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# Poor school connectedness in adolescence and adulthood depressiveness: a longitudinal theory-driven study from the Northern Sweden Cohort

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**Background:** Foundations for mental health are laid early in family and school life. Family climate embraces the emotional connections within a family, and school connectedness embraces both functional and affective dimensions of relationship with school. Based on the lack of theory-driven and longitudinal epidemiological studies addressing public mental health, the aim of this longitudinal study was to investigate the associations between adolescents' school connectedness, family climate and depressiveness in adulthood, by relying on Bronfenbrenner's ecological theory. **Methods:** The data are from the Northern Swedish Cohort, and the sample consists of 481 women and 526 men born in 1965 who participated in data collection at age 16, 21, 30 and 43. The generalized linear model method with random intercepts was used to examine the associations between family climate and school connectedness and depressiveness in adulthood. **Results:** Poor school connectedness was associated with depressiveness in adulthood [ $\beta = 0.038$  (95% CI 0.018–0.058)  $P \leq 0.001$ ], but poor family climate was not [ $\beta = 0.014$  (95% CI –0.004–0.032)]. No difference in associations was observed between those experiencing social/material adversities in adolescence. **Conclusions:** This study shows that poor school connectedness in adolescence can affect depressiveness in adulthood. The study confirms the complex processes that determine mental health and proposes a theoretical approach appealing to public mental health research. In addition, this study concludes that more life-course studies are needed to advance the knowledge of the mechanisms behind the associations between family climate and school connectedness and depressiveness in adulthood.

## Introduction

Mental and substance use disorders are a global public health challenge present in all age groups and are responsible for about 7% of disease burden worldwide.<sup>1</sup> A major objective in WHO's global mental health action plan concerns the implementation of prevention strategies for mental health problems.<sup>2</sup> As processes that determine mental health are complex, theory-driven epidemiological studies of mental health are needed for thorough understanding.<sup>3, 4</sup> Because the foundations for adult mental health are laid early in life, research needs to focus on childhood and adolescence developmental processes that influence mental health. Furthermore, adolescence is considered a second sensitive period after early childhood as puberty and the rapid maturation of the brain are critical aspects for the psychological development that determines health and well-being.<sup>5</sup> The everyday life settings of the family and the school are important contexts for adolescents' development, and safe and supportive families, schools and peers are essential conditions for positive development.<sup>5</sup> The concept of family climate, used to describe the emotional connections within a family, includes the dimensions of warmth, supervision, conflict and order,<sup>6</sup> satisfaction and affect in the family<sup>7</sup> and emotional atmosphere within the family.<sup>8</sup> Previous research has identified the long-lasting negative health effects of maltreatment in childhood.<sup>9–11</sup> However, little is known about less severe family-relational

problems even though previous research indicates negative long-term consequences for mental health and well-being.<sup>12–14</sup> Various terms and measures have been used to capture children's and adolescents' connectedness with school<sup>15, 16</sup> including functional dimensions such as grades, participation and engagement and affective dimensions such as liking school and sense of belonging.<sup>15</sup> Regardless of the factors measured and labels used, school connectedness has been found to strongly associate with adolescent's academic outcomes<sup>15</sup> and depressive symptoms.<sup>17, 18</sup> However, the few studies of long-term health consequences of poor school connectedness into adulthood have short follow-up.<sup>19–21</sup>

### *Bronfenbrenner's ecological theory of human development*

An ecological approach has been proposed as a suitable theoretical framework to address the complexity of public (mental) health problems since it embraces the interdependence and mutual interrelations between individuals and contexts.<sup>22, 23</sup> In his ecological theory of human development,<sup>24, 25</sup> Bronfenbrenner highlights human development as a product of the interplay between the individuals and their environment. Originally, Bronfenbrenner emphasized the importance of societal and contextual factors for human development by highlighting the interrelations within and between the different layers of environmental systems embedding the

individual (*micro-, meso-, exo- and macrosystem*).<sup>24</sup> In the later version of the theory, which he labelled the Process-Person-Context-Time (PPCT) model, he highlighted the personal characteristics and individual processes to a greater extent and merged the original nested layers of environmental system into a context component of the model.<sup>26</sup> Bronfenbrenner accentuates the proximal processes as the 'driving engines of development' through which individual and societal aspects influence the individual development.<sup>25</sup> These enduring reciprocal interrelations are between the developing individual and persons, objects and/or symbols in his/her immediate environment occurring on a regular basis.

