Non-suicidal self-injury and its co-occurrence with suicidal behavior: An epidemiological-study among adolescents and young adults

Voss C, Hoyer J, Venz J, Pieper L, Beesdo-Baum K. Non-suicidal self-injury and its co-occurrence with suicidal behavior: A epidemiological-study among adolescents and young adults.

Objective: Non-suicidal self-injury (NSSI) comprising thoughts and behaviors is common and often co-occurring with suicidal behavior like ideation, plan, and attempt. As limited data are available for adolescents and young adults, this study aims to present prevalence estimates for lifetime NSSI, its co-occurrence with suicidal behavior, conditional probabilities and their association with socio-demographic characteristics, severity characteristics of suicidal behavior, and health service utilization.

Method: The epidemiological Behavior and Mind Health (BeMIND) study assessed in 2015/16 a random-community sample of $N = 1180$ aged 14–21 years from Dresden, Germany, regarding lifetime NSSI via self-administered questionnaire and suicidal behaviors via standardized interview.

Results: Any lifetime NSSI was reported by 19.3% (thoughts: 18.0%, behaviors: 13.6%) of the sample with higher prevalence in females ($OR = 2.7, 95\% CI 1.9–3.8, P < 0.001$). Lifetime prevalence of co-occurring NSSI and suicidal behavior was 7.7%. Females had a 3.3- to 8.8-fold odds of co-occurrence than males. Among those with any NSSI, 39.6% endorsed suicidal behavior, and 66.3% of those with any suicidal behavior reported NSSI. 42.3% of those with any NSSI reported to have used mental healthcare services at any time during their life with higher rates in those with co-occurring suicidal behavior (62.3%).

Conclusion: Non-suicidal self-injury and co-occurring suicidal behavior is common in adolescents and young adults—especially females. The limited utilization of mental healthcare services underpins the need for improving recognition of NSSI and suicidal behavior as well as the accessibility of mental healthcare services during adolescence and emerging adulthood.

Significant outcomes

- Any lifetime non-suicidal self-injury (NSSI) was reported by 19.3% (thoughts: 18.0%, behaviors: 13.6%).
- Lifetime prevalence of co-occurring NSSI and suicidal behavior was 7.7% with higher prevalence in females.
- Any mental healthcare use was reported by 42.3% of those with any NSSI and by 62.3% of those with co-occurring suicidal behavior.
Introduction
Non-suicidal self-injury (NSSI) and suicidal behaviors are two distinct behaviors demonstrated by their differences in frequency, used methods, severity, and function (1–4). The use of different terms and definitions impedes the understanding of these behaviors and their associations (4, 5). Here, NSSI can be understood as a thought or behavior (i.e. action) to do deliberate, self-inflicted destructions of body tissue without a suicidal intent (4), and suicidal behavior can be understood as suicidal ideation, plan or attempt with the intend to die (6). On the one hand, etiological theories regarding suicidal behavior include NSSI as a risk factor for suicidal behavior (6, 7), which was supported by empirical evidence in several meta-analyses (8–11). On the other hand, these behaviors have shared risk factors like mental disorders (e.g., depression (8, 12)) or early childhood traumatic events (4, 8), and a similar sensitive period for the first onset in adolescence and young adulthood (5, 9, 13–15).

Increasing prevalence estimates of NSSI were found in recent years (16–18). In a study from England, an increase in the prevalence of NSSI behaviors was found in an adult sample aged 16–74 years from 2000 to 2014, with the highest increase (6.5%–19.7%) in females aged 16–24 years (16). Overall, lifetime prevalence estimates vary widely for NSSI behavior from 1.5% to 54.8% with a mean lifetime prevalence of 18.0%–26.4% in males and up to 33.8% in females (19–21). Comparing different age groups, adolescent samples show the highest lifetime prevalence estimates compared to young adults (20). In contrast to NSSI behaviors, less is known about NSSI thoughts. A study in college students aged 18–35 years found a lifetime prevalence of 22.6% and a 12-month prevalence of 8.8% (22). A higher estimate of 24.1% for the past 6 months was found in a study of 15 year olds (23). Compared to NSSI, lifetime prevalence estimates of suicidal behavior are lower, but they also show a wide range between 1.5 and 37.9% (5, 15, 24).

An increasing number of studies examined the co-occurrence of NSSI and suicidal behavior. However, only a few studies examined the association with all types of suicidal behavior including ideation, plan, and attempt in adolescents and young adults from the general population and results vary depending on the direction of the analysis (25–27). So far, research demonstrated high numbers of co-occurrence of NSSI and suicidal behaviors in adolescents and young adults (25–27). Moreover, this co-occurrence seems to be associated with an impaired health over time, for example, more depressive symptoms, and lowered self-esteem (8, 28, 29). However, previous research lacks the differentiation between NSSI thoughts and behaviors as well as their associations with all types and course characteristics of suicidal behavior like age at onset and frequency in adolescence and young adulthood. Such data are crucial to understand the burden and relevance of NSSI thoughts and behaviors in this critical developmental period. Moreover, knowledge is scarce regarding sex, age, and education status differences as well as mental healthcare utilization.

Aims of the study
The aims of the present study are (1) to present lifetime prevalence estimates for any NSSI including thoughts (NSSI-T) and behaviors (NSSI-B) and to examine associations with socio-demographic characteristics; (2) to describe the co-occurrence of NSSI and lifetime suicidal behavior including ideation, plan and attempt, and to examine conditional probabilities and their associations with socio-demographic characteristics and characteristics of suicidal behavior (i.e., age at onset and number of episodes); and (3) to report frequencies of lifetime mental healthcare utilization in those with NSSI with and without any suicidal behavior.

Method
Study design and procedures
Cross-sectional data come from the Behavior and Mind Health (BeMIND) study, an epidemiological
cohort study among adolescents and young adults from Dresden, Germany (30). An age- and sex-stratified random sample of 14–21 year olds was drawn from the population registry, followed by a maximum of three written invitation letters to participate in the study. Between November 2015 and December 2016, N = 1180 subjects participated in the study (response/participation rate 21.7%, cooperation rate 42.8% 31) comprising of two assessment days around one week apart in the Center for Longitudinal and Epidemiological Studies (CELOS) at the Technische Universität Dresden. The two assessment days at the study center included a standardized diagnostic interview, questionnaires, cognitive paradigms, and bio-sampling (blood and hair samples). In between, smartphone-based ecological momentary assessments over four days and an online questionnaire examining risk and protective factors were issued. All participants provided written informed consent or assent, and of those under 18 years of age, written informed consent of all legal guardians were gathered. Participants received 50 Euro as incentive. The BeMIND study protocol has been accepted by the ethics committee of the Technische Universität Dresden, Germany (EK381102014). For a comprehensive overview of the BeMIND study program, recruitment and detailed sample characteristics, see Beesdo-Baum, Voss, Venz, Hoyer, Berwanger, Kische, Ollmann, Pieper (30). The present study follows the Strengthening the Reporting of Observational Studies (STROBE) guidelines (32).

Measures

At the first assessment day, an updated version (33) of the fully standardized computer-assisted Munich-Composite International Diagnostic Interview (DIA-X/M-CIDI; 34,35–38) was conducted face-to-face by trained clinical interviewers accompanied by tablet-based self-administered questionnaires. During the interview, all participants answered questions about socio-demographic characteristics, suicidal behavior, and service use, and filled out a self-administered questionnaire for NSSI and course characteristics of suicidal behavior.

