Social inequality in adolescent mental health in a life course perspective (LONG/TRENDS)

1. Excellence

The increase in mental health problems is a major public health problem and of great concern to the society (WHO, 2013). Societies are facing major challenges in health and wellbeing; increasing chronic disease burden, immigration issues, major fall-outs in employment and education, and increasing social inequality (Devaux & De Looper, 2012; Fall & Roberts 2012). To meet the present and future challenges, and to foster environments that support health and wellbeing, actions moving forward must be a public policy concern. Material, psychosocial and behavioural factors during childhood determine health, living conditions, and societal participation at later stages in life. Critical and sensitive periods like transition between school levels, moving out of parents' home, change in marital status, parenthood, and the transition into work life, are periods where the individual can be particularly susceptible to positive or negative fluctuations in social support, economic hardship and health behaviors, giving rise to social inequality in mental health (Reiss, 2013). Through cross-disciplinary research, collaboration and dissemination, the proposed project addresses mental health inequalities (i.e. differences in mental health based on gender, occupation, education, income, material health and subjective social position) within a life course perspective.

1.1 State of the art, knowledge needs and project objectives

The inability of large groups of young people to achieve their full potential for mental, physical, and social wellbeing will lead to losses that societies cannot afford. The cost of mental health problems was in 2009 estimated to be 60-70 billion NOK per year and outbid the cost of all other diseases (Holthe, 2012). The dropout rate in upper secondary school in Norway, although relatively stable for more than 30 years, has been high, also compared to other OECD countries (EC, 2018), and the associated societal lifetime cost is 1 million NOK per person (Falch et al., 2009). Public expenditures linked to mitigating the effects of adverse development and facilitating positive development at an early age will be much more effective than attempting to deal with the consequences of social inequality and health problems later in a person's life.

Young people who experience connectedness with family and school, a sense of community, social support, and who are engaged in their communities, are less likely to use drugs and alcohol, less likely to drop out of high school, less likely to be involved in criminal behavior and more likely to experience better mental health (Fall & Roberts, 2012; Scales et al., 2016). They are also more likely to be socially advantaged, pointing at important areas of concern regarding social inequalities in mental health. These are the areas to be examined in this project, applying the state-of the-art recommendation for research on social inequality, namely a life course perspective (Bartley, 2016; Marmot, 2013). We aim to address three knowledge gaps. First, systematic reviews have identified a gap when it comes to trends in social inequalities in self-rated mental health over an extended period, particularly among children and adolescents (Bartley, 2016; Dahl et al., 2014). Secondly, gender is largely missing from work aiming to understand mechanisms linking social inequality to health over the life-course (Sweeting et al., 2016). Thirdly, the exact mechanisms behind the protective effect of family and social support on mental health are still not fully understood, and research into the contribution of social support to mental health inequalities is scarce (Bartley, 2016).

Our objectives are to fill the gaps in knowledge asked for in the call where we:
a) Identify how different types and levels of social support and family structure may lead to mental health inequalities,
b) Assess societal trends in mental health inequalities among adolescents
c) Examine how major life events (transitions) can influence mental health inequality
d) Determine the role of gender in understanding mechanisms linking inequality to mental health over the life-course.
e) Develop more accurate methods for measuring SES in the adolescent population

1.2 Novelty and ambition

The novelty of this study is the combination of substantive and methodological developments, the possibility to track developmental processes in social inequality, identify critical periods, societal trends, as well as doing international comparisons and applying longitudinal datasets. By examining the quality and comparability of indirect measures of SES in adolescent populations, by implementing decomposition methods of sources of inequality, and by developing new measures tailored to the Nordic situation, the current project contributes with methodological development that will increase the validity and specificity of causal claims in health inequality research. Together the four datasets in the project cover ages from 7- 40, and two datasets includes surveys on parents, offering the possibility to look at social inequality in a generation perspective. In line with the call, this study applies good health data, built over several years to provide needed knowledge on social inequality, life stages and transitions. The cost benefit of using existing health databases, alongside an interdisciplinary research collaboration, gives the possibility to more rapidly build an extensive knowledge base on important steps to promote mental health and social equality. Using existing data is also ethical in relation to the cost invested by those who have participated in the studies.

