

Oral hygiene and the use of fluoride toothpastes in children and adolescents in Slovenia in 2019

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Abstract

Introduction: We present the results of the »National Survey on Oral Health of Children and Adolescents in Slovenia in 2019«, which established for the first time at the national level, the level of oral health care among children and adolescents. The aim of our study was to assess the state of oral health of children and adolescents and provide recommendations for its promotion. We report in more detail the results and findings related to oral hygiene and fluoride use. **Methods:** The target population were children and adolescents aged 0–17 years. The sample, representative for gender and age, included 3,200 children and adolescents (1% of this population in Slovenia). The survey was conducted using the EGOHID questionnaire. Data were weighted by gender and age. The distributions of proportions between different groups (by gender or age) and comparisons were analysed with the chi-square test and the CCP test to compare proportions between different groups. **Results:** Only 62% of children aged 0–5 regularly brushed their teeth (or were assisted by parents). The proportion of children who brushed their teeth regularly increased slightly after the age of 5, with 80% of children brushing their teeth regularly. On average, 20% of children/adolescents did not brush their teeth regularly between the ages of 6–10 and 11–17. Among adolescents aged 15–17, 91% of girls and only 66% of boys regularly brushed their teeth (hi-square test = 17.4, $p < 0.001$; $p < 0.001$). After the age of 4, the proportion of children whose parents helped clean their teeth decreased sharply, with 81% of 5-year-olds, 71% of 6-year-olds and 62% of 7-year-olds being helped. Only 30% of children before the age of 1 used fluoride-containing toothpaste. 66% of children/adolescents, aged 3–13, were expected to use fluoride-containing toothpaste. After the age of 14, the proportion of adolescents who did not know if their toothpaste contained fluoride increased, and as many as 33% of adolescents stated that they did not use toothpaste that

contained fluoride. 47% of parents believed that daily cleaning of teeth with fluoride-containing toothpaste was good for the child's teeth, and 13% thought that it was harmful. As many as 20% of parents of children aged 0–5 believed that fluoride-containing toothpaste was harmful to their teeth, compared to 9% of parents of children aged 6–10. *Discussion and conclusions:* Controlled cleaning of teeth with fluoride-containing toothpaste at least twice a day is recommended as an effective measure to prevent dental and oral diseases. It is recommended that children start brushing their teeth as soon as the first tooth erupts into the oral cavity and help them until they develop the necessary motor skills. Findings and recommendations for improving oral health represent a step towards reducing the burden of dental and oral diseases and costs in the (dental) health care system.

Keywords: oral health, children, adolescents, oral hygiene, fluorides

Introduction

Oral health is an integral part of general health and has a significant impact on the quality of life of the individual and society. Oral health, like other aspects of health, is determined by individual, social and physical environment (WHO, 2016). With the aim of transforming and modernizing the existing system of oral health and dental care indicators, a project group has prepared a selection of 40 indicators for monitoring oral health as part of the European Global Oral Health Indicators Development (EGOHID) project (Bourgeois et al., 2005; Bourgeois and Llundra, 2005; Bourgeois et al., 2008a).

In Slovenia, we also follow the trend of establishing a system for monitoring oral health indicators. In this paper, we focus on the “National Survey on Oral Health of Children and Adolescents in Slovenia in 2019”, with which we determined for the first time at the national level how parents/guardians of children/adolescents, and adolescents take care of (their) oral health, and how they assess (their) oral health. The aim of our study was to assess the state of oral health of children and adolescents and provide recommendations for promoting oral health. We report in more detail the results and findings related to oral hygiene and fluoride use.

Methods

When conducting the study, we followed the recommended international methodology for reporting on oral health (Bourgeois et al., 2008a; Bourgeois et al., 2008b; WHO, 2013).

Research design

We conducted a survey on the oral health of children and adolescents at the national level for the first time. It was designed as a cross-sectional epidemiological survey of the Health Interview Survey (HIS) type.

