

Early-life course factors and oral health among young Norwegian adults

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Abstract

Objective: Using a national sample of young Norwegian adults, we examined whether unpleasant experience with dental care during childhood is associated with tooth loss and oral health-related quality of life in adulthood after accounting for early- and later-life socio-behavioural circumstances and dental avoidance behaviour.

Methods: 2433 individuals aged 25-35 years participated in an electronic survey. Oral quality of life was measured using the oral impact of daily performance (OIDP) inventory. Generalized linear models and negative binomial regression models were used to estimate the association of early unpleasant experiences with dental care and tooth loss and OIDP scores. Incidence rate ratio (IRR) and 95% confidence intervals (CI) were used to estimate the relative differences in prevalence of tooth loss and OIDP scores.

Results: Adjusting for early-life characteristics only, the prevalence of tooth loss was 1.42 (IRR = 1.42, 95% CI: 1.24-1.64) and 1.96 (IRR = 1.96, 95% CI: 1.70-2.26) times higher among individuals who reported unpleasant experiences a few times or several times, than in individuals who did not report unpleasant experiences with dental care in childhood. Adjusting further for educational level, smoking and tooth brushing attenuated the relative differences (IRR = 1.40, 95% CI: 1.22-1.62 and IRR = 1.88, 95% CI: 1.62-2.17, respectively). Lastly, when adjusting for dental avoidance behaviour, the prevalence of tooth loss was 1.29 (IRR = 1.29, 95% CI: 1.11-1.50) and 1.58 (IRR = 1.58, 95% CI: 1.32-1.88) times higher among individuals who reported unpleasant experiences a few times or several times than in those who did not. Corresponding associations of early unpleasant experience with OIDP were (IRR = 1.41 95% CI: 1.22-1.63) and (IRR = 1.69, 95% CI: 1.42-2.01) when adjusting for early-life characteristics, and (IRR = 1.39, 95% CI: 1.20-1.60) and (IRR = 1.51, 95% CI: 1.27-1.80) when adjusting for education, smoking and tooth brushing. When adjusting for dental avoidance behaviour, the association of early unpleasant experience with OIDP became nonsignificant.

Conclusion: Unpleasant dental care experiences during childhood are associated with poor oral health in adulthood, independent of later-life socio-behavioural characteristics including negative dental care seeking. This highlights the importance of

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tailoring regular contacts with dental healthcare services in childhood to build confidence in children and thus has implications for healthcare policy.

KEYWORDS

oral health, public health, tooth loss

1 | INTRODUCTION

Oral diseases are prevalent and represent a major public health problem globally.¹⁻³ Dental caries, periodontal disease and tooth loss prevalence increase with age and have a negative impact on quality of life.⁴ Moreover, oral diseases show marked socio-economic disparities across age groups and welfare regimens.⁵⁻⁹

According to 'the critical period life course' model, early-life unfavourable socio-economic and behavioural circumstances might influence oral conditions in later life.¹⁰⁻¹² Alternatively, the influences from early-life circumstances will be modified across time.¹⁰⁻¹² The Newcastle Thousand Families cohort revealed that the impact of childhood socio-economic status on tooth retention in adulthood diminished with increasing age concomitant with increasing influence of adult socio-economic position.^{13,14} Åstrøm et al¹⁵ demonstrated that young adults with stable favourable socio-economic positions reported better oral health-related quality of life compared to their stable deprived counterparts. Prolonged exposure to low socio-economic position as well as upward and downward mobility in the social hierarchy influence periodontal disease, self-rated oral health and tooth retention in middle- and older-aged people.^{16,17}

Adverse experience during childhood is defined as exposure to exogenous stressors such as parental death, domestic violence and unpleasant healthcare experiences.¹⁸ International studies have reported on long-term impact of adverse experiences during childhood on quality of life in adulthood.¹⁸ According to a Norwegian and Swedish study, dental fear following early unpleasant experience with dental treatment is common in young adults.^{19,20} Unpleasant dental experience may act as barriers towards use of dental care and in turn lead to poor oral health.²¹⁻²⁶ Åstrøm et al²³ investigated young Norwegian adults in 1997 and 2007 and found that dental fear was significantly associated with less frequent dental visits in both survey years. Moreover, there is evidence of an association between irregular dental care utilization and poor oral health.²⁴ Identifying relationships between unpleasant childhood experiences and subsequent oral health constitutes an important step in planning public health policies for vulnerable populations.

