

## Article

# Interplay of subjective and objective economic well-being on the mental health of Norwegian adolescents

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## ABSTRACT

Objective and subjective socioeconomic status (SES) are important determinants of adolescent mental health problems, but we know less about how they interact. Research has demonstrated independent associations of both variables to mental health problems, but less is known about their relationship and role in adolescent mental health problems. Data from the youth@hordaland study, a survey of 9079 Norwegian adolescents aged 16 to 19 were linked to official tax register information about household income, and was used to examine the relationship between perceived economic well-being and household income. We also investigated how perceptions of economic well-being interacted with household income in relation to adolescent mental health problems. The overall relationship between perceived and actual household income was relatively low ( $r = .33$  [95% CI = 0.32–0.35],  $p < .001$ ), although this relationship was somewhat higher in adolescents with either low or high household incomes. Low income and unfavorable perceptions of economic well-being were associated with most mental health problems. Importantly, the mental health benefits associated with higher income appeared to depend on the adolescents' perceptions of their family's relative economic position. The results show moderate associations between perceived economic well-being and household income and that the influence of perceived economic well-being on conduct- and peer problems depended on the level of household income. Symptoms of depression explained some of this association. Knowledge about how the adolescents feel about their relative economic standing may be potentially important information for adolescents with mental health problems, and additional work is needed to understand how adolescents establish perceptions of economic rank.

Low socioeconomic status (SES) has been associated with poor health and development in adolescents (McLaughlin et al., 2012; Newacheck et al., 2003). Adolescents with lower SES as measured by objective indicators (e.g. low income, lower parental education and occupational status) have more symptoms of mental health problems compared to peers with higher SES (Letourneau et al., 2013; Reiss, 2013).

Low income influence children's mental health largely indirectly through adverse effects on their physical surroundings and psychosocial experiences (Dearing, 2008; Duncan, Morris, & Rodrigues, 2011). Specifically, low income constraints material and psychosocial investments and supportive resources that could be developmentally stimulating (Foster, 2002). Low income also increases parental stress, with negative consequences for the parent-child relationship (Bøe et al., 2014; Conger,

Conger, & Martin, 2010). Low income is also associated with more chaotic living conditions (Evans et al., 2005), potentially resulting in less efficient physiological responses to stressful situations (Evans et al., 2007).

There are also strong suggestions that *subjective SES* (i.e., perceptions of having a lower SES or poorer financial status) is of importance (Goodman et al., 2001). In a review of the literature on subjective SES and health, Quon and McGrath (2014) demonstrated that lower subjective SES influences most health outcomes negatively, with particularly strong effects for mental health outcomes. This finding is in line with other studies of adolescents where subjective ratings of SES predict health outcomes at a similar level to objective SES-indicators (Bøe et al., 2018; Elgar et al., 2016; Quon & McGrath, 2014). This association

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between subjective SES and mental health may reflect the adverse effect of perceiving yourself to be in a lower socioeconomic position. A lower social status may by itself incur negative psychological consequences (Marmot, 2004; Wilkinson & Pickett, 2010), through stress-related physiological pathways (McEwen & Gianaros, 2010). Subjective measures may also be a broader SES concept, encompassing characteristics such as wider family wealth, the socioeconomic characteristics of neighborhoods, and past economic experiences (Braveman et al., 2005). The association between subjective SES and mental health problems could also be initiated from the opposite direction; depressive and negative cognitions could contribute to lower ratings of subjective social status (Schubert et al., 2016; Shaked et al., 2016). Studies of the association between depression and subjective SES, however, suggest that although related, subjective status is not uniquely confounded by symptoms of depression or negative affect (Lundberg & Kristenson, 2008; Operario, Adler, & Williams, 2004).

Cross-national findings showing that subjective SES may be more influential on mental health than objective indicators of SES in particular regions (e.g. Western Europe; Quon & McGrath, 2014). However, this is probably not an either/or relationship; Even in wealthy countries, those who grow up in families with relatively low income may still experience some of the associated deprivation (such as lower stimulating resources, higher parental stress and poorer parent-child relationships, and more chaotic home environments). The relative contribution of subjective SES and income to mental health may therefore be better understood by studying the influence of subjective SES over the distribution of household incomes.

Questions still remain about how objective and subjective indicators of SES are related. Goodman et al. (2001) found subjective social status to be unrelated to paternal education levels, but others have found moderate correlations between subjective indicators and parent education, household income, and possession of material assets (Elgar et al., 2016; Goodman et al., 2007). In a related paper using the same sample as in the current study, Bøe et al. (2018) recently demonstrated that adolescents from single parent households, with relative low income, and where parents were not working had a higher chance of rating their perceived economic well-being as poorer than others.

