Examining the link between socio-economic position and mental health in early adolescents
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Life stressors as mediators of the relation between Socio-economic Position and Mental Health Problems in Early Adolescence:
The TRAILS study.

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ABSTRACT

Objective: Life stressors and family socio-economic position have often been associated with mental health status. The aim of the present study is to contribute to the understanding of the pathways from low socio-economic position and life stressors to mental problems. Method: In a cross-sectional analysis using data from a longitudinal study of early adolescents (N = 2,149, 51% girls; mean age 13.6 years, SD 0.53, range 12-15), we assessed the extent of mediation of the association between family socio-economic position and mental health problems by different types of life stressors in multiple regression models. Stressors were rated as environment-related or person-related. Information on family socio-economic position was obtained directly from parents, and internalizing and externalizing problem behaviors were assessed by reports from multiple informants (parents, self, and teachers). Results: Low socio-economic position was associated with more mental health problems and more life stressors. Both environment-related and person-related life stressors predicted mental health problems independently of socio-economic position. The associations between socio-economic position and all mental health outcomes were partly mediated by environment-related life stressors. Mediation by environment-related and person-related life stressors as assessed by linear regression amounted to 56% (95% confidence interval (CI) 35% to 78%) and 7% (95% CI: 25% to 38%) for internalizing problems and 13% (95% CI 7% to 19%) and 5% (95% CI: 2% to 13%) for externalizing problems, respectively. Conclusions: Environment-related, but not person-related life stressors partly mediated the association between socio-economic position and adolescent mental problems. The extent of mediation was larger for internalizing than for externalizing problems. Because the effect sizes of the associations were relatively small, targeted interventions to prevent impaired mental health may have only modest benefits to adolescents from low socio-economic background.

Key Words: stressors, adolescents, mental health.
INTRODUCTION

Family socio-economic position (SEP) is known to contribute to the development and persistence of mental health problems in childhood and adolescence (Wadsworth, Achenbach, 2005; Loeber, Farrington, Stouthamer-Loeber, Van Kammen, 1998). Previous studies have found a modest, albeit, consistent associations of low SEP with poor mental health (Achenbach, Verhulst, Baron, Akkerhuis, 1987; Leventhal, Brooks-Gunn, 2000; Amone-P’Olak, Burger, Ormel, Huisman, Verhulst, Oldehinkel, 2009), particularly with respect to externalizing problems (Loeber, Farrington, Stouthamer-Loeber, Van Kammen, 1998; Amone-P’Olak, Burger, Ormel, Huisman, Verhulst, Oldehinkel, 2009).

The modest effect of low SEP on adolescent mental health could be because low SEP is not directly causing psychopathology (i.e., it could be a distal risk factor). It has been suggested that low SEP promotes environments with higher densities of proximal risk factors, which are, in turn, directly related to mental health problems (Felner, Brand, DuBois, Adan, Mulhall, Evans, 1995). Proximal risk factors for psychopathology in adolescents that may mediate the association of low SEP with impaired mental health include unfavorable family environment (Tracy, Zimmerman, Galea, McCauley, Stoep, 2008), adverse parenting behaviors, and life stressors (Grant, Compas, Thurm, et al, 2006). Life stressors are established risk factors for psychopathology (Grant, Compas, Thurm et al, 2006; Brown, Harris, 1978; Kendler, Kessler, Walters, et al., 1995). It is well documented that adolescents in low SEP experience more life stressors (Evans, 2004; Hatch, Dohrenwend, 2007), yet few studies have directly tested the degree of mediation of the relation between SEP and mental health by life stressors in adolescents (Felner, Brand, DuBois, Adan, Mulhall, Evans, 1995; Tracy, Zimmerman, Galea, McCauley, Stoep, 2008; Costello, Compton, Keeler, Angold, 2003).

Specific subtypes of life stressors may have different associations with SEP and adolescent mental health problems. Particularly, life stressors such as repeating a grade and contact with police have been associated more strongly with externalizing problems in adolescents (Grant, Compas, Thurm et al, 2006), whereas life stressors such as parental divorce or separation have been associated more with internalizing problems, especially among girls (Grant, Compas, Thurm et al, 2006). It is possible therefore that different life stressors may uniquely mediate the relation between SEP and adolescent mental health to varying degrees.