Life-course epidemiology has highlighted that unpleasant childhood experiences act as risk factors for poor health suggesting a dose-response relationship with compromised quality of life.^{10,18,26} Moreover, studies have started to investigate the role of behaviours in explaining associations between oral health and early-life circumstances using various statistical methods, such as change-in-estimate regression models, structural equation modelling (SEM) and counterfactual models.^{7,9,27-30} Little is known, however, as to how

unpleasant experience with dental care during childhood is associated with tooth loss and poor oral quality of life in younger adulthood. Using a national sample of young Norwegian adults, we examined whether unpleasant experience with dental care during childhood is associated with tooth loss and oral health-related quality of life in adulthood after accounting for early- and later-life socio-behavioural circumstances and dental avoidance behaviour.

2 | MATERIALS AND METHODS

2.1 | Study population

The present study used data from a national survey conducted in Norway in 2016. A sample of 9052 young adults aged 25-35 years, randomly selected from the Norwegian National Population Registry, was invited to participate in an online survey. An introductory letter explaining the purpose of the study and an electronic questionnaire were sent to all eligible participants. The study was undertaken with the understanding and written consent of each participant in accordance with ethical principles and the guidelines of the Declaration of Helsinki. Ethical permission was granted by the Ombudsman, Norwegian Center for Research Data. NORSTAT (www.norstat.no) was responsible for sending out questionnaires and data collection. A total of 2625 individuals filled in and returned the questionnaire (2625/9052, response rate 29%). We excluded from the analyses 84 individuals providing incomplete information and another 118 individuals with missing information on the exposure variable (early unpleasant experience with dental care), reducing the sample size to 2423 individuals.

2.2 | Outcome measures

The study outcomes were (a) tooth loss and (b) oral impacts on daily performances (both self-reported). Participants were asked to provide information on the number of natural permanent teeth they had. As previously done,^{11,17} the information was grouped into five categories; 'all teeth present', 'missing 1-2 teeth', 'missing a few teeth', 'missing many teeth' and 'missing all teeth'. As missing teeth was not frequent in this age group, we re-grouped the information in a two-category variable: 'all teeth present' (reference category) and 'missing any number of teeth'. Oral health-related quality of life was measured using the 8-item oral impact on daily performances, OIDP inventory.³¹ Each OIDP item had originally the following response

categories: 'never affected', 'affected less than once a month', 'affected once or twice a month', 'affected once or twice a week' and 'affected every day or nearly every day'. For these analyses, each item's response options were grouped into two: 'never affected' (category one—assigned null points) and 'affected less than once a month' or 'affected once or twice a month' or 'affected once or twice a week' or 'affected every day or nearly every day' (category two—assigned one point). An overall OIDP score (ranging from null to eight points) was then constructed adding up points from the eight individual item responses.

2.3 | Exposure and covariates

Unpleasant experience with dental care during childhood—the exposure variable of our study—was derived from the concept adverse childhood experience.¹⁸ Participants were asked about unpleasant or frightening experiences during dental treatment as children and were provided with four answering options: 'no', 'yes, sometimes', 'yes, several times' and 'I do not remember'. Individuals replying, 'I do not remember' (n = 118), were not included in the analyses.

Early-life measured covariates were mother's education ['lower level of education' (primary and secondary school) 'medium level of education' (high school) and 'higher level of education' (university/college)], and country of birth ('born in Norway' and 'born abroad'). We also included later-life exposure variables. These were own educational level ('primary or secondary education', 'college/bachelor' and 'university/ master or PhD'), smoking ('smoking daily/sometimes' and 'never smoking') and tooth brushing ('at least twice a day' and 'less than twice a day'). Moreover, we asked study participants 'Have you avoided dental attendance due to dental fear?' and 'Have you avoided scheduling dental appointments due to dental fear?' Based on their answers, we grouped the participants into those responding 'never' (category one) and those responding 'at least once' or 'often' or 'almost always' or 'always' (category two). For these analyses, we created an aggregate variable capturing avoiding scheduling or attending a dental appointment with the following categories: 'never avoiding scheduling or attending dental appointments' (reference category), 'avoiding either attending or scheduling a dental appointment' and 'avoiding both scheduling and attending dental appointments'.