In studies of adults, correlations between subjective position and objective indicators such as occupation, income, and education have most commonly ranged between 0.20 to about 0.60 (Ekehammar, Sidanius, & Nilsson, 1987; Goyder, 1975; Ostrove, Adler, Kuppermann, & Washington, 2000). However, few studies have assessed the correlation between household income and perceived economic status in adolescents, possibly due to difficulties obtaining robust information about parental and household SES from adolescent participants (Currie et al., 2008). In the few studies on adolescents where SES proxy information has been obtained (e.g., perceived wealth (Iversen & Holsen, 2008), residential area deprivation and family affluence (Sweeting & Hunt, 2014), and parental self-reported income (Bannink, Pearce, & Hope, 2016; Goodman et al., 2003)) correlations have been modest and in the range of 0.04–0.27. To our knowledge, no other prior studies have investigated the relationship between subjective and objective indicators of SES and mental health, where adolescents are the main respondents.

Using a large sample of adolescent participants in the youth@hordaland study, we aimed to investigate the agreement between ratings of perceived economic well-being and household income, and to examine how these variables interacted in their association to mental health problems. To account for some of the potential bidirectional association between depression related negative cognitions and ratings of subjective SES, we also investigated whether the association between subjective SES and conduct problems was attenuated when adjusted for adolescent self-reported symptoms of depression.

Age, gender, family composition, ethnicity, parental work status and parental education levels are factors that may be associated with household income and mental health problems (Conger et al., 2010;

Reiss, 2013). By examining the role of these factors in our analyses, we aim to investigate the independent associations between household income and economic well-being and mental health problems.

Based on previous work, we expected modest correlations between household income and perceived economic well-being. To determine whether household income or perceived economic ranking has most influence on adolescent mental health we planned to examine how the interaction between these variables was associated with mental health outcomes. If subjective ratings are key, adolescent symptoms of mental health problems should closely follow their subjective rating, *independent of household income*. However, if household income is key, symptoms of mental health problems should more closely track the adolescent income level, *independent of their subjective rating*. Finally, regarding the issue of bidirectional associations between mental health problems and subjective SES, we expected adjustments for depression to explain some, but not all, of the association to conduct problems.

## Methods

### Participants and procedure

We used data from the youth@hordaland-survey of adolescents conducted in 2012 in the county of Hordaland in Western Norway ( $N = 10,220$ , 53% participation rate). All adolescents in upper secondary education (aged 16–19 years) received information about the study via e-mail, and one classroom school hour was allocated for them to complete the questionnaire. The questionnaire was web-based and covered a broad range of mental health issues, sleep behaviors and sleep problems, daily life functioning, use of health care and social services and demographics information. Permissions was also sought to obtain school data, and to link this information with national Norwegian registries. Those not in school received information by post to their home address. Uni Research Health collaborated with Hordaland County Council to conduct the study. The study was approved by The Regional Committee for Medical and Health Research Ethics in Western Norway.

Hordaland county is considered representative of Norway with regards to gender and rural/urban residence distribution, and the median household income is comparable to that of the national average (Statistics Norway, 2012a). In the period 2005–2010, the mean proportion of children characterized as living in *relative poverty* (i.e. with equivalised household income less than 60% of the population median) in Hordaland county was slightly lower (7.3%) than in the country as a whole (8.9%). Official data shows that in 2012, 92% of all adolescents in Norway aged 16–19 attended high school (Statistics Norway, 2012b), compared to 98% in the current sample. The GPA in the current sample was comparable to the national GPA, but somewhat lower than the mean GPA in Hordaland country (Hysing et al., 2016). In the current study, 9079 adolescents were available for analyses.

### Measures

*Perceived economic well-being.* We assessed perceived economic well-being by the following question to the adolescents: “Compared to others, how would you rate your family’s economic situation?” The response options were “Poorer than others,” “Equal to others,” or “Better than others.” Similar questions have previously been used with adolescents to determine their perceived socioeconomic status (Quon & McGrath, 2014).

*Household income.* Household income was obtained from the Norwegian national income registry, and is based on tax return data from the Norwegian Tax Administration. This information is considered reliable, precise and of high quality and is used by the Norwegian government to estimate taxable income. Using each participant’s personal identification number, we were able to obtain information about the *equivalised disposable household income* for the year 2011. Equivalised household income is a measure of household income (i.e. the sum of

wages and salaries, income from self-employment, property income and transfers received minus total assessed taxes and negative transfers), adjusted by an equivalence scale to enable comparisons between households of different sizes and compositions. It indicates the economic resources that are available to a standardized household, and accounts for inflation/changes in median income over time. The equivalence scale used in the current study is the European Union scale (a modification of the OECD equivalence scale) where the first adult is given a weight of 1, subsequent adults are given a weight of 0.5 and each child below 14 is given the weight 0.3 (Hagenaars, de Vos, & Zaidi, 1994; Vos & Zaidi, 1997).

