Family composition and children's dental health behavior: evidence from Germany

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Abstract

Objective: To assess whether children's dental health behavior differs between family compositions of either natural parents or birth mothers together with stepfathers.
Methods: We use data from the German Health Interview and Examination Survey for Children and Adolescents (KiGGS) public use file. This is the first nationally representative sample on child health in Germany and particularly contains variables for dental attendance, tooth care, and eating behavior of 13,904 children below 14 years of age. A series of zero-inflated Poisson, ordinary least squares, binary, and ordered logistic regression models was set up in order to identify whether family composition is a significant explanatory variable for children's dental health behavior.
Results: Family composition turned out as a significant parameter for some aspects of children's dental health behavior. Specifically, children who grow up in families with a birth mother and a stepfather have only half the probability to access dental services but, once seeking treatment, the number of visits is significantly higher in comparison with children raised by their natural parents. Moreover, children growing up in such a patchwork family setting consume a higher amount of sugary foods and drinks. This appears mainly attributable to differential consumption habits for juices, cookies, and chocolate.
Conclusions: Children who grow up in settings other than the nuclear family may develop different dental health behaviors than children who grow up with both natural parents, albeit more research is needed to identify the extent to which such behavioral changes lead to variations in caries occurrence.

Introduction

In most industrialized countries, the traditional pattern of children being raised by both natural parents has been more and more replaced by patchwork families. These include many different constellations between children and persons which either are or act as parents. The most frequent scenario, however, is that a child is growing up with a natural mother and a stepfather. For instance, in Germany, about 7 percent of all families with children younger than 18 years are stepfamilies. The overall number of stepchildren amounts to about 850,000 – 80 percent of which being raised by a natural mother and a stepfather (1).

Empirical evidence from previous studies in social sciences suggests that children who grow up in stepfamilies develop differently than peers who grow up with both natural parents. Specifically, children raised in such patchwork families are shown to achieve poorer educational attainment, labor market attachment, and general life chances when compared with peers who grow up together with both natural parents (2-11). Motivated by these findings, this study aimed to assess whether similar associations can be found for children's dental health behavior. In particular, the object of investigation was whether family compositions of a birth mother and a stepfather are associated with differences in children's dental

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health behavior as compared with family compositions of solely natural parents.

Dataset and estimation strategy

The data for this study originate from the German Health Interview and Examination Survey for Children and Adolescents (KiGGS) public use file. KiGGS is the first nationally representative sample on child health in Germany and particularly contains variables for dental attendance, tooth care, and eating behavior of 17,641 children residing in Germany. Data were collected between May 2003 and May 2006 using self-completion questionnaires of parents and children older than 10 years, medical face-to face interviews with parents, and medical examinations carried out by trained medical staff (see (12) for the study protocol).

Only children below 14 years of age are considered in this paper. The reason for this is that up to an age of 13 years, two separate variables exist for children's dental and orthodontic attendance. In contrast, KiGGS does not distinguish between visits to a dentist or an orthodontist once children are 14 years or older. Orthodontic treatment, however, is not considered a focus of this study. A potential source for biased results is, thus, eliminated by dropping observations of children who are 14 years or above. In total, 13,904 children below 14 years remained included for purpose of the present analysis.

Three groups of dependent variables represent children's dental health behavior and were, accordingly, targeted for investigation. First, dental visits are reported by the count variable "dental attendance" which indicates the total number of dental attendances within the past 12 months. Figure 1 plots this parameter and depicts an overrepresentation of zeros ("no dental visit") which we will take into account by using zero-inflated Poisson regression. Second, children's tooth care is depicted by means of variables for toothbrushing frequency, use of fluoridated toothpaste, as well as intake of fluoridated salt and fluoride tablets. Finally, the intake of sugary food as a caries risk factor is represented by the following set of variables: a) average daily consumption of sugar; b) frequency of consuming sugary products, i.e., how often a particular sugary food is consumed; and c) intensity of consuming sugary products, i.e., the quantity of a particular sugary food which is ingested per event of consumption. The food products considered are soft drinks, juices, cakes, cookies, chocolate, other sweets, honey/jam, and nougat creme. Note that for construction of the variable "average daily consumption of sugar," we followed the recommendations as given in the documentation for the KiGGS public use file (13); thereby, parameters for the sugary content of foods and drinks were excerpted from Kluthe (14). Descriptive statistics of all dependent variables are shown in Table 1.