**Lifetime non-suicidal self-injury.** To examine NSSI, a questionnaire was used based on two dichotomous items of the self-injurious thoughts and behaviors interview for self-harming behavior (SITBI-G; 39,40) after the interview section for depression. One item assessed NSSI thoughts (NSSI-T): ‘Have you ever had thoughts of purposely hurting yourself without wanting to die? (e.g., cutting, scratching, or burning)’; the second item assessed NSSI behaviors (NSSI-B): ‘Have you ever purposely hurt yourself without wanting to die?’

**Lifetime suicidal behavior.** Lifetime suicidal behavior was assessed in all participants during the interview section for depression using the following questions: Ideation: ‘Have you ever thought over a period of days or weeks about killing yourself, that is, to attempt suicide?’ Plan (if ideation): ‘Have you ever made a specific plan for killing yourself?’ Attempt (all participants): ‘Have you ever attempted suicide?’ Participants endorsing lifetime suicidal behavior were additionally asked for age at onset and the number of episodes of ideation, plan, and number of attempts using a self-administered questionnaire.

**Mental health service utilization.** Service utilization was assessed in section Q of the interview by asking the following gate question: ‘Have you ever visited/located any of the healthcare institutions [as listed in the respondent’s booklet] because of mental health, psychosomatic, or substance use problems, either by yourself, or by advise of others, for example, medical doctors, relatives, or your partner?’. If the individuals endorsed the gate question, healthcare use of different institutions was coded separately comprising inpatient (i.e., psychiatric hospital or home for children), outpatient (i.e., general practitioner (if reason was mental health problem), psychotherapist), and complementary healthcare services (i.e., counseling centers for students, telephone counseling).

**Statistical analysis**

All analyses were weighted to ensure a comparable distribution with the whole population of adolescents and young adults aged 14–21 years in Dresden regarding age and sex. Robust standard errors were calculated by using the first-order Taylor-series linearization method to obtain correct 95% confidence intervals (95% CI) for prevalence estimations (41). The prevalence of the co-occurrence was examined in the total sample and the conditional probabilities (42) were determined by calculating the frequency of individuals with suicidal behavior among those with NSSI and vice versa. Logistic regression models (odds ratios (OR) with 95% CIs) were used to quantify the associations; negative binominal regression (Incidence Rate Ratios, IRR) was used for count data (frequency); and exact Fisher’s test was used for associations.
with mental healthcare use if there were five or less cases in one group. To ensure stability of the models, the most frequent category of a variable was used as the reference category. Tests were done at the 2-sided α = 0.05 level. Regarding course characteristics for suicidal behavior, a dichotomous item was calculated differentiating early and late onset based on the median and categorical variables were built for number of episodes both using previous findings (15). Missing data were conservatively counted as no occurrence (four individuals for suicidal behavior and seven for NSSI and help-seeking behavior). Stata software package, release 14.2, was used to conduct the analyses (43).

Results
Sample characteristics

In the following, the reported percentages are based on weighted data. The weighted mean age of the N = 1180 participants was M = 17.9, SD = 2.3, and 48.3% were female (n = 685). Most participants reported a German citizenship (97.1%) and living with their parents (65.1%; 17.1%, 12.5%, and 5.4% lived with other people, that is, roommates, alone, or with a partner, respectively). Three quarter (76.5%) reported currently a high education, that is, A-Level, a fifth (18.5%) a middle education, that is, secondary school, and 5.0% another (e.g., private schools) or low education status (e.g., lower secondary school levels). More information about the sample characteristics can be found in detail elsewhere (30).

Prevalence of any NSSI, NSSI-T and NSSI-B

Any lifetime NSSI was reported by 19.3% (95% CI 17.1–21.8), NSSI-T by 18.0% (95% CI 15.8–20.4), and NSSI-B by 13.6% (95% CI 11.7–15.8) of the adolescents and young adults. Table 1 depicts associations with socio-demographic characteristics. Females revealed a significantly higher prevalence of any NSSI (27.1% [95% CI 23.8–30.7] vs. 12.1% [95% CI 9.3–15.5]), NSSI-T (25.9% [95% CI 22.6–29.4] vs. 10.6% [95% CI 8.0–14.0]), and NSSI-B (20.6% [95% CI 17.6–23.9] vs. 7.1% [95% CI 5.1–10.0]) than males (lower OR CI at least 1.9). No age group differences were found. The current education status was associated with NSSI-T and NSSI-B indicating more NSSI in the group with a middle, low or other compared to high education status. Among those with an average compared to a good or very good subjective financial status, a significant higher prevalence was found for all types of NSSI. Growing up with a single or no parent was associated with all types of NSSI.

Regarding the co-occurrence of NSSI-T and NSSI-B, both were reported by 12.3% (95% CI 10.5–14.3; females: 19.3% [95% CI 16.4–22.6] vs. males: 5.7% [95% CI 3.8–8.4]). Only NSSI-T was reported by 5.7% (95% CI 4.4–7.3; females: 6.6% [95% CI 4.9–8.8] vs. males: 4.9% [95% CI 3.2–7.5]) and only NSSI-B by 1.4% (95% CI 0.8–2.3; females: 1.3% [95% CI 0.6–2.6] vs. males: 1.5% [95% CI 0.7–3.0]). Significant sex differences emerged indicating that those with both compared to none were more likely females (OR = 4.1, 95% CI 2.6–6.5, P < 0.001). No age group differences were found. Reporting both (OR = 1.7, 95% CI 1.1–2.4, P = 0.011) was more likely in the group with a middle, low or other compared to high education status.

Co-occurrence of NSSI and suicidal behaviors

Prevalence and associations. Lifetime prevalence estimates of suicidal behavior in the present sample are published elsewhere (15). Table 2 and Figure 1 depict the frequencies of the co-occurrence of any NSSI, NSSI-T and NSSI-B with suicidal ideation, plan, attempt, and any suicidal behavior for the total sample, by sex, age cohort, and current education status. Overall, 23.2% (95% CI 20.8–25.9; female: 28.9% [95% CI 25.5–32.5], males: 17.9% [95% CI 14.5–21.9]) reported any NSSI and/or any suicidal behavior during their lifetime (any NSSI-T and/or suicidal behavior: 22.0% [95% CI 19.5–24.6]; any NSSI-B and/or suicidal behavior: 19.4% [95% CI 17.1–21.9]).

The lifetime co-occurrence of any NSSI with any suicidal behavior was reported by 7.7% (95% CI 6.2–9.4) of the adolescents and young adults. Results for NSSI-T and NSSI-B are presented in Figure 1. Those with NSSI and co-occurring suicidal behavior had 3.3- to 8.8-fold odds to be female than male (Appendix Table S1), which is also illustrated in Figure 1. There was no significant difference with regard to age. For the current education status, there was an association indicating that those with NSSI and co-occurring suicidal behavior had more likely a middle, low or other than a high education status.