**Symptoms of general mental health problems.** In the youth@hordaland study, adolescents completed the self-report version of the Strengths and Difficulties Questionnaire (Goodman, 1997, 1999). The SDQ consists of five subscales measuring emotional symptoms, conduct problems, hyperactivity-inattention, peer relationship problems, and prosocial behaviors (not included in the current study). Respondents indicated on a three-point Likert-type scale to which extent a symptom applied to them, using the options “Not true”, “Somewhat true”, or “Certainly true”. Each of the four subscales consists of five items, and all scale scores ranged from 0 to 10, with higher scores indicating more problems. Due to the ordinal and categorical nature of the response options, reliability was assessed using polychoric correlation-based version of the reliability coefficients (Gadernann, Guhn, & Zumbo, 2013). These analyses, suggested satisfactory internal consistency for all subscales ( $\alpha$  emotional problems = 0.82, conduct problems = 0.71, hyperactivity-inattention = 0.76, and peer problems = 0.75). Previous investigations have found the SDQ to be a reliable and valid instrument for use in samples of adolescents (Bøe et al., 2016; Muris, Meesters, & Van den Berg, 2003).

**Symptoms of depression.** We used the short version of the Moods and Feelings Questionnaire (SMFQ) (Angold et al., 1995) to measure symptoms of depression. The SMFQ consists of 13 statements (e.g., “I am feeling low”, “No one likes me”, etc.) that the adolescents responded to using the response categories “Not true”, “Sometimes true”, or “True”. The SMFQ is a valid instrument (Turner et al., 2014) with adequate psychometric properties (Sharp, Goodyer, & Croudace, 2006), and a previous study based on the youth@hordaland study found the SMFQ to be unidimensional, supporting the use of the sum score of SMFQ (Lundervold et al., 2013). Reliability in the current sample was excellent (range = 0–26, ordinal  $\alpha$  = 0.95).

**Demographic variables.** Gender and date of birth were identified with the personal identity number in the Norwegian National Population Register. Age ( $M = 17.4$ , range 16.0–19.3) was derived by calculating the interval of time between date of birth and date of study participation. Family structure (i.e. single- or two-parent households), parental education levels (elementary, intermediate and higher) and parental work affiliation (i.e. both work, one is unemployed, or both are unemployed), were reported by adolescents.

### Statistical analysis

Prior to the main analyses, adolescents with negative household income were excluded, as were adolescents with extremely high income, as this could have revealed their identity (the total number of excluded adolescents was 75 out of a total sample of 9154).

Correspondence between perceived economic well-being and household income was assessed with Spearman’s rank correlation coefficient  $\rho$ , a nonparametric measure appropriate for use when correlating continuous and ordinal variables. To quantify accuracy, household income was converted to nine ordered bins using the `ntile` function in R, and recombined into three groups: *low*, *medium* and *high*, corresponding to the lowest-, middle- and upper tertile of the ranked household incomes, see Table 2.

Accuracy ratings were operationalized as correspondence between the adolescents’ ratings of perceived economic well-being, and the

**Table 1**  
Table of descriptives.

	Overall n = 9079	Missing %
Gender = Male (%)	4270 (47.0)	0.0
Age (mean (sd))	17.41 (0.83)	0.3
Family structure = Single parent (n (%))	1334 (16.6)	11.6
At least one parent born abroad (n (%))	1170 (13%)	1.0
Parental work status (n (%))		12.6
Both work	6985 (88.0)	
One unemployed	500 (6.3)	
Both unemployed	55 (0.7)	
Other <sup>a</sup>	398 (5.0)	
Highest parental education level (n (%))		1.4
Higher	4060 (45.3)	
Intermediate	2795 (31.2)	
Elementary	371 (4.1)	
Unknown	1727 (19.3)	
Perceived economic well-being (n (%))		2.7
Better than others	2222 (25.2)	
Equal to others	5976 (67.7)	
Poorer than others	632 (7.2)	
Equivalised household income in NOK (2011) (median (sd))	322,968 (120,014)	0.0

<sup>a</sup> Other included students, retirees and stay-at-home parents.

