

The role of social cognitions in the social gradient in adolescent mental health: A longitudinal mediation model

Dominic Weinberg, Gonneke W.J.M Stevens, Margot Peeters,
Kirsten Visser, Willem Frankenhuis and Catrin Finkenauer
Utrecht University

Purpose. The social gradient in adolescent mental health is well established: adolescents' socioeconomic status (SES) is negatively associated with their mental health. However, despite changes in social cognition during adolescence, and theory and evidence that SES, social cognitions, and adolescent mental health are associated, little is known about whether social cognitions mediate this gradient.

Methods. This study used three data waves, each six months apart, from a socioeconomically diverse sample of 1,429 adolescents ($M_{\text{age}} = 17.9$) in the Netherlands. With a longitudinal mediation model, we examined whether three social cognitions (self-esteem, sense of control, and optimism) mediated the associations between perceived family wealth and four indicators of adolescent mental health problems (emotional symptoms, conduct problems, hyperactivity, and peer problems).

Results. Adolescents with lower perceived family wealth reported more emotional symptoms and peer problems concurrently and an increase in peer problems six months later. Adolescents with lower perceived family wealth reported a decrease in sense of control six months later, and lower sense of control predicted increases in emotional symptoms and hyperactivity six months later (though not in the multivariate model with all three social cognitions). Perceived family wealth predicted neither later self-esteem nor optimism, though we found concurrent positive associations between perceived family wealth and all three social cognitions, and concurrent negative associations between social cognitions and mental health problems.

Conclusion. Our findings indicate that social cognitions may be an overlooked mediator of the social gradient in adolescent mental health. Future research on this social gradient may benefit from incorporating a focus on social cognition.

Data analysis scripts, project codebook, preregistered data analysis plan. <https://osf.io/fsw3j/>

Keywords. social gradient; adolescent mental health; socioeconomic status; social cognitions; sense of control; longitudinal mediation

The social gradient in adolescent mental health is persistent and robust: adolescents with lower socioeconomic status (SES) have worse mental health than adolescents with higher SES (Devenish et al., 2017; Reiss, 2013). A solid understanding of this social gradient is vital to improving adolescents' mental health.

Furthermore, this social gradient persists into adulthood and has enormous social and economic costs (Mackenbach et al., 2011; Patton et al., 2016; Vigo et al., 2016). Research on the mediators of this gradient has generally focused on the family context, documenting several factors that may explain the worse mental

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Correspondence to Dominic Weinberg, Utrecht University, Utrecht, The Netherlands. Email: d.w.weinberg@uu.nl

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health of adolescents with lower SES. These include having fewer material resources, experiencing fewer stable and supportive relationships, and facing more stressful and threatening family and neighborhood environments (R. D. Conger & Donnellan, 2007; McLoyd et al., 2009). Less attention has been paid to adolescent-level factors, such as social cognitions – the psychological processes that adolescents use to make sense of themselves and others (Fiske & Taylor, 2013). Social cognitions are influenced by the socio-economic context in which people develop (Kraus et al., 2012; Stephens et al., 2014). Furthermore, three social cognitions – self-esteem, sense of control, and optimism – are deemed fundamental to mental health (Taylor & Brown, 1988). In combination, these two propositions suggest that people with lower SES have more negative social cognitions, and those with more negative social cognitions have worse mental health, and thus that social cognitions may mediate the social gradient in mental health.

However, little is known about whether, and which, social cognitions mediate this social gradient in adolescence (Adler & Tan, 2017; E. Chen et al., 2002; Heberle & Carter, 2015). This gap in the literature is striking because social cognitions are formed by making social comparisons and internalizing the views of others (Gecas, 1982), which are pronounced features of adolescence (Crone & Dahl, 2012; Jacobs et al., 2003). Furthermore, adolescence is an important phase in the preparation for adulthood and a critical juncture in the attainment of social status. During this life stage, the role of parental SES in social cognitions may increase because adolescents are reorienting from parents to peers (Brown & Larson, 2009; Prinstein, 2017) while also contemplating their own educational and occupational futures (Flanagan et al., 2014; Hagquist, 2007; Schoon & Lyons-Amos, 2017). Furthermore, these developmental changes may also increase the extent to which social cognitions play a role in the social gradient in mental health, so associations between SES, social cognitions, and mental health may be greater for adolescents than for children and adults. Therefore, this study explored whether three social cognitions – self-esteem, sense of control, and optimism – mediated the social gradient in adolescent mental health.

Mediation by social cognitions: self-esteem, sense of control, and optimism

Several reviews have emphasised the role of SES in the development of adaptive and contextually-appropriate social cognitions (Frankenhuis & Nettle, 2020;

Kraus et al., 2012; Pepper & Nettle, 2017; Piff et al., 2017; Sheehy-Skeffington, 2020; Stephens et al., 2014). Adolescents with lower SES, who are likely to face more stressful and threatening family, school, and neighborhood environments, develop social cognitions which correspond with the uncertainty and stress of these contexts (Kraus et al., 2012; Sheehy-Skeffington, 2020; Stephens et al., 2014). We expect that SES influences three important social cognitions: self-esteem – the evaluation of one's importance, worth, or value (Blascovich & Tomaka, 1991); sense of control – the belief that one's actions determine outcomes (Lachman & Weaver, 1998; Whitehead et al., 2016); and optimism – a generalised feeling of confidence in positive future outcomes (Carver et al., 2010). Taylor and Brown's (1988) landmark paper identified these three social cognitions to be fundamental for maintaining positive mental health. Subsequent reviews have corroborated the evidence that adult mental health is indeed predicted by self-esteem (Mann et al., 2004), sense of control (Orton et al., 2019), and optimism (Carver et al., 2010). However, less is known about the role of these three social cognitions in adolescent mental health. Below, we outline both overlapping and distinct reasons why each of the three social cognitions may mediate the social gradient in adolescent mental health.

First, adolescents with lower SES may be more likely to feel inferior to their counterparts with higher SES and receive stigmatizing treatment (Bosma et al., 2012; McLoyd et al., 2009), experiences expected to lead to lower self-esteem (Falci, 2011; Heberle & Carter, 2015; Rosenberg & Pearlin, 1978). In turn, adolescents with lower self-esteem than their peers may have more mental health problems, perhaps through processes of seeking and receiving less social support, experiencing more stress, and applying detrimental coping cognitions and behaviors (Donnellan et al., 2005; Orth et al., 2012). A meta-analysis has found robust evidence that SES is positively related to self-esteem during adolescence (Twenge & Campbell, 2002). Individuals with lower self-esteem in early adolescence, as compared to those with higher self-esteem, showed greater increases in mental health problems later in adolescence (Ciarrochi et al., 2007; Masselink et al., 2018; Orth et al., 2008). One cross-sectional study in late adolescents found that SES was positively related to self-esteem and self-esteem positively related to life satisfaction (Yan et al., 2020). Yet, to our knowledge, no longitudinal research has considered self-esteem as a mediator of the social gradient in adolescent mental health.