Previous research has distinguished between two categories of life stressors that have different relations with psychopathology: independent and dependent life events (Brown, Harris, 1978; Kendler, Karkowski, Prescott, 1999). Independent life events are ones that are unlikely to depend on an individual’s behavior and/or outside the control of an individual (e.g., death of a parent). In
contrast, dependent events are more likely to be influenced by an individual's behavior (e.g., contact with police). Independent stressful life events (SLEs) have been associated with the onset of major depression in adults, and the association is suggested to be causal (Kendler, Karkowski, Prescott, 1999). Dependent life events, on the other hand, have been shown to negatively influence people with previous depression, a non-causal association that may be a result of personality factors that predispose to both dependent life events and onset of depression (Kendler, Karkowski, Prescott, 1999). Because independent life events occur mainly in the environment of the child, we will refer to them as environment-related life stressors (ERLS). Similarly, we will refer to dependent life events as person-related life stressors (PRLS) because they are mainly determined by personal and behavioral characteristics of the child.

Past studies on SEP, life stressors, and mental health have drawn on adult samples, and it has not been established whether the same relations between these variables exist in the adolescent population. In adults, SEP and mental health may have reciprocal influences, with mental health problems and SEP, each exerting an influence on the other. These reciprocal effects are implausible in pre- and early-adolescents because, at this age, children’s mental health is less likely to adversely influence family SEP (Wadsworth, Achenbach, 2005).

The few studies on mediation by life stressors in the relation between socio-economic background and mental health in adolescence have yielded conflicting results in that some studies did find evidence of mediation (Felner, Brand, DuBois, Adan, Mulhall, Evans, 1995; Tracy, Zimmerman, Galea, McCauley, Stoep, 2008), whereas others did not (Costello, Compton, Keeler, Angold, 2003). Differences in sampling may explain part of the conflicting findings. For example, other studies have used samples from rural settings (e.g. Costello, Compton, Keeler, Angold, 2003) while others sampled children from urban areas (e.g. Tracy, Zimmerman, Galea, McCauley, Stoep, 2008). Yet rural and urban areas report different rates of mental health problems (Vollebergh, Van Dorsselaer, Monshouwer, et al., 2006). Another source of conflicting findings could be the use of different indices of SEP. Some studies used level of family income (Tracy, Zimmerman, Galea, McCauley, Stoep, 2008) and others education or occupation (Felner, Brand, DuBois, Adan, Mulhall, Evans, 1995). Although individual measures of SEP may be correlated with each other, they are not interchangeable because they may be linked to different etiological mechanisms (Geyer, Hemstrom, Peter, Vagero, 2006; Shavers, 2007; Araya, Lewis, Rojas, Fritsch, 2003). Further, in the Great Smoky Mountains Study (Costello, Compton, Keeler, Angold, 2003), the authors suggested that the relatively small sample size of the proportion of children that moved out of poverty may have lead to limited statistical power to detect mediation (Costello, Compton, Keeler, Angold, 2003).
To date, we have not come across any study that examined the extent to which either environment-related or person-related life stressors explain the effect of SEP on mental health in early adolescents. This distinction may be important because the source of these stressors may indicate whether interventions should be directed at either the environment of the child (e.g., neighborhood interventions) or at the child itself (e.g., coping strategies). Further, previous research has mainly focused on individual life events (e.g., parental divorce) (Amato, Keith, 1991) or a single mental health outcome (e.g., depression or aggression) at a time rather than considering subtypes of life events and multiple dimensions of psychopathology (Tracy, Zimmerman, Galea, McCauley, Stoep, 2008; Guerra, Huesmann, Tolan, Van Acker, Eron, 1995).

The present study is a cross-sectional analysis of data from a large population-based ongoing cohort study of early adolescents, using a robust measure of family SEP, reports on various life stressors, and reports on mental health by multiple informants. We aimed to quantify, through our analyses, the extent to which the relation between low SEP and poor mental health was mediated by life stressors and whether this was different for environment-related and person-related life stressors.

METHOD

Sample

Subjects were participants in the TRacking Adolescents' Individual Lives Survey (TRAILS), a prospective cohort study of Dutch (pre) adolescents, aimed at charting the trajectory of mental health problems from childhood into early-adulthood. The TRAILS study was approved by the Central Committee on Research Involving Human Subjects. Sample selection involved five municipalities in the North of the Netherlands, including both urban and rural areas. The five municipalities were requested to give names and addresses of all inhabitants born between October 1, 1989, and September 30, 1990, (first two municipalities: mean age 11.29 years, SD 0.52, range 10.0-12.0) or October 1, 1990, and September 30, 1991, (last three municipalities: mean age 10.72 years, SD 0.37, range 10.0-11.5). Two birth cohorts were used to minimize the age range during the initial assessment.