**Table 2**  
Agreement between adolescents’ perceived economic well-being and household income tertile.

Economic well-being	Household Income		
	Low <sup>a</sup>	Medium <sup>b</sup>	High <sup>c</sup>
Poorer than others	Accurate (72.8%)	Underestimating	Underestimating
Equal to others	Overestimating	Accurate (37.3%)	Underestimating
Better than others	Overestimating	Overestimating	Accurate (54.8%)

<sup>a</sup>  $N = 3,027$ ,  $M$  household income = 226,188 ( $SD = 53,076$ ) NOK, [USD  $M = 26,501$ ,  $SD = 6218$ ].

<sup>b</sup>  $N = 3,026$ ,  $M$  household income = 323,820 ( $SD = 22,792$ ) NOK, [USD  $M = 37,931$ ,  $SD = 2669$ ].

<sup>c</sup>  $N = 3,026$ ,  $M$  household income = 465,280 ( $SD = 104,742$ ) NOK, [USD  $M = 54,506$ ,  $SD = 12,270$ ].

tertile of their household income; that is, adolescents who rated their perceived economic well-being as “poorer than others” and had *low* household income were categorized as “accurate”, adolescents who perceived their economic well-being as “equal to others” and had *medium* household income were categorized as “accurate”, and adolescents who rated their economic well-being as “better than others” and had *high* household income were categorized as “accurate”. Complementary, adolescents with “poorer than others” perceived economic well-being and *medium* or *high* household incomes were labelled as “underestimating” their household incomes; adolescents who perceived their economic well-being as “equal to others”, but had *low* household income were labelled as “overestimating” their income, while those with *high* income were labelled as “underestimating” their income; and adolescents who rated their economic well-being as “better than others”, but had *low* or *medium* household income were labelled as “overestimating” their income.

Regression analyses were used to investigate how perceptions of economic well-being interacted with household income in their associations with adolescent mental health problems. In these analyses objective income was centered on the equivalised population median income for 2011 (NOK 308,938 [USD 39,899]), and  $z$ -transformed. In the regression analyses, “Poorer than others” perceived economic well-being was used as the reference category.

The regression analyses were ran in several blocks: We ran two *Crude* models where household income and perceived economic well-being

were the only predictors (note that the results of these two models have been combined into one column in Table 3, in the *Joint* model household income and perceived economic well-being were entered simultaneously, the *Interaction* model assesses the interaction between objective income and economic well-being, and the *Fully adjusted* model included in addition the covariates gender and age of participants, family composition, parental work status, parental education levels, and ethnic origin of parents. Preliminary analyses did not reveal any significant two- or three-way interactions with gender nor age in the associations with economic well-being or household income. Due to the substantial number of analyses ran, all *p*-values were adjusted to control the false discovery rate (Benjamini & Yekutieli, 2001).

The interaction effects were further examined to determine at which income level symptoms of mental health problems were significantly lower for adolescents with a more favorable economic well-being rating, compared to those with a “poorer than others” rating. Using the R package *margins* (Leeper, 2018), marginal effects of the regression models were calculated over the whole range of the *z*-transformed income distribution. We then identified the point along the income distribution where the 95% confidence intervals of the marginal effects were lower than zero (corresponding to a significant marginal effect at *p* < .05) and the corresponding equivalised household income where those with more favorable ratings had significantly fewer symptoms of mental health problems.

Finally, in an attempt to address the issue of potential reciprocity in mental health problems and perceived economic well-being, which were both self-reported, we ran one additional (*Fully adjusted*) regression model where we investigated the association with conduct problems as the outcome, and including symptoms of depression as an additional covariate.

Multiple imputation using the R-package *mice* was used to handle missing data (van Buuren, 2018). R version 3.5.1 for Mac (R Core Team, R, 2018) was used for all statistical analyses.

**Results**

*Descriptives*

The total sample consisted of slightly more females than males and the majority of adolescents lived in two-parent households (83.4%), see Table 1. Most adolescents came from families with one or two working parents (99.3%), and where at least one of their parents had higher or intermediate education level (95.9%). The median equivalised household income was somewhat greater than the equivalised median income in the Norwegian population in 2011 (NOK 308,938 [USD 37,026]). Only a small percentage of adolescents rated their subjective economic well-being as being poorer than others (7.2%).

*Agreement analysis*

The correlation between perceived economic well-being and household income was 0.33 [95% CI = 0.32–0.35], *p* < .001. The distribution of household incomes within groups of adolescents based on perceived economic well-being can be seen in Fig. 1.

