Association of parental death and illness with offspring suicidal ideation: cross-sectional study in a large cohort of university students

Massimiliano Orri (0000-0003-1389-2610),[1,2] Melissa Macalli,[2] Cedric Galera,[2,3,4] Christophe Tzourio,[2]

Affiliations

[1] McGill Group for Suicide Studies, Douglas Mental Health University Institute, Department of Psychiatry, McGill University, Montreal, QC, Canada

[2] Univ. Bordeaux, Inserm, Bordeaux Population Health Research Center, U1219, CHU Bordeaux, F-33000 Bordeaux, France

[3] Charles Perrens Hospital, Department of Child and Adolescent Psychiatry, Bordeaux, France

[4] Research Unit on Children's Psychosocial Maladjustment, Montreal, QC, Canada

Corresponding author

Massimiliano Orri, PhD, McGill Group for Suicide Studies, Douglas Mental Health University Institute, Department of Psychiatry, McGill University, 6875 Boulevard LaSalle, Montréal (QC) H4H 1R3, Montreal, Canada. Tel. +1 514 761 3161, Email. massimiliano.orri@mcgill.ca

Word count: 3382

Citation: Orri M, Macalli M, Galera C, Tzourio C. (2022) Association of parental death and illness with offspring suicidal ideation: cross-sectional study in a large cohort of university students. *Social Psychiatry and Psychiatric Epidemiology*. 2022;57:2251–2260

Abstract

Purpose. To 1) investigate the association of parental death and illness with suicidal ideation using a large sample of university students, and 2) test whether associations were moderated by perceived family support.

Methods. We used data from N=15,008 French university students enrolled in the i-Share cohort (mean age, 20.5 years; 77% women). Students self-reported information on parental death, including the cause, parental illness (cardiovascular, stroke, cancer, depression/anxiety, alcohol abuse), and perceived family support during childhood/adolescence. Twelve-month suicidal ideation was self-reported and categorized into no, occasional, and frequent ideation.

Results. Occasional and frequent suicidal ideation were respectively reported by 2692 (17.5%) and 699 (4.6%) students. After adjustment for age, gender, and parental education, we found associations between parental death and risk of occasional and frequent suicidal ideation (respectively, RR=1.98 [1.81-2.17] and RR=2.73 [2.30-3.24]). Parental deaths from illness, accidents, and suicides had the strongest associations. We also found associations for parental depression/anxiety (occasional, RR=1.98 [1.81-2.17]; frequent, RR=2.73 [2.30-3.24]), alcohol use problems (occasional, RR=1.71 [1.5-1.94]; frequent, RR=2.33 [1.89-2.87]), and cardiovascular diseases (occasional, RR=1.22 [1.06-1.40]; frequent, RR=1.83 [1.47-2.27]). For participants who experienced parental death and stroke, associations with occasional and frequent suicidal ideation (respectively) increased as perceived family support increased ($Ps_{interaction} \leq 0.005$).

Conclusions. Students who experienced parental death and common parental illnesses were at risk of reporting suicidal ideation, especially if their family were perceived as an important source of support. As information on parental death or illness can be routinely collected during health visits, attention should be paid to students reporting such experiences.

Keywords. Suicidal ideation, parental death, parental illness, university students, cross-sectional

Introduction

University students are considered as a population vulnerable to mental health problems [1–3]. The WHO World Mental Health Surveys International College Student Project [3], revealed that 31% of university students screened positive for at least one common mental disorders (i.e., major depression, mania/hypomania, generalized anxiety disorder, panic disorder, alcohol use disorder, and substance use disorder) in the 12-month period before the survey. Mental disorders typically had onsets in early to middle adolescence and persisted into the college years, underlying that adolescence and young adulthood are key periods for establishing the foundations for long-term mental health. These periods are also characterized by the onset of suicidal behaviors, with are common among youth aged 15-25 years [4–6]. Non-fatal suicidal behaviors, such as suicide attempt, are among the most important risk factors for suicide mortality and are associated with important long-term consequences such as mental health and substance use, interpersonal, and socioeconomic problems [6–8]. Suicidal ideation is a key precursor of suicide attempt, thus identifying youth who think about suicide is critical to prevent the transition from ideation to suicide attempt [4, 9, 10]. A previous study has shown that 17.2% of university students reported suicidal ideation, 8.8% a suicide plan, and 1.0% a suicide attempt in the 12 months before the survey [11]. Identifying college students at risk for suicide is important to organize prevention initiatives and offer the necessary support to the most at-risk students. This is emphasized by growing efforts of several university leaderships to promote access to mental health services both on and off-campus for students struggling with suicidal thoughts and behaviors (to illustrate, see the *Interactive Screening Program* Proposed by the American Foundation for Suicide Prevention [12]). Different factors may contribute to suicide risk in college students. Following Turecki and Brent's developmental model of suicide risk [4], a range of predisposing and precipitating risk factors are hypothesized to increase suicide risk during the life course, including intimate partner violence, unsupportive social environment, adverse childhood experiences, and mental health problems [4, 13–16]. Specifically, in college students, high levels of stress related to transitioning from high school to university, increasing workload, adaptation to new social environment, and financial difficulties are all factors that may influence suicide risk in this population [17, 18]. However, in addition to these situational stressors, past events may also increase students' vulnerability to suicide during this important life transition.

Experiencing parental death or parental illness during childhood and adolescence has a significant impact on human development. This experience may also influence the way in which youth cope with stressful life events later in life, including those happening during the transition from high school to university. Previous studies have shown that experiencing the death or illness of a parent is associated with an increased risk of long-term mental health problems and suicide in youth [19–23]. However, to our knowledge, no previous studies have specifically focused on university students. Moreover, previous studies were mostly based on data from administrative registers, which only recorded suicidal acts that received medical attention (e.g., severe suicide attempt) and death by suicide but did not measure suicidal ideation. Studies are necessary to clarify whether students who experienced parental loss or illness are more at risk of developing suicidal ideation during the university years, as this may allow to identify youth at risk of suicide and, if necessary, deploy preventive interventions.