Regarding non co-occurrence, only suicidal behavior was reported by 3.9% (95% CI 2.8–5.4) and only NSSI by 11.7% (95% CI 9.9–13.7) of the adolescents and young adults (Table 2). Significant sex differences emerged indicating that those reporting both and NSSI only were more likely females and those with suicidal behavior only more likely males (Appendix Table S1). No age group
differences were found. Reporting both was positively associated with a middle, low, or other compared to high education status. Results were similar for any NSSI, NSSI-T, and NSSI-B.

**Conditional probabilities.** Appendix Table S2 shows conditional probabilities of NSSI and suicidal behavior. Overall, NSSI and suicidal behavior were positively associated. In those with any NSSI, 39.6% (95% CI 33.2–46.3) endorsed any lifetime suicidal behavior (ideation: 39.3%, plan: 22.4%, attempt: 11.8%). No significant differences in socio-demographic characteristics were found in those with NSSI with and without suicidal behavior (Appendix Table S3).

In those with any suicidal behavior, 66.3% (95% CI 56.8–74.7) reported any NSSI, 65.5% NSSI-T (95% CI 56.0–73.9), and 50.4% NSSI-B (95% CI 41.3–59.4). Any NSSI was reported by 70.7% (95% CI 61.0–78.9) with ideation, 86.2% (95% CI 74.1–93.2) with a plan and 67.8% (95% CI 48.6–83.4) with an attempt (Appendix Table S2). Reporting any NSSI (OR = 10.5, 95% CI 4.3–25.8, P < 0.001), NSSI-T (OR = 9.3, 95% CI 3.8–22.4, P < 0.001) or NSSI-B (OR = 8.9, 95% CI 3.7–21.3, P < 0.001) compared to none was more likely in females. No age cohort or education status differences were found.

**Association with characteristics of suicidal behaviors.** Table 3 depicts the characteristics of suicidal behavior and its association with the co-occurrence of any NSSI, NSSI-T, and NSSI-B. Any NSSI, NSSI-T, and NSSI-B were positively associated with characteristics like ever having a partner (RR = 1.2, 95% CI 1.0–1.5, P = 0.02). Any NSSI was reported by 66.3% (95% CI 56.8–74.7) of those with a partner, 62.4% (95% CI 52.5–72.6) of those with a partner, and 60.1% (95% CI 49.3–71.1) of those with a partner. Any NSSI was reported by 66.3% (95% CI 56.8–74.7) of those with a partner, 62.4% (95% CI 52.5–72.6) of those with a partner, and 60.1% (95% CI 49.3–71.1) of those with a partner.
Table 2. Prevalence of the co-occurrence of NSSI and suicidal behavior (N = 1180)

| Co-Occurrence† | Total n (%) | Male n (%) | Female n (%) | 14–17 n (%) | 18–21 n (%) | High n (%) | Middle, low or other n (%) |
|----------------|-------------|------------|--------------|--------------|-------------|------------|----------------------------|
| Any NSSI       | 1180        |            |              |              |             |            |                            |
| Any NSSI & ideation | 97 (8.4) | 18 (3.8) | 79 (11.6) | 44 (6.5) | 53 (8.4) | 61 (6.8) | 36 (11.3) |
| Any NSSI & plan | 57 (4.3)   | 6 (1.4)   | 51 (7.3)   | 25 (3.4)   | 32 (5.0)   | 35 (3.8)  | 22 (6.2)  |
| Any NSSI & attempt | 31 (2.3) | 3 (0.6)   | 28 (4.1)   | 12 (1.7)   | 19 (2.7)   | 15 (1.6)  | 16 (4.8)  |
| Any NSSI or suicidal behavior | 288 (23.2) | 84 (17.9) | 204 (28.9) | 149 (21.9) | 139 (24.2) | 201 (21.9) | 87 (27.4) |
| Suicidal behavior only | 40 (3.9)   | 27 (5.9)  | 13 (1.7)   | 18 (2.9)   | 22 (4.6)   | 28 (3.7)  | 12 (4.4)  |
| NSSI only       | 150 (11.7) | 39 (8.2)  | 111 (15.4) | 86 (12.4)  | 64 (9.0)   | 112 (11.8)| 38 (11.4) |
| Both            | 98 (7.7)   | 18 (3.3)  | 80 (11.1)  | 45 (6.6)   | 53 (8.4)   | 61 (6.5)  | 37 (11.6) |
| NSSI-T          |            |            |              |              |             |            |                            |
| NSSI-T & ideation | 96 (7.5) | 18 (3.8)  | 76 (11.4)  | 44 (6.5)   | 52 (8.2)   | 60 (6.3)  | 36 (11.3) |
| NSSI-T & plan   | 57 (4.3)   | 6 (1.4)   | 51 (7.3)   | 25 (3.4)   | 32 (5.0)   | 35 (3.8)  | 22 (6.2)  |
| NSSI-T & attempt| 31 (2.3)   | 3 (0.6)   | 28 (4.1)   | 12 (1.7)   | 19 (2.7)   | 15 (1.6)  | 16 (4.8)  |
| NSSI-T or suicidal behavior | 273 (22.0) | 76 (16.5) | 197 (27.8) | 142 (20.9) | 131 (22.9) | 189 (20.6) | 84 (26.3) |
| Suicidal behavior only | 41 (4.0)  | 27 (5.9)  | 14 (1.9)   | 18 (2.9)   | 23 (4.8)   | 29 (3.9)  | 12 (4.4)  |
| NSSI-T only     | 135 (10.4)| 31 (6.8)  | 104 (14.3) | 79 (11.2)  | 56 (8.8)   | 100 (10.5)| 35 (10.3) |
| Both            | 97 (7.8)   | 18 (3.3)  | 79 (11.6)  | 45 (6.6)   | 52 (8.4)   | 60 (6.3)  | 37 (11.6) |
| NSSI-B          |            |            |              |              |             |            |                            |
| NSSI-B & ideation | 77 (5.9) | 11 (2.2)  | 66 (9.6)   | 35 (5.0)   | 42 (6.3)   | 47 (4.7)  | 30 (9.0)  |
| NSSI-B & plan   | 47 (3.4)   | 4 (0.8)   | 43 (6.2)   | 21 (3.0)   | 26 (3.7)   | 27 (2.7)  | 20 (5.8)  |
| NSSI-B & attempt| 27 (1.9)   | 2 (0.4)   | 25 (3.5)   | 11 (1.5)   | 16 (2.2)   | 13 (1.3)  | 14 (4.3)  |
| NSSI-B or suicidal behavior | 239 (19.4) | 69 (14.7) | 170 (24.4) | 120 (17.7) | 119 (20.5) | 162 (17.7) | 77 (24.6) |
| suicidal behavior only | 60 (5.7)  | 34 (7.5)  | 26 (3.3)   | 27 (4.4)   | 33 (6.2)   | 42 (5.4)  | 18 (6.7)  |
| NSSI-B only     | 101 (7.8)  | 24 (5.0)  | 77 (10.9)  | 57 (8.2)   | 44 (7.6)   | 73 (7.6)  | 28 (8.6)  |
| Both            | 78 (5.8)   | 11 (2.2)  | 67 (9.7)   | 36 (5.1)   | 42 (6.3)   | 47 (4.7)  | 31 (9.3)  |

NSSI, non-suicidal self-injury; NSSI-B, non-suicidal self-injurious behavior; NSSI-T, non-suicidal self-injurious thoughts.
†Data are weighted to refer to the age and sex distribution in the general population of individuals aged 14–21 years in Dresden, Germany. The numbers of participants are unweighted, and percentages are column percentages referring to the subsample of the total sample (N = 1180) defined by the column head.