Second, we expect adolescents with lower SES to have fewer social and material resources to exercise control over their environment than adolescents with higher SES (Marmot, 2004; Stephens et al., 2014). They may also be socialised into holding autonomy-limiting beliefs, through their greater likelihood of experiencing authoritarian parenting or living in disadvantaged neighborhoods (K. J. Conger et al., 2009; Lareau, 2003). Adolescents with lower SES are thus expected to have a lower sense of control (Bosma et al., 2014; Shifrer, 2019; Wheaton, 1980). Adolescents with lower sense of control, are more likely than adolescents with higher sense of control to feel trapped, frustrated, and anxious, and be at risk of mental health problems (Bosma et al., 2014; Chorpita & Barlow, 1998; Whitehead et al., 2016). Evidence from two longitudinal studies in mid-late adolescence has shown, independently, that SES was positively associated with sense of control six years later (Ahlin & Antunes, 2015), and that sense of control was negatively associated with mental health problems two years later (Sullivan et al., 2017). We know of only one longitudinal study examining sense of control as a mediator of the social gradient in adolescent mental health, which found that sense of control at age 16 mediated the association between SES at age 5 and depression at age 18 (Culpin et al., 2015).

Third, we expect adolescents with lower SES to be less optimistic than adolescents with higher SES, because they have fewer resources to achieve their future goals (Brumley et al., 2017; McLoyd et al., 2009) and experience more stressful events that can be projected onto their own futures (Boehm et al., 2015; Gallo & Matthews, 2003). Optimism helps adolescents cope with threat and stress, motivates persistence and agentic action (Hitlin et al., 2015), and supports the maintenance of social relationships (McWhirter & McWhirter, 2008), all of which are key drivers of positive mental health (S. Cohen & Wills, 1985). Indeed, some evidence suggests that less optimistic adolescents are at greater risk of developing mental health problems (Patton et al., 2011). Two cross-sectional studies in late adolescence found optimism to mediate the association between SES and depression (Piko et al., 2013; Zou et al., 2020), but longitudinal research is lacking.

Although the studies described above provide insight into the mediating role of social cognitions in the social gradient in adolescent mental health, they do not

give a complete picture. First, they studied self-esteem, sense of control, and optimism in isolation, yet, these three social cognitions are interrelated (Ben-Zur, 2003; Hitlin & Johnson, 2015; Kim et al., 2019). Establishing the robustness of each of these mediational contributions is a stepping-stone towards selecting the most efficacious of the interventions and services which aim to establish better mental health and more positive social cognitions in adolescents with lower SES (Goyer et al., 2017; Yeager et al., 2018). Second, existing studies have used only one indicator of adolescent mental health (depression or life satisfaction), and we are unaware of research which includes both internalizing and externalizing problems, despite differences in the strength of the social gradient by adolescent mental health outcome (Devenish et al., 2017; Quon & McGrath, 2014; Reiss, 2013). Third, existing studies either did not test mediation with longitudinal data or did not control for stability in the constructs over time, which are important facets in establishing evidence for causal effects (MacKinnon et al., 2007). Our study addresses all three issues.

The current study

The current study extends the literature by investigating three potential mediators of the association between SES and different indicators of adolescent mental health: self-esteem, sense of control, and optimism. The study uses a sample of adolescents in vocational education, who followed a range of study paths that are likely to influence their educational and occupational futures. Furthermore, it uses autoregressive path analysis, specifically a lagged panel model design with three waves of longitudinal data spanning one year (Cole & Maxwell, 2003). This design is well-suited to testing the between-person effects outlined above (Orth et al., 2021). We expected that all three social cognitions would mediate the association between SES and adolescent mental health. This study focused on subjective SES (perceived family wealth) based on recent findings that it is more strongly associated with adolescent mental health than objective measures of SES (Weinberg et al., 2019). We included four indicators of mental health problems: emotional symptoms, conduct problems, hyperactivity, and peer problems.

Methods

We preregistered an analysis plan at the Open Science Framework, although the eventual analyses deviated from this plan.¹ The preregistration and analysis scripts are available at <https://osf.io/fsw3j/>.

Sample

We used data from the Youth Got Talent project, an ongoing longitudinal study investigating the SES-mental health gradient in adolescence. Adolescents (aged 16+) attended classes ($n = 72$) in three vocational schools in the region of Utrecht in the Netherlands and participated in training mainly in creative, technical, and health education. Adolescents ($N = 1,429$) filled out questionnaires on three occasions: in autumn 2019/winter 2020 (T1, $n = 1,231$); roughly six months later in late spring 2020 (T2, $n = 830$); and roughly one year after the first wave in autumn 2020/winter 2021 (T3, $n = 576$). There was substantial attrition, with only about a quarter of the adolescents (386) participating at all three time-points. Structural changes made to the project necessitated by the Covid-19 pandemic and education transitioning to being (largely) online in spring 2020 were substantially responsible for the attrition. We were also unable to reach participants that had dropped out of school between measurements. Roughly a quarter of the classes that participated in Wave 1 did not participate in Wave 2. Within classes that participated, the adolescent response rate was over 65% and about 15% of the non-responding adolescents had dropped out of school before Wave 2. In Wave 3, one school dropped out of the study, so nearly half of the classes that participated in Wave 1 did not participate in Wave 3. Within classes that participated, the adolescent response rate was over 60% and roughly 20% of the non-responding adolescents had dropped out of school before Wave 3. Researchers administrated self-report questionnaires in the classroom (T1) or during online lessons (T2 and T3) and these took about 20-30 minutes to complete. Adolescents gave active consent and were informed that data would be anonymised.

We included all participants in this study. Just over half of the adolescents were girls (57%) and 19% had a non-western migration background. The mean age of all participants at T1 was 17.9 years (ranging from 15-30). There was missing data based on attrition, but very little missing data per time-point when an adolescent

participated: in all three waves, over 90% of participants answered over 95% of the questions. Demographic characteristics of adolescents who participated at all three time-points ($n = 386$) were compared to those of adolescents who participated in fewer than three time-points ($n = 1,043$). Adolescents who participated in all waves: were younger ($M_{age} = 17.4$ vs $M_{age} = 18.0$), less often had a non-western migration background (9% vs 23%), and at T1 had higher family affluence (.55 vs. 48), higher perceived family wealth (3.12 vs. 2.98), lower self-esteem (4.61 vs. 4.84), and lower levels of conduct problems (0.81 vs. 1.00). All these differences between adolescents who participated at all three time-points, and those who did not, were small (J. Cohen, 1992), and we found no differences between the groups at T1 in sense of control, optimism, or the other mental health problems measured. The project was approved by the Ethics Assessment Committee of the Faculty of Social Sciences at Utrecht University in 2018 (FETC18-070; updated in 2020).

Measures

Socioeconomic status

At all three time-points, adolescents reported *perceived family wealth* by answering the question, “How well off do you think your family is?” The item had a 5-point response scale from 1 (*very well off*) to 5 (*not at all well off*) and we reversed the scale so that higher scores indicated higher perceived family wealth. The measure is easy to answer for adolescents and reflects the subjective dimension of SES (Inchley et al., 2017).

Adolescent social cognitions

Social cognitions were measured with the same instruments at all three time-points. Adolescents reported *self-esteem* using the single item self-esteem scale (Robins et al., 2001). The item, “I have high self-esteem”, was measured on a 5-point Likert scale, ranging from 1 (*not very true of me*) to 7 (*very true of me*). Higher scores indicated higher self-esteem. The item is reliable, valid in older adolescents, has convergent correlation with the most widespread instrument for measuring self-esteem, and is widely-used and considered to be an appropriate brief instrument for measuring global self-esteem in longitudinal (online) studies (Brailovskaia & Margraf, 2020; Robins et al., 2001)

Adolescents reported *sense of control* using the sense of control scale (Lachman & Weaver, 1998). The scale consists of 12 questions, covering two subscales

¹ After submitting a preregistration, which described a cross-sectional study, it became possible to address the research questions

more thoroughly using longitudinal data. The analytic plan described in this paper therefore differs somewhat from the plan in the preregistration.

of personal mastery (four questions) and perceived constraints (eight questions), measured on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Sample items are “I can do just about anything I really set my mind to” (personal mastery) and “What happens in my life is often beyond my control” (perceived constraints). We decided a priori to omit one item (in the constraints subscale, “I sometimes feel I am being pushed around in my life”), due to the lack of a suitable Dutch translation, leaving 11 questions. In line with previous research, we reverse-coded the perceived constraints subscale, and then computed the mean of the two scales to create a measure of control, with higher scores indicating higher sense of control (Lachman & Agrigoroaei, 2010).² The scale has good psychometric properties (Lachman & Weaver, 1998), including in adolescents (B. Chen et al., 2021). In the current study, the scale had good internal consistency ($\alpha = .79/.79/.81$ at T1/T2/T3).