The quality of the parent-offspring relationship likely influences the potential consequences of parental loss or illness on offspring mental health [24, 25]. For example, losing a parent perceived as a strong supporting figure may have increasingly negative impact on wellbeing and mental health compared to situations in which the parent is perceived as less supporting. A previous study conducted in a large cohort of university students, showed that youth who perceived their family as an important source of support showed a lower risk of suicidal behavior, suggesting that the perception of family support plays a role in youth suicide risk [26]. To our knowledge, no previous study has tested whether the increased suicide risk associated with parental death or illness may vary as a function of the young people's perception of their family support.

The aim of this study was to investigate the association of parental death and parental illness with offspring suicidal ideation using a large sample of university students. A secondary aim was to investigate whether the associations varied as a function of the perceived family support.

Methods

Participants

Data were drawn from the ongoing internet-based Students' Health Research Enterprise (i-Share) project, a population-based study including university students at French-speaking universities and higher education

institutions in France. The study was launched in 2013 with the aim of investigating students' health and health-related behaviors. Eligibility criteria to take part in i-Share were: having a valid registration at a university or higher education institute, being 18 years of age or older, being able to read and understand French, and providing informed consent for participation. Information on recruitment, measures, and study design are available elsewhere [18, 26, 27]. University students were informed about the purpose and aims of the study through flyers, communications in classes, social media, and a newsletter (http://www.i-Share.fr). After formal preregistration on the i-Share online portal, a change of password, and electronic signature of the informed consent, students completed an on-line questionnaire collecting information on a variety of aspects, including sociodemographic characteristics, personal and familial histories, physical and mental health, living conditions, lifestyle. For the present cross-sectional study, we used data from all students enrolled in the i-Share cohort between 2013 and 2020 and for whom data on the variables of interest were available.

The i-Share project was approved by the Commission Nationale de l'Informatique et des Libertés (DR-2013-019).

Assessment of suicidal ideation

Suicidal ideation was assessed with the following question: *In the last 12 months, how often have you thought of attempting suicide (had suicidal ideation)?* Response options were: (1) no suicidal thoughts, (2) occasional suicidal thoughts, (3) frequent suicidal thoughts, and (4) prefer not to answer.

Assessment of parental death and illness

Participants were asked about parental death using two questions (one for each parent): *Is your father/mother still alive?* (no, coded 1, yes, coded 0). We considered the death of any of the parents as the exposure. Additionally, participants were asked to indicate the cause of death by selecting among the following response options: *illness, accident, suicide, other, don't want to answer*. In case both parents died (n = 25 participants), we coded the cause of death as follows: *illness* in one parent and either *illness*, *no response*, or *other* in the other parent was coded as *illness*; *accident* in one parent and *illness* in the other parent was coded as *accident*; *nonresponse* in one parent and *other* in the other parent was coded as *other*; *suicide* in one parent and any other cause of death in the other parent was coded as *suicide*. This choice assumes that violent/sudden death such as suicide or accidents are more impactful than other causes of death such as illness. Participants were asked about

parental somatic illness using questions assessing current or history of cardiovascular diseases, cancer, and stroke. Additionally, they were asked about (currently or in the past) parental depression or anxiety, and parental alcohol abuse problems.

Assessment of perceived family support

Perceived family support was measured with the following question: *During your childhood and adolescence, how would you describe the support and comfort provided by your family?* Response options were: (1) none, (2) low, (3) moderate, (4) strong, and (5) extremely strong.

Statistical analysis

Analyses were performed with R version 4.0 [28]. Descriptive statistics were reported for continuous variables using mean and standard deviation, and for categorical variables using counts and percentages. Associations of parental death and parental illness with suicidal ideation were estimated using multinomial logistic regressions and expressed as Relative Risk Ratios (RR) with accompanying 95% confidence intervals. Attributable fractions (i.e., the proportions of suicidal ideation cases attributable to the exposure) were calculated [29]. We estimated both unadjusted models and models adjusted for age (continuous variable), gender (male, female), and mother and father level of education (unknown, primary school, secondary school, high school, university, professional). Models were estimated for parental death and for each illness in the primary analyses. In a secondary analysis, we estimated associations for each cause of death separately (exploratory analysis, due to the low prevalence). To investigate the moderating role of perceived family support in the association between parental death or illness and offspring suicidal ideation, we introduced an interaction term in the model. All statistical tests were two-sided, and the threshold for statistical significance was 5%.

Results

Participant characteristics and prevalence of the exposures and outcome

From the initial sample of 17,906 participants, we selected 16,702 with age between 18 and 24 years. Depending on the exposure, 14,082 to 15,008 had complete data for both suicidal ideation and the selected exposures. Most of the participant were women (77%), and the average age was 20.5 (SD, 1.8; **Table 1**).

A total of 699 participants (4.8%) experienced the death of a parent (**Table 2**). The most common cause of death was illness (n = 389, 2.8%), followed by suicide (n= 91, 0.7%) and accident (n = 75, 0.5%). The parental illness that participants most often reported was depression/anxiety (n = 5942, 41.7%), followed by alcohol abuse (n = 1637, 11.0%). Occasional suicidal ideation was reported by 2692 (17.5%) participants, while 699 (4.6%) reported frequent suicidal ideation in the past 12 months; 584 (3.8%) preferred not to disclose this information.

Association between parental death and suicidal ideation

We found a statistically significant association between parental death and offspring suicidal ideation (**Table 3**). Students who have experienced parental death, compared to those who have not, were at increased risk of reporting occasional (RR, 1.30; CI, 1.08-1.58) and frequent (RR, 1.76; CI, 1.29-2.41) suicidal ideation. At the population level, only a small proportion of suicidal ideation risk was attributable to parental death (attributable fraction, < 0.01). Adjustment for the selected covariates did not change the results (RR, 1.32; CI, 1.08-1.63, and RR, 1.91; CI, 1.37-2.65, for the risk of reporting occasional and frequent suicidal ideation, respectively). Experiencing parental death was also associated with increased risk of not wanted to disclose information about suicidal ideation, even though the association was no longer formally significant in the adjusted model (RR, 1.34; 0.90-2.01).