Figure 1. Venn diagrams to proportionally illustrate the co-occurrence between NSSI-T (dot circle), NSSI-B (dash circle), and any suicidal behavior (solid circle). Abbreviations: NSSI, non-suicidal self-injury; NSSI-B, non-suicidal self-injurious behavior; NSSI-T, non-suicidal self-injurious thoughts. Part a) shows the co-occurrence in relation to the total sample (N = 1180; black rectangle) with a prevalence estimate for NSSI-T of 18.0% (only NSSI-T: n = 69), NSSI-B of 13.6% (only NSSI-B: n = 16) and any suicidal behavior of 11.5% as well as a co-occurrence for NSSI-T and any suicidal behavior of 7.6% (95% CI 6.1–9.3) and for NSSI-B and any suicidal behavior of 5.8% (95% CI 4.6–7.3). Part b) shows the co-occurrence in relation to the female sample (N = 685; black rectangle) with a prevalence estimate for NSSI-T of 25.9% (only NSSI-T: n = 47), NSSI-B of 20.6% (only NSSI-B: n = 8) and any suicidal behavior of 13.5% as well as a co-occurrence for NSSI-T and any suicidal behavior of 11.6% (95% CI 9.3-14.3) and for NSSI-B and any suicidal behavior of 9.7% (95% CI 7.6–12.3). Part c) shows the co-occurrence in relation to the male sample (N = 495; black rectangle) with a prevalence estimate for NSSI-T of 10.6% (only NSSI-T: n = 22), NSSI-B of 7.1% (only NSSI-B: n = 8) and any suicidal behavior of 9.7% as well as a co-occurrence for NSSI-T and any suicidal behavior of 3.8% (95% CI 2.3–6.1) and for NSSI-B and any suicidal behavior of 2.2% (95% CI 1.6–4.0).
with the number of episodes of suicidal ideation, and NSSI-B was associated with more episodes of a suicide plan. An early age at onset of plan was associated with NSSI-B.

Mental healthcare utilization

As shown in Table 4, 42.3% of those with any NSSI reported to have used any healthcare service for mental health problems at some point during their lifetime (NSSI-T: 42.7%; NSSI-B: 46.0%, Appendix Table S4). In those with any NSSI, most common was the use of an outpatient service (36.1%) including mental health specialist (32.3%) and/or psychotherapist (27.7%). Moreover, inpatient care services were used by 13.6%, for example, inpatient clinic (9.6%), but also complementary care services were used (10.6%) like professional counseling centers (7.0%). There was no significant difference in any healthcare use for the distinct groups of NSSI-T only, NSSI-B only and both. In those with any NSSI, there were no significant sex (OR \(= 1.4, 95\% CI \(0.7-2.8, P = 0.28\)) and age cohort (OR \(= 1.4, 95\% CI 0.8-2.4, P = 0.20\)) differences in any mental healthcare utilization. Though, those with a middle, low, or other compared to high education status (OR \(= 2.6, 95\% CI 1.4-4.7, P = 0.002\)) were more likely to use healthcare services. Similar results were found for NSSI-T and NSSI-B.

Regarding those with any NSSI, service use was significantly more frequently reported by those with co-occurring suicidal behavior including any mental healthcare use (OR \(= 3.9, 95\% CI 2.2-7.1, P < 0.001\)), the use of inpatient care services (OR \(= 2.7, 95\% CI 1.2-6.1, P = 0.021\)), and outpatient care services (e.g., mental health specialist, psychiatrist, psychotherapist; OR \(= 4.0, 95\% CI 2.2-7.4, P < 0.001; \) adjusted for sex and age). Similar results were found for NSSI-T and NSSI-B (Appendix Table S4).

Discussion

Non-suicidal self-injury and suicidal behavior are common behaviors during adolescence and young adulthood, though a detailed description of their lifetime co-occurrence is lacking taking types of
NSSI (thoughts and behaviors) and suicidal behaviors, that is, ideation, plan, and attempt into consideration. Using a random-community sample of adolescents and young adults aged 14–21 years from Dresden, Germany, results showed (1) high lifetime prevalence estimates for non-suicidal self-injury including thoughts (18.0%) and behaviors (13.6%)—especially in females; (2) high co-occurrence of non-suicidal self-injury and suicidal behaviors with differences in females and males and an association of NSSI with the number of episodes of suicidal ideation and also plan for NSSI-B; and (3) insufficient mental healthcare utilization in those with non-suicidal self-injury with and without suicidal behavior.

NSSI prevalence and its socio-demographic correlates

Regarding the prevalence estimates, the results of the present study for NSSI behaviors fall in the lower range of prevalence estimates from previous national and international studies in adolescents and young adults (19, 20). Though, prevalence estimates were higher compared to a study in adults from Germany (3.1%; 44). Nearly every fifth adolescent and young adult reported thinking about deliberately hurting themselves (18.0%) and 13.6% actually hurt themselves at least once during their life. For NSSI thoughts, the present study found similar results to a study in college students aged 18–35 years (22.6%; 22), but lower rates compared to a regional school-based study in aged 15 year olds in Germany (24.1% past 6 months; 23). Females showed a prevalence estimate more than twice as high than males, which confirms previous results of a meta-analysis showing that females report 1.5-times more NSSI behaviors (21). More than every fourth girl/women (25.9%) thought about deliberately hurting herself and more than every fifth girl/women (20.6%) actually hurt herself at least once during their life. Several explanations exist why NSSI is more common in females than males (21), even though the function as an emotion regulation approach seems to be equal (1). So far, the primary methodological/descriptive explanation is the use of different methods in females and males, similar to the findings of different method use for suicide attempts. While females seems to more likely use cutting or scratching methods, males seems to more likely punch or burn themselves, or bang their heads (45, 46), though results regarding punching and burning were not significant for males compared to females in a meta-analysis (21). In the present study, the examples ‘cutting, scratching, or burning’ were used, whereby males might have had less