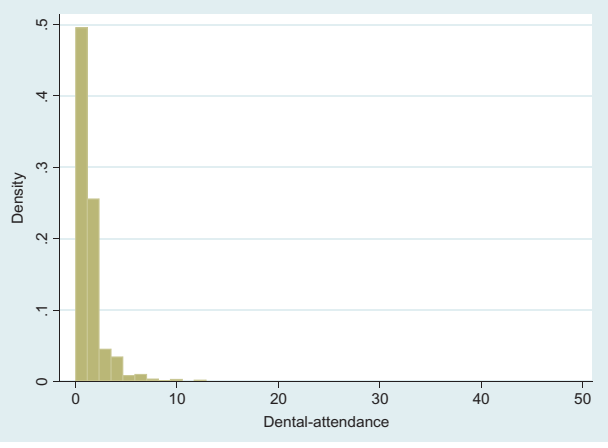

Figure 1 Histogram for the variable "dental attendance."

In order to detect correlations between children's dental health behavior and family composition, a number of specific dummy variables are applied. They detect whether a child grows up in circumstances other than together with both natural parents. In particular, the variable "stepfather" indicates whether a child is raised by a natural mother and a stepfather; "stepmother" indicates when a child lives with a stepmother and the natural father; "single mother" and "single father" depict situations in which a child grows up with only one natural parent alone; a child can also be raised by "relatives," "adoptive parents," or in a "protectory." Note that for avoidance of multicollinearity in our regression models, we leave out "nuclear family" as a reference variable. Further control variables considered in this study include children's age, sex, migration status, type of health insurance, and place of residence. Finally, it is also controlled for parents' socioeconomic status in terms of educational attainment, employment status, and net household income. Descriptive statistics of all explanatory variables are shown in Table 2.

According to the underlying distribution of each respective dependent variable, a series of zero-inflated Poisson, ordinary least squares (OLS), binary, and ordered logistic regression models was set up in order to identify whether family formation is a significant explanatory variable for children's dental attendance, tooth care, and nutritional habits. All data analysis was carried out with the software package STATA/SE 10.0.

Results

The zero-inflated Poisson regression model as specified in Table 3 indicates that "stepfather" is a significant explanatory variable for the number of children's dental visits within the past 12 months. On the one hand, the parameter estimate for logistic zero inflation reveals that children who grow up in families with a birth mother and a stepfather are about twice less likely to access dental services. On the other hand, the

Table 1 Descriptive Statistics of Dependent Variables

Variable	Variable description	Mean (prevalence)	Std. Dev.	Min	Max	*N*
Dental attendance	Count of dental visits within past 12 months	1.338	1.578	0	48	13,526
Toothbrushing	Frequency of toothbrushing					10.630
	Twice a day	0.66				
	Once a day	0.22				
	At least once a week	0.03				
	Once a week or less often	0.0001				
	Never	0.02				
	No teeth yet	0.07				
Fluoridated toothpaste	Use of fluoridated toothpaste					9.486
	Yes	0.88				
	No	0.12				
Fluoridated salt	Use of fluoridated salt					10,878
	Never	0.22				
	Sometimes	0.62				
	Mostly	0.16				
Fluoride tablet	Use of fluoride tablets					13,904
	Yes	0.05				
	No	0.95				
Daily sugar consumption (in gram)	Average daily intake of sugar (in gram)	148.423	141.936	5.186	980.461	4,811
Soft drink (frequency)	Frequency of consumption					12,211
	Never	0.19				
	Once per month	0.12				
	2-3 times per month	0.17				
	1-2 times per week	0.15				
	3-4 times per week	0.08				
	5-6 times per week	0.03				
	Once per day	0.08				
	2-3 times per day	0.11				
	4-5 times per day	0.04				
	More than 5 times per day	0.03				
Soft drink (intensity)	Intensity of consumption					12,185
	Never	0.19				
	1/4 glass (or less)	0.07				
	1/2 glass	0.14				
	1 glass (200 mL)	0.39				
	2 glasses	0.15				
	3 or more glasses	0.07				
Juice (frequency)	Frequency of consumption					12,202
	Never	0.05				
	Once per month	0.03				
	2-3 times per month	0.08				
	1-2 times per week	0.12				
	3-4 times per week	0.10				
	5-6 times per week	0.06				
	Once per day	0.15				
	2-3 times per day	0.25				
	4-5 times per day	0.11				
	More than 5 times per day	0.05				
Juice (intensity)	Intensity of consumption					12,197
	Never	0.05				
	1/4 glass (or less)	0.07				
	1/2 glass	0.19				
	1 glass (200 mL)	0.44				
	2 glasses	0.17				
	3 or more glasses	0.08				