To extend theory-driven epidemiological studies of the complex processes determining mental health, this study investigates the associations between family climate and school connectedness in adolescence and depressiveness in adulthood, using Bronfenbrenner's ecological theory.

## Methods

### Study population

The data are from the Northern Swedish Cohort (NoSCo), which consists of all students who in 1981 attended or should have attended last year of compulsory school in the municipality of Luleå, Sweden ( $n = 1083$ ). Luleå is a middle-sized industrial town in Northern Sweden that is comparable to Sweden as a whole in relation to life expectancy, sociodemographic factors and health status.<sup>27, 28</sup> The data were collected at five time points 1981, 1983, 1986, 1995 and 2008. Of those still alive, 94% (1007) responded to the surveys for all five waves of data collection.<sup>27</sup> The study was approved by the Swedish Ethical Review Authority. The study sample consists of 481 women and 526 men born in 1965 who participated in data collection at age 16, 21, 30 and 43. Due to internal missing values, the analytic sample included 944 participants. Since the cohort is closed, it includes a lower proportion of participants with non-European background compared with the Swedish population; otherwise, the cohort has been shown comparable to the country as a whole in terms of socio-demographic as well as health behaviour and health status.<sup>27, 28</sup>

### Conceptual model of analysis

In our study, variables of the NoSCo representing the different components of the PPCT model as well as the original nested layers of environmental systems were mapped in a conceptual model embracing both early and later versions of Bronfenbrenner's theory and included in the analysis (figure 1).

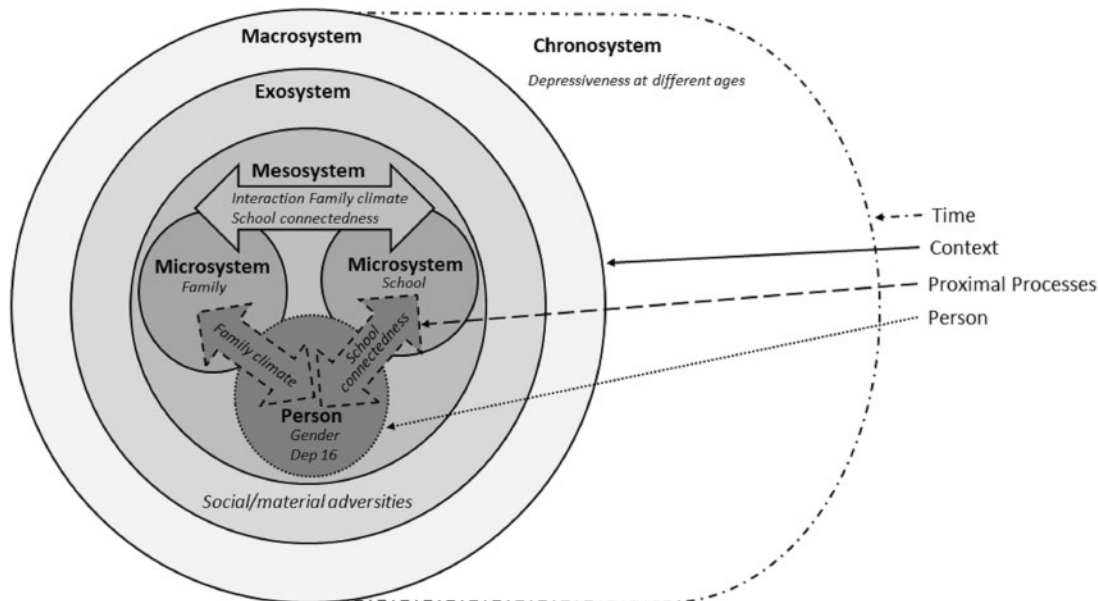
### Measures

#### Depressiveness

Six symptoms comprised the outcome measure of depressiveness at all ages: *sleeping problems, poor appetite, general tiredness, feeling down and sad, dejected about the future and concentration difficulties*. Each symptom was coded with value of 0–2, and the composite measure was computed as the mean of the values for the six symptoms, higher mean indicating more depressive symptoms. For a more detailed description, see Hammarström et al.<sup>29</sup> who also found this measure of depressiveness to have acceptable construct validity and good factorial invariance over time.