Ambition: As poor mental health and social inequality can be characterised as severe problems with no single solution, inter- and cross-disciplinary research is needed. We combine expertise from several disciplines: public health, health promotion, developmental psychology, positive youth development, education, epidemiology and methodology, with national, and international experts. Together this will give the needed knowledge to move public policies forward with more tuned actions.

1.3 Research questions and hypotheses, theoretical approach and methodology

The overall goal of the project is to investigate mental health and social inequalities in a life course perspective by analysing:
RQ1. How do critical and sensitive periods, accumulation, and pathways play a role in the development of mental health and social inequalities in a life course perspective?
RQ 2. How do social connectedness, social support, family structure, sense of community and civic participation relate to mental health and social inequalities in adolescence in a longitudinal perspective?
RQ 3:How can a Nordic Socioeconomic Index of social inequality be developed?

RQ4. Which trends in social inequality in self-reported health behaviors and mental health and wellbeing, and their psychosocial determinants among adolescents are present from 1993 to 2018?

Theoretical approach

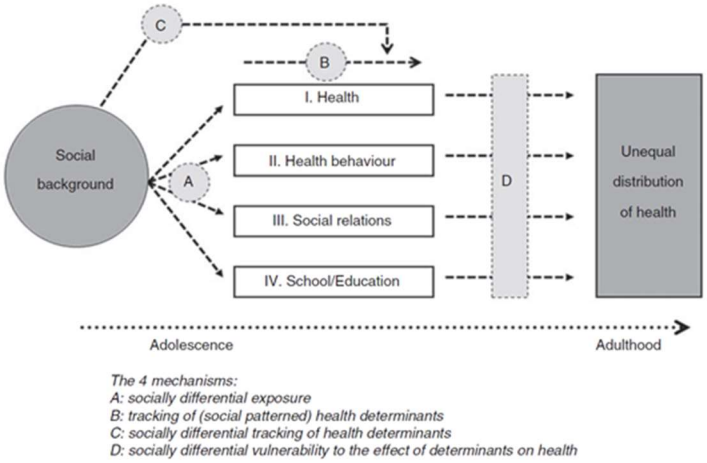

Figure 1. Pathways working over adolescence to stimulate/create adult health inequalities: the Adolescent Pathway Model.

Individuals are not passive passengers throughout life. The development of health inequalities probably reflects a way of life that is caused both by life choices (where the person actively evaluates and chooses what he/she will do) and life opportunities (social position and to some extent age, gender and livelihoods). The Adolescent pathways model by Due et al 2011, aims to explain how health inequality may develop through various pathways from adolescence to adulthood, in an interplay between life choices and life opportunities. As illustrated in Figure 1, it includes two pathways that lead through adolescent health (I) and health behavior (II) to later adult health, and a pathway, running through school/education (IV) to adult health via the formation of adult socioeconomic circumstances. In addition, the model includes a relational pathway (III) to capture evidence of the potential importance for future health and socioeconomic circumstances of young people's relationships. All pathways link adolescent social circumstances to adult health, and therefore have the potential to contribute to the social patterning of adult health.

Following these pathways, the project examines mechanisms of mental health inequalities, depicted as socially differential exposure, tracking and vulnerability (A, B, C and D) in Figure 1. It is well documented that the social environment plays an important role in explaining social inequalities in health (Allen et al., 2014; Dahl et al., 2014; Viner et al., 2012). Consequently, knowledge about mechanisms linked to the following social phenomena, will contribute to an increased insight into mental health inequalities; a) Social background and material factors like education, occupation, family affluence, wealth and income, b) Lifestyle as reflected in health behaviors like smoking, eating habits, substance use and physical activity (in particular physical activity, as there is growing evidence of the positive influence of physical activity on mental health), and c) Psychosocial mechanisms including family structure, perceived social support, mental health, distress and positive or negative life events. In particular, inequalities in social support is a key factor in understanding how mental health inequalities arise, as there is solid evidence that social support is strongly related to mental health (Sarason, 2013).