Table 1 *Continued*

Variable	Variable description	Mean (prevalence)	Std. Dev.	Min	Max	*N*
Cake (frequency)	Frequency of consumption					12,237
	Never	0.04				
	Once per month	0.13				
	2-3 times per month	0.32				
	1-2 times per week	0.35				
	3-4 times per week	0.10				
	5-6 times per week	0.02				
	Once per day	0.04				
	2-3 times per day	0.004				
	4-5 times per day	0.00008				
Cake (intensity)	Intensity of consumption					12,217
	Never	0.04				
	1/4 piece (or less)	0.10				
	1/2 piece	0.24				
	1 piece	0.49				
	2 pieces	0.12				
	3 or more pieces	0.01				
Cookies (frequency)	Frequency of consumption					12,214
	Never	0.05				
	Once per month	0.10				
	2-3 times per month	0.23				
	1-2 times per week	0.31				
	3-4 times per week	0.17				
	5-6 times per week	0.05				
	Once per day	0.07				
	2-3 times per day	0.02				
	4-5 times per day	0.001				
	More than 5 times per day	0.001				
Cookies (intensity)	Intensity of consumption					12,191
	Never	0.05				
	1 cookie (or less)	0.05				
	2 cookies	0.21				
	3 cookies	0.30				
	4 cookies	0.20				
	5 or more cookies	0.19				
Chocolate (frequency)	Frequency of consumption					12,216
	Never	0.03				
	Once per month	0.05				
	2-3 times per month	0.15				
	1-2 times per week	0.32				
	3-4 times per week	0.21				
	5-6 times per week	0.07				
	Once per day	0.13				
	2-3 times per day	0.03				
	4-5 times per day	0.002				
	More than 5 times per day	0.002				
Chocolate (intensity)	Intensity of consumption					12,194
	Never	0.03				
	1/8 bar of chocolate (or less)	0.17				
	1/4 bar of chocolate	0.54				
	1/2 bar of chocolate	0.19				
	1 bar of chocolate	0.06				
	2 or more bars of chocolate	0.004				

Table 1 *Continued*

Variable	Variable description	Mean (prevalence)	Std. Dev.	Min	Max	*N*
Other sweets (frequency)	Frequency of consumption					12,220
	Never	0.05				
	Once per month	0.05				
	2-3 times per month	0.12				
	1-2 times per week	0.28				
	3-4 times per week	0.21				
	5-6 times per week	0.08				
	Once per day	0.16				
	2-3 times per day	0.04				
	4-5 times per day	0.004				
	More than 5 times per day	0.002				
Other sweets (intensity)	Intensity of consumption					12,174
	Never	0.05				
	1 bit	0.06				
	2-5 bits	0.46				
	6-10 bits	0.32				
	11-20 bits	0.09				
	21 or more bits	0.02				
Honey/jam (frequency)	Frequency of consumption: honey or jam					12,230
	Never	0.20				
	Once per month	0.10				
	2-3 times per month	0.15				
	1-2 times per week	0.24				
	3-4 times per week	0.12				
	5-6 times per week	0.05				
	Once per day	0.13				
	2-3 times per day	0.007				
	4-5 times per day	0.0004				
	More than 5 times per day	0.0002				
Honey/jam (intensity)	Intensity of consumption					12,196
	Never	0.20				
	$^1/_2$ teaspoon (or less)	0.12				
	1 teaspoon	0.39				
	2 teaspoons	0.24				
	3 teaspoons	0.04				
	4 or more teaspoons	0.01				
Nougat creme (frequency)	Frequency of consumption					12,209
	Never	0.22				
	Once per month	0.11				
	2-3 times per month	0.15				
	1-2 times per week	0.22				
	3-4 times per week	0.12				
	5-6 times per week	0.05				
	Once per day	0.12				
	2-3 times per day	0.01				
	4-5 times per day	0.001				
	More than 5 times per day	0.0004				
Nougat creme (intensity)	Intensity of consumption					12,190
	Never	0.22				
	1/2 teaspoon (or less)	0.10				
	1 teaspoon	0.33				
	2 teaspoons	0.26				
	3 teaspoons	0.07				
	4 or more teaspoons	0.02				