### Table 4. Mental healthcare utilization in those with NSSI and co-occurring suicidal behavior

| Mental healthcare use† | Any NSSI (N = 248) | Any suicidal behavior | # | OR [95% CI‡] (Fisher’s test)$P$ |
|------------------------|-------------------|----------------------|---|----------------------|----------------------|---|
|                        | Total n(%)        | No n(%)              | Yes n(%) | OR [95% CI‡] (Fisher’s test)$P$ |
| Any healthcare use      | 103 (42.3)        | 43 (29.2)            | 60 (62.3) | 3.9 [2.2; 7.1] < 0.001 |
| Inpatient care services | 34 (13.6)         | 12 (8.9)             | 22 (20.6) | 2.7 [1.2; 6.1] 0.021 |
| Inpatient clinic        | 25 (9.6)          | 10 (7.1)             | 15 (13.5) | 1.9 [0.8; 4.7] 0.16 |
| Daycare clinic          | 9 (3.8)           | 3 (2.4)              | 6 (5.9) | (P = 0.16) |
| Other inpatient facility| 4 (1.4)           | 1 (0.4)              | 3 (3.0) | (P = 0.30) |
| Outpatient care services| 67 (26.1)         | 34 (23.2)            | 53 (65.7) | 4.0 [2.2; 7.4] < 0.001 |
| General practitioner    | 14 (6.8)          | 5 (4.4)              | 8 (10.4) | 2.1 [0.8; 7.7] 0.24 |
| Mental health specialist| 78 (32.3)         | 29 (19.5)            | 49 (62.0) | 4.3 [2.3; 8.1] < 0.001 |
| Psychiatrist            | 21 (10.0)         | 4 (2.8)              | 17 (21.0) | (P < 0.001) |
| Psychotherapist         | 69 (27.7)         | 26 (17.6)            | 43 (54.2) | 3.4 [1.8; 6.4] < 0.001 |
| Other psychologist      | 12 (5.0)          | 5 (3.2)              | 7 (7.8) | (P = 0.23) |
| Psychiatric or Psychotherapeutic | 22 (9.4) | 8 (5.6)              | 14 (15.2) | 2.4 [0.9; 6.5] 0.087 |
| Social psychiatric      | 3 (1.5)           | 1 (0.4)              | 2 (2.3) | (P = 0.56) |
| Complementary care services | 26 (10.6) | 12 (8.1)            | 14 (14.4) | 1.9 [0.8; 7.4] 0.16 |
| Professional counseling centers | 18 (7.0) | 9 (6.4)              | 9 (6.9) | 1.2 [0.4; 3.2] 0.74 |
| Telephone counseling    | 2 (0.5)           | 1 (0.4)              | 1 (0.7) | (P = 1.0) |
| Other complementary     | 8 (3.9)           | 4 (2.7)              | 4 (5.8) | (P = 0.72) |

CI, confidence interval; NSSI, non-suicidal self-injury; OR, odds ratio.
†Data are weighted to refer to the age and sex distribution in the general population of individuals aged 14 to 21 years in Dresden, Germany. The numbers of participants are unweighted, and percentages are column percentages. Participants could endorse several response options.
‡Associations between service use as the dependent variables and suicidal behavior as independent variable were determined in those with NSSI by logistic regression analyses, adjusting for sex and age.
§If there were five or less cases in one group, the exact Fisher’s test was used to test associations.
chance to endorse the items resulting in lower prevalence estimates for males. Interestingly, the estimates for those showing NSSI-T only, and NSSI-B only did not differ by sex, while reporting both was more often in females than males. Current education status, subjective financial situation, growing up with a single parent and number of siblings were associated with NSSI. No association was found between citizenship, living arrangement, subjective social class, and urbanization. Previous studies found similar results regarding income (25), citizenship, education status and family compensation, though results stayed not significant in multivariate analyses (26). However, no overview exists so far combining the results regarding sociodemographic correlates of NSSI of previous studies. Like for other mental health problems during childhood and adolescence (47), lower socioeconomic status measured by different indicators might be a general risk factor for NSSI, similar to findings for suicide behavior (48).

Co-occurrence of NSSI and suicidal behavior

The present study assessed the lifetime co-occurrence of NSSI and suicidal behavior in different ways and directions. First, 23.2% reported any NSSI and/or suicidal behavior during life with 19.4% for NSSI-B and/or suicidal behavior, which shows that around every fifth individual in this age group is affected. These findings highlight the need for the assessment of suicidal behavior in individuals with any NSSI—regarding both thoughts and behaviors. The result for the prevalence of NSSI-B and/or suicidal behavior is marginally lower to a previous finding in a random sample of university students aged 18–24 from the US (24.9%; 27). Considering the distinct groups for NSSI-B, 5.7% reported suicidal behavior only, 7.8% NSSI-B only, and 5.8% reported both, which also differs only slightly from the above mentioned study in university students. Here, 7.9% reported suicidal behavior only, 10.2% reported NSSI-B only, and 6.9% reported both (27). Regarding the conditional probabilities, the current study showed that 39.6%–42.7% of those with NSSI reported also any suicidal behavior (ideation: 39.3%–42.0%, plan: 22.4%–24.9%, attempt: 11.8%–14.2%) and illustrated that suicidal ideation, plan, and attempt were significantly more common in those with NSSI compared to those without NSSI. In those with suicidal behavior, more than half of the individuals reported also NSSI. Moreover, 86.2% of those with a suicide plan reported NSSI thoughts. Results are comparable to results from a school-based sample of 15 year olds from Germany, where more suicidal behavior was reported in those with occasional and repetitive compared to no NSSI-B for suicidal ideation (43.3%, 81.9%, 7.6%), plan (20.5%, 55.4%, 2.5%), and attempt (26.1%, 55.0%, 3.3%), respectively (26). In a community sample of young adults ages 19–26 years from Mexico City, 48.6%, 18.7%, 25.2% of those with NSSI-B reported suicidal ideation, plan, or attempt, respectively (25). Overall, previous studies found higher rates for suicide attempts in those with NSSI-B compared to the results of the present study. Considering the other direction, previous studies found also higher rates for NSSI-B in those with suicidal behavior. NSSI-B was reported by 40.7% of those with suicidal ideation and 63.6% of those with attempt in the past 12 months (49) as well as by 56.6% of those with lifetime ideation, 61.9% plan, and 68.1% attempt (25). Different theoretical considerations exist how NSSI and suicidal behavior are linked with each other, for example, the Gateway Theory, the Third Variable Theory, or Joiner’s Interpersonal Theory of Suicide (28). Mostly, etiological theories regarding suicidal behavior include NSSI as a risk factor for suicidal behavior (6, 7). Beyond research confirming the role of NSSI as a risk factor for suicidal behavior (8–11), there is also research indicating suicidal behavior as a risk factor for NSSI (9, 50). Interestingly, besides sex and current education status none of the other examined socio-demographic variables were associated with the co-occurrence of both behaviors. Future studies need to address which risk factors contribute to a co-occurrence of both behaviors in contrast to those which lead to either of these behaviors.

So far, most studies examined the association of NSSI severity indicators and suicidal behavior. The present study adds valuable information about NSSI and its association with severity characteristics of suicidal behavior including age at onset and number of episodes or attempts. Here, number of episodes of suicidal ideation was associated with NSSI illustrating a higher number of episodes in those with NSSI compared to no NSSI. In addition, NSSI-B was associated with number of episodes of plan. Looking at age at onset, only an earlier onset of plan was more common in those with NSSI-B compared to those without NSSI-B. Results are in line with some previous studies showing higher levels of suicidal ideation in those with NSSI (51). No association was found with the number of suicide attempts in general. Previous studies found that frequency of NSSI was associated with the number of attempts, which was not analyzed in the present study (26, 52), though results are mixed (27, 53). Others found
associations with the methods of NSSI and number of attempts (54).