Adolescents reported *optimism* using the future emotions questions scale (Hektner, 1995; Liebenberg et al., 2015). The scale asked, “when thinking about the future, to what extent do you feel any of the following?”. The scale listed seven emotions, with responses measured on a 5-point Likert scale running from 1 (*not at all*) to 5 (*very much*). The scale has good internal as well as convergent and divergent validity in adolescents (Liebenberg et al., 2015). In line with previous research, we calculated the mean of the three positive emotions – confident, enthusiastic, powerful – as our measure of optimism (Boden et al., 2016). In the current study, the items had good internal consistency ($\alpha = .82/.79/.83$ at T1/T2/T3).

Adolescent mental health problems

Mental health problems were measured with the same instruments at all three time-points. Adolescents reported *emotional symptoms*, *conduct problems*, *hyperactivity*, and *peer problems* using the SDQ-R: a revised version of the self-report Strengths and Difficulties Questionnaire (SDQ) that has better psychometric properties in adolescents than the original (Duijnhof et al., 2019; R. Goodman, 1997). The SDQ-R asks about behavior and feelings over the past six months – sample items are “I get very angry and often lose my temper” and “I worry a lot”. The SDQ-R has a 3-point ordinal response scale: 0 (*not true*), 1 (*somewhat true*), 2 (*certainly true*). The SDQ-R consists of 15 items measuring four subscales: emotional symptoms (5 items); conduct problems (4 items); hyperactivity–inattention problems

(3 items); and peer relationship problems (3 items). In this study, two subscales, emotional symptoms (ordinal $\alpha = .82/.82/.84$ at T1/T2/T3) and hyperactivity–inattention problems (ordinal $\alpha = .79/.80/.81$ at T1/T2/T3), had good internal consistency (Gadermann et al., 2012), though internal consistency for conduct problems (ordinal $\alpha = .58/.71/.67$ at T1/T2/T3) and peer problems subscales (ordinal $\alpha = .53/.51/.59$ at T1/T2/T3) was less adequate, in line with former research (Duijnhof et al., 2019). For participants who completed more than half of the subscale items, we computed mean scores, which were then multiplied by five to retain comparability with the original SDQ, such that higher subscale scores indicated more problems (ranging from 0 to 10).

Potential confounding variables

We included four confounding variables, given the likely effect of gender, age, migration background, and family affluence on adolescent mental health in the Netherlands (Duijnhof et al., 2020). At T1 (or later, if missing at T1), adolescents reported: whether they were a girl (coded 0) or boy (coded 1); month and year of birth (used to calculate age at the date of data collection); parents’ birth countries; and family affluence. We also considered adding dummy variables for the three schools, but these were not associated with any of the social cognitions or mental health problems, thus were not included in the models.

Conforming with previous research in the Netherlands, and Dutch statistical agencies, we measured migration background by distinguishing between: adolescents with both parents born in the Netherlands; adolescents with at least one parent with a western immigration background; and adolescents with at least one parent with a non-western immigration background (Duijnhof et al., 2020; Statistics Netherlands, CBS, 2020). Only 6% of adolescents had a western immigration background, so we merged this group with adolescents whose parents were born in the Netherlands, as both groups are western.

Adolescents reported *family affluence* using the Family Affluence Scale (FAS), which consists of six items about family material assets: car(s)/van(s), own bedroom, holiday(s) abroad, computer(s), dishwasher, and bathroom(s) (Torsheim et al., 2016). For participants who completed all scale items, we summed item scores, then r-dit-transformed the sum score into a continuous family affluence score (range = 0-1; mean = 0.5), with a higher score indicating more material assets

² A slightly different approach to calculating the sense of control scale was outlined in our pre-registration. The change, made at the stage of examining descriptive statistics, was made to preserve scale

values (whereas the approach outlined in the preregistration included standardisation, and thus did not).

(Elgar et al., 2017). The FAS is a reliable and valid instrument that enables adolescents to report their family affluence (Torsheim et al., 2016).

Data analysis

We investigated descriptive statistics to see whether school, gender, age, migration status, school, and family affluence were associated with perceived family wealth and mental health and thus needed to be treated as confounders. We followed guidelines for using path analysis to test mediational hypotheses with longitudinal data, accounting for stability of, and prior associations between, the variables (Cole & Maxwell, 2003). Confounders were included in all models, and error covariances and autoregressive paths were constrained to be time-invariant. We used R, version 4.0.3 (R Core Team, 2020), and the lavaan package, version 0.6-5 (Rosseel, 2012). We modelled missing data using Full Information Maximum Likelihood (FIML) and evaluated goodness-of-fit using two measures, with good model fit indicated by $CFI \geq .95$ and $RMSEA < .06$ (Hu & Bentler, 1999).

In our initial model (Model 1), we specified a longitudinal model to examine whether SES predicted later increases in mental health problems (see Figure 1 for diagram showing results). Next, we investigated mediation of the path from perceived family wealth to mental health through social cognitions, entering one social cognition at a time (Models 2a-c; see Figures 2-4 for diagrams showing results). Finally, we investigated a multiple mediation model with all three social cognitions (Model 2d; see also Figures 2-4). To examine mediation, we tested the significance of indirect effects (i.e., the product of the path from perceived family wealth at T1 to social cognition at T2, and the path from social cognition at T2 to mental health problem at T3). To control for inflation of Type I error rates based on multiple testing, we applied the Benjamini-Hochberg procedure with a false discovery rate of 0.05 (Benjamini & Hochberg, 1995). We interpreted standardised regression coefficients as negligible ($|r| < 0.1$), small ($|r| = 0.1-0.3$), medium ($|r| = 0.3-0.5$), or large ($|r| > 0.5$) (J. Cohen, 1992).

Results

Descriptive statistics

Table 1 shows variable means and standard deviations, all correlations between confounders and the

main study variables, and concurrent correlations between the variables. Compared to scale midpoints, adolescents' perceptions of their family wealth remained fairly average over the three time-points, and they reported relatively high self-esteem, sense of control, and optimism, all of which were fairly stable across time. The mean levels of mental health problems were relatively low, except for hyperactivity, which was somewhat higher, and there was substantial variation in all mental health problems. Emotional symptoms and hyperactivity increased from T1 to T3. Associations between the confounders and the main study variables were fairly stable over time. There were several exceptions to this: slight changes in associations between the confounders and optimism from T1 to T3, and changes in associations between migration background, and to some extent, family affluence, and the main study variables at T3. These changes may have been due to changes in the sample characteristics across the time-points (see the sample description above).