The plot illustrates that the median household income was lowest among adolescents who perceived their economic well-being as “poorer than others” (Mdn NOK = 245,611 [USD 29,312]), higher for adolescents who perceived it to be “equal to others” (Mdn NOK = 315,157 [USD 37,618]), and highest for adolescents who perceived their economic well-being as “better than others” (Mdn NOK = 378,570 [USD 45,188]). The widths of the plot also show that a higher number of adolescents who perceived their economic situation as “poorer than others” had lower incomes, relative to adolescents with more favorable ratings of their economic well-being.

This pattern of household income distribution over perceived economic well-being was also mirrored in a significant main effect of

**Table 3**  
Regression analyses of associations between household income and perceived economic well-being and symptoms of mental health problems.

	Crude <i>b</i> ( <i>se</i> )	Joint <i>b</i> ( <i>se</i> )	Interaction <i>b</i> ( <i>se</i> )	Adjusted <sup>a</sup> <i>b</i> ( <i>se</i> )	Adjusted <sup>b</sup> <i>b</i> ( <i>se</i> )
<b>SDQ Conduct problems</b>					
Household income	−0.11 (0.01) ***	1.74 (0.05) ***	0.14 (0.08)	0.20 (0.08) *	0.17 (0.07) *
Economic well-being: Equal to others	−0.43 (0.06) ***	−0.12 (0.02) ***	−0.48 (0.07) ***	−0.39 (0.07) ***	−0.18 (0.07) *
Economic well-being: Better than others	−0.30 (0.06) ***	−0.35 (0.06) ***	−0.27 (0.07) ***	−0.17 (0.08) *	0.02 (0.07)
Household income x Economic well-being: Equal to others			−0.26 (0.08) **	−0.26 (0.08) **	−0.22 (0.08) *
Household income x Economic well-being: Better than others			−0.28 (0.08) ***	−0.31 (0.08) ***	−0.26 (0.08) **
<b>SDQ Peer problems</b>					
Household income	−0.20 (0.02) ***	2.28 (0.07) ***	2.37 (0.08) ***	1.30 (0.37) **	0.17 (0.07) *
Economic well-being: Equal to others	−0.63 (0.07) ***	−0.18 (0.02) ***	0.01 (0.09)	0.12 (0.09)	−0.18 (0.07) **
Economic well-being: Better than others	−0.71 (0.07) ***	−0.52 (0.07) ***	−0.61 (0.08) ***	−0.51 (0.08) ***	0.02 (0.07)
Household income x Economic well-being: Equal to others		−0.50 (0.08) ***	−0.57 (0.09) ***	−0.47 (0.09) ***	−0.22 (0.08) **
Household income x Economic well-being: Better than others			−0.18 (0.10)	−0.20 (0.10) *	−0.26 (0.08) ***
<b>SDQ Emotion problems</b>					
Household income	−0.20 (0.03) ***	−0.11 (0.03) ***	0.11 (0.14)	−	−
Economic well-being: Equal to others	−1.19 (0.11) ***	−1.13 (0.11) ***	−1.23 (0.13) ***	−	−
Economic well-being: Better than others	−1.53 (0.11) ***	−1.40 (0.12) ***	−1.50 (0.14) ***	−	−
Household income x Economic well-being: Equal to others			−0.23 (0.15)	−	−
Household income x Economic well-being: Better than others			−0.23 (0.15)	−	−
<b>SDQ Hyperactivity-/inattention problems</b>					
Household income	−0.15 (0.02) ***	−0.10 (0.03) ***	0.05 (0.13)	−	−
Economic well-being: Equal to others	−0.85 (0.09) ***	−0.78 (0.09) ***	−0.86 (0.11) ***	−	−
Economic well-being: Better than others			−0.83 (0.12) ***	−	−

(continued on next page)

Table 3 (continued)

	Crude	Joint	Interaction	Adjusted <sup>a</sup>	Adjusted <sup>b</sup>
	b (se)	b (se)	b (se)	b (se)	b (se)
Better than others	-0.91 (0.10) ***	-0.79 (0.10) ***			
Household income x Economic well-being: Equal to others			-0.12 (0.13)	-	-
Household income x Economic well-being: Better than others			-0.20 (0.14)	-	-
SMFQ Depression symptoms					
Household income	-0.51 (0.06) ***	-0.33 (0.07) ***	0.23 (0.34)	-	-
Economic well-being: Equal to others	-3.21 (0.25) ***	-3.01 (0.25) ***	-3.28 (0.30) ***	-	-
Economic well-being: Better than others	-3.45 (0.27) ***	-3.05 (0.28) ***	-3.30 (0.33) ***	-	-
Household income x Economic well-being: Equal to others			-0.58 (0.35)	-	-
Household income x Economic well-being: Better than others			-0.60 (0.36)	-	-

Note: \*\*\*p < .001; \*\*p < .01; \*p < .05.