In a secondary analysis, we distinguished between causes of parental death (**Table 4**). Statistically significant associations were found for deaths resulting from illness (RR, 1.34; CI, 1.04-1.71 for reporting occasional suicidal ideation, and RR, 1.60; CI, 1.05-2.43 for reporting frequent suicidal ideation), accident (RR, 3.07; CI, 1.50-6.25 for frequent suicidal ideation), and suicide (RR, 1.72; CI, 1.07-2.77 and RR, 2.07; CI, 0.94-4.54 for occasional and frequent suicidal ideation, respectively). A strong association was also found for not wanting to answer the suicidal ideation question for those whose parent died by suicide (RR, 3.08; 1.52-6.25).

Association between parental illness and suicidal ideation

Relative Risk Ratios for the association between each examined parental illness and suicidal ideation are reported in **Table 3**. In adjusted models, we found statistical evidence for associations between parental depression/anxiety and suicidal ideation reported occasionally (RR, 1.98; CI, 1.81-2.17) and frequently (RR, 2.73; CI, 2.30-3.24), with attributable fractions of 0.28 and 0.41, respectively. Similarly, we found that

participants who reported that their parents suffered from alcohol use problems had an increased risk of showing suicidal ideation (occasional: RR, 1.71; CI, 1.5-1.94; frequent: RR, 2.33; CI, 1.89-2.87), but the associated attributable fractions were lower than those found for depression (0.08 and 0.13, respectively). Moreover, statistically significant associations were found for cardiovascular diseases (RR, 1.22; CI, 1.06-1.40; attributable fraction, 0.02 and RR, 1.83; CI, 1.47-2.27; attributable fraction, 0.08; for reporting suicidal ideation sometimes and often, respectively). Finally, we found that participants whose parent suffered from any of the investigated illnesses were more likely to not wanting to answer to the suicidal ideation question, with statistically significant associations for cancer and depression/anxiety.

Moderating role of perceived family support

The results of the interaction analyses are shown in **Figure 1**. We found an interaction between parental death and perceived family support in the association with occasional suicidal ideation ($P_{interaction}$ = 0.005): the risk of suicidal ideation for participants who experienced parental death increased as the strength of perceived family support increased. The same trend, but with larger confidence intervals including the null, was observed for frequent suicidal ideation ($P_{interaction}$ = 0.339). A similar interaction was also found for parental stroke in the association with frequent ($P_{interaction}$ = 0.008) but not occasional ($P_{interaction}$ = 0.688) suicidal ideation. No statistical evidence of interaction for the other parental illnesses was found.

Discussion

In this study, we found that university students who experienced parental death were at increased risk of reporting suicidal ideation both occasionally and frequently. Associations were stronger for participants describing the relationship with their family as strongly supportive compared to those describing it as less supportive. Similarly, we found that participants who experienced parental illness were at increased risk of reporting suicidal ideation, with main associations for parental depression/anxiety, alcohol use, and cardiovascular diseases. For parental stroke, association with frequent suicidal ideation was significant only for participants reporting strong family support, while no evidence of effect modification of family support was found for the other illnesses.

To our knowledge, this study is the first exploring the association between parental death and illness with suicidal ideation in a sample of university students. Previous studies, mostly based on administrative registers, have found that experiencing the death of a parent increased the risk of hospitalization for suicide attempt and suicide mortality [19–22]. However, in those studies, no information was available on suicidal ideation. Our study extends these findings by showing that losing a parent during childhood and adolescence is also associated with suicidal ideation. This is important, as suicidal ideation is a key antecedent of suicidal behavior, and studies have shown that the transition from suicidal ideation to attempt is rapid, with 20% of youth with suicidal ideation attempting suicide within one year [30]. Thus, by identifying factors associated with suicidal ideation, our findings contribute to the detection of early suicidal manifestations. However, it is important to note that, due to the low prevalence of parental death, the contribution of parental death to youth suicidal ideation risk appears to be low at the population level (attributable fraction < 0.01), which suggests that the experience of parental death should be interpreted by health professionals in the context of other individual and environmental characteristics contributing to suicide. One of these may be the relationship with the parent [24, 25]. Indeed, our findings show that a strong perceived family support may increase the vulnerability of experiencing suicide ideation for students who experienced parental death. A previous study conducted in the i-Share cohort showed that perceived family support is associated with a strong reduction of the risk of suicidal ideation [26], therefore clinicians should be aware that when this support disappears, resilience towards suicidal ideation may be compromised. Another important element may be the timing of parental death. For example, one study showed that the risk of suicide was especially high for offspring whose parent deceased during childhood and adolescence, but not for those whose parent deceased during young adulthood [19]. Another study showed a pattern of increasing risks of offspring suicide and suicide attempt with decreasing age at parental death [20]. As information on the timing of parental death was not collected in the i-Share cohort, further studies are necessary to investigate whether the developmental period in which parental death occurred is associated with suicidal ideation among university students.

Similar to parental death, we found that experiencing parental illness was associated with increased risk of offspring suicidal ideation. However, this risk was not found for all investigated illnesses. Specifically, we found strong associations for parental mental health-related problems, namely depression/anxiety and alcohol

abuse problems. This is in line with previous studies showing that growing up with parents experiencing depression or with substance use problems is associated with increased risk of suicide-related outcomes [31–36]. The attributable fraction for depression/anxiety was especially important, suggesting that the risk of frequent and occasional suicidal ideation may be reduced by 41% and 28%, respectively, if parental depression/anxiety could theoretically be prevented.