Concurrent associations between the main study variables were generally stable over time. At all time-points, perceived family wealth was positively associated with social cognitions (r s ranged from .11 to .21), and negatively associated with emotional symptoms and peer problems (r s range from -.11 to -.18). At all time-points, the social cognitions were positively associated with each other (r s range from .43 to .53) and negatively associated with mental health problems (r s range from -.13 to -.60), with one exception: self-esteem was not associated with conduct problems ($r = -.05/-.07/.00$ at T1/T2/T3). Apart from hyperactivity and peer problems, which had a small, or no, association ($r = .11/.07/.05$ at T1/T2/T3), all other associations between mental health problems were positive (r s range from .21 to .36).

Associations between confounders, perceived family wealth and mental health problems

In Model 1, when we included confounding variables and perceived family wealth only, we found that older adolescents reported higher levels of emotional symptoms and peer problems at T1; girls reported higher levels of emotional symptoms at T1 than boys, and boys reported higher levels of conduct problems at T1 than girls; adolescents with a Dutch/western migration background reported more emotional symptoms and more hyperactivity at T1 than adolescents with a non-western migration background; and adolescents with higher family affluence reported fewer emotional

symptoms at T1. Perceived family wealth at T1 was associated with emotional symptoms and peer problems at T1. All autoregressive paths for perceived family wealth and the mental health problems were significant, indicating stability in these constructs. Perceived family wealth at T1 was only associated with peer problems at T3 (one year later; see Figure 1).

Mediation of associations between perceived family wealth and mental health problems

Models 2a-d examined indirect effects of perceived family wealth on mental health problems. Considering the three social cognitions one at a time, the results of the model with single mediators (2a-c) were compared to those of the multiple mediation model (which included the three social cognitions in concert, 2d). Mediation paths were constrained to be time-invariant (i.e., T1-T2 paths were equal to T2-T3 paths), so results showed whether perceived family wealth predicted change in social cognitions six months later, and whether social cognitions predicted change in mental health six months later.

Testing mediation through self-esteem

Models 2a and 2d showed that perceived family wealth at T1 was positively associated with self-esteem at T1, but there was no evidence perceived family wealth predicted change in self-esteem six months later (see Figure 2). Self-esteem at T1 was concurrently negatively associated with emotional symptoms, hyperactivity, and peer problems (i.e., at T1). Lower self-esteem also predicted increases in emotional symptoms six months later, a result which attenuated slightly, but still held, in the multiple mediation model (2d). In this model, lower self-esteem also predicted increases in later conduct problems. There was no evidence for indirect effects of perceived family wealth on mental health problems through self-esteem. In sum, we found no mediation, because perceived family wealth did not

predict changes in self-esteem, though lower self-esteem did predict increases in later emotional symptoms and decreases in later conduct problems.

Testing mediation through sense of control

Models 2b and 2d showed that perceived family wealth at T1 was concurrently positively associated with sense of control, and perceived family wealth also positively predicted sense of control six months later (see Figure 3). Sense of control at T1 was concurrently negatively associated with all four mental health problems. Lower sense of control also predicted increases in emotional symptoms and hyperactivity six months later, though the former result did not hold in the multiple mediation model (2d). There were indirect effects of perceived family wealth on both emotional symptoms and hyperactivity through sense of control, though both findings disappeared in the multiple mediation model. In sum, we found evidence for mediation: lower perceived family wealth predicted a decrease in sense of control, and lower sense of control predicted increases in later emotional symptoms and hyperactivity (though only in univariate model but not in a multivariate model with all three social cognitions).

Testing mediation through optimism

Finally, Models 2c and 2d showed that perceived family wealth at T1 was positively associated with optimism at T1, but we found no evidence that perceived family wealth predicted later optimism (see Figure 4). Optimism at T1 was concurrently negatively associated with all four mental health problems, and less optimism also predicted increases in all four mental health problems six months later. However, these findings all attenuated, and were not found in the multivariate model which included all three social cognitions (2d). There was no evidence of indirect effects of perceived family wealth on mental health through optimism. In sum, we found no mediation, because perceived family wealth did not predict changes in optimism, though less optimism did predict increases in later mental health problems (but not once self-esteem and sense of control were also taken into account).

Table 1. Descriptive statistics (means, standard deviations, ranges, *ns* and correlations) for study variables

	1	2	3	4	5	6	7	8	9	10	11	Mean	SD	Range	<i>n</i>
1. Age ^a												17.85	1.95	15-30	1423
2. Gender ^b	.04											0.43	0.49	0-1	1427
3. Migration background	.19**	-.06*										0.19	0.39	0-1	1377
4. Family affluence	-.16**	.07*	-.25**									0.50	0.28	0-1	1273
	T1														
5. Perceived family wealth	-.18**	.08**	-.21**	.41**								3.02	0.74	1-5	1199
6. Self-esteem	.07*	.16**	.19**	.06*	.11**							4.77	1.49	1-7	1196
7. Sense of control	-.04	.14**	-.01	.11**	.21**	.47**						3.70	0.51	2-5	1186
8. Optimism	-.01	.05	.07*	.10**	.16**	.44**	.52**					3.80	0.75	1-5	1183
9. Emotional sympt.	.04	-.29**	-.12**	-.10**	-.15**	-.57**	-.45**	-.41**				3.08	2.53	0-10	1192
10. Conduct prob.	.04	.09**	-.02	-.01	-.04	-.05	-.18**	-.21**	.25**			0.94	1.35	0-10	1191
11. Hyperactivity	-.06*	-.02	-.16**	.09**	.01	-.20**	-.19**	-.19**	.32**	.28**		4.46	3.02	0-10	1193
12. Peer prob.	.14**	-.03	-.01	-.05	-.11**	-.16**	-.16**	-.21**	.36**	.21**	.11**	2.61	1.94	0-10	1192
	T2														
5. Perceived family wealth	-.18**	.08*	-.17**	.40**								3.17	0.75	1-5	798
6. Self-esteem	.07	.23**	.07*	.08*	.17**							4.64	1.39	1-7	805
7. Sense of control	-.03	.17**	-.05	.14**	.18**	.43**						3.60	0.48	2-5	802
8. Optimism	-.02	.07*	.04	.07*	.20**	.44**	.48**					3.77	0.71	1-5	800
9. Emotional sympt.	.01	-.32**	-.03	-.11**	-.16**	-.56**	-.48**	-.37**				3.54	2.55	0-10	805
10. Conduct prob.	.05	.03	.10**	-.08*	-.04	-.07*	-.27**	-.16**	.27**			1.03	1.49	0-10	806
11. Hyperactivity	-.07	-.03	-.08*	-.03	-.05	-.15**	-.21**	-.13**	.33**	.29**		5.07	3.04	0-10	806
12. Peer prob.	.10**	-.05	.01	-.06	-.10**	-.21**	-.19**	-.15**	.31**	.24**	.07*	2.84	1.96	0-10	806
	T3														
5. Perceived family wealth	-.14**	.06	-.19**	.39**								3.22	0.77	1-5	555
6. Self-esteem	.03	.26**	.02	.09*	.16**							4.62	1.42	1-7	559
7. Sense of control	-.09*	.16**	-.01	.08	.19**	.47**						3.56	0.51	1.8-5	559
8. Optimism	-.13**	.11*	-.01	.05	.14**	.53**	.51**					3.71	0.79	1-5	558
9. Emotional sympt.	.02	-.36**	.05	-.14**	-.18**	-.60**	-.50**	-.44**				3.67	2.66	0-10	558
10. Conduct prob.	.06	.09*	.10*	-.04	-.05	.00	-.24**	-.14**	.25**			1.06	1.43	0-7.5	558
11. Hyperactivity	-.07	-.06	.03	.02	-.06	-.17**	-.22**	-.17**	.35**	.22**		5.41	3.01	0-10	559
12. Peer prob.	.13**	-.04	.07	-.14**	-.12**	-.16**	-.24**	-.18**	.33**	.24**	.05	2.72	1.93	0-10	558

Note. Correlations between main study variables are shown per time-point. ^a Participants under 16 at the start of data collection were not included at T1, but participated in T2 and/or T3 once they had reached 16. ^b Reference category: girl. ^c Reference category: Dutch/western. * $p < .05$. ** $p < .01$.

