Supplementary Table 1: Percentages of missing data in covariates and potential risk and promotive factors

|  |  |
| --- | --- |
| **Variables entering the imputation** | **Percentage of missingness (%)** |
| **Covariates** | |
| Gender | 3.78 |
| Lives with a stepsibling | 6.83 |
| Number of siblings in household | 3.06 |
| Early emotional problems | 9.37 |
| Early peer problems | 9.31 |
| Early hyperactivity and inattention | 9.26 |
| Early conduct problems | 9.57 |
| ASD diagnosis | 7.59 |
| Victimised by peers | 9.17 |
| Household income | 21.38 |
| Maternal depression | 11.21 |
| Frequent parental alcohol use | 7.06 |
| Domestic violence | 25.68 |
| **Potential risk and promotive factors** | |
| Overcrowding | 5.38 |
| Financial strain | 5.08 |
| Parental monitoring | 5.75 |
| Parental relationship | 5.75 |
| No close friend | 5.82 |
| School motivation and engagement | 5.84 |
| Neighbourhood safety | 5.77 |

Note: Percentage missingness is displayed for the subscales making up internalising (emotional and peer problems) and externalising (hyperactivity and inattention and conduct problems) problems, as these measures were created for imputed data post-imputation.

Supplementary Table 2**:** The association between sibling victimisation frequency (at 11 and/or 14 years old) and mental health and wellbeing outcomes at 17 years old (complete case)

|  |  |  |
| --- | --- | --- |
| **Mental Health and Wellbeing Outcomes** | **Unadjusted** | **Adjusted** |
| Internalising Problems | 0.15 [0.13, 0.17]\*\*\* | 0.11 [0.08, 0.13]\*\*\* |
| Externalising Problems- Girls | 0.18 [0.15, 0.21]\*\*\* | 0.15 [0.12, 0.19]\*\*\* |
| Externalising Problems- Boys | 0.11 [0.08, 0.14] \*\*\* | 0.11 [0.07, 0.14]\*\*\* |
| Mental Wellbeing | -0.13 [-0.15, -0.11] \*\*\* | -0.12 [-0.14, -0.09]\*\*\* |
| Self-Harm | 1.04 [1.03, 1.05]\*\*\* | 1.04 [1.03, 1.04]\*\*\* |

Note:

1. With complete case data. For complete case unadjusted data: Internalising n = 8801, Externalising- Girls n = 4347, Externalising- Boys n = 4133, Mental Wellbeing n = 8924, Self-Harm n = 8779; For complete case adjusted data: Internalising n = 5045, Externalising- Girls n = 2603, Externalising- Boys n = 2442, Mental Wellbeing n = 5106, Self-Harm n = 7733.

2. Standardised beta values and [95% confidence intervals] are reported for Internalising and Externalising Problems and Mental Wellbeing. The Odds Ratio and [95% confidence interval] is reported for Self-Harm.

3. Positive coefficients indicate worse outcomes for Internalising and Externalising Problems. For Mental Wellbeing, negative coefficients indicate worse outcomes. For Odds Ratios (Self-Harm), a higher value indicates a higher likelihood of the outcome occurring.

4. Adjusted models controlled for child’s biological sex (with the exception of Externalising models, which are stratified by gender), pre-existing mental health difficulties (early internalising and externalising problems), diagnosis of autism spectrum disorder, whether cohort member lives with a stepsibling(s), number of siblings in the cohort member’s household, experience of peer victimisation, family household income, maternal depression, frequent parental alcohol use, and household domestic violence.