Of all the children approached (N = 3,145), 6.7 per cent (n = 211) were excluded because of mental or physical incapability or language problems, leaving a total of 2,934. Finally, 76.0% participated in the baseline assessment (T1: N = 2,230, mean age 11.1 years, SD 0.56, range 10.0-12.0), and 96.4 per cent (N = 2,149) were assessed at follow-up (T2: mean age 13.6 years, SD 0.53, range 12.0-15.0), held approximately 2 and a half years after T1 (mean follow-up time
2.47, SD 0.48, range 0.73-3.25). The T1 assessment was conducted from March 2001 through July 2002, and the T2 assessment was conducted from September 2003 to December 2004.

The present study includes those 2,149 adolescents who participated in the T2 assessment. Responders and non-responders did not significantly differ in levels of problem behaviors or on socio-demographic variables (Huisman, Oldehinkel, De Winter et al., et al. 2008).

**Data Collection**

The university-educated interviewers received extensive training in interviewing skills, study background, and interview content. At T1, the interviewers visited parents or guardians (preferably mothers, 95.6%) at their homes to administer interviews covering a wide range of topics, including their SEP and their children’s mental health. Interviews were conducted and questionnaires filled out after a complete description of the study was given and written informed consent was obtained from the participants. At both T1 and T2, the children filled out questionnaires at school supervised by TRAILS assistants. The teachers were asked to fill out a brief questionnaire for all TRAILS children in their class. No financial incentives were given; parents instead received a small present (pen or umbrella) for their participation.

**Measures**

*Mental Health Outcomes.* Two dimensions of mental health problems were included in this study: internalizing and externalizing problems. These problems were assessed at T1 and T2 with the parent-rated Child Behavior Checklist (CBCL) (Achenbach, 1991a), the Youth Self-Report (YSR) (Achenbach, 1991b), and the Teacher Checklist of Psychopathology (TCP) with a time frame of the past 6 (CBCL and YSR) or past 2 months (TCP). The TCP is composed of descriptions of problem behaviors similar to Achenbach’s Teacher Report Form (Achenbach, 1991c). The TCP was developed to reduce the respondent burden for teachers, as each had several participants to report on. This measure contains descriptions (vignettes) of problem behaviors corresponding to the syndrome scales of the CBCL and YSR (vignettes available on request). Response options for each description of the TCP ranged from 0 (not applicable) to 4 (very clearly or frequently applicable). The TCP vignettes correlated around 0.60 with the full Teacher Report Form syndrome scales filled out by a small sample of teachers (Ferdinand, 2003, internal report available on request). Next, we created broadband scales of internalizing problems (Anxious/Depressed, Withdrawn/Depressed, and Somatic Complaints) and externalizing problems (Aggressive behavior and Rule-breaking behavior). The validity of these scales have been documented (Achenbach, 1991a; 1991b; 1991c) and reiterated in a Dutch sample (Verhulst, Van der Ende, Koot, 1997). In our sample, the reliability statistics are as follows: CBCL-Internalizing (32
items, Cronbach $\alpha = .85$), CBCL-Externalizing (35 items, $\alpha = .90$), YSR-Internalizing (31 items, $\alpha = .87$), YSR-Externalizing (32 items, $\alpha = .85$); TCP-Internalizing (3 vignettes, $\alpha = .71$), and TCP-Externalizing (2 vignettes, $\alpha = .78$).

Reports from different sources are needed to reduce rater bias in the prediction of mental health problems and provide better estimates of diagnosis than those based on a single source. It has also been demonstrated in previous studies that a combination of parent and teacher information results in an improvement of predictive power (Verhulst, Koot, Van der Ende, 1994). For this reason, we computed a combined estimate using the scores on mental health problems given by the children, parents, and teachers at T2. To place the same weight on information from different informants, the scores on YSR, CBCL, and TCP were first standardized to a scale of 0 to 1 before averaging over informants.

**Measurement of SEP.** Socio-economic position was assessed at T1 using five indicators: family income and educational and occupational levels of both parents using the International Standard Classification of Occupations (Ganzeboom, Treiman, 1996). We created a SEP variable by averaging the five indices after standardization. The SEP index captured 61.2 per cent of the variance in the five indices with an internal consistency of 0.84 in the TRAILS population (Veenstra, Lindenberg, Oldehinkel, De Winter, Verhulst, Ormel, 2005). Missing values (e.g. when there is only one parent in the family) did not affect the associations of the SEP variable with other variables.

