimed to investigate the occurrence of missed dental appointments among 16–19-year-old adolescents in a Swedish county, as well as to explore associations between background and concomitant factors and dental avoidance, and to investigate if these patterns of associations differed between areas with different sociodemographic profiles. Missed dental appointments were recorded for more than a fifth of the adolescents and our case–control design revealed that adolescents with avoidance behavior in terms of missed appointments more often had documented sociodemographic load, DF/DBMPs, and tobacco use. They also had poorer oral health, more invasive dental treatments, and over the past years, more missed and canceled appointments.

In the present study, 21.3% of all adolescents (23.4% of boys and 18.9% of girls) had missed at least one dental appointment during 2012. The finding that boys were more likely to miss their dental appointments is in concordance with other studies [4,6,13,24]. Poorer oral health has been shown to be more common among boys [24–26] and is also a factor associated with dental avoidance.

No association between age and dental avoidance was found in the present study, contradicting the results of a Norwegian study by Skaret et al. [4]. This may be explained by the fact that our study included a narrower age span and that the assessments were based on 1 year, 2012, while the Norwegian study investigated missed/canceled dental appointments across the age span of 12–18 years.

In the present study, dental avoidance was shown to be more common among adolescents with known sociodemographic load, which is consistent with previous findings. For example, one Swedish study [15] revealed that dental avoidance among adolescents referred to specialized pediatric dentistry because of DBMPs was more common when living with a single parent. Further, studies from Norway [4–6] reported that missed/canceled dental appointments were more common among adolescents who were working and/or had no specified occupation. This may indicate that adolescents should be asked about their everyday life and situation every time they visit dental care as this might reveal aspects to consider in relation to dental attendance behaviors.

DF is one of the main reasons reported for dental avoidance among children [7] and adolescents [6,13,15,27–29] as well as adults [30–33]. In our study, the effect of DF/DBMPs as discriminator for avoidance behavior in terms of missed appointments in cases became clear during the first four steps of the logistic regression analysis, although a decrease in OR was observed when other groups of factors with potential impact were sequentially entered. In the fifth step, when the history of dental visits and missed and canceled appointments was entered into the model, the impact of DF/DBMPs was no longer significant. In fact, signs of previous dental avoidance, by itself accounting for 21% of the explained variance (first model), and being a significant part of the final model, explaining three additional percentage points of the variance, emerged as the most prominent discriminator. Consequently, although we can only report a relatively modest impact of the model (Nagelkerke $R^2 = 24\%$), we consider it an important finding that a history of missed and canceled dental appointments predicted future missed and canceled appointments. One way to interpret this is that dental personnel should be observant to an early pattern of missed and canceled dental appointments in order to keep adolescents in regular dental care. However, we should also pay attention to signs of DF/DBMPs, as well as treatment load, in order to prevent the initiation of a dental avoidance behavior.

Regarding tobacco use, the findings in the present study are in consistence with previous studies reporting that dental avoidance is more common among adolescents who smoke [14,34–36] and snuff [14]. The fact that different negative health behaviors coexist points to the importance of giving full attention to any such indication in order to guide adolescents into continued regular dental health and care.

In the present study, cases had poorer oral health, and more often had a recorded history of emergency dental visits and dental treatment events, than controls. Even though we only used notes on dentin caries made during the dental examination, and not on decayed, missing, and filled teeth (DMFT), our findings are in accordance with a Norwegian study showing that adolescents with missed appointments had significantly higher DMFT scores at the age of 18 compared with others in the same age group [4]. Therefore, we need to bear in mind that both poor oral health and treatment load should be seen as risk factors for dental avoidance. This implication was further supported by the differences between serious and moderate avoiders, also indicating a risk gradient. It is important to prevent missed and canceled dental appointments as they have negative consequences for adolescents' oral health [4–6] and financial consequences for PDCs. The results of the present study indicate a need for further research on barriers and, at least as importantly, facilitators to adolescents' use of dental care in Sweden. In order to find ways to prevent dental avoidance among adolescents, in-depth knowledge on their perceptions is crucial, which may call for a complementary study approach.

The present study had a retrospective design, being based on data from dental records between 2009 and 2012.

One strength of this study is that it is based on dental records, which routinely document factors such as oral health status, emergency visits, invasive dental treatments (extractions and operative treatment), and previous dental visits, as well as history of missed and canceled dental appointments. Another strength is that the randomization of cases and controls resulted in a representative sample distribution across all 23 PDCs in the county. The 23 PDCs represent different living areas, i.e. urban, small town, and rural, and areas with low and moderate/high SES.

On the other hand, incompleteness of, and uncertainty in, this type of routine dental records may hamper the reliability of the data. Potential discriminatory variables may be under-reported, in particular for adolescents with an uncomplicated attendance pattern. There is a risk that dental personnel may not be consistent in registering conditions such as DF/DBMPs, and may in fact be unaware of them unless patients openly show DF or some other kind of problem during dental visits.

To summarize, and despite the methodological shortcomings, this study indicates that missed dental appointments among adolescents remain a challenge for dental care, calling for further initiatives to complement the SMS text reminders.

Conclusions

In conclusion, based on this study's results, a variety of environmental/medical, individual/lifestyle, and situational factors may be associated with dental avoidance behavior among 16–19-year-olds. To keep adolescents in regular dental care, dental personnel should be aware of adolescents' everyday life and situation when meeting and treating them in dental care. Secondly, we need to be observant of adolescents' DF/DBMPs, oral health status, and treatment load as well as an early pattern of missed and canceled appointments.

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Disclosure statement

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