2.4 | Statistical analyses

Data were analysed using SPSS version 22.0 (IBM Corp. Released 2013, IBM SPSS Statistics for Windows, Armonk NY: IBM Corp) and STATA 15 (Stata Corp LP, College Station, TX).

Early- and later-in-life socio-behavioural characteristics between men and women as well as across exposure categories were compared using chi-square test for categorical variables and Mann-Whitney or Kruskal-Wallis tests for continuous variables. We used generalized linear models for binary outcomes to model tooth loss as

a function of unpleasant dental experience. The obtained incidence rate ratios (IRR) estimate the relative differences in the prevalence of tooth loss across exposure categories. We used multiple negative binomial regression to model the OIDP sum score as a function of unpleasant dental experience. The obtained IRRs estimate the relative difference in OIDP score across exposure categories.

We fitted three models. Model 1 was adjusted for early-life socio-behavioural circumstances such as age, gender, country of birth and mothers' education. In model 2, we additionally adjusted for later-life socio-behavioural factors in terms of own education, smoking and tooth brushing frequency. In order to estimate the association between our exposure variable and oral health that cannot be explained by dental avoidance behaviour, we further adjusted our model (model 3) for the later variable.

3 | RESULTS

We included in the study 2423 Norwegian adults aged 25-35 years [mean (SD), 30.1 (3.2) years], of whom 42.7% were men. Appendix S1 summarizes early- and later-life characteristics, overall and by participants' sex. A total of 29.3% and 16.4% of the participants reported unpleasant experience with dental care during childhood a few times and several times, respectively. The proportions who had lost at least one tooth and confirmed avoidance of scheduling and attending dental care were 30.7% and 14.0%, respectively. Male participants were slightly older than female participants. The proportion of participants reporting unpleasant experiences with dental care during childhood, level of education of their mothers and country of origin were similar between men and women. A higher proportion of women than men had attained college or higher education.

In order to assess the potential for selection bias due to under- or overrepresentation of certain demographic groups, we compared our responding sample with the general population in Norway aged 25-44 years. This comparison revealed similar distributions of age, gender and educational attainment. To illustrate, the proportions of individuals aged 25-29 years and 30-35 years in our sample were 43.7% and 56.3%. Corresponding figures in the general population were 46.3% and 53.0%, respectively. Men accounted for 42.7% of our sample and 51.3% of the general population. The proportions of study participants with primary, secondary or higher education were 27.4%, 38.8% and 33.8%, respectively. The corresponding figures in the general population were 26.5%, 37.8% and 32.9%.

Table 1 summarizes early- and later-life socio-behavioural characteristics of study participants and oral health outcomes across the main exposure (unpleasant experiences with dental care during childhood) categories. Participants whose mothers had attained higher education reported less often unpleasant experiences with dental care. Participants reporting unpleasant experiences with dental care were more often smokers and reported brushing their teeth less often than the unexposed group. Lastly, unpleasant experiences with dental care during childhood were associated with avoidance to schedule or/and attend dental care in adulthood.

TABLE 1 Unpleasant early dental care experience by respondent characteristics

	Unpleasant experiences with dental care in childhood		
	Never (n = 1323)	A few times (n = 712)	Several times (n = 398)
Age**, years, mean (SD)	29.9 (3.2)	30.3 (3.2)	30.6 (3.2)
Gender (male), % (n)	45.1 (596)	41.0 (292)	38.2 (152)
I. Early-life factors, % (n)			
Mother's education**			
Low	10.7 (142)	13.5 (96)	20.1 (80)
Middle	39.7 (525)	40.3 (287)	39.4 (157)
High	49.6 (656)	46.2 (329)	40.5 (161)
Country of birth			
Norway	91.8 (1214)	93.0 (662)	91.2 (363)
Outside Norway	8.2 (109)	7.0 (50)	8.8 (35)
II. Later-life factors, n (%)			
Highest attained education**			
Primary/ Secondary	25.2 (327)	25.3 (175)	36.5 (142)
College/ Bachelor	38.3(497)	40.4 (280)	39.8 (155)
University/ Master/PhD degree	36.4 (472)	34.3 (238)	23.7 (92)
Smoking**			
Daily/ Sometimes	11.0 (145)	14.0 (100)	23.4 (93)
Never smoker	89.0 (1178)	86 (612)	76.6 (305)
Tooth brushing**			
At least twice a day	70.7 (932)	64.6 (459)	60.3 (237)
Less than twice a day	29.3(386)	35.4 (251)	39.7 (156)
Avoidance behaviour**			
No	90.1 (1192)	56.0 (399)	22.6 (90)
Avoiding ordering or attending	7.3 (97)	26.0 (185)	32.7 (130)
Avoiding both ordering and attending	2.6 (34)	18.0 (128)	44.7 (178)
III. Study outcomes, % (n)			
Missing teeth**			
None	76.2 (1008)	65.7 (468)	52.5 (209)
≥1 missing	23.8 (315)	34.3 (244)	28.9 (189)
OIDP score**			
Median (IQR)	0 (0-2)	1 (0-3)	1 (0-3)