Genetic, environmental, and psychological mechanisms may explain these associations. First, suicide risk is influenced by individual's genetic predispositions. For example, twin and family studies report that the heritability of suicide-related outcomes ranges from 17% to 50%[37–40], although heritability estimated from molecular studies is significantly lower (3-7%)[41–43] and no specific genes contributing to suicide have been identified. Part of this heritability is explained by mental health problems, who are genetically transmitted from parents to offspring, and that manifest in endophenotypes such as impulsive-aggression [40, 44, 45]. These mechanisms may explain the increased risk of suicidal ideation of offspring who experienced parental death by suicide, as well as those experiencing parental depression/anxiety and alcohol abuse problems. Second, mental health problems and substance use may impair the parent's capacity to care for the offspring. For example, several studies have shown that maternal depression and parental alcohol abuse are linked to using less responsive parenting proactive and creating a negative family climate, which in turn increase the risk of mental health problems in the offspring [46–48]. Third, losing a parent during childhood is a major traumatic event that may have long-term negative psychological repercussion on the offspring [49]. The traumatic impact may even be stronger for deaths occurring abruptly, such as by accident and suicide, in line with both previous studies [50] and the results of our exploratory analyses on the specific causes of parental death.

In addition to parental mental health-related problems, we found evidence for associations between parental cardiovascular illness and offspring suicidal ideation. Cardiovascular illnesses are often debilitating events, requiring long rehabilitation and adaptations of the family; children adjustment during the time of parental illness may be emotionally difficult and generate intense distress, which can have long-lasting effects on offspring mental health [51]. However, no evidence for an association was found for other parental illnesses, such as cancer, that are associated with intense emotional burden for family members [52]. Cardiovascular diseases may also include sudden events such as myocardial infarction, that may be lived as a traumatic event

and influence later risk of mental health problems, especially if the offspring witnessed the event. This may also be true for stroke, for which we have not found a statistical association. However, as the magnitude of the estimates for stroke were comparable to those for cardiovascular illness, the absence of a statistically significant association in our sample may only reflect low statistical power. Additionally, evidence for a moderation effect of perceived family support suggests that parental stroke is associated with offspring suicidal ideation for those who perceived a stronger family support.

Finally, it is worth noting that associations were found between parental cancer and parental depression/anxiety with offering's unwillingness to report their suicidal ideation. Our analysis suggests that this response category, often treated as missing data or categorized as not reporting suicidal ideation, may be informative and deserving further exploration. For example, being aware that young people who experienced such parental illness are less prone to disclose their suicidal ideation may suggest that clinicians should use special care when assessing suicide risk among those youths.

Strengths and limitations

This study is based on data from one of the largest community-based cohorts of university students. Our large sample size allowed us to investigate with sufficient statistical power associations between exposures and outcomes that are rare at the population level. Additionally, owing to the detailed data collection, we were able to assess perceived family support and test hypotheses that it was not possible to investigate in previous registry-based studies. Despite these strengths, our results should be interpreted in the light of the following limitations. First, the findings are not generalizable to the general population or the population of university students. In particular, we observed that women participated more frequently in the i-Share cohort than men. Second, the study is solely based on self-reported information, which may be affected by measurement errors and memory bias (especially for the retrospectively collected information of parental illness). Third, as mentioned, we have no information on the timing of parental death or illness, therefore it was not possible to investigate whether our associations were heterogeneous with respect to the time elapsed since parental death or illness. Similarly, we have no information about the severity of the reported parental illnesses or the chronicity, while previous studies suggested that these variables may play an important role in determining offspring outcomes [53]. Fourth, our exposures were death and illness in at least one of the parents, and we were not able to study cases in which both

parents died. This can be an additional source of unaccounted heterogeneity in our associations leading to underestimation of our associations, as previous studies suggested that risk of suicide is substantially increased in offspring who have lost both parents [22]. Fifth, information of which family member provided support was not available, therefore it is unknown whether the deceased or ill parent was the source of the reported family support. Sixth, information on suicide attempt was not available, therefore is unknown whether our exposures also increased the risk of suicidal acts in our sample.

Conclusions

This study shows an increased risk of reporting suicidal ideation for university students that experienced the death of a parent, especially for those students who perceived their family as a strong source of support in their childhood and adolescence, as well as for those who experienced parental depression/anxiety, alcohol abuse, and cardiovascular diseases. As information on parental death or illness can be routinely collected during health visits, particular attention should be paid to students who report such experiences.

Acknowledgements. We would like to thank the program 'Invest for the future' (reference ANR-10-COHO-05), the Nouvelle-Aquitaine Regional Council (Conseil Régional Nouvelle-Aquitaine) (Grant N°4370420), the Bordeaux 'Initiatives d'excellence' (IdEx) program of the University of Bordeaux (ANR-10-IDEX-03-02), Public Health France (Santé Publique France) (contract 19DPPP023-0), the National Cancer Institute (INCA) (grant INCA_11502), and the Medical Research Foundation (FRM). This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement no. 793396 (awarded to Dr. Orri). Dr. Macalli received a PhD grant of the Nouvelle-Aquitaine Regional Council (Grant N° 17 EURE-0019) and by the PhD Digital Public Health Graduate School Program supported within the framework of the PIA3 (Investment for the Future) (Project reference: 17-EURE-0019). The authors are grateful to the coordinating team of the i-Share project: Clothilde Pollet, Edwige Pereira, Marie Mougin, Elena Milesi, Aude Pouymayou and Garance Perret.

Conflict of interest. The authors declare no conflict of interest.

Author contributions. Dr. Orri conducted the statistical analyses and wrote the first draft. All authors contributed to study conceptualization, data interpretation, and writing of the final draft.