Mental healthcare utilization

About 42% of those with any NSSI reported any lifetime healthcare utilization because of mental health problems. Rates were higher for those with any suicidal behavior compared to none (62.3% vs. 29.1%), especially for using a psychiatrist (21.0% vs. 2.8%). Similar rates were found for NSSI-T and NSSI-B. These findings are similar to previous studies assessing help-seeking behavior in adolescents with self-harming behavior (55, 56). There are only a few studies comparing those with and without suicidal behavior showing more help-seeking in those with suicidal behavior (57) and more online help-seeking behavior (58). Several barriers for mental healthcare utilization were discussed so far like stigmatization, fear of confidentiality, or other negative consequences like hospitalization (55, 56). Although a large proportion of those with NSSI identify their need for help (59), the present study underpins the insufficient use of mental healthcare services in this critical age group even if individuals have free access to mental health services like in the present sample.

Limitations

The present study assessed adolescents and young adults up to age 21. Therefore, all results are restricted to this age. About 42% of those with any NSSI reported any lifetime healthcare utilization because of mental health problems. Rates were higher for those with any suicidal behavior compared to none (62.3% vs. 29.1%), especially for using a psychiatrist (21.0% vs. 2.8%). Similar rates were found for NSSI-T and NSSI-B. These findings are similar to previous studies assessing help-seeking behavior in adolescents with self-harming behavior (55, 56). There are only a few studies comparing those with and without suicidal behavior showing more help-seeking in those with suicidal behavior (57) and more online help-seeking behavior (58). Several barriers for mental healthcare utilization were discussed so far like stigmatization, fear of confidentiality, or other negative consequences like hospitalization (55, 56). Although a large proportion of those with NSSI identify their need for help (59), the present study underpins the insufficient use of mental healthcare services in this critical age group even if individuals have free access to mental health services like in the present sample.

Mental healthcare utilization

About 42% of those with any NSSI reported any lifetime healthcare utilization because of mental health problems. Rates were higher for those with any suicidal behavior compared to none (62.3% vs. 29.1%), especially for using a psychiatrist (21.0% vs. 2.8%). Similar rates were found for NSSI-T and NSSI-B. These findings are similar to previous studies assessing help-seeking behavior in adolescents with self-harming behavior (55, 56). There are only a few studies comparing those with and without suicidal behavior showing more help-seeking in those with suicidal behavior (57) and more online help-seeking behavior (58). Several barriers for mental healthcare utilization were discussed so far like stigmatization, fear of confidentiality, or other negative consequences like hospitalization (55, 56). Although a large proportion of those with NSSI identify their need for help (59), the present study underpins the insufficient use of mental healthcare services in this critical age group even if individuals have free access to mental health services like in the present sample.

An underestimation of the prevalence estimates might be the case in the present study because of a smaller number of participants with a lower education status, and the exclusion of currently institutionalized individuals (e.g., hospitalization), because previous studies indicated more NSSI in those with lower education status (26) and in non-responders (65, 66). In addition, a recall bias might have lowered the prevalence estimates because of the retrospective assessment of NSSI and suicidal behavior including its onset (38, 67–69). As the age range was 14 to 21, data are right censored indicating that some individuals will develop either of these behaviors until age 21 which leads to an underestimation of the prevalence. Also, face-to-face assessment might have resulted in fewer reports of suicidal behavior (24, 70). The assessment of NSSI with single items also resulted in lower prevalence estimates in previous studies (19) and the binary assessment showed differences in the association with risk factors compared to a dimensional assessment (50). However, in the present study, NSSI needed to be presented only ones during life which might have overestimated the group of individuals in need for help. So far, it is unknown, when NSSI is starting to be harmful (50). Considering the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) research criteria for NSSI, a frequency of NSSI on five or more days in the past 12-months is understood as relevant (71), data driven approaches found significant difference in severity between five and six (72), while others found even higher cut-offs (73). Others found curvilinear associations between frequency of NSSI and co-occurring suicidal behavior indicating no clear picture (74). The items assessing NSSI are from a validated questionnaire, though only two items were used in the present study. Regarding mental healthcare utilization, participants were asked for any lifetime service use because of mental health problems but not particularly because of or following NSSI or suicidal behavior, which has to be considered when interpreting the results. The present study only looked at cross-sectional associations between NSSI and suicidal behavior; therefore, no causal inferences can be drawn.

To conclude, the lifetime co-occurrence of NSSI and suicidal behavior in adolescence and young adulthood is frequent with females being more commonly affected by both behaviors than males. To guide targeted measures for early detection and intervention, future studies should examine temporal associations and interactions of both behaviors. Real life studies, for example, by using smartphone-based ecological momentary approaches, appear as valuable avenue to gain more insights into the short-term dynamics of co-occurrence as well as its predictors. The identification of underlying (overlapping) risk factors and mechanisms driving these behaviors like genetic variation (75), reward seeking (76, 77), or stress (78, 79) is crucial to improve etiopathogenetic models and to derive distal and proximal targets for prevention.
Voss et al.

Acknowledgements

We thank the adolescents and young adults as well as their families for their participation in the Behavior and Mind Health (BeMIND) Study and providing their valuable time to complete the study assessments. The BeMIND study is part of the research program ‘The epidemiology of functional and dysfunctional behavioral and psychological factors in health and disease (EBP)’ funded by the German Federal Ministry of Education and Research (BMBF) project no. 01ER103 and 01ER107. The funder played no part in the design or conduct of the study; collection, management, analysis, or interpretation of the data; preparation, review, or approval of the manuscript; or decision to submit the manuscript for publication. Open access funding enabled and organized by Projekt DEAL.

Conflict of interest

None.

Peer Review

The peer review history for this article is available at https://publons.com/publon/10.1111/acps.13237.

Data availability statement

Data available on request from the authors. The data that support the findings of this study are available from the corresponding author upon reasonable request.