#### Exposure: poor family climate and poor school connectedness

To capture the proximal processes as described in Bronfenbrenner's theory, we identified variables available in the NoSCo that were considered to capture interrelations occurring within the microsystems of the family and the school. These variables were included in an explorative factor analysis (EFA) by extracting principal components with varimax rotation. It resulted in two components representing composite measures capturing the latent measure of school connectedness and family climate, which both showed an acceptable construct validity on reliability tests (Cronbach's  $\alpha = 0.72$ ). Family climate included three items with response options ranging from 1 to 5. *How is your contact with your mother? How is your contact with your father? How are you enjoying yourself at home?* 1 = *Very good* to 5 = *Very bad*. School connectedness included seven items with response options ranging from 1 to 5. *How are you enjoying yourself at lessons? How are you enjoying yourself at breaks? How are you enjoying yourself with classmates? How do you consider you use your ability in school?* 1 = *very good* to 5 = *very bad*. *Do you learn something that you believe can benefit the future?* 1 = *Yes, a lot* to 5 = *No, very little*. Do



**Figure 1** Conceptual model of the analysis. The variables included in the analysis (italics) are mapped in an illustration integrating Bronfenbrenner's original nested layers of environmental systems with his later PPCT model.

you get opportunity to make decisions in school? 1 = Yes, often to 5 = Very seldom. How much time do you usually spend in doing homework? 1 = I seldom do homework to 5 = More than 1.5 h (reversed). The included items were averaged to create scores of the composite measure with high score indicating poor family climate or poor school connectedness.

**Person: gender**

According to the PPCT model, effects of proximal processes on developmental outcome are modified by personal characteristics. For example, gender, according to Bronfenbrenner, is an easily noted quality of the individual that can influence reactions from the social environment<sup>25</sup> and is also known to have immense importance for the socialization of children and adolescents. Furthermore, we included symptoms of depressiveness at age 16 since depressiveness influences the individual’s ability to engage in proximal processes<sup>25</sup> and is the strongest determinant of later depressiveness.

**Context: social and material adversities**

This study focuses on the *microsystems* of the family and the school, where the proximal processes in focus took place. According to Bronfenbrenner, the *mesosystem* refers to the interrelations between the different microsystems<sup>24</sup> and to capture these relationships requires analyzing the interactions between family climate and school connectedness. The *exosystem* is captured by measuring the adolescents’ social and material situation assuming that social and/or material adversities might negatively influence the proximal processes. These adversities were captured by objective measures of living conditions at age 16<sup>30</sup>: *parental loss, residential instability, parental illness* (social adversities) and *parental unemployment, poor material standard of living and residential crowding* (material adversities). Moreover, the impact of the interrelations between the exosystem and the microsystems were assessed by stratifying the analysis of the associations between proximal processes and depressiveness by the presence or absence of social/material adversities at age 16. In the stratified analysis, the composite score of material and social adversities was dichotomized: scores up to the 80th percentile were coded with 0 and those above with 1, as suggested by Gustafsson et al.<sup>30</sup>

**Time**

Time was captured by the longitudinal design of the study, measuring symptoms of depressiveness at different points in adulthood—at age 21, 30 and 43.

**Statistical analysis**

SPSS statistics 23 was used in all analyses. Means and standard deviations (SDs) were calculated. Since the study included repeated measures of depressiveness at four points from adolescence to mid adulthood, the generalized linear model (GLM) method with random intercepts was used to analyze the associations between poor school connectedness and family climate and future depressiveness. A GLM allows for analyses of within-subject effects of exposure on repeated observations of depressiveness. Goodness of fit of the models was assessed using the SPSS standard method full log-quasi-likelihood function, and the statistical significance of the parameter estimates was calculated using Wald chi-square method. Basic model assumptions for the models were checked by distribution plots of model residuals (the difference between observed and model predicted value of the dependent variable) and by the correlation coefficients between the independent variables in a model and the model residual. All residuals examined had approximate normal distribution, and all correlations were close to zero. To investigate if it was possible to assume the effects of risk factors to stay constant during the entire follow-up period, we calculated separate models for each year: 1986, 1995 and 2007 (results not shown). The values did not differ substantially over the years, and thus, we chose to use them as constant effects over time.