**Measures of Life Stressors.** Life stressors encompassed SLEs and more chronic problems that we refer to as long-term difficulties. At T2, the adolescents were given a list of 22 SLEs and asked to indicate which events they had experienced over the past 2 years (designated as “A” in Table 3.1). Concurrently, a parent questionnaire with a list of 15 items was used to obtain information on lifetime (adolescent’s life) long-term difficulties (designated as “P” in Table 3.1). We considered the number of life stressors without taking into account their perceived severity. The life stressors were independently and blindly (to SEP and psychopathology) rated as environment-related or person-related by those authors who have a background in psychology (K. A-P., J.O., and A.J.O.). J.O. and A.J.O. were specifically trained in the Life Event and Difficulty Schedule of Brown and Harris (Brown, Harris, 1978). In case of disagreement, consensus classification was rendered. To assess the effect of potential misclassification, two sensitivity analyses were conducted: one in which the contentious items ($n = 4$) were all added to the environment-related category and another in which the contentious events were included in the person-related category.
### TABLE 3.1 Prevalence of Life Stressors in the Study Population (N = 2,149)

<table>
<thead>
<tr>
<th>Life Stressors</th>
<th>Informant</th>
<th>Prevalence (n, %)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Person-related life stressors (PRLS)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic illness/handicap (self)</td>
<td>P</td>
<td>226 (10.6)</td>
</tr>
<tr>
<td>High work pressure at school</td>
<td>P</td>
<td>340 (15.2)</td>
</tr>
<tr>
<td>Fewer friends than desired</td>
<td>P</td>
<td>217 (10.1)</td>
</tr>
<tr>
<td>Bullying in the streets</td>
<td>P</td>
<td>208 (9.7)</td>
</tr>
<tr>
<td>Severe conflict with family member</td>
<td>P</td>
<td>122 (5.7)</td>
</tr>
<tr>
<td>Severe conflict with someone else</td>
<td>P</td>
<td>86 (4.0)</td>
</tr>
<tr>
<td>Serious sickness or accident (self)</td>
<td>P</td>
<td>374 (17.4)</td>
</tr>
<tr>
<td>Repeating a grade</td>
<td>A</td>
<td>127 (5.9)</td>
</tr>
<tr>
<td>Dismissal from school</td>
<td>A</td>
<td>32 (1.5)</td>
</tr>
<tr>
<td>Contact with the police</td>
<td>A</td>
<td>245 (11.4)</td>
</tr>
<tr>
<td>Loss of friendship due to conflict</td>
<td>A</td>
<td>234 (10.9)</td>
</tr>
<tr>
<td>Romantic break-up</td>
<td>A</td>
<td>647 (30.1)</td>
</tr>
<tr>
<td>Run away from home</td>
<td>A</td>
<td>80 (3.7)</td>
</tr>
<tr>
<td>Loss of valuable stuff †</td>
<td>A</td>
<td>202 (9.4)</td>
</tr>
<tr>
<td>Victim of violence †</td>
<td>A</td>
<td>155 (7.2)</td>
</tr>
<tr>
<td>Victim of malicious rumor or gossip</td>
<td>A</td>
<td>557 (25.9)</td>
</tr>
<tr>
<td>Victim of bullying at school</td>
<td>A</td>
<td>539 (25.1)</td>
</tr>
<tr>
<td>Victim of sexual harassment</td>
<td>A</td>
<td>256 (11.9)</td>
</tr>
<tr>
<td><strong>Environment-related life stressors (ERLS)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic illness/handicap family member</td>
<td>P</td>
<td>417 (19.4)</td>
</tr>
<tr>
<td>Housing problems</td>
<td>P</td>
<td>90 (4.2)</td>
</tr>
<tr>
<td>Neighborhood problems</td>
<td>P</td>
<td>105 (4.9)</td>
</tr>
<tr>
<td>Financial problems</td>
<td>P</td>
<td>114 (5.3)</td>
</tr>
<tr>
<td>Parental unemployment</td>
<td>P</td>
<td>146 (6.8)</td>
</tr>
<tr>
<td>Severe conflict between family members</td>
<td>P</td>
<td>133 (6.2)</td>
</tr>
<tr>
<td>Serious sickness/accident of a family member</td>
<td>P</td>
<td>531 (24.7)</td>
</tr>
<tr>
<td>Serious illness of brother or sister</td>
<td>P</td>
<td>196 (9.1)</td>
</tr>
<tr>
<td>Serious sickness/accident of close friend</td>
<td>A</td>
<td>185 (8.6)</td>
</tr>
<tr>
<td>Death of a mother</td>
<td>A</td>
<td>15 (0.7)</td>
</tr>
<tr>
<td>Death of father</td>
<td>A</td>
<td>15 (0.7)</td>
</tr>
<tr>
<td>Death of brother or sister</td>
<td>A</td>
<td>11 (0.5)</td>
</tr>
</tbody>
</table>

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Note:

Parental assessment of long-term difficulties (designated as P in Table 3.1) regarded the adolescents’ lifetime. A = reported by the adolescent; P = reported by parent.