5. \*\*\* indicates *p* <.001

Supplementary Table 3a: The association between potential risk and promotive factors and children’s resilience to internalising problems, low wellbeing, and self-harm following sibling victimisation (complete case)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Internalising** | | **Mental Wellbeing** | | **Self-Harm** | |
| **Risk/Promotive Factors** | **Univariate** | **Multivariate**  (n = 4799) | **Univariate** | **Multivariate**  (n = 4841) | **Univariate** | **Multivariate**  (n = 4791) |
| **Family level** | | | | | | |
| Overcrowding | 0.02  [-0.01, 0.07] | 0.03  [-0.01, 0.07] | 0.03  [-0.01, 0.04] | 0.04  [-0.00, 0.07] | 0.00  [-0.04, 0.05] | 0.01  [-0.03, 0.05] |
| Financial Strain | -0.15  [-0.24, -0.05]\*\* | -0.13  [-0.22, -0.04]\*\* | -0.13  [-0.22, -0.03]\*\* | -0.11  [-0.20, -0.02]\* | -0.08  [-0.17, -0.02] | -0.07  [-0.16, 0.03] |
| Parental Monitoring | -0.01  [-0.04, 0.02] | -0.05  [-0.08, -0.02]\*\* | 0.06  [0.03, 0.09]\*\*\* | 0.02  [-0.01, 0.05] | 0.06  [0.04, 0.10]\*\*\* | 0.04  [0.01, 0.07]\* |
| Parental Relationship | 0.00  [-0.03, 0.03] | -0.01  [-0.03, 0.02] | 0.02  [0.00, 0.05]\* | 0.01  [-0.02, 0.04] | 0.00  [-0.02, 0.04] | -0.01  [-0.04, 0.02] |
| **Peer level** | | | | | | |
| No Close Friend | -0.57  [-0.74, -0.39] \*\*\* | -0.46  [-0.63, -0.29] \*\*\* | -0.41  [-0.58, -0.28]\*\*\* | -0.29  [-0.46, -0.12]\*\* | -0.19  [-0.37, -0.01]\* | -0.14  [-0.32, 0.04] |
| **School level** | | | | | | |
| School Motivation and Engagement | 0.21  [0.18, 0.23] \*\*\* | 0.20  [0.17, 0.23] \*\*\* | 0.24  [0.21, 0.27]\*\*\* | 0.23  [0.20, 0.26]\*\*\* | 0.17  [0.05, 0.29]\*\*\* | 0.15  [0.12, 0.18]\*\*\* |
| **Neighbourhood level** | | | | | | |
| Neighbourhood Safety- very safe | 0.28  [0.16, 0.39] \*\*\* | 0.18  [0.06, 0.29]\*\* | 0.20  [0.08, 0.31]\*\*\* | 0.07  [-0.04, 0.19] | 0.09  [-0.03, 0.19]\*\* | 0.09  [-0.03, 0.21] |
| Neighbourhood Safety- safe | 0.13  [0.02, 0.24]\* | 0.08  [-0.03, 0.19] | 0.05  [-0.06, 0.16] | -0.02  [-0.12, 0.09] | 0.09  [-0.03, 0.20] | 0.05  [-0.07, 0.16] |

Note:

1. Using complete case data.
2. Standardised beta values and [95% confidence intervals]
3. Positive coefficients indicate better than expected outcomes, negative coefficients indicate worse than expected outcomes.
4. All models adjusted for: child’s biological sex, pre-existing mental health difficulties (early internalising and externalising problems), diagnosis of autism spectrum disorder, whether cohort member lives with a stepsibling(s), number of siblings in the cohort member’s household, experience of peer victimisation, family household income, maternal depression, frequent parental alcohol use, and household domestic violence.
5. \*\*\* indicates *p* <.001, \*\* indicates *p* <.01, \*indicates *p* <.05
6. For the Neighbourhood Safety variable, the responses are in comparison to those who answered ‘Not very Safe’.

Supplementary Table 3b: The association between potential risk and promotive factors and children’s resilience to externalising problems following sibling victimisation (complete case)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Externalising- Girls** | | **Externalising- Boys** | |
| **Risk/Promotive Factors** | **Univariate** | **Multivariate**  (n = 2484) | **Univariate** | **Multivariate**  (n = 2315) |
| **Family level** | | | | |
| Overcrowding | 0.01  [-0.04, 0.07] | 0.02  [-0.04, 0.07] | 0.02  [-0.04, 0.07] | 0.02  [-0.03, -0.08] |
| Financial Strain | -0.17  [-0.29, -0.04]\*\* | -0.14  [-0.26, -0.02]\* | -0.13  [-0.27, -0.00] | -0.11  [-0.24, -0.02] |
| Parental Monitoring | 0.11  [0.07, 0.15]\*\*\* | 0.04  [0.00, 0.08] | 0.09  [0.05, 0.13]\*\*\* | 0.04  [0.00, 0.08] |
| Parental Relationship | 0.03  [-0.01, 0.07] | -0.00  [-0.04, 0.03] | 0.02  [-0.02, 0.06] | -0.00  [-0.04, 0.04] |
| **Peer level** | | | | |
| No Close Friend | -0.15  [-0.43, 0.14] | 0.05  [-0.21, 0.32] | -0.07  [-0.30, 0.16] | 0.05  [-0.17, 0.27] |
| **School level** | | | | |
| School Motivation and Engagement | 0.32  [0.28, 0.36] \*\*\* | 0.30  [0.27, 0.34] \*\*\* | 0.32  [0.28, 0.36] \*\*\* | 0.31  [0.27, 0.35] \*\*\* |
| **Neighbourhood level** | | | | |
| Neighbourhood Safety- very safe | 0.30  [0.13, 0.45]\*\*\* | 0.18  [0.01, 0.33]\* | 0.28  [0.11, 0.45]\*\* | 0.12  [-0.05, 0.28] |
| Neighbourhood Safety- safe | 0.18  [0.02, 0.31]\* | 0.13  [-0.02, 0.28] | 0.14  [-0.02, 0.30] | 0.05  [-0.10, 0.20] |

Note:

1. Using complete case data.
2. Standardised beta values and [95% confidence intervals]
3. Positive coefficients indicate better than expected outcomes, negative coefficients indicate worse than expected outcomes.
4. All models adjusted for: pre-existing mental health difficulties (early internalising and externalising problems), diagnosis of autism spectrum disorder, whether cohort member lives with a stepsibling(s), number of siblings in the cohort member’s household, experience of peer victimisation, socio-economic position of the family, maternal depression, frequent parental alcohol use, and household domestic violence.
5. \*\*\* indicates *p* <.001, \*\* indicates *p* <.01, \*indicates *p* <.05
6. For the Neighbourhood Safety variable, the responses are in comparison to those who answered ‘Not very Safe’.