References

1. Klonsky ED. The functions of deliberate self-injury: a review of the evidence. Clin Psychol Rev 2007;27:226–239.
2. Klonsky ED, May AM, Saffer BY. Suicide, suicide attempts, and suicidal ideation. Annu Rev Clin Psychol 2016;12:307–330.
3. Muehlenkamp JJ. Self-injurious behavior as a separate clinical syndrome. Am J Orthopsychiatry 2005;75:324–333.
4. Nock MK. Self-injury. Annu Rev Clin Psychol 2010;6:339–363.
5. Nock MK, Borges G, Bromet EJ, Cia CB, Kessler RC, Lee S. Suicide and suicidal behavior. Epidemiol Rev 2008;30:133–154.
6. O’Connor RC, Nock MK. The psychology of suicidal behaviour. Lancet Psychiatry 2014;1:73–85.
7. Van Orden KA, Witte TK, Cukrowski KC, Brathwaite SR, Selby EA, Joiner TE Jr. The interpersonal theory of suicide. Psychol Rev 2010;117:575–600.
8. Grandclerc S, De Labrouhe D, Spodenkiewicz M, Lachal J, Moko MR. Relations between nonsuicidal self-injury and suicidal behavior in adolescence: a systematic review. PLoS One 2016;11:e0153760.
9. Castellini P, Lucas-Romero E, Miranda-Mendez A et al. Longitudinal association between self-injurious thoughts and behaviors and suicidal behavior in adolescents and young adults: A systematic review with meta-analysis. J Affect Disord 2017;215:37–48.
10. Franklin JC, Ribeiro JD, Fox KR et al. Risk factors for suicidal thoughts and behaviors: A meta-analysis of 50 years of research. Psychol Bull 2017;143:187–232.
11. Ribeiro JD, Franklin JC, Fox KR et al. Self-injurious thoughts and behaviors as risk factors for future suicide ideation, attempts, and death: a meta-analysis of longitudinal studies. Psychol Med 2016;46:225–236.
12. Mars B, Heron J, Crane C et al. Differences in risk factors for self-harm with and without suicidal intent: Findings from the ALSPAC cohort. J Affect Disord 2014;158:407–414.
13. Cha CB, Franz PJ, Guzman EM, Glenn CR, Kleiman EM, Nock MK. Annual Research Review: Suicide among youth - epidemiology, (potential) etiology, and treatment. J Child Psychol Psychiatry 2018;59:460–482.
14. Gandhi A, Luyckx K, Baeten I et al. Age of onset of nonsuicidal self-injury in Dutch-speaking adolescents and emerging adults: An event history analysis of pooled data. Compr Psychiatry 2018;80(Supplement C):170–178.
15. Voss C, Olmann TM, Michel M et al. Prevalence, onset, and course of suicidal behavior among adolescents and young adults in Germany. JAMA Netw Open 2019;2:e1914386.
16. McManus S, Gurrell D, Cooper C et al. Prevalence of nonsuicidal self-harm and service contact in England, 2000–14: repeated cross-sectional surveys of the general population. Lancet Psychiatry 2019;6:573–581.
17. Wester K, Trefal H. King K. Nonsuicidal self-injury: increased prevalence in engagement. Suicide Life Threat Behav 2018;48:690–698.
18. Griffin E, McMahon E, McNicholas F, Corcoran P, Perry JJ, Arensman E. Increasing rates of self-harm among children, adolescents and young adults: a 10-year national registry study 2007–2016. Soc Psychiatry Psychiatr Epidemiol 2018;53:663–671.
19. Muehlenkamp JJ, Claes L, Havertape L, Plener PL. International prevalence of adolescent non-suicidal self-injury and deliberate self-harm. Child Adolesc Psychiatry Ment Health 2012;6:10.
20. Swannell SV, Martin GE, Page A, Hasking P, St John NJ. Prevalence of nonsuicidal self-injury in nonclinical samples: systematic review, meta-analysis and meta-regression. Suicide Life Threat Behav 2014;44:273–303.
21. Bresin K, Schöenleiber M. Gender differences in the prevalence of nonsuicidal self-injury: A meta-analysis. Clin Psychol Rev 2015;38:55–64.
22. Sivertsen B, Hysing M, Knappstad M et al. Suicide attempts and non-suicidal self-harm among university students: A prevalence study. BJPsych Open 2019;5:e26.
23. Plener PL, Fischer CJ, In-Albon T et al. Adolescent nonsuicidal self-injury (NSSI) in German-speaking countries: comparing prevalence rates from three community samples. Soc Psychiatry Psychiatr Epidemiol 2013;48:1439–1445.
24. Evans E, Hawton K, Rodham K, Deeks J. The prevalence of suicidal phenomena in adolescents: a systematic review of population-based studies. Suicide Life Threat Behav 2005;35:239–250.
25. Bijnens C, González-Herrera I, Castro-Silva E et al. Nonsuicidal self-injury in Mexican young adults: Prevalence, associations with suicidal behavior and psychiatric disorders, and DSM-5 proposed diagnostic criteria. J Affect Disord 2017;215(Supplement C):1–8.
26. Brunner R, Parzer P, Häfner J et al. Prevalence and psychological correlates of occasional and repetitive deliberate self-harm in adolescents. Arch Pediatr Adolesc Med 2007;161:641–649.
27. Whitleck J, Knox KL. The relationship between self-injurious behavior and suicide in a young adult population. Arch Pediatr Adolesc Med 2007;161:634–640.
28. Hamza CA, Stewart SL, Willoughby T. Examining the link between nonsuicidal self-injury and suicidal behavior: a
review of the literature and an integrated model. Clin Psychol Rev 2012;32:482–495.
29. MUEHLENKAMP JJ, GUTIERREZ PM. Risk for suicide attempts among adolescents who engage in non-suicidal self-injury. Arch Suicide Res 2007;11:69–82.
30. BREZERO-BAUM K, VOS C, VENZ J et al. The Behavior and Mind Health (BeMIND) study: Methods, design and baseline sample characteristics of a cohort study among adolescents and young adults. Int J Methods Psychiatr Res 2020;29:e1804.
31. American Association for Public Opinion Research (AAPOR). Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys. 9th ed. USA: American Association for Public Opinion Research; 2016.
32. von CHRISTL E, ALTMAN DG, EIGER M et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Epidemiology 2007;18:800–804.
33. HOWER J, VOS C, STREIBLE J et al. Test-retest reliability of the computer-assisted DIA-X-S interview for mental disorders. BMC Psychiatry 2020;20:280.
34. REED V, GANGER D, PFISTER H et al. To what degree does the Composite International Diagnostic Interview (CIDI) correctly identify DSM-IV disorders? Testing validity issues in a clinical sample. Int J Methods Psychiatr Res 1998;7:142–155.
35. WITTCHE H-U, PFISTER H. DIA-X. Diagnostisches Expertensystem. Interview. Querschnitt. Ergänzungsheft. Frankfurt: Swets & Zeitlinger; 1997.
36. WITTCHE H-U, LACHER G, WENGBRECHT U, PFISTER H. Test-retest reliability of the computerized DSM-IV version of the Munich-Composite International Diagnostic Interview (M-CIDI). Soc Psychiatry Psychiatr Epidemiol 1998;33:568–578.
37. LACHER G, WITTCHE H-U, PERKONING A et al. Structure, content and reliability of the Munich Composite International Diagnostic Interview (M-CIDI) substance use sections. Eur Addict Res 1998;4:28–41.
38. CHRISTL B, WITTCHE HU, PFISTER H, LEB R, BRONISCH T. The accuracy of prevalence estimations for suicide attempts. how reliably do adolescents and young adults report their suicide attempts? Arch Suicide Res 2006;10:253–263.
39. NOCK MK, FUGLEBERG EB, PHOTOS VI, MICHEL BD. Self-Injurious Thoughts and Behaviors Interview: development, reliability, and validity in an adolescent sample. Psychol Assess 2007;19:309–317.
40. FISCHER G, AMM ET, PARZER P et al. The German version of the self-injurious thoughts and behaviors interview (SITBI-G): a tool to assess non-suicidal self-injury and suicidal behavior disorder. BMC Psychiatry 2014;14:265.
41. SKINNER C, HOLT D, SMITH T. Analysis of Complex Surveys. Chichester, UK: Wiley; 1989.
42. KOTU V, DASHPANDA B. Chapter 4 - Classification. In: KOTU V, DASHPANDA B. eds. Data Science (Second Edition). Cambridge, USA: Morgan Kaufmann; 2019:65–163.
43. StataCorp. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP; 2015.
44. PLEASER PL, ALLBROGGEN M, KAPUTA ND, BRABLER E, FIEGERT JM, GROSCHWITZ RC. The prevalence of Non-suicidal Self-Injury (NSSI) in a representative sample of the German population. BMC Psychiatry 2016;16:353.
45. SØRNBERGER MJ, HEATH NL, TOSTE JR, MCLOUTH R. Non-suicidal self-injury and gender: patterns of prevalence, methods, and locations among adolescents. Suicide Life Threat Behav 2012;42:266–278.
46. ANDOVER MS, PRIMACK JM, GIBB BE, PEPPER CM. An examination of non-suicidal self-injury in men: Do men differ from women in basic NSSI characteristics? Arch Suicide Res 2010;14:79–88.
47. REIS F. Socioeconomic inequalities and mental health problems in children and adolescents: a systematic review. Soc Sci Med 2013;90:24–31.
48. HUANG X, RIBEIRO JD, MUSACCHIO KM, FRANKLIN JC. Demographics as predictors of suicidal thoughts and behaviors: A meta-analysis. PLoS One 2017;12:e0180793.
49. GEORGIADES K, BOYLAN K, DUNCAN L et al. Prevalence and correlates of youth suicidal ideation and attempts: evidence from the 2014 Ontario child health study. Can J Psychiatry 2019;64:265–274.
50. FOX KR, FRANKLIN JC, RIBEIRO JD, KLEIMAN EM, BENTLEY KH, NOCK MK. Meta-analysis of risk factors for non-suicidal self-injury. Clin Psychol Rev 2015;42:156–167.
51. GLENN CR, KROLLSKY ED. Social context during non-suicidal self-injury indicates suicide risk. Pers Individ Dif 2009;46:25–29.
52. ANDOVER MS, GIBB BE. Non-suicidal self-injury, attempted suicide, and suicidal intent among psychiatric inpatients. Psychiatry Res 2010;178:101–105.
53. NOCK MK, JOINER TE Jr, GORDON KH, LLOYD-RICHARDSON E, PRINSTEIN MJ. Non-suicidal self-injury among adolescents: diagnostic correlates and relation to suicide attempts. Psychiatry Res 2006;144:65–72.
54. LLOYD-RICHARDSON EE, FERRINE N, DERRKER L, KELLEY ML. Characteristics and functions of non-suicidal self-injury in a community sample of adolescents. Psychol Med 2007;37:1183–1192.
55. ROWE SL, FRENCH RS, HENDERSON C, ORGINN D, SLADE M, MIRAN P. Help-seeking behaviour and adolescent self-harm: a systematic review. Aust N Z J Psychiatry 2014;48:1083–1095.
56. MICHIELMORI L, HINDLEY P. Help-seeking for suicidal thoughts and self-harm in young people: a systematic review. Suicide Life Threat Behav 2012;42:507–524.
57. BAETENS I, CLAES L, MUEHLENKAMP J, GRIETENS H, ONSHENA P. Non-suicidal and suicidal self-injurious behavior among Flemish adolescents: A web-survey. Arch Suicide Res 2011;15:56–67.
58. FROSTY M, CASBY L. Who seeks help online for self-injury? Arch Suicide Res 2016;20:69–79.
59. EVANS E, HAWTON K, REDHAM K. In what ways are adolescents who engage in self-harm or experience thoughts of self-harm different in terms of help-seeking, communication and coping strategies? J Adolesc 2005;28:573–587.
60. GALEA S, TRACY M. Participation rates in epidemiologic studies. Ann Epidemiol 2007;17:643–653.
61. SCHONI RF, STAFFORD F, McGONAGLE KA, ANDRESSI P. Response Rates in National Panel Surveys. Ann Am Acad Pol Soc Sci 2013;645:60–87.
62. MORTON SM, BANDARA DK, ROBINSON EM, CARR PE. In the 21st Century, what is an acceptable response rate? Aust N Z J Public Health. 2012;36:106–108.
63. KEEBLE C, BAXTER PD, BARRIER S, LAW GR. Participation rates in epidemiology studies and surveys: a review 2007–2015. Int J Epidemiol 2016;44:1–14.
64. LANGIE C, FINGER JD, ALLEN J et al. Implementation of the European health interview survey (EHSIS) into the German health update (GEDA). Arch Public Health 2017;75:40.
65. MARS B, CORNISH R, HERON J et al. Using data linkage to investigate inconsistent reporting of self-harm and questionnaire non-response. Arch Suicide Res 2016;20:113–141.
66. Svensson T, Inoue M, Sawada N et al. The association between complete and partial non-response to psychosocial questions and suicide: the JPHC Study. Eur J Public Health 2015;25:424–430.