Abbreviations: IQR, interquartile range; OIDP, oral impact on daily performances; SD, standard deviation.

***P* < .001.

Table 2 summarizes the outcomes of analyses of the association between unpleasant experience with dental care during childhood and tooth loss. When adjusting for early-life characteristics only (model 1), the prevalence of tooth loss were 1.42 (IRR = 1.42, 95% CI: 1.24-1.64) and 1.96 (IRR = 1.96, 95% CI: 1.70-2.26) times higher among individuals who reported unpleasant experiences a few times or several times than among individuals who did not report unpleasant experiences with dental care in childhood. Adjusting further for educational level, smoking and tooth brushing (model 2) slightly attenuated the relative differences (IRR = 1.40, 95% CI: 1.22-1.62 and IRR = 1.88, 95% CI: 1.62-2.17, respectively). Lastly, when adjusting for dental avoidance behaviour (model 3), the prevalence of tooth loss was 1.29 (IRR = 1.29, 95% CI: 1.11-1.50) and 1.58 (IRR = 1.58, 95% CI: 1.32-1.88) times higher in among individuals who reported unpleasant experiences a few times or several times than in those who did not.

Table 3 summarizes the analyses of the association between unpleasant experiences with dental care in childhood and OIDP scores. When adjusting for early-life characteristics only (model 1), unpleasant experiences with dental care (either a few or several times) were associated with poorer oral health-related quality of life (as measured by increased OIDP score) (IRR = 1.41, 95% CI: 1.22-1.63 and IRR = 1.69, 95% CI: 1.42-2.01, respectively). Adjusting for later-life course characteristics (model 2), attenuated the regression estimates to (IRR = 1.39, 95% CI 1.20-1.60 and IRR = 1.51, 95% CI 1.27-1.80, respectively). When further adjusting for dental avoidance behaviour in model 3, the regression estimates became nonsignificant and were attenuated to (IRR = 1.12, 95% CI 0.97-1.29) and (IRR = 0.98, 95% CI 0.81-1.20).

4 | DISCUSSION

Our study demonstrated an association between unpleasant experiences with dental care in childhood and poor oral health in young adulthood. The findings indicate that unpleasant experiences are associated with later-life socio-behavioural circumstances, such as own educational level, smoking and tooth brushing in addition to avoiding scheduling and attending dental care and might to some degree operate through those patterns. By indicating direct and indirect associations between oral health outcomes and unpleasant experience with dental care during childhood, this study supports the critical period and the chain of effects life-course models. This implies that unpleasant early-life circumstances have enduring effects on disease in later life but that these effects might also be modified across the life span.¹⁰ Although avoidance of dental appointments and dental visits associated with unpleasant experience with dental care during childhood as well as measures of oral health, it explained only parts of the association between unpleasant experience with dental care in childhood and oral health. Evidence that dental avoidance behaviour, smoking and irregular tooth brushing are associated with tooth loss and impaired oral quality of life is in line with Andersen's extended