Supplementary Table 4: Exploratory Analyses- adjusted regression models including an interaction term of sibling victimisation frequency by each potential protective factor predicting mental health and wellbeing at age 17 (complete case data)

|  |  |
| --- | --- |
| **Potential Protective Factors**  *(for each outcome)* | **Standardised Beta Values for interaction term** *(potential protective factor \* sibling victimisation frequency)*  **[95% Confidence Intervals]** |
| **Internalising** | |
| Parental Monitoring | 0.01 [-0.04, 0.02] |
| School Motivation and Engagement | -0.01 [-0.05, 0.00] |
| Neighbourhood Safety- Very Safe | 0.11 [-0.00, 0.22] |
| **Externalising- Girls** | |
| School Motivation and Engagement | -0.02 [-0.06, 0.01] |
| Neighbourhood Safety- Very Safe | 0.08 [-0.08, 0.23] |
| **Externalising- Boys** | |
| School Motivation and Engagement | -0.00 [-0.04, 0.03] |
| **Mental Wellbeing** | |
| School Motivation and Engagement | 0.00 [-0.03, 0.03] |
| **Self-Harm** | |
| Parental Monitoring | -0.01 [-0.04, 0.02] |
| School Motivation and Engagement | -0.01 [-0.03, 0.02] |

Note:

1. Using complete case data.
2. Adjusted models controlled for child’s biological sex (with the exception of Externalising models, which are stratified by gender), pre-existing mental health difficulties (early internalising and externalising problems), diagnosis of autism spectrum disorder, whether cohort member lives with a stepsibling(s), number of siblings in the cohort member’s household, experience of peer victimisation, socio-economic position of the family, maternal depression, frequent parental alcohol use, and household domestic violence.

Supplementary Table 5: Sensitivity analysis, exploring the association between sibling victimisation frequency (at 11 and/or 14 years old) and mental health and wellbeing outcomes at 17 years old, defining ‘sibling victimisation frequency’ as the average victimisation score at age 11 and 14 (instead of summing the scores)

|  |  |  |
| --- | --- | --- |
| **Mental Health and Wellbeing Outcomes** | **Unadjusted** | **Adjusted** |
| Internalising Problems | 0.15 [0.13, 0.17]\*\*\* | 0.12 [0.10, 0.14]\*\*\* |
| Externalising Problems- Girls | 0.18 [0.15, 0.21]\*\*\* | 0.17 [0.14, 0.20]\*\*\* |
| Externalising Problems- Boys | 0.11 [0.08, 0.13] \*\*\* | 0.11 [0.08, 0.14]\*\*\* |
| Mental Wellbeing | -0.13 [-0.15, -0.11] \*\*\* | -0.13 [-0.15, -0.11]\*\*\* |
| Self-Harm | 1.04 [1.03, 1.05]\*\*\* | 1.03 [1.03, 1.04]\*\*\* |

Note:

1. Standardised beta values and [95% confidence intervals] are reported for Internalising and Externalising Problems and Mental Wellbeing. The Odds Ratio and [95% confidence interval] is reported for Self-Harm.

2. Positive coefficients indicate worse outcomes for Internalising and Externalising Problems. For Mental Wellbeing, negative coefficients indicate worse outcomes. For Odds Ratios (Self-Harm), a higher value indicates a higher likelihood of the outcome occurring.

3. Adjusted models controlled for child’s biological sex (with the exception of Externalising models, which are stratified by gender), pre-existing mental health difficulties (early internalising and externalising problems), diagnosis of autism spectrum disorder, whether cohort member lives with a stepsibling(s), number of siblings in the cohort member’s household, experience of peer victimisation, socio-economic position of the family, maternal depression, frequent parental alcohol use, and household domestic violence.

4. \*\*\* indicates *p* <.001

A picture containing line, diagram, plot, slope

Description automatically generatedSupplementary Figure 1: Plotting the significant interaction between sibling victimisation and neighbourhood safety for resilience to internalising problems at age 17

Note:

1. Dotted line= Those with scores equal to or above +1 standard deviation of the mean level for sibling victimisation frequency; Solid line= Those with scores equal to or below -1 standard deviation of the mean level for sibling victimisation frequency.
2. Mean residuals for internalising symptoms age 17 are plotted on the Y axis. A negative residual value represents higher than expected levels of internalising problems than predicted for a certain level of exposure to sibling victimisation, a positive residual value represents lower than expected levels of internalising problems.