Observers

The target population of the »National Survey on Oral Health of Children and Adolescents in Slovenia in 2019« were children and adolescents under the age of 18 on February 13, 2019, who lived as members of private households. The sample, representative for gender and age, was prepared by the Statistical Office of the Republic of Slovenia (SURS) from its databases based on simple random sampling. The sampling frame was the Central Population Register of Slovenia. The sample included approximately 3,200 children and adolescents, which accounts for 1% of this population in Slovenia.

Research tool

The survey was conducted using the EGOHID questionnaire on the oral health of children and adolescents. Questionnaires for children and adolescents differed from each other according to the requirements and age characteristics of the population (0–5 years, 6–10 years, 11–17 years). They contained 33–37 closed and/or open-ended questions. We created the online survey questionnaires using the online tool 1KA (2019). They could only be accessed by using the personalized password that the invitees received in the notification letter.

Research procedure

The set of indicators was prepared in accordance with the EGOHID methodology (EC, 2004; Bourgeois et al., 2008a). In 2018, we conducted a pilot verification of the international methodology for monitoring global oral health indicators in Slovenia (Šket, 2015). In January 2019, the SURS prepared a sample of 3,200 children and adolescents. The observation period took place from February 13 to March 30, 2019. Respondents were sent notification letters by mail with the option of completing an anonymous questionnaire online using a personalized password. We also sent them a reminder by post.

Observed outcomes and explanatory factors

In our study, we examined the frequency of teeth cleaning since the eruption of the first tooth. In the analysis, we combined the categories of brushing your teeth twice or several times a day and the categories once a day, several times a week, once a week and never, since regular teeth brushing means brushing your teeth at least twice a day. We were interested in whether parents/guardians help or have helped children in brushing their teeth. The question was answered by those parents/guardians whose children brush their teeth, or where they were assisted. Additionally, we asked whether children/adolescents use toothpaste, and if they do, whether it contains fluoride.

Other observed outcomes are presented in more detail in the scientific monograph (Artnik et al., 2020).

The interpretation of the results was based on the number and proportions of people in the selected categories, according to demographic variables (gender, age, education of parents/guardians, living environment) or other variables that were determined according to the research needs or for planning further measures.

Methods of analysis

The data obtained from the study were weighted by gender and age, considering one-year age groups. The analysis of sample and population weighted data was performed in the computer programs IBM SPSS Statistics for Windows, version 21.0 (2020) and R program, version 3.6.0 (n. d.).

The distributions of proportions between different groups (by gender or age) and comparisons were tested using the chi-square test and the CCP test (Column Comparison Proportion test) to compare proportions between different groups. In both cases, we used a 95% confidence interval in order to be able to assess the studied situation (Benjamini and Hochberg, 1995; IBM, 2017).

Results

Among the 3,200 selected persons, 3,164 were suitable (these persons could be reached at the addresses that were accessible to us). The questionnaire was completed by 1,406 parents or adolescents, which represented a response rate of 44%, namely in the age group 0–5 years 43% (469 children), in the age group 6–10 years 46% (465 children) and in the age group 11–17 years 45% (472 adolescents).

Frequency of teeth cleaning

We found out that only 62% of children aged 0–5 brushed their teeth regularly (or their parents helped them). The proportion of children who brushed their teeth regularly is the smallest among children under the age of 1; parents regularly brushed the teeth of only 30% of children up to the age of 1. Among children aged 1–4 years, the proportion increased to 65% (Figure 1).

The proportion of children who brushed their teeth regularly increased slightly after the age of 5, namely 80% of children brushed their teeth regularly. On average, 20% of children/adolescents did not brush their teeth regularly between the ages of 6–10 and 11–17.

For children aged 0–10 years who brushed their teeth regularly, we noted that the differences in the proportion between boys and girls were not statistically significant. Among adolescents aged 11–17, 86% of girls and 74% of boys brushed their teeth regularly; differences in the proportion between genders were statistically significant (chi-square test = 9.517, $p = 0.002$; CCP test, $p = 0.02$). The biggest (statistically significant) differences were seen among adoles-