Table 2 Descriptive Statistics of Explanatory Variables

Variable	Variable description	Mean/prevalence	Std. Dev.	Min	Max	*N*
Nuclear family	Child grows up with both natural parents					13,777
	Yes	0.83				
	No	0.17				
Stepfather	Child grows up with natural mother and step-father					13,777
	Yes	0.06				
	No	0.94				
Stepmother	Child grows up with natural father and step-mother					13,777
	Yes	0.003				
	No	0.997				
Single mother	Child grows up with single mother					13,777
	Yes	0.10				
	No	0.90				
Single father	Child grows up with single father					13,777
	Yes	0.005				
	No	0.995				
Relatives	Child grows up with other relatives					13,777
	Yes	0.002				
	No	0.998				
Adoptive	Child grows up with adoptive parents					13,777
	Yes	0.004				
	No	0.996				
Protectory	Child grows up in protectory					13,777
	Yes	0.0009				
	No	0.9991				
West	Child lives in former Germany-West	0.667				13,904
	Yes	0.67				
	No	0.33				
Sex	The child's sex female	0.49				13,904
	Male	0.51				
Age	The child's age in years	6.651	4.001	0	13	13,904
Migrant	Child has migrational background					13,828
	Yes	0.15				
	No	0.85				
Basic school (mother)	Mother has graduated from basic school					13,705
	Yes	0.20				
	No	0.80				
Middle school (mother)	Mother has graduated from middle school					13,705
	Yes	0.46				
	No	0.54				
Grammar school (mother)	Mother has graduated from grammar school					13,705
	Yes	0.29				
	No	0.71				
Some college (mother)	Mother has graduated from any other school					13,705
	Yes	0.02				
	No	0.98				
Academic track (mother)	Mother has attained academic degree					13,329
	Yes	0.16				
	No	0.84				
Basic school (father)	Father has graduated from basic school					13,186
	Yes	0.27				
	No	0.63				
Middle school (father)	Father has graduated from middle school					13,186
	Yes	0.36				
	No	0.64				

Table 2 *Continued*

Variable	Variable description	Mean/prevalence	Std. Dev.	Min	Max	*N*
Grammar school (father)	Father has graduated from grammar school					13,186
	Yes	0.32				
	No	0.68				
Some college (father)	Father has graduated from any other school					13,186
	Yes	0.02				
	No	0.98				
Academic track (father)	Father has attained academic degree					12,884
	Yes	0.24				
	No	0.76				
Mother unemployed	Mother is unemployed					13,655
	Yes	0.44				
	No	0.56				
Father unemployed	Father is unemployed	0.113				13,111
	Yes	0.11				
	No	0.89				
Net household income	Net monthly household income less than 500 €	0.01				13,138
	500-750 €	0.03				
	750-1,000 €	0.05				
	1,000-1,250 €	0.06				
	1,250-1,500 €	0.08				
	1,500-1,750 €	0.07				
	1,750-2,000 €	0.10				
	2,000-2,250 €	0.10				
	2,250-2,500 €	0.11				
	2,500-3,000 €	0.15				
	3,000-4,000 €	0.14				
	4,000-5,000 €	0.05				
	More than 5,000 €	0.04				
Private insurance (full)	Child is fully covered by private health insurance					13,627
	Yes	0.08				
	No	0.92				
Private insurance (add-on)	Child is partially covered by private health insurance					13,627
	Yes	0.12				
	No	0.88				
No insurance	Child is not covered by any health insurance					13,627
	Yes	0.001				
	No	0.999				

