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Estimating the number of children in households with substance use disorders

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Short title: Children in households with substance use disorders

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Abstract

Background: Parental substance misuse is reported to endanger the health and psychological development of children and adolescents. The aim of the present study was to estimate the number of children currently affected by substance use disorders (SUDs) of any adult living in the same household.

Methods: Data came from the 2018 German Epidemiological Survey of Substance Abuse (ESA) among 18-64-year-olds (n=9,267) and from population statistics. DSM-IV diagnostic criteria were used to assess SUD (abuse or dependence) related to tobacco, alcohol, cannabis, cocaine or amphetamine. Based on the number of household members, the number of children below the age 18 years and the information on SUD status of the respondent living in this household, the number of children in households with at least one member with SUD was estimated.

Results: In 2018, there were 13,597,428 children younger than 18 years living in Germany. Of these, 5.2–7.9% (686,482–696,279) were estimated to live in households where at least one adult had an alcohol-related disorder, 5.0–7.4% (674,065–690,792) in households where at least one adult was tobacco dependent and 0.38–1.05% (93,229–142,141) in households where at least one adult had a disorder related to the use of illicit drugs. The total number of children in close contact with SUD adults was estimated at 7.4–11.2% (1,000,725–1,522,667).

Conclusions: The large number of children affected by adults with SUD has implications for identification and prevention. Substantial variation in estimates, resulting from differences in methods, definition of exposure and exposure to whom, calls for international standardization in order to make estimates comparable.

Keywords: Children, adolescents, substance use disorders, estimation, Germany

Background

Parental substance misuse (PSM) is reported to endanger the healthy development of children and adolescents. These children and adolescents are at increased risk of negative outcomes such as emotional, social and behavioural adjustment problems as well as deficits in cognitive and academic functioning (1-3). They also face a higher risk of early substance use involvement as well as mental health problems (4, 5). For instance, anxiety disorder (6), depression (7, 8), attention-deficit/hyperactivity disorder (9, 10) and also disturbed social behaviour (11, 12) were more common in children and adolescents of parents with substance use disorder (SUD) compared with the offspring of parents without SUD.

PSM is often associated with problematic parenting, mood swings, disinhibited behaviour and unmet parental responsibilities (13, 14). Older children from substance-misusing parents must sometimes step in to fulfil the role of their parents such as feeding a baby or taking care of younger siblings while parents experience withdrawal symptoms or recover from a hangover (15). Parental and family problems often lead to an atmosphere in the home of fear, chaos, uncertainty, secrecy and stigma of living with these problems (16). Furthermore, unstable parent-child relationships due to separation from or death of a parent, conflicts, aggression and violence in the family aggravate these adverse living conditions (17, 18).

Research on the types of harm associated with PSM is largely based on cohort studies attempting to identify adverse childhood experiences by taking a lifetime perspective of exposure to substance misuse (SM) from mainly biological parents (19, 20). Estimating the

number of children affected by parental substance misuse (CaPSM), however, constitutes a major challenge on account of various definitions of exposure. A lifetime approach longitudinally assesses how many children were confronted with SM parents during childhood and adolescence resulting in a prevalence until maturity. This may be achieved using a retrospective approach by asking young adults older than 18 years about their experiences with PSM during childhood and adolescence. The number of people who were affected by PSM in the course of their childhood and adolescence as well as the number of people not affected can be directly assessed and the percentage of children affected by PSM can be calculated.

Another way to quantify the number of CaPSM assesses cross-sectionally how many minors were confronted with PSM at a certain point in time (current prevalence). This may be achieved using a complete household approach. By selecting households via a household survey and collecting all necessary information on parents and the number of children living with them, the number of children currently affected by SM adults as well as the number of children not affected can be estimated. However, the majority of surveys are based on an individual household member approach (IHMA) where only one adult in a selected household is interviewed. Based on an SM assessment of the selected respondent, the number of children living in the household and information on the respondent–child relationship, the number of CaPSM can be estimated. As information on the SM status of other members living in the same household as the respondent is not usually assessed in household surveys, the number of CaPSM using the IHMA approach assumes that there is no more than one adult with SM status living in the household.