TABLE 2 Summary of multivariate models for tooth loss prevalence

Characteristics	Incidence rate ratios (95% confidence interval)		
	Model 1	Model 2	Model 3
Unpleasant experiences with dental care in childhood			
Never	1 ^{ref}	1 ^{ref}	1 ^{ref}
A few times	1.42 (1.24-1.64)	1.40 (1.22-1.62)	1.29 (1.11-1.50)
Several time	1.96 (1.70-2.26)	1.88 (1.62-2.17)	1.58 (1.32-1.88)
Age (one year increase)	1.04 (1.02-1.06)	1.04 (1.02-1.06)	1.04 (1.02-1.06)
Gender (female vs male)	0.87 (0.78-0.98)	0.88 (0.79-1.01)	0.87 (0.78-0.98)
Mother's education			
Low	1 ^{ref}	1 ^{ref}	1 ^{ref}
Middle	1.06 (0.88-1.26)	1.07 (0.89-1.28)	1.08 (0.90-1.29)
High	1.01 (0.85-1.21)	1.04 (0.86-1.24)	1.05 (0.88-1.26)
Country of birth			
Norway	1 ^{ref}	1 ^{ref}	1 ^{ref}
Abroad	1.07 (0.87-1.30)	1.07 (0.88-1.31)	1.08 (0.88-1.32)
Highest attained education			
Primary/Secondary		1 ^{ref}	1 ^{ref}
College/Bachelor		1.01 (0.87-1.17)	1.03 (0.89-1.19)
University/Master/PhD degree		0.95 (0.81-1.12)	0.99 (0.84-1.17)
Smoking			
No		1 ^{ref}	1 ^{ref}
Daily/Sometimes		1.18 (1.01-1.37)	1.15 (0.99-1.34)
Tooth brushing			
At least twice a day		1 ^{ref}	1 ^{ref}
Less than twice a day		1.16 (1.03-1.31)	1.15 (1.02-1.30)
Avoidance behaviour			
No			1 ^{ref}
Avoiding ordering or attending			1.14 (0.96-1.34)
Avoiding ordering and attending			1.41 (1.19-1.68)

behavioural model of health services and supports findings of previous studies.^{32,33}

A strength of this study is its life-course conceptualization, emphasizing early childhood as a susceptible period for the development of poor oral health.¹⁰ Generally, there is a lack of studies in which participants report upon their early-life circumstances. Another strength is the use of direct questions on dental care avoidance due to dental fear instead of proxy measures of frequency dental attendance patterns. A large national sample made it possible to make estimations with reasonable degree of external validity. Despite the low participation rate, our sample was very similar to the general Norwegian population aged 25-44 years (by December 2016) with regard to age, gender and education attainment distribution. Further, we believe that low participation rates are a bigger issue in incidence, prevalence or mortality studies than in aetiology/association studies such as ours. The present findings should be interpreted with some potential limitations in mind. A life-course perspective

of chronic disease considers the importance of time to assess the long-term effect of early-life circumstances on subsequent oral health. This requires prospective cohort studies and thus, the present cross-sectional design, with no data on the temporal sequence of events, is a limitation to consider when interpreting the findings. Moreover, cross-sectional data might misinterpret mediation of longitudinal processes.³⁴ Future studies adopting prospective designs are needed to improve our understanding of how associations of early experiences with dental care and oral health are explained by later-life circumstances. Both outcome measures were self-reported, but a high level of agreement has been obtained between self-reported and clinical measures of tooth loss in various settings.^{35,36} Thus, it is unlikely that that our reliance on the self-reported number of natural teeth has severely biased the findings. Moreover, the retrospective nature of the main exposure variable might have incurred memory bias and self-reports of dental avoidance behaviour, smoking and tooth brushing might be influenced by social desirability

and thus being skewed in a direction which agrees with norms and expectations. Such underreporting might lead to misclassification. Finally, we cannot exclude residual confounding from other risk factors of tooth loss and oral impacts on daily performances.

As suggested by model differences in the estimated regression coefficients presented, dental avoidance seemed to account for parts of the association between unpleasant experience with dental care during childhood and oral health. Previous studies, using various approaches to mediation analysis, have documented on the direct and indirect associations between childhood experiences and oral health.^{18,26,27} In a prospective study of Swedish adults, Bernabe et al²⁷ observed a long-lasting, damaging effect of negative dental experiences in childhood on tooth loss at older ages. Frequency of dental visits within the past year did not play a role in the association between early negative dental care experience and tooth loss in that study.²⁷ In accordance with the study of Bernabe et al,²⁷ studies reported by Vettore et al⁹ and Vendrame et al²⁸ could not

verify assumptions of indirect effects through behaviours in the association between childhood socio-economic position and adult oral health. By contrast, Celeste et al,²⁹ revealed that a minor amount of 1.4% of ethnic disparity in tooth loss was explained by the combination of dental visits, marital status and alcohol consumption. Using natural effect models in a recent Danish study, Hac et al³⁰ showed that smoking and alcohol consumption explained about 11% and 26% of social inequality in tooth loss among adult men and women, respectively.