As an expansion of this model, studies of time trends in health behaviors and health among children and adolescents, as well as cross-country comparisons, can enhance our understanding of how societal trends influence social inequalities in mental health (Bartley, 2016; Dahl et al., 2014). Findings from trend studies are useful because they identify changes in public health and provide indications of future challenges. Thus, they produce knowledge that may point to the need for new types of prevention and health promotion efforts. Such studies can also provide evidence for the effectiveness (or lack thereof) of political initiatives, health services and other measures in reducing social inequalities in health.

Methodology

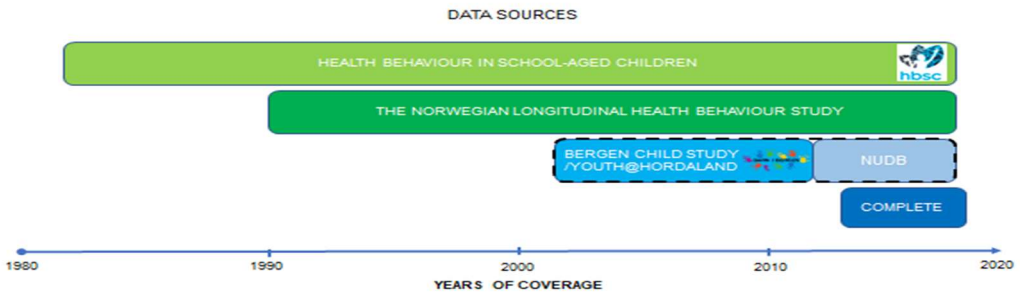

Figure 2. Overview of the data sources available to the project and their years of coverage.

Data stem from four databases, one cross-sectional and three longitudinal, available at University of Bergen/Department of Health Promotion and Development (HEMIL-senteret) and NORCE Norwegian Research Centre AS (c.f. Figure 2). These are the HBSC study, a cross-national survey among nationally representative samples of 11-, 13- and 15-year olds initiated in 1983 and repeated every four years since 1985, the most recent data were collected in 45 countries in 2018. The NLHBS study is a two-generation longitudinal study of a cohort born in 1977 with nine waves of surveys over 27 years (1990-2017), and three waves of data from their parents during 1990-1996. The third is the COMPLETE study (2016-2019)

following students through three years of upper secondary school (Larsen et al., 2018). The fourth database is youth@hordaland, the final wave of a series of studies of a cohort of children born in 1993-1995, which has been tracked from primary school until upper secondary school through surveys in 2002, 2006, 2009 and 2012, and further into tertiary education through register linkage. All databases include reliable and valid measurements of social inequality, mental health and perceptions of relations to peers, family, school, leisure activities and work life.

Data management plan; The project coordinator position included in the budget of the proposed project will have the overall responsibility for managing the data as one of the tasks. This includes coordinating the merging of data files within the HBSC countries as well as assisting in merging and building NLHBS files and COMPLETE files. Partners will take active part in analysis and dissemination. The data are stored on firewall-protected servers at the Norwegian Centre for Research Data (NSD) and in SAFE at UiB, and are made available to researchers involved in the project through password-protected access. The HBSC data are also made available Open Access three years after the international datafile is ready.

Data analyses; Data will be analyzed using inferential statistics in IBM SPSS statistics 25, Mplus version 7.2, R and STATA, which is a good tool to calculate hierarchical levels and structural equation models (SEM) (Muthén & Muthén, 2010; R Core Team, 2019).

Regression models using ridit transformed scores provide a flexible framework for establishing relative and absolute health inequality indices (Mackenbach & Kunst, 1997). Progress in understanding the mechanisms of inequality also depends on approaches that decompose sources of inequality, either through path analytic decomposition of regression coefficients (Boe et al., 2014) or decomposition of concentration index (O'Donnell et al., 2007).