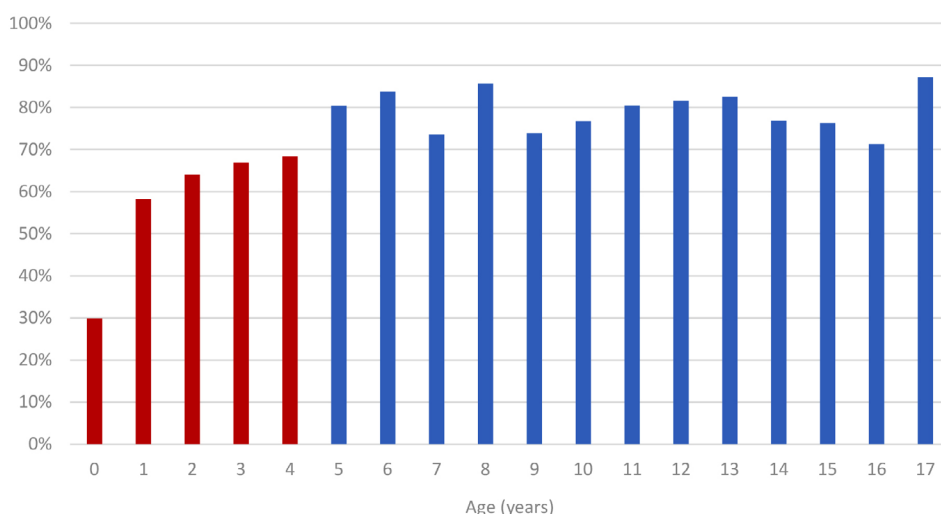


Figure 1: Proportion of children and adolescents who brush their teeth/get their teeth brushed regularly (at least twice a day), at different ages.

cents aged 15–17 years, among whom 91% of girls and only 66% of boys regularly brushed their teeth (chi-square test = 17.4, $p < 0.001$; $p < 0.001$).

The results showed that the education of the parents had no effect on whether children aged 0–5 brushed their teeth more regularly. The proportion of children who brushed their teeth or had their teeth brushed regularly and whose parents had at least a higher education increased in the age group of children 6–10 years, compared to children aged 0–5 years; these proportion differences were statistically significant (chi-square test = 43.855, $p < 0.001$; CCP test, $p < 0.001$).

In a rural living environment, there was a lower proportion of children/adolescents who regularly brushed their teeth, compared to children and adolescents from urban or suburban environments. The differences were most noticeable in children aged 0–5 years; 55% of children in rural areas cleaned their teeth regularly, 66% in urban areas and 71% in suburban areas.

Parents' help in brushing their children's teeth

The results showed that parents of most children (97%) aged 0–4 years helped with brushing their teeth (Figure 2).

This proportion drops sharply after 4 years of age, when parents helped 81% of 5-year-olds, 71% of 6-year-olds and 62% of 7-year-olds. The sum of the yellow and red coloured columns in Figure 2 shows the proportion of children in different age groups whose parents did not (anymore) help with brushing their teeth. The results showed that parents of 30% of 6-year-olds and 40% of 7-year-olds no longer helped with brushing their teeth. Parents' help in brushing their children's teeth drops sharply between the ages of 7 and 10.

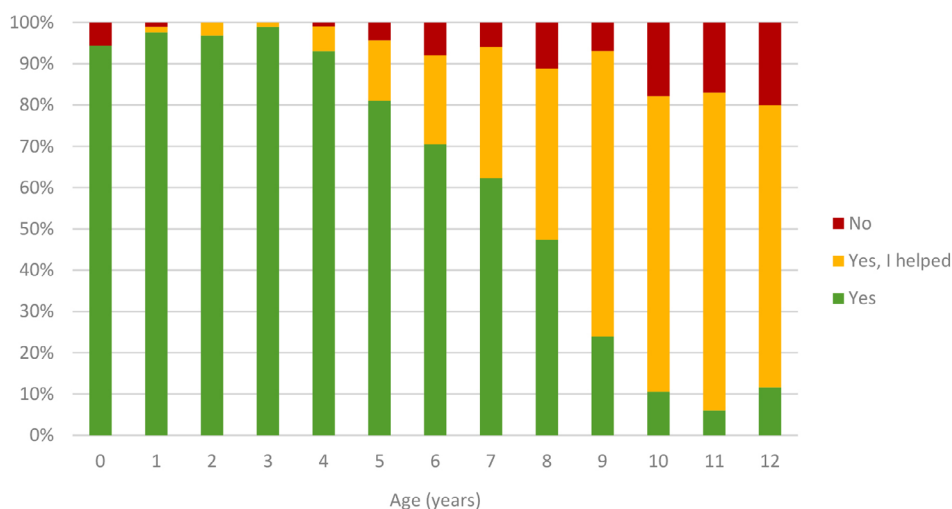


Figure 2: Proportion of children/adolescents according to the help of parents/guardians in cleaning teeth at different ages.