† Victimization, property losses, and hospital admission (self) were considered person related in most cases because of provocation, carelessness, and hospitalization not because of accidents, respectively.

†† Indented item is a sub-question dependent on preceding question.

Data Analyses

Multiple Imputation of Missing Data. The percentage of missing data was between 6% and 31% for mental health dimensions. The SR contained few missing data (1.5%-7%) probably because the questionnaire was usually administered in classrooms, supervised by TRAILS assistants. Missing parent data (7.8%-14%) were mostly because of parents not returning the questionnaires. Most missing data concerned teacher reports (13.6%-31%). Missing teacher data were generally unrelated to child characteristics (Huisman, Oldehinkel, De Winter et al., 2008) but related to teachers being overloaded by other duties besides several TRAILS participants in their classes. Family SEP contained few missing data (1.9%) because the information was obtained through an interview. To minimize the loss of statistical power and risk of bias, we used multiple imputations. This is the preferred method of dealing with missing data when data are not missing completely at random (Donders, Heijden, Stijnen, Moons, 2006). Multiple data sets (i.e., five data sets) were generated to account for the uncertainty in imputed data (Rubin, 1987). They were analyzed in an identical way, and the regression coefficients and standard errors were pooled using Rubin’s method for multiple imputation inference (Rubin, 1987). We used the NORM program for multiple imputation (Schafer, 1999).

Statistical Analyses. First, we calculated descriptive statistics for the study population. Subsequently, we tested the proposed mediations using multiple linear regression models. Our interest was exclusively in the extent of explanation of the outcome variables by life stressors as a
measure of mediation and not so much in the structure of the total model. Therefore, we fitted a more parsimonious multiple linear regression model using the criteria outlined by Baron and Kenny (1986).

To ensure that all variables in the mediation model were comparable, we standardized them to a mean of zero and SD of 1 (z scores). We first quantified the relation between SEP and mental health, SEP and life stressors, and life stressors and mental health, adjusted for SEP. Next, we assessed mediation by determining the degree of attenuation in the relation between SEP and mental health when including life stressors as a covariate. The attenuation was scaled as the relative decrease in the regression coefficient for SEP. Analyses for person-related and environment-related life stressors were first performed separately. We then built a mediation model with person-related and environment-related life stressors simultaneously included. We applied bootstrapping methods to obtain 95% confidence limits (95% confidence interval (CI)) for the mediated effects (Preacher, Hayes, 2008). Confidence intervals based on bias-corrected bootstrapping have been shown to be the most accurate method of assessing mediated effects (MacKinnon, Lockwood, Williams, 2004). To obtain dimension-specific results, we partialled out the shared variance between internalizing and externalizing problems.

Previous studies indicate that vulnerability to life stressors is sex specific, with girls reporting more stressors and rating them as more stressful than boys (Grant, Compas, Thurm, et al, 2006). Hence, we included sex and the interaction term between sex and life stressors as predictors in additional analyses. In instances where the informant of the life stressor is the same person as the informant on mental health, associations between mental health and life stressors may be biased. To address this possibility, we performed an additional analysis including only teacher reports (TCP) because the teachers did not report on life stressors.

RESULTS

The demographic characteristics of the study population are shown in Table 3.2. The average number of symptoms experienced in the past 6 months was 0.72 (SD 1.42, range 0-17) for externalizing problems and 0.82 (SD 1.51, range 0-18) for internalizing problems. More adolescents reported experiencing at least one symptom in the internalizing domain (n = 1,079; 50.2%) than in the externalizing domain (n = 1,021; 47.5%). On average, more adolescents experienced ERLS (3.74, SD 2.07, range 0-13) than PRLS (1.96, SD 1.75, range, 0-11). The correlation between the number of ERLS and PRLS was 0.34 (p < .001).
TABLE 3.2  Demographic Characteristics of the Study Population (N = 2,149)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Female gender (n, %)</td>
<td>1096 (51)</td>
</tr>
<tr>
<td>Age (mean, sd, (min-max))</td>
<td>13.6, 5.3, (12-15)</td>
</tr>
<tr>
<td>Socio-economic position</td>
<td>(n, %)</td>
</tr>
<tr>
<td>Education: Low education</td>
<td>752 (35)</td>
</tr>
<tr>
<td>Intermediate education</td>
<td>817 (38)</td>
</tr>
<tr>
<td>High education</td>
<td>580 (27)</td>
</tr>
<tr>
<td>Occupation: Low occupation</td>
<td>860 (40)</td>
</tr>
<tr>
<td>Intermediate occupation</td>
<td>860 (40)</td>
</tr>
<tr>
<td>High occupation</td>
<td>429 (20)</td>
</tr>
<tr>
<td>Family income: Low income</td>
<td>645 (30)</td>
</tr>
<tr>
<td>Middle income</td>
<td>1118 (52)</td>
</tr>
<tr>
<td>High income</td>
<td>386 (18)</td>
</tr>
</tbody>
</table>

