

Trends in periodontal status: results from the German Oral Health Studies from 2005 to 2023 – Online Appendix

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ABSTRACT

Objectives: The objective of this study was twofold: firstly, to provide an overview of trends in periodontal status among younger adults aged 35 to 44 years and younger seniors aged 65 to 74 years between 2005 and 2023, based on data from the German Oral Health Studies (DMS); secondly, to quantify the extent to which observed differences in tooth count variables between consecutive studies can be attributed to differences in characteristics.

Method and materials: The data from DMS IV (2005), DMS V (2014), and DMS • 6 (2023) were analyzed. The participants completed questionnaires concerning their oral health behaviors, and general and oral health. For this analysis, probing depths (PD) were calculated from three sites on 12 index teeth as a common denominator. The number of teeth, severity, and extent of PD and the Community Periodontal Index (CPI) were reported. Multivariate decomposition was employed to analyze differences by time.

Results: The proportion of edentate younger seniors notably declined, from 23.2% to 5.4%, between 2005 and 2023. Similarly, the mean number of teeth for dentate younger seniors was 2.4 teeth higher in DMS • 6. While the mean PD remained 2.4 mm for younger adults and 2.8 mm for younger seniors, inconsistent patterns were observed for extent variables. In most cases, a decline of the extent variables was observed between DMS IV and DMS V, with a rebound at DMS • 6 for severe cases in younger seniors (with PD \geq 6 mm). The proportion of younger adults and seniors with CPI scores of 0 to 2 increased considerably between DMS IV and DMS V, but rebounded at DMS • 6. Overall, the prevalence of these cases increased by approximately 10% points and 5% points, respectively. The majority of the observed reduction in the number of missing teeth (in younger adults) or the prevalence of having less than 20 teeth (in younger seniors) between DMS IV and DMS V and between DMS V and DMS • 6 were explained by an increase in the proportion of highly educated individuals, an increase in the proportion of those who have never smoked (only younger adults), an increase in the proportion of individuals using electric toothbrushes or interdental cleaning devices, and a reduction in the proportion of individuals with lifetime periodontal treatment.

Conclusion: Over the last two decades, there has been a significant improvement in periodontal health in Germany, with the most notable enhancements occurring between DMS IV and DMS V. The prevalence of periodontal disease has decreased significantly in recent decades, largely due to the implementation of preventive measures. This underscores the importance of integrating preventive measures into dental practice as a public health strategy.

KEYWORDS: dental care, dentists, DMS 6, multivariate decomposition, number of missing teeth, periodontitis, trend analysis

Table of contents

| | |
|---|---|
| Table A1.1: Detailed results from multivariate decomposition models for dentate younger adults (35- to 44-year-olds; dependent variable: “number of missing teeth”; Poisson models) | 3 |
| Table A1.2: Detailed results from multivariate decomposition models for dentate younger seniors (65- to 74-year-olds; dependent variable: “having less than 20 teeth”; coded as yes/no; logistic models) | 4 |
| Table A1.3: Detailed results from multivariate decomposition models for dentate and edentate younger seniors (65- to 74-year-olds; dependent variable: “having less than 20 teeth”; coded as yes/no; logistic models) | 5 |
| Authors | 6 |
| Impressum | 7 |

Appendix 1

Table A1.1: Detailed results from multivariate decomposition models for dentate younger adults (35- to 44-year-olds; dependent variable: “number of missing teeth”; Poisson models)