Although the majority of children live with their biological parents, estimates including only biological parents may neglect potentially adverse conditions for children living with social parents with substance use problems, or where significant others they are living with are misusing substances. Social parents may be step, adoptive or foster parents, grandparents or other relatives. Other cohabiting adults who are not legal guardians may be new partners of a parent, grandparents, older siblings, other relatives or other people within a flat- or house-sharing community. However, many biological parents with substance use problems never lived in the same household as their minor offspring or do not live with them any more. Similarly, social parents or significant others with substance use problems may have affected the child's wellbeing but may no longer live in the same household. Thus, estimates of CaPSM broadly differ in terms of the chosen methodological approach and the definition of exposure.

Of importance also is the pattern of substance use and the severity of substance use problems considered. What is labelled 'excessive' or 'problematic' substance use is much more common than 'pathological' substance use, in the sense of SUD. Where to draw the line between acceptable, problematic and pathological substance use is not always completely unambiguously defined by the existing measures and diagnostic instruments. Yet another important aspect is the particular substance the parent or carer is misusing. The impact of parental dependent tobacco smoking on children is obviously very different from the impact of misusing alcohol or using strongly intoxicating and mind-altering substances (13, 14, 21).

Obviously, restricting exposure to biological parents will result in lower estimates than a definition that precludes assessment of biologically versus socially transmitted risk. Similarly, estimates of lifetime exposure at any point in the child's life will be higher than measures of current exposure. And, finally, considering excessive substance use or SUD of parents or cohabiting adults will clearly affect the estimate. Existing estimates are consistently based on household surveys and take the perspective of current rather than lifetime exposure. For instance, Manning, Best, Faulkner and Titherington (22) estimated the number of children under the age of 16 currently living in households with alcohol- or drugs-misusing adults in the UK. Case definitions included, among others, current binge drinking, alcohol dependence, daily drug use and drug dependence of any adult living in the same household. Using data from the Canadian Community Health Survey, estimates were based on children under age 12 currently living with biological parents, i.e. excluding other adults in the household who were not the child's parents. Problem behaviour was defined as a 12-month diagnosis of psychiatric disorders including alcohol and substance use disorders based on the World Mental Health Composite International Diagnostic Interview (WMH-CIDI) (23).

A German study in the 1990s estimated the number of children under age 18 who were ever living with at least one parent with an alcohol use disorder (24). More recently, another German study using data from the 2012 health survey 'Gesundheit in Deutschland aktuell' (GEDA) focused on current harmful alcohol use based on a score of five or more points for men and four or more points for women on the Alcohol Disorder Identification Test (AUDIT-C) as well as regular binge drinking (six or more alcoholic drinks on one

occasion at least once in the last month). Social and biological parents with children under age 18 were considered (25).

Information on the number of children affected by SUD of adults is needed in order to address specific needs for health care initiatives and professional as well as non-professional support. It is also important to distinguish between different substances, as the impact on children's psychological development differs greatly by type of substance misuse of parents or significant others they live with. As we live in an age where single and divorced mothers and fathers and patchwork families are more common than ever, and separations and divorces are even more likely if one of the partners has a SUD problem, the present study focused on current SUD problems of cohabitating adults including biological and social parents as well as other adults living in the same household. We estimated the number of children under age 18 living in households where at least one adult is currently affected by SUD. Although any substance use may affect a person's control over emotions, judgements or behaviour negatively, we restrained our estimates to the more severe conditions of SUD as defined by the DSM-IV criteria of abuse and dependence (26). The psychoactive substances considered in relation to SUD were tobacco, alcohol and illicit substances such as cannabis, cocaine or amphetamine.

2 Methods

2.1 Data

Estimates were based on data from the German Epidemiological Survey of Substance Use (ESA) conducted in 2018 (27) and on data on population statistics (28). The sample includes

German-speaking individuals aged between 18 and 64 years living in private households. A multistage sample selection was performed: first, 254 municipalities (sample points) were randomly selected followed by a random selection of the target population from population registers. Data were collected by standardized self-administered questionnaires (paper–pencil), telephone interviews or online questionnaires. The adjusted sample included 9,267 individuals (response rate: 41.6%). Details on the methods and design of the ESA 2018 have been published elsewhere (27).