Note:
Low education: elementary and lower secondary education; intermediate education: higher tracks of secondary education; high education: senior vocational education and university;
Low occupation (e.g., plant and machine operators, craft-related trades); intermediate occupation (e.g., technicians, clerks, service workers); high occupation (e.g., legislators, professionals).
Monthly family income (minus tax) was categorized as: low income (lower than € 3,000), intermediate income (€ 3,000 – € 5,000) and high income (above € 5,000).

Figures 3.1 and 3.2 give the results of the mediation analyses. Low SEP was inversely associated with both dimensions of mental health problems, especially externalizing problems. Family SEP was inversely associated with ERLS and PRLS, but the association was markedly stronger for ERLS. Each regression coefficient represents the number of SD change in the outcome variable per SD change of the independent variable. For example, the regression of internalizing problems on ERLS means that a change of 1 SD in ERLS is associated with a 0.182 SD change in internalizing problems.
When mental health outcomes were regressed on ERLS while adjusting for SEP, the estimates were positive and statistically significant for both outcome dimensions, although slightly stronger for internalizing than externalizing problems. The proportion of explained variance for the model including ERLS increased from $R^2 = 0.08$ ($F_{4, 2144} = 81.32, p < .001$) to $R^2 = 0.14$ ($F_{5, 2143} = 89.28, p < .001$) for internalizing problems and from $R^2 = 0.10$ ($F_{4, 2144} = 77.69, p < .001$) to $R^2 = 0.13$ ($F_{5, 2143} = 89.38, p < .001$) for externalizing problems. The same pattern was observed when mental health outcomes were regressed on PRLS while adjusting for SEP. The proportion of explained variance for the model when including PRLS increased from $R^2 = 0.08$ ($F_{4, 2144} = 81.32, p < .001$) to $R^2 = 0.21$ ($F_{5, 2143} = 145.79, p < .001$) for internalizing problems and from $R^2 = 0.10$ ($F_{4, 2144} = 77.69, p < .001$) to $R^2 = 0.16$ ($F_{5, 2143} = 108.17, p < .001$) for externalizing problems. Independent of their association with SEP, PRLS was more strongly related to mental health outcomes than ERLS. Interaction terms for sex by ERLS and sex by PRLS were not significant.

Including ERLS as a potential mediator significantly reduced the associations of SEP with internalizing and externalizing problems. Regression coefficients decreased by 56% for internalizing problems and 13% for externalizing problems (Figures 3.1 and 3.2). The bootstrap results showed significant mediation for all outcomes, with 95% CI of 35% to 78% for internalizing problems and 7% to 19% for externalizing problems, indicating mediation by ERLS for both domains of mental health problems.
Person-related life stressors mediated the association between SEP and mental health dimensions less strongly than ERLS, and mediation by PRLS was not statistically significant. Regression coefficients were reduced by 7% for internalizing problems and 5% for externalizing problems. The bootstrap results for the mediated (indirect) effects were not significant for either internalizing problems (95% CI: -25% to 38%) or externalizing problems (95% CI: -2% to 13%), indicating no mediation by PRLS.

Figure 3.1

Two multiple regression mediation models in which PRLS and ERLS were entered separately.† Represents the β after ERLS were added to the model (effects of SEP mediated by ERLS = 56% (95% CI 35% to 78%)). †† Represents the β after PRLS were added to the model (effects of SEP mediated by PRLS = 7% (95% CI -25% to 38%)). The β's above the continuous line from SEP to INT represent the direct effect of family SEP on INT (adjusted for sex and EXT). Associations of INT with life stressors (ERLS, PRLS) are adjusted for SEP. CI = confidence interval; ERLS = environment-related life stressors; EXT = externalizing problems; INT = internalizing problems; PRLS = person-related life stressors; SEP = family socio-economic position.
Figure 3.2
Two multiple regression mediation models in which PRLS and ERLS were entered separately. † Represents the β after ERLS were added to the model (effects of SEP mediated by ERLS = 13% (95% CI 7% to 19%)). †† Represents the β after PRLS were added to the model (effects of SEP mediated by PRLS = 5% (95% CI -2% to 13%)). The β’s above the continuous line from SEP to EXT represent the direct effect of family SEP on EXT (adjusted for sex and INT). Associations of EXT with life stressors (ERLS and PRLS) are adjusted for SEP. CI = confidence interval; ERLS = environment-related life stressors; EXT = externalizing problems; INT = internalizing problems; PRLS = person-related life stressors; SEP = family socio-economic position.