Fluoride-containing toothpaste use

In the study we found that among two-year-old children, approximately every tenth child does not use (any) toothpaste, but after the age of 3, almost all children use it (Figure 3). Further, the analysis showed that only 30% of children before the age of 1, used fluoride-containing toothpaste.

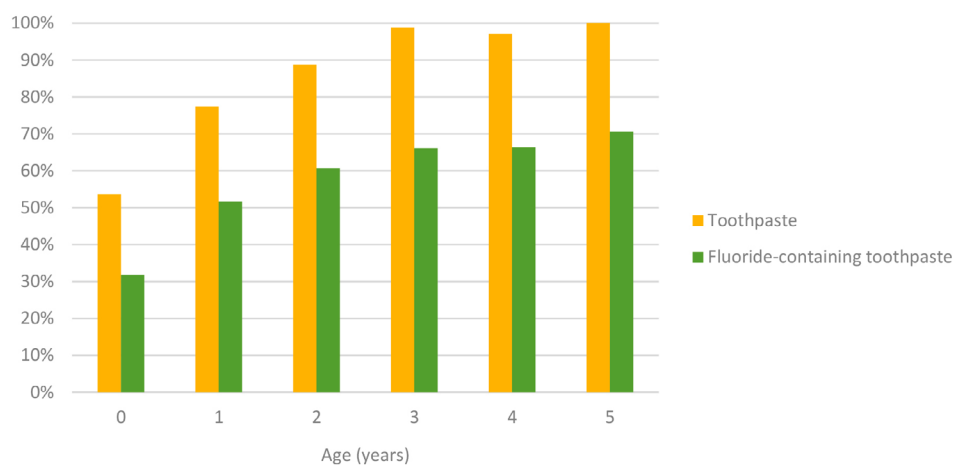


Figure 3: Proportion of children using (any) toothpaste and proportion of children using fluoride-containing toothpaste at different ages.

Children/adolescents aged 3–13 years were most likely to use fluoride-containing toothpaste. 66% of children/adolescents, aged 3–13, were expected to use fluoride-containing toothpaste, 18% of children/adolescents indicated that they did not use fluoride-containing toothpaste, and 17% of children/adoles-

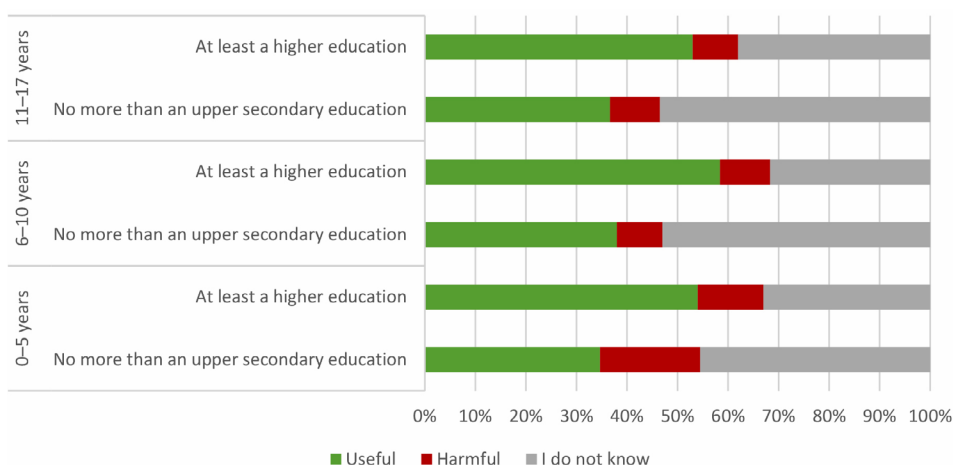


Figure 4: Proportion of parents/guardians in different age groups of children/according to education and opinion on the usefulness/harmfulness of daily cleaning of teeth with fluoride-containing toothpaste.

cents did not know whether they used fluoride-containing toothpaste. After the age of 14, the proportion of adolescents who did not know if their toothpaste contains fluoride increased, and as many as 33% of adolescents stated that they did not use toothpaste that contains fluoride.