In the section on demographics in ESA 2018, participants were asked about both the number of children under the age of 18 years and the number of adults including the respondent who currently lived in their household. Moreover, information about the family status of the respondents (married/partnership, divorced, widowed), whether children were present and the relationship with each child (biological, step, adoptive or foster parent, brother or sister, nephew or niece, other) was collected. SUD related to tobacco, alcohol, cannabis, cocaine or amphetamine was assessed using the abuse and dependence criteria of the DSM-IV (26). Diagnoses were based on the Munich Composite International Diagnostic Interview (M-CIDI; 29, 30); by definition, only dependence was assessed for tobacco-related disorder.

2.2 Analysis

The analysis was based on the study participants' information on the number of people living in their households, the number of children below age 18 living in these households and information on the participants' SUD status. Owing to the low number of individuals fulfilling criteria for disorders related to cocaine (n = 14) or amphetamine (n = 27), these disorders

were combined with cannabis-related disorder and labelled 'illicit substance use disorders'. As the sample represents individuals in the adult population, it is assumed that the results are proportional to a full census covering the target population. In every household with more than one adult, the children would be counted repeatedly. For instance, considering six children in a household with three adults and adding up the number of all children would incorrectly result in 18 children, even though there are actually only six. To avoid multiple counting, the share of children per adult was considered. By dividing the number of children related to each respondent by three (share of children per adult), the total sum over all adults represents the correct number of children in each household $6/3 + 6/3 + 6/3 = 6$.

When counting the number of SUD-affected children based on the number of children reported by the adults in each household, the fundamental problem arises that children living with non-SUD adults are erroneously counted as non-SUD affected even though they are obviously affected by another SUD adult in the same household. As the number of adults per household with SUD was not assessed in ESA, there is no precise way to compensate for this shortcoming. However, it is possible to calculate a lower and an upper point estimate for the number of children affected by SUD in households by applying the two most extreme diametrical assumptions:

- Assumption 1: Either all or none of the adults in each household are affected by SUD
- Assumption 2: No more than one adult in each household is affected by SUD

For each individual in the sample, three variables were used: the number of children in the household (n_c), the number of adults in the household (n_a) and the SUD status i of the

adult ($i \in \{SUD, nonSUD\}$). Based on Assumption 1 and adding the share of children per adult for all households, the number of SUD affected children ($N_{SUD.1}$) and the number of non-SUD affected children ($N_{nonSUD.1}$) was calculated:

$$N_{SUD.1} = \sum_{i=SUD} \bar{n}_c \cdot n_a$$

$$N_{nonSUD.1} = \sum_{i=nonSUD} \bar{n}_c \cdot n_a$$

Under Assumption 1, adding the shares of children for all SUD adults represents the correct number of children affected by SUD in the households as Assumption 1 rules out the possibility that non-SUD adults live in households with SUD adults. For example, if there are six children living in a household with three SUD adults, all six children are affected by SUD and summing the children's shares of all three SUD adults adds correctly to six affected children ($3 \cdot 2 = 6$).

Under Assumption 2, we are confronted with the situation that the shares of children linked to non-SUD adults who are actually affected by SUD adults living in the same households are misclassified. Assuming that there is no more than one SUD adult in every household, all other adult household members must be non-SUD adults. The total number of misclassified shares of children (adjustment term) needs to be subtracted from the number of originally (Assumption 1) classified unaffected children $N_{nonSUD.1}$ and added to the number of originally classified affected children $N_{SUD.1}$. For example, if there are six children in a household with two non-SUD adults and one SUD adult, all six children are

affected by SUD, but only the SUD adult's children share is initially considered as affected ($1 \cdot 2 = 2$), even though six children are actually affected. The difference of four children must be compensated for to arrive at correct estimates. Using the adjustment term