References

1. Duffy A, Saunders KEA, Malhi GS, et al (2019) Mental health care for university students: a way forward? Lancet Psychiatry 6:885–887. https://doi.org/10.1016/S2215-0366(19)30275-5

2. Wilcox HC, Arria AM, Caldeira KM, et al (2010) Prevalence and predictors of persistent suicide ideation, plans, and attempts during college. J Affect Disord 127:287–294. https://doi.org/10.1016/j.jad.2010.04.017

3. Auerbach RP, Mortier P, Bruffaerts R, et al (2019) Mental disorder comorbidity and suicidal thoughts and behaviors in the World Health Organization World Mental Health Surveys International College Student initiative. Int J Methods Psychiatr Res 28:e1752. https://doi.org/10.1002/mpr.1752

4. Turecki G, Brent DA (2016) Suicide and suicidal behaviour. Lancet Lond Engl 387:1227–1239. https://doi.org/10.1016/S0140-6736(15)00234-2

5. Hawton K, Saunders KEA, O'Connor RC (2012) Self-harm and suicide in adolescents. Lancet Lond Engl 379:2373–2382. https://doi.org/10.1016/S0140-6736(12)60322-5

6. Orri M, Vergunst F, Turecki G, et al (undefined/ed) Long-term economic and social outcomes of youth suicide attempts. Br J Psychiatry 1–7. https://doi.org/10.1192/bjp.2021.133

7. Goldman-Mellor SJ, Caspi A, Harrington H, et al (2014) Suicide attempt in young people: a signal for long-term health care and social needs. JAMA Psychiatry 71:119–127. https://doi.org/10.1001/jamapsychiatry.2013.2803

8. Borschmann R, Becker D, Coffey C, et al (2017) 20-year outcomes in adolescents who self-harm: a population-based cohort study. Lancet Child Adolesc Health 1:195–202. https://doi.org/10.1016/S2352-4642(17)30007-X

9. Klonsky ED, May AM, Saffer BY (2016) Suicide, Suicide Attempts, and Suicidal Ideation. Annu Rev Clin Psychol 12:307–330. https://doi.org/10.1146/annurev-clinpsy-021815-093204

10. O'Connor Rory C., Kirtley Olivia J. (2018) The integrated motivational–volitional model of suicidal behaviour. Philos Trans R Soc B Biol Sci 373:20170268. https://doi.org/10.1098/rstb.2017.0268

11. Mortier P, Auerbach RP, Alonso J, et al (2018) Suicidal Thoughts and Behaviors Among First-Year College Students: Results From the WMH-ICS Project. J Am Acad Child Adolesc Psychiatry 57:263-273.e1. https://doi.org/10.1016/j.jaac.2018.01.018

12. (2019) Suicide prevention on university and college campuses (State priority). In: Am. Found. Suicide Prev. https://afsp.org/university-and-college-campus-suicide-prevention/. Accessed 27 May 2022

13. Forte A, Orri M, Turecki G, et al ((under review)) Identifying environmental pathways between irritability during childhood and suicidal behaviour in adolescence: findings from a 20-year population-based study

14. Geoffroy M-C, Boivin M, Arseneault L, et al (2018) Childhood trajectories of peer victimization and prediction of mental health outcomes in midadolescence: a longitudinal population-based study. CMAJ 190:E37–E43. https://doi.org/10.1503/cmaj.170219

15. Oncioiu SI, Boivin M, Geoffroy M-C, et al (2021) Mental health comorbidities following peer victimization across childhood and adolescence: a 20-year longitudinal study. Psychol Med

16. Orri M, Séguin JR, Castellanos-Ryan N, et al (2020) A genetically informed study on the association of cannabis, alcohol, and tobacco smoking with suicide attempt. Mol Psychiatry

17. Blasco MJ, Castellví P, Almenara J, et al (2016) Predictive models for suicidal thoughts and behaviors among Spanish University students: rationale and methods of the UNIVERSAL (University & mental health) project. BMC Psychiatry 16:122. https://doi.org/10.1186/s12888-016-0820-y

18. Macalli M, Navarro M, Orri M, et al (2021) A machine learning approach for predicting suicidal thoughts and behaviours among college students. Sci Rep 11:11363. https://doi.org/10.1038/s41598-021-90728-z

19. Wilcox HC, Kuramoto SJ, Lichtenstein P, et al (2010) Psychiatric Morbidity, Violent Crime, and Suicide Among Children and Adolescents Exposed to Parental Death. J Am Acad Child Adolesc Psychiatry 49:514–523. https://doi.org/10.1016/j.jaac.2010.01.020

20. Niederkrotenthaler T, Floderus B, Alexanderson K, et al (2012) Exposure to parental mortality and markers of morbidity, and the risks of attempted and completed suicide in offspring: an analysis of sensitive life periods. J Epidemiol Community Health 66:233–239. https://doi.org/10.1136/jech.2010.109595

21. Kuramoto SJ, Runeson B, Stuart EA, et al (2013) Time to Hospitalization for Suicide Attempt by the Timing of Parental Suicide During Offspring Early Development. JAMA Psychiatry 70:149–157. https://doi.org/10.1001/jamapsychiatry.2013.274

22. Jakobsen IS, Christiansen E (2011) Young people's risk of suicide attempts in relation to parental death: a population-based register study. J Child Psychol Psychiatry 52:176–183. https://doi.org/10.1111/j.1469-7610.2010.02298.x

23. Hollingshaus MS, Smith KR (2015) Life and death in the family: Early parental death, parental remarriage, and offspring suicide risk in adulthood. Soc Sci Med 131:181–189. https://doi.org/10.1016/j.socscimed.2015.02.008

24. Hardt J, Egle UT, Johnson JG (2007) Suicide attempts and retrospective reports about parent-child relationships: evidence for the affectionless control hypothesis. GMS Psycho-Soc Med 4:Doc12

25. Kushal SA, Amin YM, Reza S, Shawon MSR (2021) Parent-adolescent relationships and their associations with adolescent suicidal behaviours: Secondary analysis of data from 52 countries using the Global School-based Health Survey. EClinicalMedicine 31:. https://doi.org/10.1016/j.eclinm.2020.100691

26. Macalli M, Tournier M, Galéra C, et al (2018) Perceived parental support in childhood and adolescence and suicidal ideation in young adults: a cross-sectional analysis of the i-Share study. BMC Psychiatry 18:373. https://doi.org/10.1186/s12888-018-1957-7