Among parents who reported that their child used fluoride-containing toothpaste, 47% believed that fluoride-containing toothpaste was beneficial for the child's teeth, 41% of parents could not decide whether brushing teeth with fluoride toothpaste was beneficial or harmful, and 13% of them believed that brushing teeth with fluoride-containing toothpaste was harmful for the child's teeth (Figure 4).

Among parents with at least a higher education, 56% believed that using toothpaste containing fluoride was beneficial for the child's teeth; compared to parents with no more than an upper secondary education, among whom only 36% thought so (Figure 4); the differences in proportions were statistically significant (chi-square test = 32.152, $p < 0.001$; CCP test, $p < 0.001$). There was a difference between parents with no more than an upper secondary education who believed that fluoride-containing toothpaste was harmful to the teeth, depending on the age group of the children. As many as 20% of parents of children aged 0–5 years believed that fluoride-containing toothpaste was harmful to their teeth, compared to 9% of parents of children aged 6–10 years (Figure 4); the difference was statistically significant (chi-square test = 6.690, $p = 0.035$; CCP test, $p = 0.031$). There were no differences between the proportions of parents of children aged 0–5 and 6–10 years with at least a higher education who believed that fluoride-containing toothpaste was harmful for the child's teeth.

Discussion

The findings of our study point to insufficient teeth cleaning, inadequate parents' help in brushing their children's teeth, and ignorance of the benefits of using fluoride toothpaste.

Frequency of teeth cleaning

The most common method of removing plaque from the tooth surface is brushing with a toothbrush. Systematic review of the relationship between age and the beginning of tooth cleaning and the development of caries has not (yet) been done, but there are many observational studies that report this (Verrips et al., 1994; Hinds and Gregory, 1995; Vanobbergen et al., 2001; Wigen et al., 2018).

The results of a study conducted in Slovenia in 2018 (Jeriček-Klanšček et al., 2019) showed that 70% of young people brush their teeth regularly. There were significant differences between genders (girls brushed teeth more often). The proportion of those who regularly brushed their teeth was highest among 17-year-old girls (81%) and lowest among 15-year-old boys (57%). The results of our study, carried out in 2019, show similar, even slightly higher proportions of young people of both genders who brush their teeth regularly.

Parents' help in brushing their children's teeth

Children cannot brush their teeth without help and should be assisted until motor and mental functions allow them to adequately brush their teeth alone. Since children's coordination is different, there is no uniformly recommended age as to when children should be assisted with toothbrushing. However, it is recommended to assist with toothbrushing at least until the child is about 6 or 7 years old (Oral Health Foundation, n. d.; WebMD, 2018; BDA, 2020; CDC, 2022), as the first permanent teeth erupt at this age.

Fluoride-containing toothpaste use

It is possible that the data on the fluoride content in toothpaste obtained from parents and adolescents (who had the possibility to complete the questionnaire themselves) were not reliable and that they did not know whether children/adolescents were using fluoride-containing toothpaste. The European Academy of Paediatric Dentistry (Toumba et al., 2019) and the American Academy of Pediatric Dentistry (AAPD, 2016) recommends brushing teeth with fluoride toothpaste at least twice a day. At the same time, we should pay attention to the appropriate concentration of fluorides according to the age of the child and the amount of toothpaste children use daily when brushing their teeth.

Conclusions

The results of the »National Survey on Oral Health of Children and Adolescents in Slovenia in 2019« represent a step towards reducing the burden of den-

tal and oral diseases and costs in the (dental) health care system. An important challenge for the future is continuous monitoring of oral health and the dental health care system in Slovenia with oral health indicators according to international recommendations, which will make it easier to plan suitable and effective programs for improving oral health. We should encourage activities to improve oral health and strengthen awareness of the importance of oral health in an individual's life. Oral health is an important part of general health, which has been proven to contribute to a better quality of life.