An interaction term family climate\*school connectedness was added to the univariate model in order to assess potential effects of interactions between the two microsystems on the association to future depressiveness. Further, to assess potential exosystem effects on the associations, the analyses were repeated on the sample stratified by the presence or absence of social/material adversities at age 16.

**Results**

Descriptive statistics are presented in table 1. The theoretical range of scores for family climate was 1.00–5.00 and the sample range

**Table 1** Descriptive statistics of the study population including mean scores of family climate, school connectedness and depressiveness

	Chronbach’s $\alpha$	n	Score mean (SD)
Family climate at age 16	0.72	1007	1.62 (0.69)
Contact with mother		1005	1.44 (0.69)
Contact with father		984	1.86 (1.06)
Enjoying yourself at home		1006	1.56 (0.76)
School connectedness at age 16	0.72	1007	2.60 (0.57)
Enjoying yourself at lessons		1006	2.71 (0.87)
Enjoying yourself at breaks		1006	2.43 (0.83)
Enjoying yourself with classmates		1006	1.85 (0.79)
Use of ability in school		1002	2.51 (1.02)
Learn something that can benefit the future		1006	2.06 (0.85)
Opportunity to make decisions in school		1003	3.32 (0.84)
Time spent in doing homework		1003	2.65 (1.22)
Depressiveness <sup>a</sup>			
Age 16	0.65	1007	0.48 (0.30)
Age 21	0.61	1007	0.39 (0.28)
Age 30	0.67	1004	0.45 (0.32)
Age 43	0.76	968	0.44 (0.36)
Social/material adversities at age 16		944	
Yes		105 (11.1%)	
No		839 (88.9 %)	
Gender		1007	
Female		481 (47.8%)	
Male		526 (52.2%)	

a: Measured from six items: Sleeping problems, poor appetite, general tiredness, feeling down and sad, dejected about the future and concentration difficulties.

**Table 2** Mixed models (repeated measures) of depressiveness (from age 21 to 42) in relation to poor family climate and poor school connectedness in adolescence

<i>n</i> = 944	Depressiveness	
	Model 1 $\beta$ (95% CI)	Model 2 $\beta$ (95% CI)
Intercept	1.59 (–0.262 to 3.44)	1.55 (–0.305 to 3.40)
Poor family climate	0.116 (0.095 to 0.138)***	0.014 (–0.004 to 0.032)
Depressiveness at age 16		0.483 (0.441 to 0.526)***
Gender (female)		0.039 (0.017 to 0.062)***
QICC <sup>a</sup>	350.2	286.8
Intercept	1.43 (–0.424 to 3.28)	1.46 (–0.388 to 3.32)
Poor school connectedness	0.124 (0.100 to 0.149)***	0.038 (0.018 to 0.058)***
Depressiveness at age 16		0.468 (0.426 to 0.510)***
Gender (female)		0.048 (0.025 to 0.071)***
QICC <sup>a</sup>	353.7	285.7

Model 1: univariate model. Model 2: includes depressiveness at age 16 and gender.

a: Goodness of fit: corrected quasi-likelihood under independence model criterion.

\*: Significance levels: \*\*\* $P \leq 0.001$ , \*\* $P < 0.01$ , \* $P < 0.05$ .

**Table 3** Mixed models (repeated measures) of depressiveness (from age 21 to 42) in relation to poor family climate and poor school connectedness in adolescence, stratified by social/material adversities in childhood