Table 3 Zero-Inflated Poisson Regression Model for Dental Attendance

	Dental attendance (incidence rate ratios)	Logistic inflation (odds ratios)
Stepfather	1.063* (0.037)	2.016** (0.703)
Stepmother	0.852 (0.110)	0.745 (2.143)
Single mother	1.027 (0.0362)	0.716 (0.233)
Single father	1.013 (0.137)	3.340 (2.713)
Relatives	0.962 (0.337)	5.119 (6.957)
Adoptive parents	1.257** (0.128)	3.721* (2.712)
Protectory	1.459 (0.441)	$9.61e^{-09}$ (0.000)
N	10,495	10,484

Standard errors in parentheses.

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$.

NB: model controls for children's age, sex, migration status, type of health insurance, place of residence as well as parents' educational attainment, employment status, and net household income.

Table 4 Binary Logistic Regression Model for Children's Supplemental Fluoride Intake (Odds Ratios)

	Fluoride tablet
Stepfather	0.532** (0.153)
Stepmother	2.618 (1.609)
Single mother	0.897 (0.184)
Single father	8.33e^{-14} (0.000)
Relatives	9.45e^{-14} (0.000)
Adoptive parents	0.479 (0.488)
Protectory	3.56e^{-14} (0.000)
N	11,770

Standard errors in parentheses.

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$.

NB: model controls for children's age, sex, migration status, type of health insurance, place of residence as well as parents' educational attainment, employment status, and net household income.

Table 5 OLS Regression Model for Children's Average Daily Consumption of Sugar

	Daily sugar consumption (in gram)
Stepfather	16.78* (9.554)
Stepmother	44.09 (30.67)
Single mother	–9.859 (9.605)
Single father	17.19 (42.41)
Relatives	–62.67 (73.22)
Adoptive parents	–21.20 (33.68)
Protectory	18.60 (73.13)
Cons	328.4*** (28.69)
N	4,170

Standard errors in parentheses.

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$.

NB: model controls for children's age, sex, migration status, type of health insurance, place of residence as well as parents' educational attainment, employment status, and net household income.

incidence rate of dental visits by children from the patchwork setting significantly exceeds the incidence rate of children growing up with both natural parents by about 6 percent. A similar pattern of dental attendance is also found for children who are raised by "adoptive parents": such children are about 3.7 times less likely to access dental services, whereas the number of dental visits increases by about 26 percent in comparison with children who are raised by both natural parents.

The model specifications for toothbrushing frequency, use of fluoridated toothpaste, and intake of fluoridated salt do not denote a difference between children growing up in non-nuclear families in comparison with children raised by both natural parents (for reasons of limited space, the according estimation outputs are not shown here). As depicted in Table 4, however, the intake of fluoride tablets is significantly influenced by family composition, i.e., the according binary logistic regression model suggests a lower probability for children's application of this caries preventive means if growing up within the patchwork familial scenario.

Regarding nutritional habits, "stepfather" turns out as a significant parameter within the OLS regression model for daily sugar consumption (see Table 5): on average, a child who grows up with the natural mother and a stepfather consumes by about 17 g more sugar per day than a child who grows up with both natural parents. In addition, the ordered logistic regression models for consumption of juices, cakes, cookies, and chocolate detect the influence of family composition as follows (see Tables 6-9): the odds ratios in Table 7 suggest a lower frequency but no significant difference regarding intensity of cake consumption for children who are raised by either the natural mother and a stepfather or by the natural mother alone (both in comparison with nuclear families). Furthermore, for children who grow up with the natural mother and a stepfather, bidirectional tendencies are observed for the consumption of juice (see Table 6), cookies (Table 8), and chocolate (Table 9): for these three sugary foods, the parameter estimates for "stepfather" reveal a significant increase in intensity alongside a significant decrease in frequency of intake in case of the patchwork familial scenario. Moreover, "single mother" is detected as a significant positive determinant of intensity of juice consumption but a significant negative determinant of frequency of eating cookies. Being raised by a "single father" is shown to have a positive significant impact on the frequency of eating cookies; being raised by a "stepmother" is detected as having a positive significant impact on the intensity of chocolate consumption. Finally, the odds ratios for consumption of the two remaining sugary foods/drinks (soft drinks, other sweets) do not significantly differ between children from non-nuclear families and the scenario with both natural parents (again, for reasons of limited space, the according estimation results are not shown here).