In order to fully capitalize on the strengths of the data sources, we will use state-of-the art procedures for handling missing data and utilize design- and modelling-based measures to overcome potential response bias. The longitudinal data will be analyzed using appropriate modelling strategies, accounting for different shapes and functions for associations over time. Instruments that have not previously been evaluated psychometrically will be subjected to measurement invariance testing, to determine that constructs are measured consistently over time. All analyses including school-based clustered data will take into account design effects as implemented in major statistical packages (STATA, SPSS, R and Mplus).

2. Impact

2.1 Potential impact of the proposed research

We propose to fill important gaps in current knowledge and understanding of this complex public policy challenge that is a poorly understood issue of great and increasing public health importance. Social inequality in mental health is an issue where there are relatively few and straightforward practical solutions. We are committed to user involvement and knowledge transfer. Based on findings from analysis of life course data as well as from trends over 25 years in the Nordic countries, the proposed project will contribute with knowledge that can be used to improve the design, implementation and evaluation of measures that can promote mental health and reduce social inequalities in mental health.

The outputs from TRENDS include *dissemination* and *communication* of knowledge and findings through articles, conference presentations, Facebook, Twitter, web sites and meetings with stakeholders, *capacity building* through two PhD and one post-doctoral position, *knowledge-transfer* through educational institutions and collaboration with policy-makers, and international and cross-sectional *collaborations*.

Scientific and academic impact. There are unique opportunities in the current project for making significant contributions to the field of social inequalities in health. We expect publications from the current project to be published in well-renowned journals and attract considerable interest from researchers in the field. The project, with its strong national and international interdisciplinary collaboration will also build capacity in innovative statistical methods (e.g., psychometrics, indexing), further strengthen international research, networks, and potentially open new avenues for cross-national collaboration.

Societal impacts. The issues tackled in the current project are societal challenges of high importance and will bring research evidence that may readily be bridged into practice. Further understanding of the processes and mechanisms related to social inequalities throughout the life-course is uncovering targets for interventions that are highly sought after. Knowledge gained in the current project will be rapidly communicated to relevant users through the researchers' affiliations with educational institutions and connections with policy makers and NGOs.
Economic and innovation impacts. Reduction of social inequality within and among countries is one of the 17 Sustainable Development Goals put forward by the United Nations. It is a grand challenge as social inequalities incur large costs in terms of social exclusion; suffering from poor health; reduced quality of – and satisfaction with – life; reduced productivity, employment and lost human potential; and reduced overall health and longevity in the population. Understanding processes; barriers and facilitators that weaken or strengthen the associations between socioeconomic factors and future health, education and employment is of great importance, and provide a foundation for interventions aimed at alleviating costs associated with social inequality.

2.2 Measures for communication and exploitation

Fourteen articles in international and national peer-reviewed journals to reach researchers as well as practionairs. We will also communicate regularly via social media like Twitter, Facebook, Instagram, and university websites as the results emerge. A Norwegian report will be made/distributed at the end to summarize mental health and inequality in a life course perspective including synergies of the cross- disciplinary collaboration to enable others to learn from the experience. In addition, relevant stakeholders (youth, policy makers, parents, teachers, and NGOs) will be included in a reference group for the project give advice on interpretation of analyses and findings. These stakeholders will further be invited to participate in dissemination of findings to their respective groups aiming to achieve better-targeted dissemination. The researchers in the project will share findings through social media, give advice at relevant conferences for practitioners and policy makers and participate in policymaking with the aim of stimulating development of interventions to reduce adolescent mental health inequality. More details are in the online application form.

3. Implementation

The LONGTRENDS project examines the complex problems of mental health and social inequalities by use of a variety of methodological and theoretical disciplines. Bridging different scientific disciplinary approaches is in this case a necessity in order to secure scientific quality and assure that the research covers the relevant impact area, including the different stakeholders. When setting up the project group, we have ensured that the different disciplinary competencies necessary for the study are in place. The project is a collaboration between the SIPA (Social Influence Processes in Adolescent health) research group at the Department of Health Promotion and Development (HEMIL-senteret), and the research group for Public Mental Health at the Department of Psychosocial Science, both at University of Bergen. External partners are the Norwegian Public Health Institute (FHI), University of Lisbon, and University of Glasgow.