$$N_{adj} = \sum_{i=SUD} \bar{n}_c \cdot (n_a - 1)$$

the number of SUD affected children ($N_{SUD.2}$) and the number of non-SUD affected children ($N_{nonSUD.2}$) were calculated:

$$N_{SUD.2} = N_{SUD.1} + N_{adj}$$

$$N_{nonSUD.2} = N_{nonSUD.1} - N_{adj}$$

In line with both assumptions, the percentage of affected children $\frac{N_{SUD}}{N_{SUD} + N_{nonSUD}}$ reflecting

the proportion of SUD affected children among all children was calculated. Under

Assumption 1, $\frac{N_{SUD.1}}{N_{SUD.1} + N_{nonSUD.1}}$ yields the lower point estimate and, under Assumption 2,

$\frac{N_{SUD.2}}{N_{SUD.2} + N_{nonSUD.2}}$ yields the upper point estimate.

Lower and upper point estimates of $N_{SUD.1}$ and $N_{nonSUD.1}$ as well as $N_{SUD.2}$ and $N_{nonSUD.2}$ were calculated separately for the conditions of tobacco, alcohol and illicit substance use disorders. Multiplying the obtained point estimates by the number of children younger than 18 years in the population ($N = 13,597,428$ as of 31 December 2018; (28)), the range in the number of children living in households with at least one member having a positive SUD diagnosis was projected to the total population. All analyses based on survey data were performed using Stata 15.1 (Stata Corp LP; College Station, TX, USA).

3 Results

The 12-month prevalence of SUDs is shown in Table 1. The prevalence of SUDs in adults ranged between 1.5% for illicit drug use disorder, 5.9% for alcohol use disorder and 8.6% for tobacco dependence.

Table 1

The family status of SUD and non-SUD families differed statistically significantly. More than two thirds (71.1%) of non-SUD respondents were married, whereas the proportion was significantly lower in respondents with SUD status (47.8%) and lowest among respondents with illicit substance use disorder (19.0%; Table 2). On average, 1.7 children were living in non-SUD households and 1.6 in SUD households with statistically significantly lower rates in households with alcohol disorders (1.5%). Compared with non-SUD households, the relationship with the child was statistically significantly different in SUD households with higher rates of biological parents in the former group (84.3% versus 64.9%). The proportion of single parent/carer families was considerably lower in non-SUD households (4.8%) compared with SUD households (9.5%), but the difference did not reach statistical significance.

Table 2

The estimates of the number of children in households with adults affected by SUD, the percentage of affected children among all children and the average number of affected and unaffected children are presented in Table 3. The results based on single substance disorders of adults suggest that the highest proportion of affected children live in households with at least one adult with an alcohol-related disorder (lower and upper

estimate: 5.2–7.9%). Almost the same proportion of children live in households with tobacco-dependent adults (5.0–7.4%), and between 0.38% and 1.05% of children live in households with at least one adult with illicit drug dependence. Considering double and multiple SUDs but excluding tobacco dependence, we estimated between 5.5% and 8.5% or 743,013 and 1,156,050 affected children. Including tobacco dependence, a total of 7.4–11.2% or 1,000,725–1,522,667 children were estimated to live in households with at least one adult with SUD.

Table 3

4 Discussion

Using a representative survey of adults and information on their SUD status as well as the number of adults and children currently living in the same household with the respondent, the number of SUD affected children cannot be precisely estimated. Not knowing the SUD status of each person in the household, summing the number of children reported by each respondent would overestimate the total number of children as a result of multiple counting. This problem could be solved by assuming that either all or none of the adults in a household are affected by SUD or only one. The first assumption results in a conservative lower point estimate of SUD affected children, whereas the second assumption results in an upper point estimate by aggregating the share of children per adult for every household (dividing the number of children by the number of adults).

It is important to note that the cross-sectional perspective of children’s current exposure to SUD taken in the present approach misses all occasions related to SUD cohabiting adults before the assessment and all occasions that will occur later until the children are of age. In

comparison with this, if adult respondents were asked whether in the past they were living together with an SUD adult until they reached maturity, a longitudinal perspective including all past and future experiences would be taken resulting in higher numbers of children affected.