27. Macalli M, Orri M, Tzourio C, Côté SM (2021) Contributions of childhood peer victimization and/or maltreatment to young adult anxiety, depression, and suicidality: a cross-sectional study. BMC Psychiatry 21:354. https://doi.org/10.1186/s12888-021-03354-4

28. R Core Team (2016) R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria

29. Rockhill B, Newman B, Weinberg C (1998) Use and misuse of population attributable fractions. Am J Public Health 88:15–19. https://doi.org/10.2105/ajph.88.1.15

30. Nock MK, Green JG, Hwang I, et al (2013) Prevalence, correlates, and treatment of lifetime suicidal behavior among adolescents: results from the National Comorbidity Survey Replication Adolescent Supplement. JAMA Psychiatry 70:300–310. https://doi.org/10.1001/2013.jamapsychiatry.55

31. Orri M, Besharati S, Ahun MN, Richter LM (2021) Analysis of Maternal Postnatal Depression, Socioeconomic Factors, and Offspring Internalizing Symptoms in a Longitudinal Cohort in South Africa. JAMA Netw Open 4:e2121667–e2121667. https://doi.org/10.1001/jamanetworkopen.2021.21667

32. Psychogiou L, Ahun MN, Boivin M, et al (2021) The mediating role of adolescents' loneliness and social withdrawal in the association between maternal depressive symptoms and suicidality in adolescence: A 20-year population-based study. Dev Psychopathol 1–9. https://doi.org/10.1017/S0954579420001753

33. Hammerton G, Mahedy L, Mars B, et al (2015) Association between Maternal Depression Symptoms across the First Eleven Years of Their Child's Life and Subsequent Offspring Suicidal Ideation. PloS One 10:e0131885. https://doi.org/10.1371/journal.pone.0131885

34. Pisinger VSC, Hawton K, Tolstrup JS (2018) Self-injury and suicide behavior among young people with perceived parental alcohol problems in Denmark: a school-based survey. Eur Child Adolesc Psychiatry 27:201–208. https://doi.org/10.1007/s00787-017-1031-x

35. Alonzo D, Thompson RG, Stohl M, Hasin D (2014) The influence of parental divorce and alcohol abuse on adult offspring risk of lifetime suicide attempt in the united states. Am J Orthopsychiatry 84:316–320. https://doi.org/10.1037/h0099804

36. Hammerton G, Zammit S, Mahedy L, et al (2015) Pathways to suicide-related behavior in offspring of mothers with depression: the role of offspring psychopathology. J Am Acad Child Adolesc Psychiatry 54:385–393. https://doi.org/10.1016/j.jaac.2015.02.006

37. Voracek M, Loibl LM (2007) Genetics of suicide: a systematic review of twin studies. Wien Klin Wochenschr 119:463–475. https://doi.org/10.1007/s00508-007-0823-2

38. Vaquero-Lorenzo C, Vasquez MA (2020) Suicide: Genetics and Heritability. In: Baca-Garcia E (ed) Behavioral Neurobiology of Suicide and Self Harm. Springer International Publishing, Cham, pp 63–78

39. DiBlasi E, Kang J, Docherty AR (2021) Genetic contributions to suicidal thoughts and behaviors. Psychol Med 51:2148–2155. https://doi.org/10.1017/S0033291721001720

40. Orri M, Geoffroy M-C, Turecki G, et al (2019) Contribution of genes and environment to the longitudinal association between childhood impulsive-aggression and suicidality in adolescence. J Child Psychol Psychiatry n/a: https://doi.org/10.1111/jcpp.13163

41. Mullins N, Bigdeli TB, Børglum AD, et al (2019) GWAS of Suicide Attempt in Psychiatric Disorders and Association With Major Depression Polygenic Risk Scores. Am J Psychiatry appi.ajp.2019.18080957. https://doi.org/10.1176/appi.ajp.2019.18080957

42. Erlangsen A, Appadurai V, Wang Y, et al (2018) Genetics of suicide attempts in individuals with and without mental disorders: a population-based genome-wide association study. Mol Psychiatry 1. https://doi.org/10.1038/s41380-018-0218-y

43. Ruderfer DM, Walsh CG, Aguirre MW, et al (2020) Significant shared heritability underlies suicide attempt and clinically predicted probability of attempting suicide. Mol Psychiatry 25:2422–2430. https://doi.org/10.1038/s41380-018-0326-8

44. Baldessarini RJ, Hennen J (2004) Genetics of suicide: an overview. Harv Rev Psychiatry 12:1–13

45. Mann JJ, Arango VA, Avenevoli S, et al (2009) Candidate endophenotypes for genetic studies of suicidal behavior. Biol Psychiatry 65:556–563. https://doi.org/10.1016/j.biopsych.2008.11.021

46. Côté SM, Ahun MN, Herba CM, et al (2018) Why Is Maternal Depression Related to Adolescent Internalizing Problems? A 15-Year Population-Based Study. J Am Acad Child Adolesc Psychiatry 57:916–924. https://doi.org/10.1016/j.jaac.2018.04.024

47. Grant T, Huggins J, Graham JC, et al (2011) Maternal substance abuse and disrupted parenting: Distinguishing mothers who keep their children from those who do not. Child Youth Serv Rev 33:2176–2185. https://doi.org/10.1016/j.childyouth.2011.07.001

48. Johnson AK, Fulco CJ, Augustyn MB (2019) Intergenerational continuity in alcohol misuse: Maternal alcohol use disorder and the sequelae of maternal and family functioning. Psychol Addict Behav J Soc Psychol Addict Behav 33:442–456. https://doi.org/10.1037/adb0000476

49. Atwoli L, Stein DJ, King A, et al (2017) Posttraumatic stress disorder associated with unexpected death of a loved one: Cross-national findings from the world mental health surveys. Depress Anxiety 34:315–326. https://doi.org/10.1002/da.22579

50. Burrell LV, Mehlum L, Qin P (2018) Sudden parental death from external causes and risk of suicide in the bereaved offspring: A national study. J Psychiatr Res 96:49–56. https://doi.org/10.1016/j.jpsychires.2017.09.023