3.1 Project manager and project group

Principal investigator of the proposal, **Ass prof. Helga Urke** has experience from coordinating a large project and will contribute with her expertise in cross- disciplinary work, health promotion, child development, and inequality. **prof. Torill Larsen**, will be assisting principal investigator. She has more than 15 years' experience with research on youth and holds expertise in implementation, health promotion, and positive youth development as well as leading cross-disciplinary projects and groups. WP leaders are; **prof. Bente Wold** (WP1), her expertise includes theories and methods in health, social and developmental psychology, as well as in health promotion and behavioral epidemiology. She has extensive experience within research methods and project management. **Ass. prof. Tormod Bøe** (WP2) is an expert on social inequalities in mental health among children and adolescents. As WP2 also include data from the youth@hordaland/Bergen Child Study, **prof. Mari Hysing**, who is the leader of that study, will contribute with her expertise in epidemiological

research and child and adolescent mental health. **Prof. Torbjørn Torsheim** (WP3) is an expert in social inequality, psychometrics and statistical methods, important for all the WPs in the proposal, and especially for the development of new methods and indicators for studying social inequality. Other partners in the different WPs will be **prof. Oddrun Samdal** (UiB) who is the head of the international Data Management Centre of the HBSC study. She has extensive expertise in; education, health promotion, health behaviour and social inequality, and will contribute to supervision of PhD candidates. **Ass. Prof. Nora Wiium** at the Department of Psychosocial Science will contribute with her expertise in health and development in youth, she has also extensive experience in quantitative analyses. **Prof. Simon Øverland** (FHI) has high competence in psychological mechanisms driving mental health problems and has worked extensively with public health concerns related to social inequality. He provides a useful link to the Norwegian Institute of Public Health and their ongoing projects on social inequalities, including a study on social and regional differences in disease burden in Norwegian municipalities. **Professor Margarida Gaspar de Matos**, University of Lisbon in Portugal has a track record of youth engagement and participation and will contribute especially with her expertise in user involvement in all WPs. **Professor Laurence Moore**, Glasgow University, UK, is an expert in impact of public health research and will contribute to international attention to the findings and impact of the present project. The international collaborators have all agreed to take a special responsibility for dissemination and knowledge exchange related to all the WPs. In addition, the project group have access to the HBSC network with more than 200 researchers from 45 countries, and good connections with WHO-Euro and several national NGOs.

3.2. Project organisation and management

The project is organized as four work packages. WP1 mainly addresses social reproduction and accumulation of mental health inequalities, WP2 will look deeper into social support, the role of family and schools. WP3 will include international and Nordic perspectives on trends and measurement quality and validity of social inequality. Together, the WPs aim to give a comprehensive understanding of mental health and social inequalities in a life course perspective, as well as the role of important arenas like family, school and communities, in an international and Nordic context. The PI, together with a project coordinator, will lead WP4 (Management, Collaboration and Dissemination). They will have the overall responsibility for enabling collaboration within and between the WPs and ensure achievement of the objectives and milestones. In addition, WP4 will produce an overall report in Norwegian, summarising mental health inequality in a life course perspective, including the synergies gained from the cross- disciplinary work. The timeline and WP is outlined in the following table:

YEAR QUA	2020 (2)	2020 (3)	2020 (4)	2021 (1)	2021 (2)	2021 (3)	2021 (4)	2022 (1)	2022 (2)	2022 (3)	2022 (4)	2023 (1)	2023 (2)	2023 (3)	2023 (4)	2024 (1)
WP1			Pathways, Critical periods and Gender													
WP 2		Family, school and community														
WP 3		Measurement validity and quality and national and Nordic trends														
WP 4	Management, Collaboration and dissemination															