Model 1 – Perceived family wealth and mental health

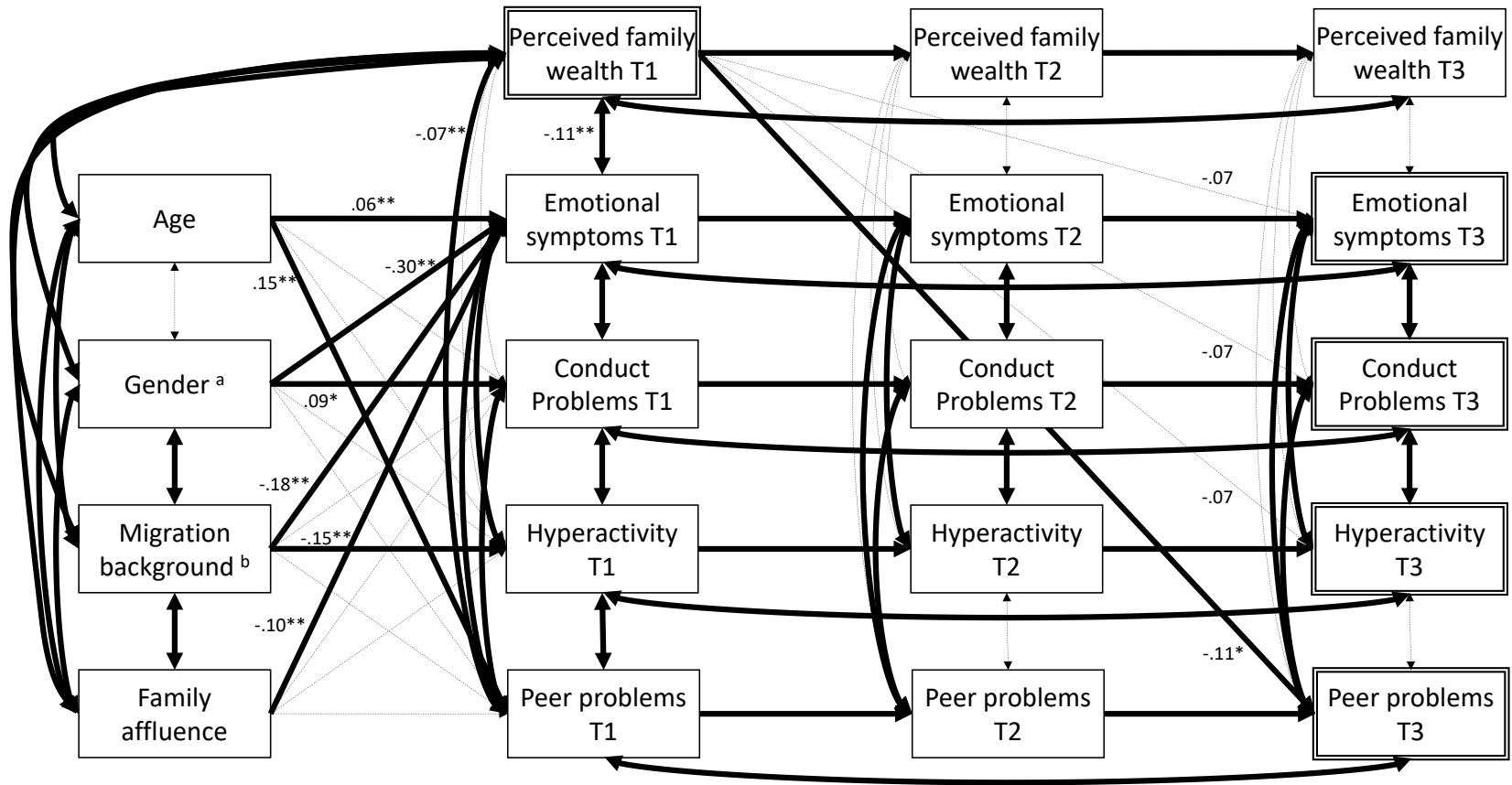
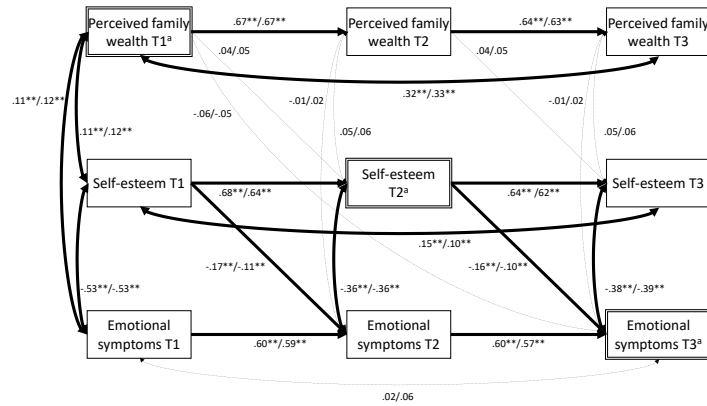


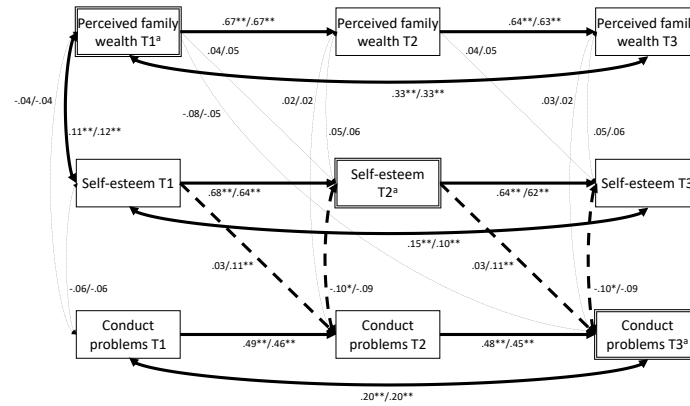
Figure 1 Model showing associations between confounders, perceived family wealth, and adolescent mental health problems (Model 1).

Note. Standardised coefficients. Continuous thick lines indicate significant paths ($p < .05$); dashed thin lines indicate insignificant paths ($p > .05$). Only significant coefficients for confounders, and associations between perceived family wealth at T1 and mental health at T1 and T3 (one year later), are shown. This model was the basis for Models 2a-d. Model fit $1 - \chi^2(111) = 400.3$, $p < .001$, CFI = 0.942, RMSEA = 0.043. ^a Reference category: girl. ^b Reference category: Dutch/western. * $p < .05$. ** $p < .01$.