In the present study, a substantial proportion (46%) of the participants confirmed early unpleasant experience with dental care a few or several times, whereas 14.0% reported avoiding both scheduling and attending dental care visits. This supports the notion by Hakeberg et al¹⁹ and Skaret et al²⁰ that children and younger adults are at risk for dental fear. As depicted in Table 1, participants who confirmed avoidance of dental care due to dental fear reported early unpleasant experience with dental care most frequently, thus

Characteristic	Incidence rate ratio (95% confidence interval)		
	Model 1	Model 2	Model 3
Unpleasant experiences with dental care in childhood			
Never	1 ^{ref}	1 ^{ref}	1 ^{ref}
A few times	1.41 (1.22-1.63)	1.39 (1.20-1.60)	1.12 (0.97-1.29)
Several time	1.69 (1.42-2.01)	1.51 (1.27-1.80)	0.98 (0.81-1.20)
Age (one year increase)	0.97 (0.95-0.99)	0.97 (0.95-0.99)	0.97 (0.95-0.99)
Gender (female vs male)	0.99 (0.88-1.13)	1.05 (0.93-1.19)	1.04 (0.91-1.17)
Mother's education			
Low	1 ^{ref}	1 ^{ref}	1 ^{ref}
Middle	0.85 (0.70-1.03)	0.85 (0.71-1.03)	0.89 (0.74-1.08)
High	0.76 (0.62-0.92)	0.82 (0.68-0.99)	0.85 (0.68-1.03)
Country of birth			
Norway	1 ^{ref}	1 ^{ref}	1 ^{ref}
Outside Norway	1.44 (1.16-1.80)	1.48 (1.19-1.85)	1.47 (1.19-1.83)
Highest attained education			
Primary/Secondary		1 ^{ref}	1 ^{ref}
College/Bachelor		0.85 (0.73-0.99)	0.87 (0.75-1.02)
University/Master/PhD degree		0.74 (0.63-0.85)	0.80 (0.68-0.94)
Smoking			
No		1 ^{ref}	1 ^{ref}
Daily/Sometimes		1.28 (1.08-1.54)	1.21 (1.01-1.44)
Tooth brushing			
At least twice a day		1 ^{ref}	1 ^{ref}
Less than twice a day		1.29 (1.13-1.47)	1.23 (1.08-1.40)
Avoidance behaviour			
No			1 ^{ref}
Avoiding ordering or attending			1.48 (1.25-1.76)
Avoiding ordering and attending			2.29 (1.89-2.78)

TABLE 3 Summary of multivariate models for association between unpleasant experiences with dental care during childhood and oral health-related quality of life

suggesting chain of effects for tooth loss and oral health-related quality of life. This corroborates with previous evidence that adverse childhood dental experiences promote subsequent beliefs that dental visiting is unimportant for prevention of oral problems.²⁴ At odds with the present findings are those by Riley and Gilbert,²⁴ who found that early childhood dental visits promote later regular dental attendance patterns, positive dental attitudes and oral health even though the early experience was painful and frightening. In agreement with the present findings, previous studies have revealed that people who attend dental care episodically for dental problems only are more likely to suffer from tooth loss and poor oral health-related quality of life than those who attend routinely for dental check-ups.³⁷ About one third of the young sample investigated reported having lost at least one tooth. In a national study from 2003 using the same self-report instrument for measuring number of natural teeth, 17% and 33% of adults 25-44 years reported missing 0-4 teeth and 5 or more teeth, respectively.³⁸ Although a substantial reduction in the global burden of severe tooth loss has occurred during recent decades, it is evident that the mean number of lost teeth increases with age and that a substantial proportion of middle- or old-aged people experience tooth loss.³⁹

5 | CONCLUSION

Unpleasant dental care experiences during childhood are associated with poor oral health in adulthood, independent of later-life socio-behavioural characteristics including negative dental care seeking. This highlights the importance of tailoring regular contacts with dental healthcare services in childhood to build confidence in children and thus has implications for healthcare policy.