67. Goldney RD, Smith S, Winefield AH, Tiggeman M, Winefield HR. Suicidal ideation: its enduring nature and associated morbidity. Acta Psychiatr Scand 1991;83:115–120.

68. Coughlin SS. Recall bias in epidemiologic studies. J Clin Epidemiol 1990;43:87–91.

69. Angold A, Erkanli A, Costello EJ, Rutter M. Precision, reliability and accuracy in the dating of symptom onsets in child and adolescent psychopathology. J Child Psychol Psychiatry 1996;37:657–664.

70. Turner CF, Ku L, Rogers SM, Lindberg LD, Pleck JH, Sonenstein FL. Adolescent sexual behavior, drug use, and violence: increased reporting with computer survey technology. Science 1998;280:867–873.

71. American Psychiatric Association (APA). Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5). 5th ed. Arlington, VA: American Psychiatric Association; 2013.

72. Amerman BA, Jacobucci R, Kleiman EM, Muehlenkamp JJ, McCloskey MS. Development and validation of empirically derived frequency criteria for NSSI disorder using exploratory data mining. Psychol Assess 2017;29:221–231.

73. Muehlenkamp JJ, Brausch AM, Washburn JJ. How much is enough? Examining frequency criteria for NSSI disorder in adolescent inpatients. J Consult Clin Psychol 2017;85:611–619.

74. Paul E, Tsypes A, Eidlitz L, Ernhout C, Whitlock J. Frequency and functions of non-suicidal self-injury: Associations with suicidal thoughts and behaviors. Psychiatry Res 2015;225:276–282.

75. Maciejewski DF, Creemers HE, Lynskey MT et al. Overlapping genetic and environmental influences on nonsuicidal self-injury and suicidal ideation: different outcomes, same etiology? JAMA Psychiatry 2014;71:699–705.

76. Poon JA, Thompson JC, Forbes EE, Chaplin TM. Adolescents’ reward-related neural activation: links to thoughts of nonsuicidal self-injury. Suicide Life Threat Behav 2019;49:76–89.

77. Glenn CR, Kleiman EM, Cha CB, Deming CA, Franklin JC, Nock MK. Understanding suicide risk within the Research Domain Criteria (RDoC) framework: A meta-analytic review. Depress Anxiety 2018;35:65–88.

78. Goodday SM, Friend S. Unlocking stress and forecasting its consequences with digital technology. NPJ Digital Med 2019;2:75.

79. Miller AB, Prinstein MJ. Adolescent suicide as a failure of acute stress-response systems. Annu Rev Clin Psychol 2019;15:425–450.

Supporting Information

Additional Supporting Information may be found in the online version of this article:

Table S1 Association of the co-occurrence of NSSI and any suicidal behavior with sex, age group, current education status (N = 1180).

Table S2 Conditional probabilities of NSSI and suicidal behavior.

Table S3 Prevalence of any suicidal behavior by any NSSI, NSSI-T and NSSI-B and sociodemographic characteristics.

Table S4 Mental health care utilization in those with NSSI-T and NSSI-B and co-occurring suicidal behavior.