The proportion of children below the age of 18 years in households with SUD in Germany in 2018 was estimated at 7.4–11.2% (1,000,725–1,522,667). Excluding exposure to tobacco-dependent adults, the result was 5.5–8.5% or 743,013–1,156,050 children. Compared with an earlier estimate of 2.65 million children who were ever living with parents with alcohol use disorders by Klein (24), our estimate (686,482–1,067,633) is considerably lower.

Naturally, asking 14- to 24-year olds from a community sample about lifelong exposure to parental alcohol use problems (31) will result in a higher estimate. The second German estimate of 6.6 million affected children is based on the approach described above but only using Assumption 1 to estimate the number of children affected by parental alcohol misuse (25). Moreover, different from our definition, the authors of this study used the AUDIT-C, i.e. five or more points for men and four or more points for women, to define alcohol use problems. Using less severe criteria of risky drinking in terms of frequency and quantity of drinking and frequency of heavy drinking occasions certainly increases the number of exposed children.

Comparisons with international estimates are similarly limited because of different definitions of exposure and substance use problems among parents, carers or adults living in the same household. The proportion of children under 20 years with one or both parents misusing alcohol was estimated at 10.7% in Denmark, 5.7% in Finland, 15.4% in Germany

and between 17% and 23% in Poland (32). Although alcohol misuse by parents was defined as alcohol problems in Denmark, in Finland, the definition comprised excessive alcohol use, in Germany, alcoholic parents and, in Poland, alcohol addiction or alcohol abuse. Similarly, estimates for the proportion of children under 20 years with one or both parents using drugs was 0.2% in both Denmark and Germany and 1.5–2.4% in the UK. The definition ranged from parents with custody of the children in Denmark to drug dependency in Germany and serious drug problems in the UK. Using a similar definition to the one in our study and conducting secondary analysis of data from national household surveys, a study in the UK estimated the proportion of children below the age of 12 currently living in a household with an alcohol-dependent adult at 5.9% and children currently living in a household with a drug-dependent adult at 2.8% (22). Grant (33) used data from the 1992 National Longitudinal Alcohol Epidemiological Survey and calculated the number of children aged 17 years or younger living in households with one or more adults who were abusing or dependent on alcohol (last 12 months) and who, at some time in their lives, had abused or were dependent on alcohol, resulting in a lower (15%) and upper estimate (43%). Excluding non-parental relationships with the child in the household, Bassani and colleagues (23) estimated that 11.4% and 8.3% of children under 12 years in Canada were exposed to SUDs and alcohol use disorders (i.e. excluding illicit substances) of their biological parents respectively.

Although our findings suggest that between 7.4% and 11.2% of all children in Germany are living in households with at least one adult with any SUD, these children may be subject to different risks depending on the type and severity of the disorder. For instance, children living in households where adults smoke have a higher risk of somatic diseases such as

asthma and other respiratory conditions (34, 35), whereas children confronted with intoxicated cohabitants are more likely to face psychologically stressful situations leading to lower school performance or behavioural problems (36-38). This can be neglect, aggression or having to take over parental roles. However, children of parents with SUD have in common a higher risk of drug involvement as well as mental health problems or disturbed social behaviour compared with the offspring of parents without SUD (4, 39). In addition, research indicates that these children are at higher risk of developing SUDs themselves, as well as non-substance-related psychopathologies (40).

Respondents with SUD in our study were almost twice as often living in single parent/carer households compared with non-SUD respondents, indicating the need for supportive strategies for these parents and children. There is evidence that young people raised by single parents are more likely to perform poorly in school and partake in deviant behaviours such as smoking, substance use and crime (41).

It is also important to point out that estimates of the number of children affected by parental SUD quantify the potential risk of adversity. The frequency and intensity of the adults' problematic SUD-related behaviours are not considered in these studies. For instance, some children may be confronted with SUD adults in their household who often behave violently when intoxicated, or who are depressed and stress their children with suicidal ideas. Others may live with adults who primarily damage their own physical health through excessive alcohol or drug consumption and only slightly affect the children in their environment. Despite experiencing negative somatic, psychological or social consequences, some children do not show signs of negative psychological developments on account of

factors of resilience supporting these children in developing stable and assertive personalities (42-45).