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CONFLICT OF INTEREST

There is no conflict of interest.

AUTHOR CONTRIBUTIONS

ANÅ conceived and designed the study, analysed and interpreted the data, drafted the work and approved the final version. GS revised the work critically for important intellectual content, and contributed to analyses and final approval of the version to be published. ORFS contributed to analysis and final approval of the version to be published.

DATA AVAILABILITY STATEMENT

The data set used and analysed during the current study is available from the corresponding author on reasonable request.

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REFERENCES

1. Peres MA, Macpherson LM, Weyant RJ, et al. Oral health 1 Oral Diseases: a global public health challenge. *Lancet*. 2019;394:249-260.
2. Dye BA. The global burden of oral disease: research and public health significance. *J Dent Res*. 2017;96:361-363.
3. Watt RG, Blanaid D, Allison P, et al. Ending the neglect of global oral health: time for radical action. *The Lancet*. 2019;20:194-196.
4. Tsakos G, Steele JG, Marcenes W, Wallis AW, Sheiham A. Clinical correlates of oral health related quality of life: evidence from a national sample of British Older people. *Eur J Oral Sci*. 2006;114:391-395.
5. Guarnizo-Herreno CC, Watt RG, Pikhart H, Sheiham A, Tsakos G. Socioeconomic inequalities in different European welfare states. *J Epidemiol Community Health*. 2013;67:729-735.
6. Tsakos G. Inequalities in oral health of elderly: rising to the public health challenge? *J Dent Res*. 2011;90:689-690.
7. Guarnizo-Herreno CC, Watt RG, Garzon-Orjuela N. Explaining oral health inequalities in European welfare state regimes: the role of health behaviors. *Community Dent Oral Epidemiol*. 2019;47:40-48.
8. Shen J, Listl S. Investigating social inequalities in older adults' dentition and the role of dental service use in 14 European countries. *Eur J Health Econ*. 2018;19:45-57.
9. Vettore MV, Faerstein E, Baker SR. Social position, social ties and adults' oral health: 13 year cohort study. *J Dent*. 2016;44:50-56.
10. Ben-Shlomo Y, Kuh D. A life course approach to chronic disease epidemiology: conceptual models. Empirical challenges and interdisciplinary perspectives. *Int J Epidemiol*. 2002;31:285-293.
11. Gulcan F, Ekback G, Ordell S, Lie SA, Åstrøm AN. Inequality in oral health related to early and later life social conditions: a study of elderly in Norway and Sweden. *BMC Oral Health*. 2015;15:20.
12. Listl S, Broadbent JM, Thomson WM, et al. Childhood socioeconomic conditions and teeth in older adulthood: evidence from SHARE wave 5. *Community Dent Oral Epidemiol*. 2018;46:78-87.
13. Pearce MS, Steele JG, Mason J, Walls AW, Parker L. Do circumstances in early life contribute to tooth retention in middle age? *J Dent Res*. 2004;83:562-566.
14. Pearce MS, Thomson WM, Walls AWG, Steele JG. Life course socio-economic mobility and oral health in middle age. *J Dent Res*. 2009;88:938-941.
15. Åstrøm AN, Wold B. Socio-behavioral predictors of young adults' self-reported oral health: 15 years of follow up in the Norwegian Longitudinal health Behavior Study. *Community Dent Oral Epidemiol*. 2012;40:210-220.
16. Ramsay SE, Papachristou E, Watt RG, et al. Socioeconomic disadvantage across the life-course and oral health in older age: findings from a longitudinal study of older British men. *J Public Health (Oxf)*. 2018;40(4):e423-e430.
17. Åstrøm AN, Ekback G, Lie SA, Ordell S. Life course social influences on tooth loss and oral attitudes among older people: evidence from a prospective cohort study. *Eur J Oral Sci*. 2015;123:30-38.
18. Hughes K, Bellis MA, Hardcastle KA, et al. The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis. *Lancet Public Health*. 2017;2:e366.
19. Hakeberg M, Berggren U, Carlsson SG. Prevalence of dental anxiety in an adult population in a major urban area in Sweden. *Community Dent Oral Epidemiol*. 1992;20:97-101.
20. Skaret E, Raadal M, Berg E, Kvale G. Dental anxiety and dental avoidance among 12 to 18 year olds in Norway. *Eur J Oral Sci*. 1999;107:422-428.