WP 1: MENTAL HEALTH AND SOCIAL INEQUALITY; PATHWAYS, CRITICAL PERIODS AND GENDER

Lead: *Bente Wold (UiB),* ***Partners****: Simon Øverland (FHI), Tormod Bøe (UiB), Torill Larsen (UiB), Helga Urke (UiB), Laurence Moore (UK), Phd (UiB)*

In this WP, we combine expertise from social psychology, health promotion, public health, social inequality, positive youth development, mental health, epidemiology and advanced statistics to address: *RQ1: How do critical and sensitive periods, accumulation, and pathways play a role in the development of social inequalities in mental health in a life course perspective?*

Most psychological theories explain the link between social support and mental health as a form of social influence whereby specific supportive actions (e.g., advice, reassurance, or tangible assistance) reduce the harmful effects of stressful life events (Sarason, 2013). However, the exact mechanisms behind this protective effect on mental health are still not fully understood, and research into the contribution of social support to inequalities in mental health is scarce (Bartley (2016). We propose filling this knowledge gap by identifying

how different types and levels of social support may cause social inequalities in mental health in critical and sensitive periods of transition (e.g., between school levels, moving out of parents' home, change in marital status, parenthood, and the transition into work life), and gender and generation perspectives. Given gender differences in child-care, and experiences both within and outside the employment market, particularly in reasons for non-employment (mainly unemployment among males, but child/family care among females), social causation effects will differ between males and females. Stresses in the lives of women resulting from combining low-paid, low-status occupations or unemployment with family and household roles, exceed those of men, and may lead to greater social inequalities in psychological distress among females than males.

***Output/articles**:* Based on NLHBS data, the pathways and mechanisms depicted in Figure 1 are examined in five papers; (1) trajectories of mental health inequalities from age 13 to age 40 as suggested by pathway I, with the aim to identify critical periods, (2) how social inequalities in health behaviors influence mental health inequalities (pathway II), (3) how social support mediates the association between stressful life events and mental health from early adolescence to middle age, and to what extent inequalities in social support relate to inequalities in mental health (pathway III), (4) whether parenthood and unemployment have gender differential effects on mental health as suggested by the 'socially differential vulnerability' pathway, (5) to what extent mental health inequalities are reproduced from one generation to the next through educational attainment, in line with pathway IV, and to what extent mental health inequalities are characterized by the accumulation of risk with either additive or triggering effects (all pathways taken together).

WP2: MENTAL HEALTH AND SOCIAL INEQUALITY: FAMILY, SCHOOL AND COMMUNITY

In this WP, we will combine expertise from mental health and social inequality, health promotion, positive youth development, child development and epidemiology to address: *RQ2: How are family structure, social connectedness, social support, and civic engagement related to social inequalities in mental health in adolescence in a longitudinal perspective?*

Lead: *Tormod Bøe (UiB)* **Partners:** *Nora Wium (UiB), Torill Larsen (UiB), Helga Urke (UiB) Mari Hysing (UiB), Margarida Gaspar de Matos (P), Post doc (UiB)*

We build on WP1 and aim to look more in detail into pathways III and IV in Figure 1. The role of important contextual arenas for social inequality in mental health is examined, particularly family structure, family wealth, parental and offspring education, as well as school and community participation. One of the great changes to family life during the second half of the 20thcentury was the steep increase in divorce rates in industrialized western societies. In Norway, the crude divorce rate (number of divorces per 1,000 persons) more than doubled from 0.7 in 1960 to 1.9 in 2016 (Eurostat, 2018). Rising divorce rates coupled with re-partnering and remarriages have greatly increased the complexity of modern families, leading many youths to grow up in non-traditional family forms, such as single parent and stepparent families (Pearce et al., 2018). Numerous studies have shown that youths with divorced or separated parents on average, have more mental health problems, get lower grades, and are less likely to complete high school and to partake in higher education, than their peers growing up with both biological parents (see Härkönen, Bernardi, & Boertien, 2017; McLanahan, Tach, & Schneider, 2013). Nevertheless, there is a great need for future studies to detail for whom and under which circumstances a divorce leads to adverse outcomes among youths (Amato, 2010). The present WP aims to expand the research field by capitalizing on detailed measurements of family background, parental divorce, resilience and mental health problems from the youth@hordaland study. Furthermore, through register linkage with the Norwegian Education Registry (NUBD), we have obtained high quality register-based information about upper secondary school completion and parental educational levels.