<sup>a</sup> Adjusted for gender, age, family composition, parental work status, parental education levels and parent ethnic origin.

<sup>b</sup> Adjusted for gender, age, family composition, parental work status, parental education levels, parent ethnic origin and symptoms of depression. Median centered and z-transformed household income used in all models.

perceived economic well-being on household incomes,  $F(2, 8827) = 571, p < .001$ . Pairwise comparisons using the Tukey HSD procedure revealed that all mean household income were significantly different from the other groups; The mean household income among adolescents with a “poorer than others” economic well-being was lower than for adolescents with an “equal to others” rating, which in turn was lower than for adolescents who perceived their economic well-being as “better than others”, see notes of Table 2 for details.

“Accuracy”, or the agreement between adolescents’ perceived economic well-being and their household income, was higher among adolescents with low (72.8%) and high (54.8%) household income, relative to adolescents with medium (37.3%) household income, see Table 2.

Regression analyses

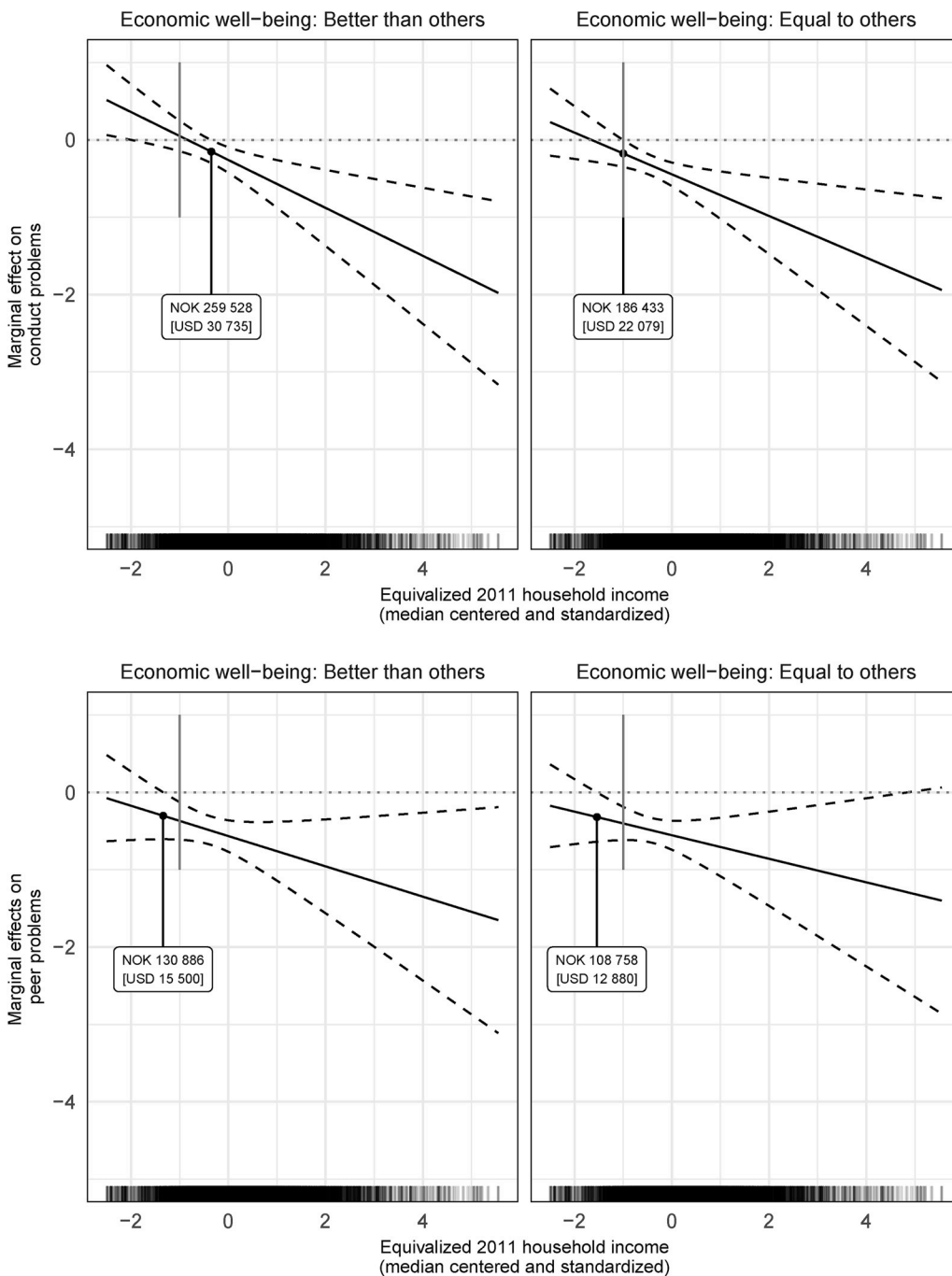
The results from the “crude” regression analyses showed that objective household income and perceived economic well-being were negatively associated with symptoms of mental health problems. Higher household income, and “equal to”- or “better than”- ratings, relative to a “poorer than others” rating, of economic well-being were associated with fewer mental health problems (Table 3). This pattern of results also appeared in the “joint” regression, suggesting both household income and perceived economic well-being were independently associated with mental health problems. Significant interaction effects were found for SDQ conduct problems and peer problems. These associations remained significant following adjustment for covariates.