References

- 1KA. Aplikacija za spletno anketiranje. En klik spletne ankete, 2019 [online]. [viewed 16 June 2022]. Available from: <https://www.1ka.si/>
- AMERICAN ACADEMY OF PEDIATRIC DENTISTRY (AAPD), 2016. *Oral Health Policies & Recommendations (The Reference Manual of Pediatric Dentistry). Policy on early childhood caries (ECC): classifications, consequences, and preventive strategies* [online]. [viewed 21 June 2022]. Available from: https://www.aapd.org/media/policies_guidelines/p_eccclassifications.pdf
- ARTNIK, B., RANFL, M., BLATNIK, J., MAGAJNA, A. and ROSTOHAR, A., 2020. *Ustno zdravje otrok in mladostnikov, 2019: nacionalna raziskava o ustnem zdravju otrok in mladostnikov v Sloveniji leta 2019*. Elektronska izd. Ljubljana. [online]. [viewed 28 June 2022]. Available from: https://www.nijz.si/sites/www.nijz.si/files/publikacije-datoteke/publikacija_otroci_ustno_zdravje.pdf
- BENJAMINI, Y. and HOCHBERG, Y., 1995. Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing. *Journal of the Royal Statistical Society. Series B (Methodological)*, vol. 57, no. 1, pp. 289–300.
- BOURGEOIS, D. M. and LLODRA, J. C., 2005. Chapter 1. Health Surveillance in Europe: European Global Oral Health Indicators Development Project. 2003 report proceedings. In: Bourgeois, D. M., ed. *Health surveillance in Europe. European Global Oral Health Indicators Development Project. Final report 2003–2005*. Lyon: Community Action Programme on Health Monitoring, European Commission, Health and Consumer Protection Directorate-General. [viewed 19 June 2022]. Available from: https://ec.europa.eu/health/ph_projects/2002/monitoring/fp_monitoring_2002_frep_o3b_en.pdf
- BOURGEOIS, D. M., LLODRA, J. C., CHRISTENSEN, L. B., PITTS, N. B., OTTOLENGHI, L. and SENEKOLA, E., 2008b. *Health surveillance in Europe. Oral health interviews and clinical surveys: guidelines*. Lyon: University Lyon. [viewed 21 June 2022]. Available from: https://ec.europa.eu/health/ph_projects/2005/action1/docs/action1_2005_frep_14_a5_en.pdf