Table 6 Results from Ordered Logistic Regression for Consumption of Juice (Odds Ratios)

	Frequency	Intensity
Stepfather	0.853** (0.0634)	1.268*** (0.0992)
Stepmother	0.999 (0.269)	1.474 (0.412)
Single mother	0.889 (0.0650)	1.241*** (0.0960)
Single father	1.205 (0.355)	1.252 (0.372)
Relatives	0.482 (0.296)	1.447 (0.893)
Adoptive parents	0.942 (0.241)	0.789 (0.218)
Protectory	0.594 (0.479)	0.556 (0.418)
N	10,495	10,484

Standard errors in parentheses.

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$.

NB: model controls for children's age, sex, migration status, type of health insurance, place of residence as well as parents' educational attainment, employment status, and net household income.

Table 7 Results from Ordered Logistic Regression for Consumption of Cake (Odds Ratios)

	Frequency	Intensity
Stepfather	0.800*** (0.0611)	1.094 (0.0916)
Stepmother	1.439 (0.417)	1.659 (0.517)
Single mother	0.869* (0.0661)	0.992 (0.0806)
Single father	1.102 (0.347)	0.837 (0.290)
Relatives	0.564 (0.365)	1.571 (1.073)
Adoptive parents	0.817 (0.211)	0.819 (0.237)
Protectory	3.707 (3.081)	1.409 (1.608)
N	10,520	10,502

Standard errors in parentheses.

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$.

NB: model controls for children's age, sex, migration status, type of health insurance, place of residence as well as parents' educational attainment, employment status, and net household income.

Discussion

These findings indicate that children who grow up in either family with a birth mother and a stepfather or with adoptive parents are less likely to access dental services. Once at the dentist, however, the number of dental visits is significantly higher in comparison with children who grow up with both natural parents. While in the latter case, the effect size may appear relatively small, the observed pattern of utilizing dental health services nevertheless suggests a tendency toward dental attendance on a non-regular basis when a child is growing up within the patchwork family setting. This finding may build upon previous evidence which shows a positive correlation between irregular dental visits and increased treatment need in terms of carious lesions [see, e.g. (15,16)]. Note, however, that we are not able to verify such a nexus in the present study as the KiGGS public use file does not include information about caries occurrence. In fact, our results should be read with some caution because one major potential factor which could have influenced the number of dental visits, i.e., level of dental needs, is not measured in our study. Notwithstanding, an increased risk of caries occurrence could also arise through the following two pathways.

First, a lower level of tooth care may account for less prevention of dental decay [see, e.g., (17-21)]. However, the findings of this study do not support a linkage between family composition and tooth care at large. In particular, no difference between non-nuclear and nuclear family scenarios was found for toothbrushing frequency, use of fluoridated toothpaste, and intake of fluoridated salt. Solely supplementary intake of fluoride is observed less frequently when a child grows up with a natural mother and a stepfather. Note, albeit, that such an application of fluoride is prevalent among only 5 percent of all children included in our study (see Table 1). Thus, a somewhat lower use of supplemental fluoride cannot be considered a definite explanation for worse oral health.