When we included ERLS and PRLS simultaneously in the same model as potential mediators, the results were similar to those when including ERLS only. The effects of SEP were reduced significantly by 50% (95% CI: 31%-70%) for internalizing problems and 11% (95% CI: 7%-16%) for externalizing problems. The association between SEP and PRLS was no longer significant (β = -0.034, 95% CI: -0.077 to 0.004) when the two potential mediators were both included in the same model. The proportion of explained variance for the model including both ERLS and PRLS increased from $R^2 = 0.08 \ (F_{4, 2144} = 81.32, \ p < .001)$ to $R^2 = 0.20 \ (F_{5, 2143} = 92.33, \ p < .001)$ for internalizing problems and from $R^2 = 0.10 \ (F_{4, 2144} = 77.69, \ p < .001)$ to $R^2 = 0.17 \ (F_{5, 2143} = 104.27, \ p < .001)$ for externalizing problems.
Restricted analyses of the participants with complete data yielded only small changes in effect sizes and patterns of statistical significance when compared with the full sample results. Equally, separate analyses with only teacher reports yielded similar patterns of results. Lastly, the sensitivity analyses conducted to assess the effect of potential misclassification of contentious items into either ERLS or PRLS produced an almost identical pattern of results as in our original categorizations.

**DISCUSSION**

Using data from a large population cohort of Dutch adolescents, we found that environment-related life stressors (ERLS), more than person-related life stressors (PRLS), mediated the association between family SEP and mental health problems in adolescents. Mediation was largely limited to life stressors in the environment of the child (i.e., ERLS). Only weak and statistically non-significant mediation was found for stressors deemed person-related (i.e., stressors dependent on the behaviors of the adolescents themselves). This pattern emerged for both internalizing and externalizing problems. Essentially, the same results were obtained when both types of stressors were entered simultaneously in the mediation model compared with the model with ERLS only. This suggests that PRLS are not an independent mediator of the association between SEP and mental health.

This study has several strengths. First, we studied mediation using a study population of adolescents, reducing the likelihood that the effects of family SEP is confounded by reciprocal influences of mental health because, at this age, children’s mental health are less likely to influence family SEP. Second, our study used multiple indicators of SEP directly obtained from parents rather than relying on family income (Tracy, Zimmerman, Galea, McCauley, Stoep, 2008; Costello, Compton, Keeler, Angold, 2003) and education or occupation (Felner, Brand, DuBois, Adan, Mulhall, Evans, 1995). Information on SEP obtained from parents has been shown to be more reliable than information on SEP obtained from children (Wardle, Robb, Johnson, 2002). Third, multiple informants reported on mental health problems, thus limiting information biases and increasing precision in reporting (Verhulst, Koot, Van der Ende, 1994). Fourth, we distinguished between ERLS and PRLS to gain insight into specific pathways through which family SEP influences adolescent mental health. Last, we used data from a large representative population sample.

Nevertheless, to appreciate our findings, some limitations must be discussed. First, we used retrospective report of life stressors, which may be prone to recall bias. Specifically, people with mental health problems are known to over report the number and severity of stressors (Grant, Compas, Thurm et al, 2006). To minimize this potential bias, we used the number of life stressors
and not their perceived severity in our analyses. Furthermore, a separate analysis of teacher reports showed the same pattern of less mediation by PRLS than by ERLS and stronger mediation for internalizing than externalizing problems. Because teachers did not report on life stressors, recall bias cannot explain our results. Second, we did not take into account any changes in family SEP across the follow-up period. However, family SEP is generally a stable construct and sudden changes within a short duration, like in our study, are unlikely. Third, although our approach to determine whether the stressors were person-related or environment-related was inspired by previous works (Brown, Harris, 1978; Kendler, Karkowski, Prescott, 1999), it differed in that our approach was not based on interviews. Our data did not include the contextual information for rating the life stressors as precisely as in studies based on interviews. This could have led to the misclassification of some life stressors. However, there was substantial agreement among the raters (intraclass correlations > 0.80), and sensitivity analyses produced almost identical results as the models using our original event classifications.