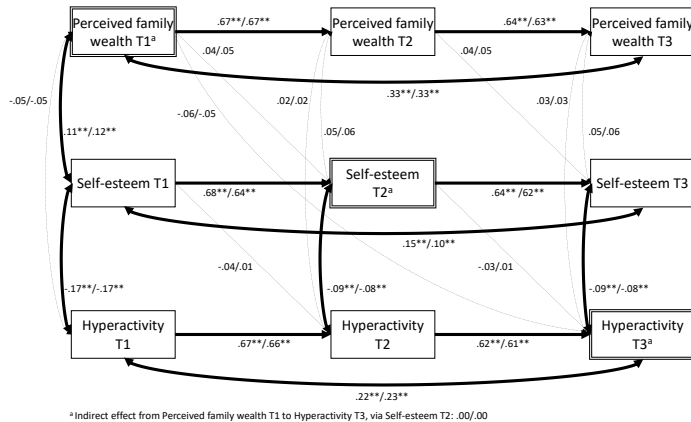
Model 2a/Model 2d – Self-esteem and Emotional symptoms



Model 2a/Model 2d - Self-esteem and Conduct problems



Model 2a/Model 2d - Self-esteem and Hyperactivity



Model 2a/Model 2d - Self-esteem and Peer problems

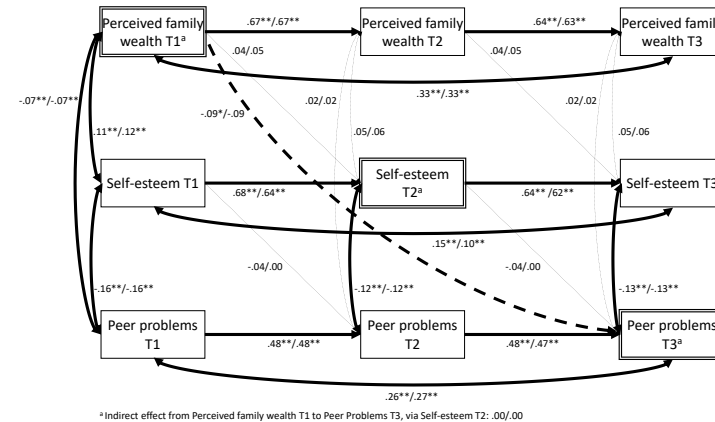
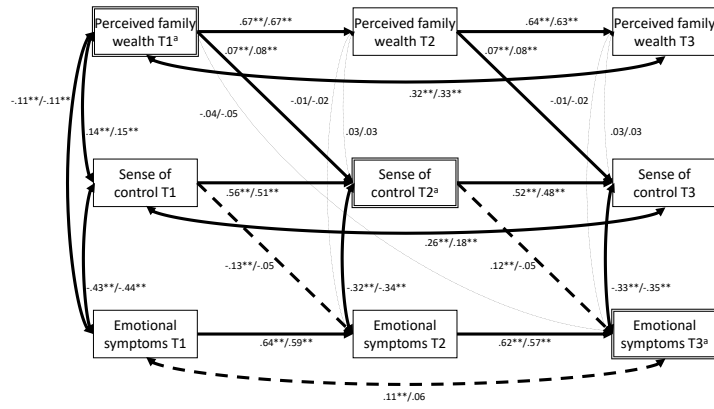


Figure 2 The association between SES and adolescent mental health problems mediated by self-esteem (Models 2a and 2d).

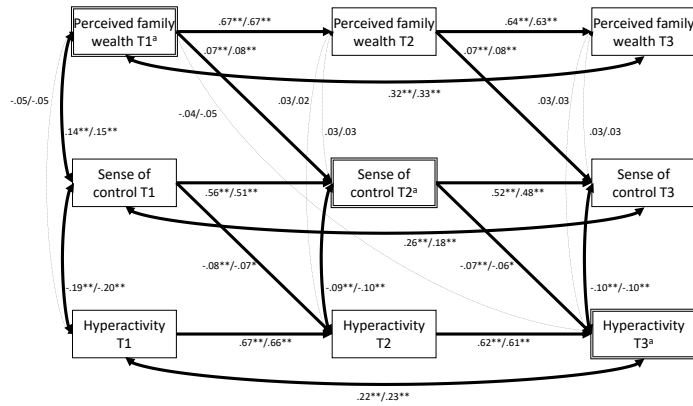
Note. Standardised coefficients (same values constrained to equality may differ slightly after standardization). The first coefficient indicates Model 2a result (self-esteem only), the second coefficient indicates the Model 2d result (all three social cognitions included in the model). Continuous thick lines indicate significant paths ($p < .05$); dashed thin lines indicate insignificant paths ($p > .05$). Dashed thick lines indicate significance of path differs between Models 2a and 2d. All paths were estimated in the same models, but results are presented in four panels (i.e., for each mental health outcome) for clarity. Associations with confounders and covariances between mental health problems are not shown. Key variables in the hypothesised mediation path are highlighted with a double border. Model fit 2a – $\chi^2(150) = 500.0, p < .001, CFI = 0.946, RMSEA = 0.040$. Model fit 2d – $\chi^2(249) = 766.4, p < .001, CFI = 0.943, RMSEA = 0.038$.

Model 2b/Model 2d – Sense of control and Emotional symptoms



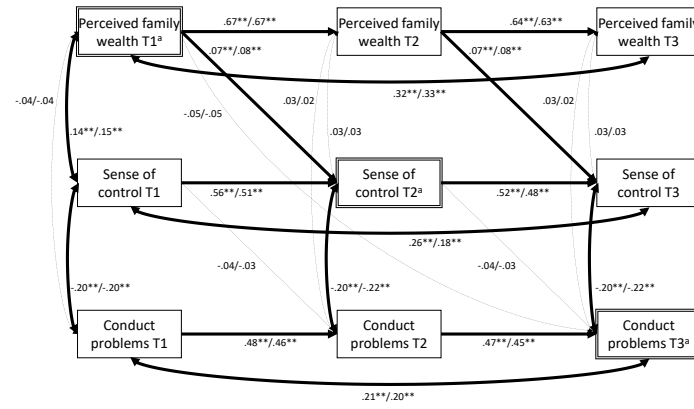
* Indirect effect from Perceived family wealth T1 to Emotional symptoms T3, via Sense of control T2: -.01*/.00

Model 2b/Model 2d – Sense of control and Hyperactivity



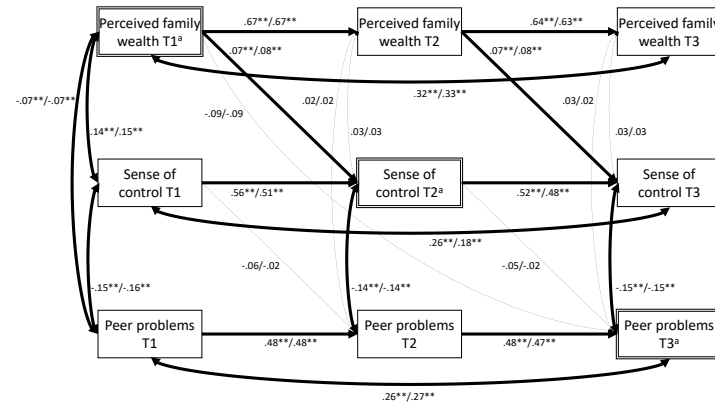
* Indirect effect from Perceived family wealth T1 to Hyperactivity T3, via Sense of control T2: -.01*/.00

Model 2b/Model 2d – Sense of control and Conduct problems



* Indirect effect from Perceived family wealth T1 to Conduct problems T3, via Sense of control T2: .00/.00