Strengths and limitations

To account for multiple counting of children in households where more than one adult lives, we based our calculations on the share of minors per adult in every household. Under Assumption 1, aggregating these shares per SUD adult and non-SUD adult provides an unbiased estimate of the number of SUD affected and non-SUD affected children in the sample. Under Assumption 2, we compensated for the percentage of shares of children associated with non-SUD adults in households where children are affected by another SUD adult. Finally, the percentage of SUD affected children could be calculated without having to resort to total population figures under both assumptions.

However, the availability of data on SUDs in our study was limited to disorders related to the use of tobacco, alcohol, cannabis, cocaine or amphetamine. These data may account for the majority of substance-related disorders in the population but do not provide complete coverage. Estimates of SUDs from survey data are usually subject to underreporting because of higher non-response in particular subgroups or socially desirable response behaviour. For instance, surveys usually miss subgroups with higher risks of SUDs such as people who were homeless, in prison, hospitalized or living in institutions at the time of the survey. Our estimates of children affected by SUDs may thus be underestimated. The fact that information on the SUD status of other household members was not collected would also have resulted in an underestimate of the number of children exposed to parental SUD disorders. However, this bias was minimized in the

present approach by providing lower and upper estimates. Unfortunately, household surveys are cross-sectional in nature with respondent substance use and parental status measured at a single point in time; yet these are not stable factors but fluctuate over time.

There is ample evidence that parents and carers of children with SUD have strong and often irreversible negative somatic and psychological effects on the wellbeing of their children. To target these children, prevention programmes and policies have been developed (15, 46, 47). For instance, secondary prevention targeting individual, familial and environmental influences by offering specific help to affected children and parents has been proved effective in reducing future problems in these children (48). In addition to providing preventive support for parents with SUD and affected children, the harmful effects of SUD on others and particularly on children need to be recognized as a public health concern in the same way as are the harmful effects on the users or the costs to society (49).

To conclude, prevalence estimates of the number of CaPSM vary substantially according to the methodological approach (lifetime or current approach) as well as the definition of exposure (substance misuse) and exposure to whom (social or biological parents, significant others children live with in the same household). In order to identify changes in exposure to risk in relation to the child's age, future approaches should be based on data from longitudinal or cohort studies with multiple and regular assessment intervals. Most importantly, however, standard approaches and definitions need to be established in order to make estimates comparable.

List of Abbreviations

CaPSM	Children affected by parental substance misuse
ESA	Epidemiological Survey of Substance Abuse
IHMA	Individual household member approach
PSM	Parental substance misuse
SM	Substance misuse
SUD	Substance use disorder

Declarations

Ethics approval and consent to participate: All participants received written correspondence comprising study information, a data privacy statement, an online access code, and an accompanying letter from the German Federal Ministry of Health. Informed consent was given either verbally (telephone arm), by ticking the informed consent box (online questionnaire) or by accepting the conditions (study content, data protection, data processing and storage) in sending back the filled in questionnaire. Participants were informed about the voluntary nature of their participation and confidentiality of their data. The questionnaire and methodology of the Epidemiological Survey of Substance Abuse (EAS) received ethical approval from the ethics committee of the German Psychological Society (DGPs; Reg.-No: GBLK06102008DGPS).

Consent for publication: Not applicable

Availability of data and material: All datasets of the Epidemiological Survey of Substance Abuse (since 1980) are available for scientific purposes at GESIS Leibniz Institute for Social Research and can be requested there. A permission in order to access the data must be

obtained in order to access the data by the IFT Institut für Therapieforschung in Munich, Germany.

Competing interests: All authors state that they do not have any competing or conflicting interests related to the work presented in the paper.

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Authors' contributions: LK, NNS and AU designed the study. NNS and AU conducted the statistical analysis. LK wrote the manuscript. All authors critically contributed to earlier drafts of the manuscript and approved the final version of the paper.

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