School and communities are alongside family of great importance for adolescents' mental health and positive development. Adolescents from upper/middle class backgrounds are more connected with family, friends, schools and social institutions, while working class children are increasingly more isolated and disconnected from society and its institutions (Putnam, 2016). Social inequality in connectedness and civic engagement are likely linked to social inequalities in mental health, but the mechanisms are not yet well known. Support for basic psychological needs are potentially an important mechanism through which socioeconomic contexts influence mental health (Di Domenico & Fournier, 2014). Higher levels of subjective SES and higher levels of household income may predict higher levels of social support and needs fulfilment. Needs fulfilment can

constitute a mediational pathway linking higher levels of subjective SES and higher levels of household income to higher levels of wellbeing, and lower levels of mental health problems.

We also aim to link data from national income registers to the youth@hordaland/Bergen Child Study to be able to use information about family economic history and longitudinal data on mental health to investigate associations between financial circumstances and mental health throughout childhood and adolescence.

***Output/articles**:* Through five related papers, we aim to examine (1) the association between parental divorce and upper secondary school completion and (2) the link between parental divorce and mental health problems among adolescents. The unique contribution of the present proposal is the ability to capture greater heterogeneity in adolescents' adjustment to divorce, by examining potential moderators (e.g., family economy, parental educational qualifications and resilience) that can shed light on possible risk and protective factors. The next two will examine the role of civic engagement and social support. (3) The role of civic engagement in mental health and wellbeing among young people. (4) Social connectedness, social support and mental health inequalities: Main and mediating effects. As data from COMPLETE are collected in three waves among upper secondary students, it is possible to examine the development longitudinally, as well as detect whether these variables produce social inequality differences in mental health. (5) In the final paper, we aim to investigate associations between household income and mental health across middle childhood and adolescence using longitudinal data on household income from 2004 until 2012, data on mental health symptoms measured in 2002, 2006, and 2012 in the Bergen Child-/youth@hordaland study.

WP3: MENTAL HEALTH AND SOCIAL INEQUALITY; NATIONAL AND NORDIC TRENDS; MEASUREMENT QUALITY AND VALIDITY.

In this WP, we combine expertise from health promotion, education, public health, social inequality and positive youth development, psychometrics and statistical methods to address: *RQ3: Is it possible to develop a Nordic Socioeconomic Index of social inequality? RQ4: What trends in social inequality in self-reported health behaviors and mental health and wellbeing, and their psychosocial determinants, are there among adolescents in Nordic countries from 1993 to 2018?*

Lead: *Torbjørn Torsheim (UiB)* **Partners:** *Oddrun Samdal (UiB), Tormod Bøe (UiB), Simon Øverland (FHI), Helga Urke (UiB), Phd (UiB)*

We build on WP 1 & 2 and aim to look more in depth into methodological challenges, and a wider societal context. While research on trends in health inequalities are starting to accumulate, little is known about the trends in adolescent populations. The Health Behaviour in School-aged Children Study. A WHO Cross-national survey (HBSC) (www.hbsc.org) provides a unique opportunity for tracking inequality back into the 1990s across representative national samples of 11-15-year-olds across more than 30 countries in Europe and North-America. However, the quality and validity of inequality studies, including the HBSC study, heavily rely on the quality of socioeconomic indicators, as well as appropriate modelling approaches. RQ3 seeks to increase the scope for valid conclusions about trends in health inequality by: a) establishing the level of comparability across time for a battery of previously used indicators, b) applying and demonstrating path analytic decomposition of sources of inequality, and c) developing and refining a set of indicators for future use in inequality research.