| | | Decomposition for “Number of missing teeth” | | | |
|---|----------------|---|------------|--|------------|
| | | DMS IV to DMS V (n=1822) | | DMS V to DMS • 6 (n=1759) | |
| | | Coefficient (95% CI) | Percentage | Coefficient (95% CI) | Percentage |
| Difference | | -0.786 (-0.922; -0.651) | | -0.510 (-0.625; -0.395) | |
| Due to difference in characteristics | | -0.221 (-0.270; -0.171) | 28.1% | -0.159 (-0.204; -0.114) | 31.2% |
| Due to difference in coefficients | | -0.566 (-0.716; -0.415) | 71.9% | -0.351 (-0.480; -0.222) | 68.8% |
| | | Model for differences in characteristics | | Model for differences in characteristics | |
| | | Coefficient (95% CI) | P value | Coefficient (95% CI) | P value |
| Age, years | - | 0.088 (0.060; 0.116) | <0.001 | 0.018 (0.011; 0.256) | <0.001 |
| Gender (ref. female) | Male | -0.024 (-0.031; -0.018) | <0.001 | -0.010 (-0.015; -0.005) | <0.001 |
| School education (ref. <10 years) | 10 years | 0.020 (0.006; 0.033) | 0.004 | 0.045 (0.019; 0.070) | 0.001 |
| | >10 years | -0.140 (-0.170; -0.109) | <0.001 | -0.118 (-0.164; -0.072) | <0.001 |
| Smoking status (ref. current smokers) | Former smokers | -0.030 (-0.044; -0.017) | <0.001 | 0.045 (0.031; 0.058) | <0.001 |
| | Never smoked | -0.016 (-0.021; -0.010) | <0.001 | -0.069 (-0.085; -0.054) | <0.001 |
| Body Mass Index, kg/m ² | - | 0.009 (0.002; 0.016) | 0.008 | 0.001 (-0.003; 0.005) | 0.779 |
| Diabetes mellitus (ref. no) | Yes | NA | NA | 0.001 (-0.001; 0.003) | 0.165 |
| Tooth brushing frequency (ref. ≥2 times daily) | <2 times daily | -0.003 (-0.009; 0.002) | 0.256 | 0.0002 (-0.001; 0.001) | 0.543 |
| Electric toothbrush utilization (ref. no) | Yes | -0.035 (-0.055; -0.014) | 0.001 | -0.023 (-0.037; -0.008) | 0.002 |
| Interdental cleaning aids utilization (ref. no) | Yes | -0.035 (-0.050; -0.020) | <0.001 | -0.022 (-0.031; -0.013) | <0.001 |
| Dental visits frequency (ref. rarely) | ≥ once a year | -0.009 (-0.020; 0.001) | 0.088 | -0.0004 (-0.001; -0.0001) | 0.023 |
| Lifetime periodontal treatment (ref. no) | Yes | -0.045 (-0.056; -0.034) | <0.001 | -0.026 (-0.042; -0.011) | 0.001 |

NA, not available.

Table A1.2: Detailed results from multivariate decomposition models for dentate younger seniors (65- to 74-year-olds; dependent variable: “having less than 20 teeth”; coded as yes/no; logistic models)

| | | Decomposition for “Having less than 20 teeth” | | | |
|---|----------------|---|------------|--|------------|
| | | DMS IV to DMS V (n=1562) | | DMS V to DMS • 6 (n=1459) | |
| | | Coefficient (95% CI) | Percentage | Coefficient (95% CI) | Percentage |
| Difference | | -0.109 (-0.156; -0.063) | | -0.076 (-0.121; -0.031) | |
| Due to difference in characteristics | | -0.029 (-0.049; -0.008) | 26.2% | -0.051 (-0.075; -0.028) | 67.6% |
| Due to difference in coefficients | | -0.081 (-0.132; -0.030) | 73.8% | -0.025 (-0.078; 0.029) | 32.4% |
| | | Model for differences in characteristics | | Model for differences in characteristics | |
| | | Coefficient (95% CI) | P value | Coefficient (95% CI) | P value |
| Age, years | - | 0.008 (0.00003; 0.015) | 0.049 | 0.004 (-0.0003; 0.009) | 0.065 |
| Gender (ref. female) | Male | 0.001 (0.0002; 0.002) | 0.012 | 0.001 (0.00004; 0.002) | 0.039 |
| School education (ref. <10 years) | 10 years | -0.008 (-0.015; -0.001) | 0.023 | 0.001 (-0.007; 0.008) | 0.837 |
| | >10 years | -0.007 (-0.014; -0.0003) | 0.041 | -0.014 (-0.024; -0.003) | 0.012 |
| Smoking status (ref. current smokers) | Former smokers | -0.004 (-0.007; -0.0004) | 0.026 | -0.004 (-0.008; 0.001) | 0.104 |
| | Never smoked | 0.012 (0.005; 0.019) | <0.001 | 0.008 (0.002; 0.013) | 0.005 |
| Body Mass Index, kg/m ² | - | -0.0003 (-0.002; 0.001) | 0.733 | 0.001 (0.0001; 0.001) | 0.016 |
| Diabetes mellitus (ref. no) | Yes | 0.001 (0.0001; 0.002) | 0.020 | 0.0001 (-0.0003; 0.0004) | 0.739 |
| Tooth brushing frequency (ref. ≥2 times daily) | <2 times daily | 0.001 (0.0003; 0.001) | 0.004 | 0.0001 (-0.0004; 0.0005) | 0.764 |
| Electric toothbrush utilization (ref. no) | Yes | -0.012 (-0.023; -0.001) | 0.030 | -0.020 (-0.029; -0.011) | <0.001 |
| Interdental cleaning aids utilization (ref. no) | Yes | -0.018 (-0.029; -0.007) | 0.001 | -0.012 (-0.018; -0.006) | <0.001 |
| Dental visits frequency (ref. rarely) | ≥ once a year | -0.002 (-0.004; -0.0001) | 0.044 | 0.002 (-0.0001; 0.003) | 0.066 |
| Lifetime periodontal treatment (ref. no) | Yes | -0.00002 (-0.0004; 0.0003) | 0.895 | -0.018 (-0.025; -0.011) | <0.001 |