Second, certain nutritional habits may translate into an increased tooth exposition to sugar and, in turn, foster an increase of carious lesions. For many years, there has been a debate in the literature about the precise *modus operandi* through which sugar intake is linked with caries formation. While some argue for the frequency, others also argue for the overall amount of sugar intake as a causing factor for carious lesions [see, e.g. (22-27)]. Either way, altered consumption patterns of sugary food can be considered potential caries risk factors. The results of the present study indicate that children who grow up together with the natural mother and a stepfather consume by about 17 g more sugar per day than children who are raised by both natural parents. As we could not identify a significantly increased sugar consumption for any other family scenario, we will narrow down the following discussion about differences in nutritional habits to children who live with their natural mother and a stepfather. In particular, our study found no difference in intensity but a decrease in frequency of cake consumption for children who grow up

Table 8 Results from Ordered Logistic Regression for Consumption of Cookies (Odds Ratios)

	Frequency	Intensity
Stepfather	0.811*** (0.0610)	1.136* (0.0868)
Stepmother	0.704 (0.198)	1.312 (0.373)
Single mother	0.876* (0.0655)	1.019 (0.0762)
Single father	1.899** (0.603)	1.090 (0.339)
Relatives	1.247 (0.952)	0.911 (0.649)
Adoptive parents	1.049 (0.277)	0.764 (0.195)
Protectory	7.548** (6.247)	0.522 (0.426)
N	10,502	10,481

Standard errors in parentheses.

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$.

NB: model controls for children's age, sex, migration status, type of health insurance, place of residence as well as parents' educational attainment, employment status, and net household income.

Table 9 Results from Ordered Logistic Regression for Consumption of Chocolate (Odds Ratios)

	Frequency	Intensity
Stepfather	0.792*** (0.0592)	1.305*** (0.107)
Stepmother	0.879 (0.240)	2.898*** (0.844)
Single mother	0.908 (0.0673)	1.067 (0.0873)
Single father	1.349 (0.417)	1.546 (0.512)
Relatives	1.731 (1.163)	1.100 (0.828)
Adoptive parents	0.749 (0.201)	0.921 (0.269)
Protectory	0.785 (0.733)	0.840 (0.780)
N	10,499	10,485

Standard errors in parentheses.

* $P < 0.10$; ** $P < 0.05$; *** $P < 0.01$.

NB: model controls for children's age, sex, migration status, type of health insurance, place of residence as well as parents' educational attainment, employment status, and net household income.

together with a birth mother and a stepfather (the "patchwork" scenario) as compared to being raised by both natural parents. Moreover, on the occasion of intake, a higher amount of juice, cookies, and chocolates seems to be consumed by children with the patchwork familial background. However, in these cases, the potential harm of more intensive consumption appears to be flattened out by less frequent intake. Nevertheless, as we could identify an on aggregate higher intake of sugar among children living in the patchwork setting, this may still present an argument in respect of increased caries risk for children living in the patchwork family setting.

Several methodological issues should be mentioned. First, our data source did not allow for consideration of different time durations that a child has lived in a specific family setting. For example, this may have biased our findings if a majority of children who live in a stepfamily are observed just after a divorce. The according familial frictions may then have affected children's daily habits (among which, e.g., nutrition) stronger than some time later. Second, the number of observations for "average daily sugar consumption" is comparably small because this variable aggregates over all variables for food/drink consumption and, thus, also over all missing observations within each consumption variable. However, this does not appear to render statistical inference impossible in our study. If anything, a larger number of observations may have led to statistical significance of parameter estimates for other family settings in addition to the natural mother and stepfather formation but not necessarily to nonsignificance of the latter. Third, the cross-sectional data used in this study only allow the detection of associations between family composition and children's dental health behavior. That is to say that an adequate identification of causalities would require longitudinal or panel datasets. For Germany, the second wave of KiGGS may provide suitable data but is not available to date. Finally, note that the KiGGS public use file includes another variable for utilization of dental health services. The respective item aims to depict the frequency of preventive dental check-ups as reported by a child's parent. However, a previous study has voiced doubt about parent's response consistency for this parameter (28). In particular, the authors suggest that the question type and according framing effects have led to considerable overreporting of dental check-ups, hence raising concerns about the according within-item construct validity. We therefore did not include this variable in our analysis.

To summarize, the present study suggests that children who grow up in settings other than the nuclear family may develop different dental health behaviors than children who grow up with both natural parents. However, more research is needed to identify the extent to which such behavioral changes lead to variations in caries occurrence.

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