The first step of this WP examines the psychometric properties of existing indicators of socioeconomic indicators, covering nine cycles of the HBSC study. Children and adolescents often lack valid information about parental income and education (Ensminger et al., 2000). Indirect measures based on reports of family material conditions (Currie et al., 2008; Wardle, Robb, & Johnson, 2002) as well subjective measures of family social status (Goodman et al., 2001) are recommended alternatives, as these measures provide accessible, relevant and developmentally appropriate sources of information about status. To be able to use theses indirect measures in trend analysis, there is a need to establish comparability across time using rigorous psychometric models. Studies on the validity have identified adequate levels of comparability across countries (Torsheim et al., 2016) and expected associations with mental health outcomes (Elgar et al., 2013; Levin et al., 2011), but there is a relative paucity of research on the level of comparability of socioeconomic indicators across historical time (Schnohr et al., 2013). This part of the work package requires intensive data management and documentation. Indicators as far back as 1985 need to be documented. Using latent variable measurement

models (Torsheim et al., 2016) we seek to establish the level of measurement invariance in a battery of indicators of socioeconomic position, including parental occupation, family affluence, subjective wealth and subjective socioeconomic status.

In step 2, using the set of identified comparable and valid socioeconomic indicators from step 1, we examine trends in health inequalities in life satisfaction and subjective health complaints using five cycles of data for life satisfaction (2001-2018), and at least seven cycles of data for subjective health complaints (1993-2018) to answer RQ4. Trends in inequality will be estimated using Poisson regression models enabling the computation of relative and absolute inequalities and testing the SES by time interaction effects. This model-based framework will demonstrate whether the total relative and absolute inequality has changed over time. In line with the pathways model, mediation pathways will be assessed, entering sex, family background, social support in family and school, and health behavior as potentially mediating or moderating variables.

The last step of this WP initiates a process to developing a Nordic Socioeconomic Index, bridging information on previously used indicators with the needs for new indicators. Existing measurement methods for future studies of inequality need to adapt to historical changes and unique cultural differences. Identifying markers of family wealth that are relevant in the relatively wealthy Nordic countries is a particular challenge. To exemplify, psychometric studies documented that computer access was a proper indicator of high wealth at the start of the century, but not in the current society (Schnohr et al., 2013). The validity of indicators is also affected by concurrent cultural and economic differences. A validity study showed that number of bathrooms and having a dishwasher was an indicator of high affluence in several European countries, but not in Norway where dishwasher ownership is omnipresent (Torsheim et al., 2016).

Output/articles: Exploring the measures and trends in inequality will produce five peer-reviewed papers. Three will be within the frame of a PhD project (1) Measurement invariance of socio-economic indicators across time, (2) Decomposing sources of relative and absolute inequality and (3) Initial Development of Nordic Socioeconomic Index of Inequality. The last two will address national (4) and Nordic trends (5) in social inequality in mental health among adolescents.

WP4: MANAGEMENT, COLLABORATION AND DISSEMINATION

Lead: *Helga Urke*, *Torill Larsen (UiB) and the Project coordinator* **Partners**: *All partners*

Work package leaders, the project coordinator together with the PI`s, form the steering committee, which is responsible for strategic planning, resource allocation and reporting. Steering committee members will communicate frequently via email and Skype and will have annual meetings. The project coordinator, together with the PI, will be responsible for administering data, and planning of meetings with stakeholders and partners. To utilize the complementary and cross-disciplinary profile among the partners, an important aim is to publish an overall electronic report in Norwegian, summarising mental health and inequalities in a life course perspective, including the synergies gained from the cross-disciplinary collaboration, and distribute to stakeholders, networks and on university websites. We will also enabling writing seminars for the peer review papers within the different WPs, throughout the whole project period, including the international partners. We will communicate our findings in a diverse range of channels (peer reviewed papers, Facebook, twitter, project web site, meetings with stakeholders) to different target groups e.g., researchers, politicians, policy makers, schools, parents and youths. The project coordinator will therefore have a special responsibility for the dissemination, in collaboration with the PI and all partners.

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