The interaction effects were further examined to determine at which income level symptoms of mental health problems were significantly lower for adolescents with a more favorable economic well-being rating, compared to those with a “poorer than others” rating, see Fig. 2.

The figure demonstrates that, among these Norwegian adolescents, the influence of household income outweighs perceptions of economic well-being only at very low household income levels. For reference, the official definition of “low income” in Norway corresponds to an equalised household income less than 60% of the equalised population median income. In 2011, this low-income threshold was NOK 185,362 [USD 22,221]. For peer problems the level where household income was more strongly associated with mental health problems relative to perceived economic well-being lies below this threshold. These results illustrate the detrimental effect of very low household income for adolescent mental health, but at the same time, it suggests



Fig. 1. Distribution of household income in categories of perceived economic well-being. The figure is a boxplot overlaid on a violin plot. The vertical bar in the middle represents the median household incomes in each category of perceived economic well-being, the upper and lower hinge is the distance between the first and third quartile while the whiskers represent ± 1.5 times the interquartile range. The outer shape represents all datapoints, and the width of the outer shape indicate the probability density of data at different values (i.e. more common values produce a wider outer shape).



**Fig. 2.** Marginal effects from fully adjusted models at different income levels. Solid lines represent the marginal effect, dashed lines 95% confidence interval of the marginal effect. When the upper 95% confidence interval is below zero (indicated by the dotted line), the marginal effect is significant ( $p < .05$ ), suggesting that adolescents with more favorable ratings of perceived economic well-being have fewer mental health problems. The points and labels indicate the corresponding equivalised household income in NOK (and USD). The rug on the x-axis depicts the frequency of adolescents at each level of household income. The gray segment line marks threshold of relative poverty.

that for the majority of adolescents in this sample, perceived economic well-being is the most important factor associated with peer- and emotional problems.

For conduct problems, the threshold where household income outweighed perceived economic well-being was somewhat higher. This may suggest that conduct problems are more responsive to low household income, relative to the other mental health problems. However, for the majority of adolescents, perceived economic well-being was still the main factor associated with their conduct problems.

In the final regression analyses, we added symptoms of depression to the fully adjusted model with conduct problems and peer problems as the dependent variable. The results showed that the coefficients attenuated somewhat, but the interaction effects remained significant (see last column of Table 3).

**Discussion**

Using a sample of more than 9000 adolescent participants from the youth@hordaland study, we investigated the correspondence between perceived economic well-being and household income. We also examined how subjective ratings of economic well-being and household income interacted in their association with mental health problems, and what role symptoms of depression played in this association. The results showed moderate associations between perceived economic well-being and household income and that the influence of perceived economic well-being on mental health problems depended on the level of household income. We also found that depression was related to some of these associations.

From previous research on the association between subjective and

objective SES-indicators, we expected modest associations between perceived economic well-being and household income (Bannink et al., 2016; Goodman et al., 2003; Iversen & Holsen, 2008). The correlation in the current study was slightly higher than previous estimates, possibly due to the more direct enquiry about the adolescents' perceptions of "family's economic situation" rather than "social status" or other indicators of subjective SES. Still, this does underscore that subjective SES encompasses other characteristics such as family wealth, the socioeconomic characteristics of neighborhoods, past economic experiences, family structure and parental work status (Braveman et al., 2005; Bøe et al., 2018).

Although the magnitude of the correlation was modest, most adolescents were fairly accurate in assessing their income distribution ranking, as evidenced in the plot of the distribution and in the pattern of mean and median income levels in the groups based on perceived economic well-being. Similar findings have been reported previously (Bannink et al., 2016), and suggests that cues of economic rank are more salient in the upper and lower end of the income distribution (Kraus, Park, & Tan, 2017).