	Depressiveness	
	Model 1 $\beta$ (95% CI)	Model 2 $\beta$ (95% CI)
Social/material adversities ( <i>n</i> = 105)		
Intercept	3.11 (–2.85 to 9.07)	2.95 (–2.98 to 8.89)
Poor family climate	0.083 (0.025 to 0.141)**	–0.025 (–0.064 to 0.015)
QICC <sup>a</sup>	51.6	46.3
Intercept	2.63 (–3.30 to 8.57)	2.70 (–3.25 to 8.64)
Poor school connectedness	0.166 (0.114 to 0.218)***	0.072 (0.021 to 0.122)**
QICC <sup>a</sup>	48.1	45.7
No social/material adversities ( <i>n</i> = 839)		
Intercept	1.40 (–0.546 to 3.35)	1.36 (–0.587 to 3.30)
Poor family climate	0.117 (0.094 to 0.141)***	0.018 (–0.002 to 0.037)
QICC <sup>a</sup>	302.7	249.0
Intercept	1.28 (–0.667 to 3.22)	1.30 (–0.645 to 3.25)
Poor school connectedness	0.112 (0.084 to 0.139)***	0.030 (0.008 to 0.052)**
QICC <sup>a</sup>	308.9	248.6

Model 1: univariate model. Model 2: includes depressiveness at age 16 and gender.

a: Goodness of fit: corrected quasi-likelihood under independence model criterion.

\*: Significance levels: \*\*\* $P \leq 0.001$ , \*\* $P < 0.01$ , \* $P < 0.05$ .

1.00–4.33, where higher score indicates poor family climate. The mean of family climate was 1.62 (table 1). With a theoretical range of scores 1.00–5.00, the sample range of school connectedness was 1.14–5.00, where higher score indicates poor school connectedness. The mean was 2.60. Reliability tests for the two composite measures indicated good internal consistency (table 1).

In the univariate prospective analysis (table 2, model 1), both poor family climate and poor school connectedness were found to be associated with future depressiveness. When depressiveness at age 16 and gender was added to the analyses, only poor school connectedness and not poor family climate was found associated with future depressiveness. Analysis of the interaction between poor family climate and poor school connectedness did not reveal any significant interaction (results not shown).

Table 3 includes the analysis of baseline data on poor family climate and poor school connectedness and the association with future depressiveness stratified on social/material adversities. An association between poor school connectedness and depressiveness was found in both groups: those with and those without social/material adversities at age 16. This was also present when adjusted for gender and depressiveness at age 16, whereas poor family climate was not associated with future depressiveness after adjustments.

## Discussion

### On the results

This study extends previous research showing that poor school connectedness is associated with depressiveness in adulthood even after adjustment for gender and experiences of depressiveness in adolescence. We were unable to identify other studies of long-term adverse effects of poor school connectedness on mental health beyond young adulthood, but previous studies with shorter follow-up have found high school connectedness associated with positive developmental outcomes such as lower use of substance use, better academic achievement and better mental health.<sup>19–21</sup> In our study, the associations between poor school connectedness and depressiveness were statistically significant, but due to the complexity of the development of depressiveness, other determinants and mechanisms related to both the period of exposure as well as other periods of life most certainly are important. The design of our study did not include analyses of explaining mechanisms, but recent research indicates that professional and social establishment in early adulthood can have a mediating role in the association between school connectedness and depressive symptoms in mid-adulthood.<sup>31</sup> Future research should include factors related to other periods of the life course that

potentially mediate or moderate the association, for example, social support, education and employment. Nevertheless, our results support the view that school is an important setting for mental health promoting initiatives. Bronfenbrenner emphasized the interrelations between different environmental systems.<sup>24, 25</sup> Although testing the effects of interrelations of the exosystem and proximal processes, we did not find any difference in associations between poor school connectedness and future depressiveness between those experiencing social/material adversities at age 16 and those with no adversities. Previous studies have indicated that school connectedness can act as a buffer against other adversities.<sup>32, 33</sup>

In our study, poor family climate, which embraced family-relational problems of which long-term adverse effects on mental health are less clear than the effects of severe maltreatment, was not found associated with future depressiveness. Weich et al.'s<sup>12</sup> review showed robust findings of long-term adverse effects of severe abuse and neglect on mental health, whereas the associations between less severe family relational problems and mental health problems were more ambiguous. Berg et al.<sup>13</sup> found negative effects of family relational problems in adolescence on psychological distress in mid-adulthood for both men and women, but these effects were only statistically significant among women when adjusted for psychological problems in adolescence. One possible explanation of poor family climate being less clearly associated with depressiveness in adulthood than poor school connectedness could be that family relations, unlike school relations, are lifelong and therefore potentially can be improved successively. A finding difficult to interpret, is the negative association between family climate and depressiveness among participants experiencing social/material adversities. One possible explanation could be that participants growing up with social/material adversities leave the family of origin and manage to improve the social and material living condition. Another possible explanation could be that other expressions of mental illness are more common in this group. A candidate would be having alcohol problems and associated anxiety problems rather than depressiveness. However, at this point, no data are available to support any of these explanations.