Model 2b/Model 2d – Sense of control and Peer problems

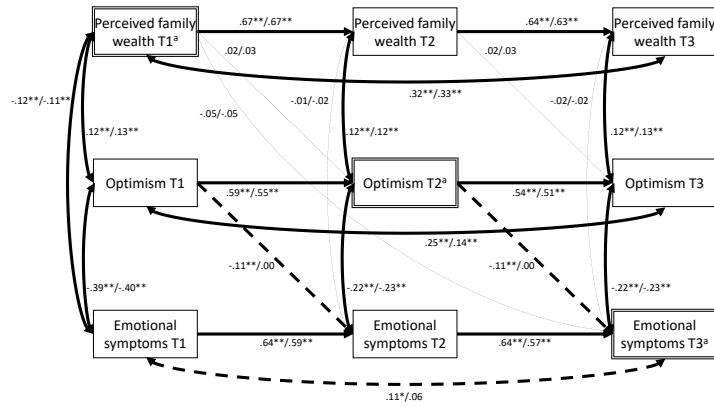


* Indirect effect from Perceived family wealth T1 to Peer problems T3, via Sense of control T2: .00/.00

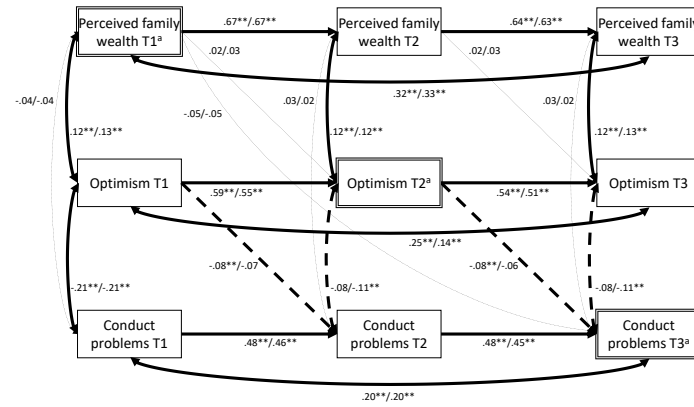
Figure 3 The association between SES and adolescent mental health problems mediated by sense of control (Models 2b and 2d).

Note. Standardised coefficients (same values constrained to equality may differ slightly after standardization). The first coefficient indicates Model 2b result (sense of control only), the second coefficient indicates the Model 2d result (all three social cognitions included in the model). Continuous thick lines indicate significant paths ($p < .05$); dashed thin lines indicate insignificant paths ($p > .05$). Dashed thick lines indicate significance of path differs between Models 2b and 2d. All paths were estimated in the same models, but results are presented in four panels (i.e., for each mental health outcome) for clarity. Associations with confounders and covariances between mental health problems are not shown. Key variables in hypothesised mediation path highlighted with double border. Model fit 2b – χ^2 (150) = 484.6, $p < .001$, CFI = 0.945, RMSEA = 0.040. Model fit 2d – χ^2 (249) = 766.4, $p < .001$, CFI = 0.943, RMSEA = 0.038.

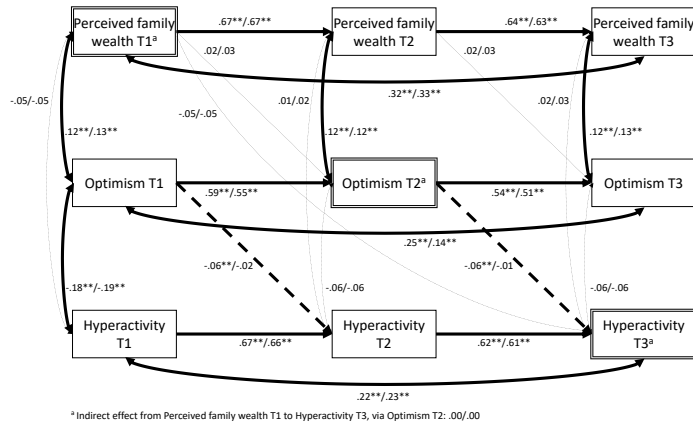
Model 2c/Model 2d – Optimism and Emotional symptoms



Model 2c/Model 2d – Optimism and Conduct problems



Model 2c/Model 2d – Optimism and Hyperactivity



Model 2c/Model 2d – Optimism and Peer problems

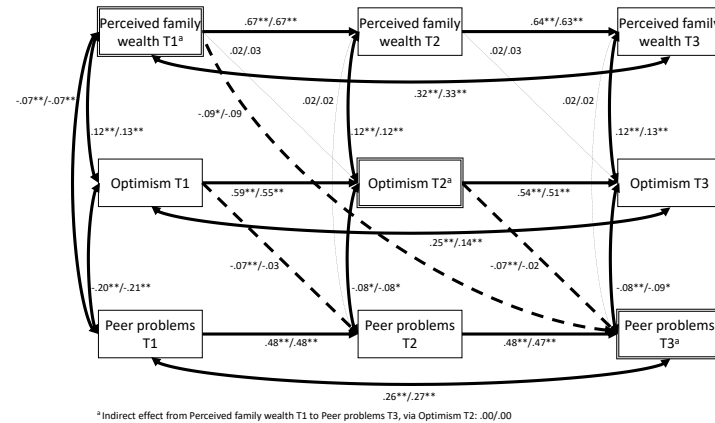


Figure 4 The association between SES and adolescent mental health problems mediated by optimism (Models 2c and 2d).

Note. Standardised coefficients (same values constrained to equality may differ slightly after standardization). The first coefficient indicates Model 2c result (optimism only), the second coefficient indicates the Model 2d result (all three social cognitions included in the model). Continuous thick lines indicate significant paths ($p < .05$); dashed thin lines indicate insignificant paths ($p > .05$). Dashed thick lines indicate significance of path differs between Models 2c and 2d. All paths were estimated in the same models, but results are presented in four panels (i.e., for each mental health outcome) for clarity. Associations with confounders and covariances between mental health problems are not shown. Key variables in hypothesised mediation path highlighted with double border. Model fit 2c – $\chi^2(150) = 473.6, p < .001, CFI = 0.945, RMSEA = 0.039$. Model fit 2d – $\chi^2(249) = 766.4, p < .001, CFI = 0.943, RMSEA = 0.038$

Discussion

This study was the first, to our knowledge, to explore whether three social cognitions – self-esteem, sense of control, and optimism – mediated the social gradient in adolescent mental health. Using longitudinal models, thereby controlling for stability in the constructs over time, we found evidence that sense of control mediated this social gradient. Adolescents with lower perceived family wealth reported a decrease in sense of control six months later, and lower sense of control predicted increases in emotional symptoms and hyperactivity six months later (though this was not seen in the multivariate model with all three social cognitions). In contrast, perceived family wealth predicted neither later self-esteem nor later optimism, so there was no longitudinal evidence for mediation through either self-esteem or optimism. However, these two social cognitions did predict later mental health: adolescents with lower self-esteem reported a later increase in emotional symptoms and a decrease in conduct problems, while adolescents with less optimism reported a later increase in all four mental health problems.

To better understand possible links between perceived family wealth, social cognitions, and adolescent mental health, we also considered concurrent associations, which helped to contextualise previous cross-sectional research findings. At T1, adolescents with lower perceived family wealth reported more negative social cognitions (lower self-esteem, lower sense of control, and less optimism), more emotional problems, and more peer problems. Additionally, adolescents with more negative social cognitions – lower self-esteem, lower sense of control, and less optimism – had worse mental health (for all four outcomes).

Our finding that adolescents with lower perceived family wealth reported (compared to adolescents with higher perceived family wealth) higher levels of emotional symptoms and peer problems, and reported a relative increase in peer problems six months later, builds on previous cross-sectional findings in the Netherlands (Weinberg et al., 2019). The longitudinal design enabled us to test more stringently the directionality of the association between perceived family wealth and adolescent mental health (see also E. Goodman et al., 2007; Rahal et al., 2020). Further longitudinal research could replicate our finding that subjective SES precedes adolescent peer problems or explore this relationship in another country or over a different length of time.