51. Sieh DS, Meijer AM, Visser-Meily JMA (20101220) Risk factors for stress in children after parental stroke. Rehabil Psychol 55:391. https://doi.org/10.1037/a0020918

52. Murray SA, Kendall M, Boyd K, et al (2010) Archetypal trajectories of social, psychological, and spiritual wellbeing and distress in family care givers of patients with lung cancer: secondary analysis of serial qualitative interviews. BMJ 340:. https://doi.org/10.1136/bmj.c2581

53. Ahun MN, Geoffroy M-C, Herba CM, et al (2017) Timing and Chronicity of Maternal Depression Symptoms and Children's Verbal Abilities. J Pediatr. https://doi.org/10.1016/j.jpeds.2017.07.007

Table 1. Characteristics of the study sample

	n (%) or mean (SD)
Years of age, mean (SD)	20.5 (1.8)
Gender, n (%)	
Men	3576 (23.3)
Women	11772 (76.7)
Current study year, n (%)	
1st	6233 (40.8)
2nd	3202 (20.9)
3rd	2453 (16.0)
4th	1565 (10.2)
5th	1048 (6.9)
6th	194 (1.3)
Missing	593 (3.9)
Field of study, n (%)	
Low and Economics	1291 (8.4)
Humanities	2296 (15.0)
Health	3294 (21.5)
Sciences	1537 (10.0)
Other	1267 (8.3)
Missing	5668 (36.9)
Sources of revenue, n (%)	
Family	12645 (93.5)
Social support scholarship	6040 (39.3)
Merit scholarship	689 (4.49)
Job (including summer jobs)	5794 (37.7)
Paid internship	143 (0.93)
Other	1059 (10.9)
Satisfaction regarding revenue, n (%)	
Satisfied to very satisfied	12268 (79.9)
Unsatisfied to very unsatisfied	3081 (20.1)
Maternal education, mean (SD)	4.7 (1.1)
Paternal education, mean (SD)	4.6 (1.3)
Education level first caregiver, n (%)	3.9 (1.0)
Unknown	420 (2.7)
Primary school	320 (2.1)
Secondary school	1696 (11.1)
High school	1877 (12.3)
Professional	2954 (19.3)
University	8059 (52.6)
Education level second caregiver, n (%)	
Unknown	711 (4.8)
Primary school	271 (1.8)
Secondary school	1376 (9.3)
High school	2079 (14)
Professional	2907 (19.6)
University	7503 (50.5)
Perceived family support, mean (SD)	3.9 (1.0)

The table reports the key sociodemographic characteristics of the sample; SD, standard deviation

Table 2. Rates of parental death and illness in the study sample

	Yes, n (%)	No, n (%)
Parental death		
Any reason	699 (4.8)	13744 (95.2)
Illness	389 (2.8)	
Accident	75 (0.5)	
Suicide	91 (0.7)	
Other	71 (0.5)	
No response	36 (0.3)	
Parental illness		
Cardiovascular	1606 (10.9)	13111 (89.1)
Stroke	461 (3.1)	14547 (96.9)
Cancer	1609 (10.7)	13392 (89.3)
Depression/anxiety	5942 (41.7)	8310 (58.3)
Alcohol abuse	1637 (11.0)	13295 (89.0)

The table reports count and percentages for parental death (with reasons) and illness

Table 3. Associations of parental death and illness with suicidal ideation in offspring

Exposure Outcome	**n/N among the exposed (%)**	**n/N among the nonexposed (%)**	**Unadjusted RR (95%CI)**	**Adjusted RR[a] (95%CI)**	**AF[b]**
Death (N = 14,443)					
Occasional suicidal ideation	143/699 (20.5)	2388/13,744 (17.4)	1.30 (1.08-1.58)	1.32 (1.08-1.63)	0.015
Frequent suicidal ideation	47/699 (6.7)	580/13744 (4.2)	1.76 (1.29-2.41)	1.91 (1.37-2.65)	0.037
Don't want to answer	37/699 (5.3)	500/13,744 (3.6)	1.61 (1.14-2.28)	1.34 (0.90-2.01)	0.030
Cardiovascular (N = 14,717)					
Occasional suicidal ideation	307/1606 (19.1)	2256/13,111 (17.2)	1.19 (1.04-1.36)	1.22 (1.06-1.40)	0.020
Frequent suicidal ideation	114/1606 (7.1)	546/13,111 (4.2)	1.82 (1.47-2.25)	1.83 (1.47-2.27)	0.084
Don't want to answer	54/1606 (3.4)	453/13,111 (3.5)	1.04 (0.78-1.39)	1.07 (0.79-1.45)	0.004
Stroke (N = 15,008)					
Occasional suicidal ideation	93/461 (20.2)	2544/14,547 (17.5)	1.23 (0.98-1.56)	1.22 (0.96-1.56)	0.007
Frequent suicidal ideation	28/461 (6.1)	656/14,547 (4.5)	1.44 (0.97-2.14)	1.45 (0.96-2.18)	0.014
Don't want to answer	19/461 (4.1)	507/14,547 (3.5)	1.27 (0.79-2.03)	1.35 (0.83-2.19)	0.008
Cancer (15,001)					
Occasional suicidal ideation	300/1609 (18.6)	2332/13,392 (17.4)	1.09 (0.96-1.25)	1.09 (0.95-1.25)	0.010
Frequent suicidal ideation	65/1609 (4)	615/13,392 (4.6)	0.90 (0.69-1.17)	0.94 (0.72-1.23)	-0.011
Don't want to answer	69/1609 (4.3)	460/13,392 (3.4)	1.27 (0.98-1.65)	1.32 (1.01-1.74)	0.029
Depression/anxiety (14,252)					
Occasional suicidal ideation	1317/5942 (22.2)	1133/8310 (13.6)	1.93 (1.77-2.11)	1.98 (1.81-2.17)	0.284
Frequent suicidal ideation	382/5942 (6.4)	241/8310 (2.9)	2.64 (2.23-3.11)	2.73 (2.30-3.24)	0.410
Don't want to answer	227/5942 (3.8)	256/8310 (3.1)	1.47 (1.23-1.77)	1.53 (1.26-1.85)	0.168
Alcohol abuse (14,932)					
Occasional suicidal ideation	395/1637 (24.1)	2217/13,295 (16.7)	1.72 (1.52-1.95)	1.71 (1.50-1.94)	0.076
Frequent suicidal ideation	132/1637 (8.1)	544/13,295 (4.1)	2.35 (1.92-2.87)	2.33 (1.89-2.87)	0.132
Don't want to answer	69/1637 (4.2)	457/13,295 (3.4)	1.46 (1.13-1.90)	1.31 (0.98-1.73)	0.049