Our findings support the view that at least part of the influence of low family SEP on offspring mental health is mediated by the experience of ERLS more than PRLS. This difference in mediation can be explained in several ways. Most likely, in our view, family SEP provides the environmental context in which the adolescents are raised and is therefore more likely to determine the exposure to ERLS (Evans, 2004). Person-related life stressors, on the other hand, are probably associated more with personality-related characteristics such as low self-esteem, shyness, or inadequate social skills (Ormel, Wohlfarth, 1991). It is also possible that PRLS may in part be due to preexisting mental health problems and result from reverse causality. The notion of reverse causality fits well with the concept of person-dependent stressors, as suggested in previous studies (Kendler, Karkowski, Prescott, 1999). Our study findings are consistent with previous studies that reported on mediation of the relation between low SEP and adjustment in adolescents by proximal SLEs (Felner, Brand, DuBois, Adan, Mulhall, Evans, 1995; Tracy, Zimmerman, Galea, McCauley, Stoep, 2008). However, in the Great Smoky Mountain Study (Costello, Compton, Keeler, Angold, 2003), the authors reported that the effect of short-term increase in income on psychiatric symptoms in low-income families was not mediated by several stressors. The likely long-standing effects of low SEP on the adolescents is a possible reason for the different findings between our study and the Great Smoky Mountain Study (Costello, Compton, Keeler, Angold, 2003).

In addition to the difference in the amount of mediation between ERLS and PRLS, the association of family SEP was markedly stronger for externalizing than for internalizing problems. Yet the extent of mediation by life stressors was considerably larger for internalizing problems. The stronger mediation for internalizing problems can be explained by stronger associations of both ERLS and PRLS with internalizing problems compared with externalizing problems. This is
consistent with previous research suggesting stronger associations of stressful events with internalizing problems than with externalizing problems (Grant, Compas, Thurm et al. 2006; Kendler, Kessler, Walters, et al., 1995).

However, the extent of mediation by life stressors in our study point to the presence of other proximal risk factors for psychopathology that may mediate the pathway from low SEP to mental problems. Possible proximal risk factors among the adolescents of low SEP include individual characteristics like poor parental supervision (Costello, Compton, Keeler, Angold, 2003), genetic influences (Kendler, Kessler, Walters, et al., 1995) or genes and environment interaction (Hudziak, Bartels, 2008). Nevertheless, a recent study showed no evidence for the interaction between serotonin transporter gene alleles and adversity as a risk factor for depression and that adversity (stressful life events) alone explains a large proportion (40%) of the risk for depression (Risch, Herrell, Lehner et al. 2009). The study by Risch and colleagues (2009) illustrates the significance of assessing the relative influence of environmental life stressors in attempting to understand the paths to mental health problems. However, the presence of these proximal risk factors (parental supervision, individual characteristics, genetic influences, etc.) is outside the scope of the present study and will be considered in subsequent studies.

Conclusions

The effect sizes of the associations between SEP and mental health found in the present study were relatively small, suggesting that interventions to diminish the influence of low SEP on impaired mental health may have only modest short-term benefits. However, these interventions are more likely to be effective when focused on the environment of the child rather than on the child itself. For example, family therapy for dysfunctional families has been shown to reduce childhood internalizing symptoms (Weissman, Pilowsky, Wickramaratne, et al., 2006). Further, coping skills such as acceptance, distraction, cognitive restructuring, and emotional regulation are reported to alleviate the effects of environment-related stressors on psychopathology (Wadsworth, Raviv, Compas, Connor-Smith, 2005). Furthermore, this period (childhood and adolescence) is the beginning of the life-course and small SEP differences may give rise to increasing differences in mental health outcomes later in life. Moreover, previous studies have suggested that the toxic effect of low SEP may be cumulative (Kuh, Ben-Shlomo, 1997; Mheen, Stronks, Mackenbach, 1998; Dohrenwend, 1990). Therefore, interventions to ameliorate the toxic effects of low family SEP on children and adolescents are still worth the effort from the public health point of view. Finally, distinguishing between ERLS and PRLS may be of theoretical relevance for future research in this area as identifying the source of life stressors may inform interventions.
REFERENCES


Araya R, Lewis G, Rojas G, Fritsch R. Education and income: which is more important for mental health? *J Epidemiol Community Health* 2003;57:501–505


Kuh D, Ben-Shlomo YE. A lifecourse approach to chronic disease epidemiology. New York: Oxford University Press; 1997


Rubin DB. Multiple Imputation for Non-response in Surveys. New York: John Wiley and Sons; 1987


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