21. Armfield JM, Stewart JF, Spencer AJ. The vicious cycle of dental fear: exploring the interplay between oral health, service utilization and dental fear. *BMC Oral Health*. 2007;7:1.
22. Schuller AA, Willumsen T, Holst D. Are there difference in oral health and oral health behavior between individuals with high and low dental fear. *Community Dent Oral Epidemiol*. 2003;31:116-121.
23. Åstrøm AN, Skaret E, Haugejorden O. Dental anxiety and dental attendance among 15 year olds in Norway: time trends from 1997 to 2007. *BMC Oral Health*. 2011;11:10.
24. Riley JL, Gilbert GH. Childhood dental history and adult dental attitudes and beliefs. *Int Dent J*. 2005;55:142-150.
25. Bright MA, Alford SM, Hinijosa MS, Knapp C, Fernandez-Baca DE. Adverse childhood experiences and dental health in children and adolescents. *Community Dent Oral Epidemiol*. 2015;43:193-199.
26. Matsuyama Y, Fujiwara T, Aida J, et al. Experience of childhood abuse and later number of remaining teeth in older Japanese: a life course study from Japan Gerodontological Evaluation Study project. *Community Dent Oral Epidemiol*. 2016;44:531-539.
27. Bernabe E, Lie SA, Mastrovito B, Sannevik J, Åstrøm AN. Childhood negative dental experience and tooth loss in later life: a 25-year longitudinal study in Sweden. *J Dent*. 2019;89:1-6.
28. Vendrame E, deAquino GM, Hilgert JB, Hugo FN, Celeste RK. Decomposing early and adult social position effects on oral health and chronic diseases in a cross-sectional study of Southern Brazil. *Community Dent Oral Epidemiol*. 2018;46:601-607.
29. Celeste RK, Gincalves LG, Faerstein E, Bastos JL. The role of potential mediators in racial inequalities in tooth loss: the Pro-Saude study. *Community Dent Oral Epidemiol*. 2013;41:509-516.
30. Hac M, Christensen LB, Lange T, et al. Social inequality in tooth loss, the mediating role of smoking and alcohol consumption. *Community Dent Oral Epidemiol*. 2019;47:416-423.
31. Adulyanon S, Vourapukjaru J, Sheiham A. Oral impacts affecting daily performance in a low dental disease Thai population. *Community Dent Oral Epidemiol*. 1996;24:385-389.
32. Andersen RM. Revisiting the behavioral model and access to medical care: does it matter? *J Health and Soc Behav*. 1995;36:1-10.
33. Hach M. *Social inequality in tooth loss - underlying mechanisms of behaviour and dental examinations*. PhD thesis. University of Copenhagen; 2019. ISBN: 978-87-93510-47-0.
34. O'Laughlin K, Martin JM, Ferrer J. Cross sectional analysis of longitudinal mediation processes. *Multivar Behav Res*. 2018;53(3):374-402.
35. Ueno M, Shimazu T, Sawada N, Tsugane S, Kawaguchi Y. Validity of self-reported tooth counts and masticatory status study of Japanese adult population. *J Oral Rehab*. 2018;45:393-398.
36. Trovik TA, Berge TI. Do tooth gaps matter? Evaluation of self-assessments: a pilot study. *J Oral Rehab*. 2007;34:814-820.
37. Åstrøm AN, Ekback G, Ordell S, Nasir E. Long term routine dental attendance: influence on tooth loss and oral health related quality of life in Swedish older adults. *Community Dent Oral Epidemiol*. 2014;42:460-469.
38. Åstrøm AN, Haugejorden O, Skaret E, Trovik TA, Klock KS. Oral impacts on daily performance in Norwegian adults: the influence of age, number of missing teeth and sociodemographic factors. *Eur J Oral Sci*. 2006;114:115-121.
39. Kassebaum NJ, Bernabe E, Dahiya M, Bhandari B, Murray CJ, Marcenes W. Global burden of severe tooth loss: a systematic review and meta analysis. *J Dent Res*. 2014;93:20-28.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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