RR, relative risk ratio; CI, 95% confidence interval; AF, attributable fraction

[a]adjusted for sex, age, parents' education

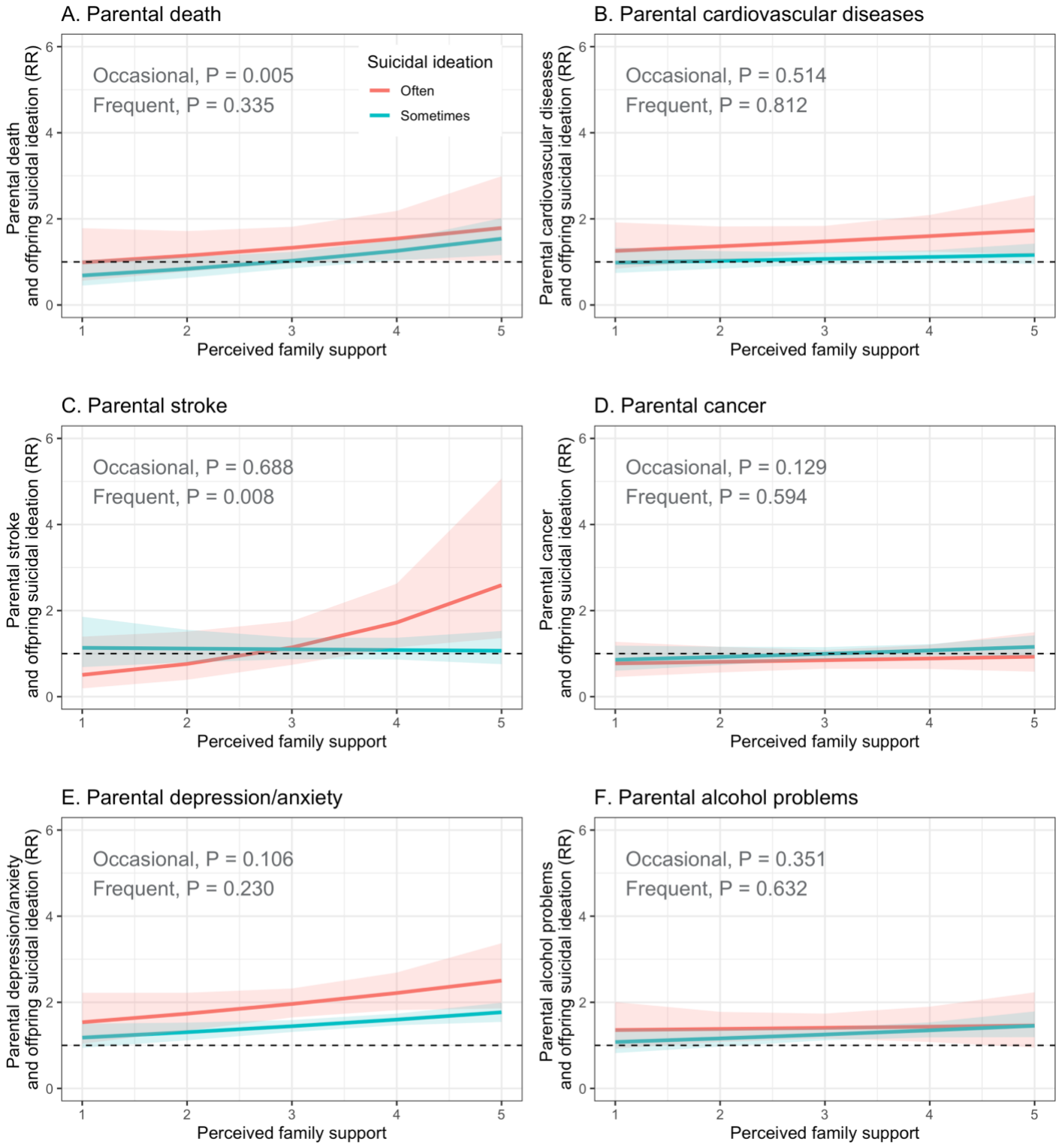
[b]AF = p*(RR-1) / 1 + p*(RR-1), where p is the prevalence of exposure and RR is the unadjusted RR

Table 4. Association between parental death and offspring suicidal ideation by cause of death

Cause of death	**RR (95% CI) for suicidal ideation**		
	Occasional suicidal ideation	Frequent suicidal ideation	Don't want to answer
Illness	1.34 (1.04-1.71)	1.60 (1.05-2.43)	1.48 (0.93-2.36)
Accident	1.16 (0.64-2.09)	3.07 (1.50-6.25)	0.79 (0.19-3.25)
Suicide	1.72 (1.07-2.77)	2.07 (0.94-4.54)	3.08 (1.52-6.25)
Other	0.82 (0.43-1.56)	0.92 (0.29-2.93)	1.06 (0.33-3.40)
Don't want to answer	1.38 (0.62-3.06)	2.13 (0.64-7.06)	2.47 (0.74-8.20)

RR, relative risk ratio; CI, 95% confidence interval

Figure 1. Interaction between parental death/illness and offspring perceived family support in the association with offspring suicidal ideation



The y-axis reports the estimated association between parental death (or illness) and offspring occasional (red) and frequent (blue) suicidal ideation for different levels of the perceived family support variable (x-axis).