The results of the regression analyses showed that higher household income and a more favorable ratings of perceived economic well-being were associated with fewer symptoms of mental health problems in the crude and joint analyses (Bøe et al., 2018). In the fully adjusted model, adolescents who rated their perceived economic well-being more favorably had lower levels of depression and fewer emotional, conduct, and peer problems compared with higher household income relative to adolescents with a "poorer than others" rating.

The findings from the current study suggest that at the lowest end of the household income spectrum, perceptions do not seem to matter much, and low income is associated with more mental health problems, in line with numerous other studies that demonstrate the adverse effects of low income and poverty on mental health (Letourneau et al., 2013; Reiss, 2013). These adolescents may have more symptoms of mental health problems due to current (and previous) experiences of the indirect effects of low income, such as constrained material and psychosocial investments, impaired parent-child relationships, and chaotic living conditions (Bøe et al., 2014; Conger et al., 2010; Evans et al., 2005; Foster, 2002).

At higher income levels, however, the influence of objective and subjective SES on adolescent mental health depend on each other, and two questions appear from the results: 1) Why do adolescents with relatively high household income perceive their economic well-being as less favorable, and 2) why are these perceptions of "having less" accompanied by more mental health problems?

One explanation for the apparent discrepancy between household income and perceived economic well-being could be that some adolescents with high income and poor perceived economic well-being, experience relative deprivation due to being surrounded by neighbors and schoolmates with even higher household incomes (Smith et al., 2012). It may also be that these adolescents are not necessarily among those with lower relative incomes among their peers, but that they rank themselves lower than their household income could justify by engaging in upwards social comparisons with peers who are even better off (Collins, 1996; Suls, Martin, & Wheeler, 2002).

With regards to the association between perceived status and mental health, it has been suggested that lower status could in itself be negative, and that the cognitive and emotional responses related to having a lower status may contribute to poorer health (Marmot, 2004; Wilkinson, 1999). This association is believed to operate through neuroendocrine pathways related to psychological stress (McEwen & Gianaros, 2010), and associated with mental health problems (Schneiderman, Ironson, & Siegel, 2005). It has been suggested that there are reciprocal associations between subjective ratings of SES and mental health problems. The analysis in the current study confirmed that symptoms of depression did account for some of the association between perceived economic well-being and income and conduct problems, but the association

remained significant. This finding is in line with other studies (Garbarski, 2010), and underscores the importance of accounting for expressions of negative affect in future studies relying on subjective ratings of SES.

### Strengths and limitations

The strengths of the current study are the large sample size, the use of validated instruments for measuring mental health problems, and the availability of high-quality household income registry data.

The results of the current study should also be interpreted in light of certain limitations. Firstly, we did not have access to any indicators of neighborhood or school level SES. Such data could have provided important information about the contextual conditions in which the adolescents rated the economic well-being, and whether these findings may result from relative deprivation. A recent study recently demonstrated that neighborhood and family income was far less predictive of adolescent mental and behavioral health relative to the influence of school context (Coley et al., 2018). The researchers also found that there were associations between types of mental health problems and the affluence of their schoolmates, demonstrating the utility of this kind of contextual SES information. We also lack information about where the adolescent lived. Residing in an urban or rural area could have implications for costs of living, and adolescents from families with high income but large expenses could experience more economic pressures than adolescents from families with lower income and more modest living expenses (Mogstad, Langørgen, & Aaberge, 2007).

Subjective ratings of SES could also be influenced by mental health problems and affective state; Adolescents with depression would presumably be more likely to perceive their perceived economic well-being less favorably compared to non-depressed individuals, which could result in spurious associations between mental health problems and subjective SES (Garbarski, 2010). In order to try to address this, we did analyses of the association between income and perceived economic well-being, and conduct problems, while adjusting for symptoms of depression. The association between income and subjective SES attenuated, but remained significant, which suggests that the bidirectional relationship between perceived economic well-being, and emotional problems and symptoms of depression explain some, but not all of the association.

Finally, the current study is cross-sectional. This precludes us from making any statements regarding the causal nature of these associations, although it seems improbable that adolescent perceptions of economic well-being or symptoms of mental health problems at the level found in the current population sample would influence household income to a large extent.

### Conclusion and implications for research and practice

The findings from the current study demonstrated a complex interplay between objective and subjective SES and adolescent mental health. Very low household income was associated with more mental health problems independent of perceived economic well-being, but the mental health benefits associated with higher income appears to depend on the adolescents' perceptions of their family's relative economic position. While the results confirm the importance of low income as a determinant of mental health problems, they also suggest that knowledge about how the adolescents feel about their relative economic standing may be potentially important information for adolescents with mental health problems.

### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssmph.2019.100471>.

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