- BOURGEOIS, D. M., LLODRA, J. C., NORBLAD, A. and PITTS, N. B., 2005. Chapter 5, A selection of essential oral health indicators. Recommended by European Global Oral Health Indicators Development Project. In: Bourgeois, D. M., ed. *Health surveillance in Europe. European Global Oral Health Indicators Development Project. Final report 2003–2005*. Lyon: Community Action Programme on Health Monitoring, European Commission, Health and Consumer Protection Directorate-General. [viewed 19 June 2022]. Available from: https://ec.europa.eu/health/ph_projects/2002/monitoring/fp_monitoring_2002_frep_o3b_en.pdf
- BOURGEOIS, D. M., LLODRA, J. C., NORDBLAD, A. and PITTS, N. B., 2008a. Report of the EGOHID I Project. Selecting a coherent set of indicators for monitoring and evaluating oral health in Europe: criteria, methods and results from the EGOHID I project. *Community dental health*, vol. 25, no. 1, pp. 4–10.
- BRITISH DENTAL ASSOCIATION (BDA), 2020. *Brushing: top tips for your patients* [online]. [viewed 21 June 2022]. Available from: <https://bda.org/about-the-bda/campaigns/oralhealth/Pages/brushing.aspx>
- CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC), 2022. *Basics of oral health. Children's oral health. What parents and caregivers can do* [online]. [viewed 29 June 2022]. Available from: <https://www.cdc.gov/oralhealth/basics/childrens-oral-health/index.html>
- EUROPEAN COMMISSION (EC), 2004. *Health and Consumer Protection Directorate-General. Selecting essential oral health indicators in Europe: Report of the Consensus Workshop* [online]. [viewed 18 June 2022]. Available from: http://ec.europa.eu/health/ph_projects/2002/monitoring/fp_monitoring_2002_a3_frep_o3_en.pdf
- FDI – WORLD DENTAL FEDERATION, 2016. *About oral health. FDI's definition of oral health* [online]. [viewed 11 July 2022]. Available from: <https://www.fdiworlddental.org/fdis-definition-oral-health>
- HINDS, K. and GREGORY, J. R., 1995. National diet and nutrition survey: children aged 1.5 to 4.5 years. Volume 2: Report of the dental survey. London: HMSO.
- INTERNATIONAL BUSINESS MACHINES CORPORATION (IBM), 2017. IBM SPSS Statistics Algorithms. Copyright IBM Corporation 1989 [online]. [viewed 16 June 2022]. Available from: ftp://public.dhe.ibm.com/software/analytics/spss/documentation/statistics/25.0/en/client/Manuals/IBM_SPSS_Statistics_Algorithms.pdf
- INTERNATIONAL BUSINESS MACHINES CORPORATION (IBM), 2020. SPSS Statistics 21.0 available for download [online]. [viewed 19 July 2022]. Available from: <https://www.ibm.com/support/pages/spss-statistics-210-available-download>
- JERIČEK-KLANŠČEK, H., ROŠKAR, M., DREV, A., PUCELJ, V., KOPRIVNIKAR, H., ZUPANIČ, T., KOROŠEC, A., GOBEC, M. and

- PRELEC POLJANŠEK, P., 2019. Z zdravjem povezana vedenja v šolskem obdobju med mladostniki v Sloveniji. Izsledki mednarodne raziskave HBSC, 2018. Ljubljana: Nacionalni inštitut za javno zdravje.
- ORAL HEALTH FOUNDATION, n. d. *Better oral health for all* [online]. [viewed 21 June 2022]. Available from: <https://www.dentalhealth.org/childrens-teeth>
- ŠKET, T., 2015. *Preverjanje mednarodne metodologije za spremljanje globalnih kazalnikov ustnega zdravja v Sloveniji*. Ljubljana: Medicinska fakulteta.
- THE R PROJECT FOR STATISTICAL COMPUTING, n. d. R version 3.6.0 [online]. [viewed 16 June 2022]. Available from: <https://www.r-project.org/>
- TOUMBA, K. J., TWETMAN, S., SPLIETH, C., PARNELL, C., VAN LOVEREN, C. and LYGIDAKIS, N. A., 2019. Guidelines on the use of fluoride for caries prevention in children: an updated EAPD policy document. *European archives of paediatric dentistry: official journal of the European Academy of Paediatric Dentistry*, vol. 20, no. 6, pp. 507–516.
- VANOBBERGEN, J., MARTENS, L., LESAFFRE, E., BOGAERTS, K. and DECLERCK, D., 2001. Assessing risk indicators for dental caries in the primary dentition. *Community dentistry and oral epidemiology*, vol. 29, no. 6, pp. 424–434.
- VERRIPS, G. H., KALSBECK, H., VAN WOERKUM, C. M., KOELEN, M. and KOK-WEIMAR, T. L., 1994. Correlates of toothbrushing in preschool children by their parents in four ethnic groups in The Netherlands. *Community dental health*, vol. 11, no. 4, pp. 233–239.
- WEBMD, 2018. *Brushing and flossing children's teeth. When should children brush and floss on their own?* [online]. [viewed 24 June 2022]. Available from: <https://www.webmd.com/oral-health/guide/brushing-flossing-child-teeth#2>
- WIGEN, T. I., BAUMGARTNER, C. S. and WANG, N. J., 2018. Identification of caries risk in 2-year-olds. *Community dentistry and oral epidemiology*, vol. 46, no. 3, pp. 297–302.
- WORLD HEALTH ORGANIZATION (WHO), 2013. *Oral Health Surveys. Basic Methods*. 5. edition, Geneva: World Health Organization.