We found evidence that sense of control was a mediator: it was concurrently associated with perceived family wealth and all four adolescent mental health outcomes; and was a longitudinal mediator of paths from perceived family wealth to emotional symptoms and hyperactivity. Our findings built on previous research, which measured SES, sense of control, and depression at a single time point (Culpin et al., 2015). Adolescents with a lower sense of control tend to have more feelings of anxiety, frustration, powerlessness, and being trapped, than their peers with higher sense of control, and these emotional responses may explain why adolescents with lower sense have higher levels of mental health problems (Bosma et al., 2014; Chorpita & Barlow, 1998; Jung et al., 2018; Whitehead et al., 2016). Most previous research on the role of sense of control in mental health has been focused on adults and been based on experiences of control in the workplace (Whitehead et al., 2016); our results support proposals to pay further attention to how sense of control develops in adolescence and its role in the social gradient in adolescent mental health (Pearce et al., 2019). For example, research could explore mechanisms that may link SES and sense of control.

We found no longitudinal evidence that self-esteem mediated the social gradient in adolescent mental health, because perceived family wealth did not predict self-esteem six months later. Possibly, the absence of findings was due to the stability in these constructs during the one year of this study, and further longer-term research into these associations may be fruitful given we found concurrent associations between perceived family wealth, self-esteem, and mental health problems, which supported existing research (Yan et al., 2020). We did find that adolescents with lower self-esteem than their peers reported an increase in later emotional symptoms. Additionally, and intriguingly, once we had taken sense of control and optimism into account, higher self-esteem predicted *more* conduct problems six months later. This result supports suggestions that higher self-esteem can be a risk factor for conduct problems when it indicates narcissism – insecure and inauthentic self-esteem which is vulnerable to ego threats (Menon et al., 2007).

Similarly, we found no longitudinal evidence that optimism mediated the social gradient in adolescent mental health. Though perceived family wealth was concurrently associated with optimism, it did not predict change in optimism six months later. Optimism is relatively stable over time (Carver et al., 2010), and an

alternative explanation for this cross-sectional association is that optimism is a precursor to perceived family wealth. Being optimistic may help adolescents perceive their SES more positively, and may also help them improve educational outcomes and other markers of SES (Ciarrochi et al., 2007), which could also increase future perceptions of wealth. This possibility was not modelled in our study, nor in prior research on optimism's role in the social gradient (Piko et al., 2013; Zou et al., 2020). However, though we found no evidence optimism mediated the social gradient, we found that adolescents with less optimism, as compared to adolescents with more optimism, reported a later increase in all four mental health problems. This finding supports evidence that optimism can reduce mental health problems (Patton et al., 2011), perhaps because it helps adolescents cope with stress, persist in the face of challenges, and develop good relationships (S. Cohen & Wills, 1985; Patton et al., 2011).

Along with specific findings for each social cognition, the study provides some support for our general hypothesis that adolescents' social cognitions mediate the social gradient in adolescent mental health. The results showed that adolescents with lower perceived family wealth had more negative social cognitions, perhaps in response to the uncertainty and stress of their developmental context (Kraus et al., 2012; Sheehy-Skeffington, 2020; Stephens et al., 2014). We also found, in general, that adolescents with more negative social cognitions had worse mental health (cf., Taylor & Brown, 1988). Notably, several longitudinal associations between the social cognitions and mental health problems disappeared in the multivariate model which took all three social cognitions into account. Alongside the medium-large correlations we saw between the social cognitions, this suggests that the three social cognitions share pathways to mental health, perhaps through processes such as adaptive coping, persistence, and relationship maintenance (Carver et al., 2010; Hitlin et al., 2015; McWhirter & McWhirter, 2008). These social cognitions may be particularly important during adolescence.

Much existing research on the social gradient in adolescent mental health has focused on family factors (R. D. Conger & Donnellan, 2007; Devenish et al., 2017), yet our findings emphasise that adolescents' internal cognitions – particularly, how adolescents interpret and make sense of themselves (Adler & Tan, 2017; E. Chen et al., 2002; Fiske & Taylor, 2013) – may also be relevant to this social gradient. During this age period, when adolescents orient towards peers, think

about their future, and reflect on social status, links between SES, social cognitions, and mental health may be greater, and further research attention on this topic is warranted (Brown & Larson, 2009; Crone & Dahl, 2012; Flanagan et al., 2014). Future research could look at dynamic relations between social cognitions and family factors during adolescence and their role in the social gradient in adolescent mental health (see also Boylan et al., 2018; R. D. Conger & Donnellan, 2007; Kim et al., 2019). It may also be important to use person-centered approaches, given evidence that positive social cognitions may be inappropriate for some adolescents in some social contexts (Pepper & Nettle, 2017; Stephens et al., 2014).

Strengths and limitations

This study has several strengths, including its longitudinal mediation model design with three waves of data, which could distinguish effects over time after taking into account the stability in constructs. It also used a socioeconomically diverse sample of adolescents in vocational education and included multiple indicators of adolescents' social cognitions and mental health problems. However, our study also has limitations. First, though longitudinal data gives an indication of the temporal precedence necessary for studying mediation, our results do not rule out that personality and genetic factors may confound these associations (Hoebel & Lampert, 2018). Furthermore, our panel model design is unable to disentangle the between-person effects (our focus) and within-person effects (Orth et al., 2021). Future studies using alternative strategies, such as using random-intercept cross-lagged panel models (Hamaker et al., 2015) to investigate within-person mediation, would provide further insight into the links between SES, social cognitions, and mental health during adolescence. Second, we were restricted to studying associations over a one-year period, which may not have been long enough for some associations (e.g., between perceived family wealth and optimism) to evolve. Third, there were fairly low levels of mental health problems in the sample. However, the SDQ has shown adequate psychometric properties in other studies with older adolescents and young adults, so is appropriate for assessing mental health in this sample (Brann et al., 2018). Fourth, self-esteem was measured with the single-item self-esteem scale, which may have lower test-retest reliability than multi-item measures of self-esteem, and be unable to distinguish between different dimensions of self-esteem (Donnellan et al., 2015). However, the item has convergent correlation with the

most widespread scale for measuring self-esteem and is therefore expected to be appropriate brief instrument. Fifth, the representativeness of our sample was limited in that there was more attrition of adolescents with lower SES backgrounds and of those with a non-western migration background. Additionally, these results for adolescents in vocational education in the Netherlands may not generalise to adolescents in pre-university education or in other cultural contexts. For example, research in adults suggests social cognitions may play a different role in social gradients in health in more collectivistic countries (Kan et al., 2014). Future work could explore the mediating role of social cognitions in late adolescence across several countries. Sixth, the study coincided with the Covid-19 pandemic, which began between T1 and T2. However, given that the effects of the pandemic have been experienced by our entire sample (G. W. J. M. Stevens et al., 2021), it is unlikely that the pandemic influenced the generalizability of the findings.

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Conclusion

Overall, by studying three mediating social cognitions, four adolescent mental health problems, and using longitudinal modelling, the results of this study illuminate the social gradient in adolescent mental health. In particular, adolescent's sense of control appears to be an important mediator of this social gradient. Interventions which can weaken the associations between SES and social cognitions, or between social cognitions and mental health, may be effective in reducing the social gradient in adolescent mental health (Yeager et al., 2018). Our results serve as a valuable starting point for further investigation into the role of adolescent social cognitions in the pathways between SES and adolescent mental health.

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