Table A1.3: Detailed results from multivariate decomposition models for dentate and edentate younger seniors (65- to 74-year-olds; dependent variable: “having less than 20 teeth”; coded as yes/no; logistic models)

| | | Decomposition for “Having less than 20 teeth” | | | |
|--|----------------|---|------------|--|------------|
| | | DMS IV to DMS V (n=1870) | | DMS V to DMS • 6 (n=1609) | |
| | | Coefficient (95% CI) | Percentage | Coefficient (95% CI) | Percentage |
| Difference | | -0.150 (-0.193; -0.108) | | -0.102 (-0.147; -0.057) | |
| Due to difference in characteristics | | -0.021 (-0.039; -0.004) | 14.2% | -0.034 (-0.056; -0.013) | 33.9% |
| Due to difference in coefficients | | -0.129 (-0.175; -0.083) | 85.8% | -0.067 (-0.118; -0.016) | 66.1% |
| | | Model for differences in characteristics | | Model for differences in characteristics | |
| | | Coefficient (95% CI) | P value | Coefficient (95% CI) | P value |
| Age, years | - | 0.009 (0.003; 0.016) | 0.004 | 0.006 (0.001; 0.011) | 0.023 |
| Gender (ref. female) | Male | 0.0003 (0.0001; 0.0005) | 0.003 | 0.0003 (-0.0001; 0.001) | 0.192 |
| School education (ref. <10 years) | 10 years | -0.013 (-0.020; -0.005) | 0.001 | -0.005 (-0.013; 0.004) | 0.282 |
| | >10 years | -0.015 (-0.022; -0.007) | <0.001 | -0.024 (-0.036; -0.013) | <0.001 |
| Smoking status (ref. current smokers) | Former smokers | -0.009 (-0.015; -0.003) | 0.003 | -0.004 (-0.007; -0.001) | 0.005 |
| | Never smoked | 0.025 (0.015; 0.035) | <0.001 | 0.009 (0.004; 0.013) | <0.001 |
| Body Mass Index, kg/m ² | - | -0.001 (-0.002; 0.001) | 0.340 | -0.0002 (-0.0003; -0.00005) | 0.004 |
| Diabetes mellitus (ref. no) | Yes | -0.0001 (-0.0003; -0.00004) | 0.010 | -0.00001 (-0.0001; 0.00004) | 0.651 |
| Dental visits frequency (ref. rarely) | ≥ once a year | -0.019 (-0.028; -0.010) | <0.001 | 0.001 (0.0004; 0.001) | 0.001 |
| Lifetime periodontal treatment (ref. no) | Yes | 0.0001 (-0.002; 0.002) | 0.905 | -0.016 (-0.023; -0.009) | <0.001 |

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