### On the theory and method

The main strength of our study is the long-term follow-up of a cohort with extremely high participation rate until mid-adulthood. In addition, the NoSCo has been shown to be comparable to Sweden as a whole in relation to sociodemographic factors and health status.<sup>27</sup> A limitation is the relative small sample size, which can create problems with statistical power in, for example, the stratified analyses. However, the sample consists of the total population of a certain age group in a municipality, which enhances the representativeness of the sample. Our study extends the use of Bronfenbrenner's theory in public mental health research by using a longitudinal study design based on both early and later concepts of the theory. Findings from a recent review of different ways of using Bronfenbrenner's theory in public mental health research<sup>34</sup> showed that the majority of previous studies used the earlier concepts of the nested layers of environmental systems without considering the interactions between systems. Only a few studies have used the later concepts, and none has used a longitudinal study design with a follow-up beyond young adulthood. Furthermore, the use of Bronfenbrenner's theory in previous studies has been criticized for mapping the contribution of individual and environmental factors to an outcome without analysing the interrelations between the individual and the environment, which is the core of Bronfenbrenner's theory throughout all the developmental stages.<sup>34–36</sup> Thus, we specifically focused on including analysis of interrelations between systems even though we were not able to include a macrosystem measure since the participants of the NoSCo were a homogenous group with respect to the broader social, economic and cultural

environment. Furthermore, the already-existing data made it possible to adequately capture the time component because of the long follow-up period and low attrition rate, which are important strengths of the study. On the other hand, it was a challenge to apply Bronfenbrenner's theory on already-existing data since variables optimally capturing the different components of the PPCT model were not always available. In addition, the use of already-existing data made it impossible to use validated instruments to assess school connectedness and family climate since these were not in focus when the original questionnaire was designed in 1981, also a limitation of the study. Especially, the family climate measure is not as comprehensive as preferred as it included only three items. Nevertheless, both measures showed an acceptable construct validity on reliability tests (Cronbach's  $\alpha = 0.72$ ) and corresponded to previous conceptualizations: the measure of school connectedness captures both functional and affective dimensions of connectedness with school and family climate captures the adolescents' relationship with their parents and satisfaction with the family. This emphasizes the importance of the theoretical grounding of epidemiological studies already in the design phase to ensure optimal measures of all aspects of interest. Even though the focus of this study was on family climate and school connectedness in adolescence, it is important to keep in mind that family climate and school connectedness earlier in life most certainly also are important in relation to future depressiveness. The PPCT model has previously been criticized for lacking focus on the broader environment's influences on mental health and therefore less appealing for public health research than the earlier concepts.<sup>34</sup> We consider the idea of proximal processes as the driving engines of development through which individual and societal aspects influence the individual development<sup>25</sup> appealing theoretical ground for studying the complex nature of mental health problems. By emphasizing the original nested layers of environmental systems within the context component of the PPCT model (figure 1), the later concepts of Bronfenbrenner's theory can also be appealing for public mental health research.

### Conclusions

This study extends previous research by showing that poor school connectedness is associated with depressiveness up to and possibly through mid-adulthood. This study also accentuates the complex process of the development of mental health problems, proposing that social/material adversities in adolescence expand the association at least in young adulthood. Further, this study illustrates how the later concepts of Bronfenbrenner's theory, the PPCT model, can be applied without losing the broader context of earlier versions. Additional life-course studies are needed to understand the mechanisms behind the associations between poor school connectedness and depressiveness in adulthood.

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*Conflicts of interest:* None declared.

## Key points

- The study adds to and extends the use of theory in public mental health research by applying Bronfenbrenner's ecological theory in a longitudinal study design based on both early and later concepts of the theory.
- This study extends previous research by showing that poor school connectedness is associated with depressiveness up to mid-adulthood.
- The results highlight the importance of school as a setting for initiatives that promote mental health.

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