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Trends in absolute and relative educational inequalities in health during times of labour market restructuring in coastal areas: The HUNT Study, Norway

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ABSTRACT

Background: Restructuring labour markets offers natural population-level experiments of great social epidemiological interest. Many coastal areas have endured substantial restructuring of their local labour markets following declines in small-scale fishing and transitions to new employment opportunities. It is unknown how educational inequalities in health have developed in formerly fishery-dependent communities during such restructuring. In this study, we compare trends in social inequalities in health in Norwegian coastal areas with adjacent geographical areas between 1984 and 2019.

Methods: We used cross-sectional population-based data from the Trøndelag Health Study (HUNT), collected four times: HUNT1 (1984–86), HUNT2 (1995–97), HUNT3 (2006–08) and HUNT4 (2017–19). Adults above 30 years of age were included. Using Poisson regression, we calculated absolute and relative educational inequalities in self-rated health, using slope (SII) and relative (RII) indices of inequality.

Results: Trends in absolute and relative inequalities in rural coastal health were generally more favourable than in adjacent geographical areas. We found a statistically significant trend of declining relative educational inequalities in self-rated health in the rural coastal population from HUNT1 to HUNT4. Absolute inequalities overall increased from HUNT1 to HUNT4, although a declining trend followed HUNT2. Nonetheless, the rural coastal population exhibited the highest prevalence of poor self-rated health across the four decades.

Conclusions: Although absolute educational inequalities in self-rated health widened in all geographical areas, the smallest increase was in rural coastal areas. Relative educational inequalities narrowed in this rural coastal population. Considering the concurrent processes of large-scale investments in the Norwegian public sector and welfare schemes, increased fishing fleet safety, and employment opportunities in aquaculture, our findings do not suggest that potential positive effects on public health of this restructuring have benefitted inhabitants with higher educational attainment more than inhabitants with lower educational attainment in this rural coastal population.

1. Introduction

Restructuring labour markets, which can be considered a natural experiment at population level, is of great interest for social epidemiological studies. Because of the extensive restructuring of fisheries and their associated communities, coastal regions are of particular interest.

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Since the 1980s, there has been a substantial decline in small-scale fishing, a development particularly apparent in North European and North American coastal areas (Olson, 2011; Pinkerton and Davis, 2015). Coastal communities that formerly relied on ocean resources have faced major crises in fish stocks, with the subsequent downsizing of this long-standing industry and the loss of the livelihoods of many coastal inhabitants and families (Johnson, 2018; Urquhart et al., 2011). In many areas, the crisis has been accompanied by international neoliberal policy shifts in fishing, where privatisation and new quota distributions have threatened the sustainability of small-scale fisheries (Pinkerton, 2017; Pinkerton and Davis, 2015).

The decline in small-scale fishing has played a significant role in the general restructuring of Norwegian rural coastal areas since the mid-20th century. Following stock collapses and subsequent quota regulations that were introduced in the 1980s (Holm et al., 2015), some Norwegian coastal communities became completely vacated, while others experienced the substantial restructuring of the local labour market (Christensen, 2014; Iversen et al., 2020; Vik et al., 2011). Today, the remaining fishing fleet is small and technologically developed, consisting of fewer and bigger vessels with safer and more automized fishing gear (Sønvisen et al., 2011). Concurrent with the decline in small-scale fishing, Norway experienced several parallel societal developments: a general large-scale investment in the public sector, in which the biggest growth in public sector employment was between 1970 and 1980; a substantial increase in the level of education in all Norwegian regions (SSB, 2019a); the continuous strengthening of welfare schemes following the National Insurance Act of 1966 (Ellingsæter et al., 2020; Mørk, 1984); as well as booming marine industries, such as aquaculture and oil. These developments have resulted in the transformation of many coastal labour markets through new employment opportunities and welfare safety nets (Christensen and Zachariassen, 2014; Sønvisen et al., 2011; Vik et al., 2011).

Although economic restructuring of societies is intertwined with public health (Stuckler et al., 2009), we still do not know how periods of industrial transitioning associate with health inequalities in coastal populations. Previous studies have indicated that social inequalities in health increase during times of economic recession (Bacigalupe and Escolar-Pujolar, 2014), although Nordic welfare regimes are assumed to buffer against increasing social inequalities in health in deteriorating economies (Lahelma et al., 2002). For example, one study found that inhabitants of Norwegian rural coastal areas who previously relied on small-scale fishing reported poorer self-rated health compared with residents in adjacent urban, inland and fjord areas (Hjorthen et al., 2020). In the same rural coastal population, self-rated health has been found to overall improve from the 1980s to 2020, resulting in narrowing health gaps to adjacent areas (Hjorthen et al., 2021). Still, we know little about how the transformations in coastal labour markets may relate to changes in social inequalities in health, as trends in social inequalities in health in coastal areas following and during times of economic restructuring remain unstudied.

1.1. Educational inequalities in health: the pathway of employment

While current knowledge about social inequalities in health in restructuring coastal communities is limited, the relationship between social position and health has been thoroughly documented. Numerous studies have indicated that social position, especially educational level, is associated with a wide range of health indicators (Marmot, 2003). The gap in health between the top and bottom of the social hierarchy is not clearly delineated; rather, it follows a gradient, in which health improves as social position rises (Braveman and Gottlieb, 2014; Marmot, 2004). Social inequalities in health have been found to persist across European countries over the last decades, including in highly developed welfare states, such as the Nordic welfare regimes (Eikemo et al., 2008; Mackenbach et al., 2018). Following the millennium, prevalences of self-assessed morbidity have overall declined in European countries, in both men and women, irrespective of educational attainment. However, during the same period, the improvement in self-assessed morbidity was greatest among the highly educated, resulting in widening social inequalities in self-assessed health in European countries (Mackenbach et al., 2018). In the Western European countries most severely affected by the 2008 economic crisis, the trends in self-assessed health were less favourable (Mackenbach et al., 2018). Still, current knowledge on developments in educational inequalities in health in specific geographical regions, such as coastal areas, is limited.

Several theories about social determinants have been presented and debated in attempts to explain the association between education and health. Educational gradients have been found to be greater in high-preventable causes of morbidity and mortality (Mackenbach et al., 2015; Phelan et al., 2004; Rydland et al., 2020). This finding has been presented as evidence for socioeconomic status being the *fundamental cause* of inequalities in health through its embodied flexible resources such as money, knowledge, power, prestige and beneficial social connections (Link and Phelan, 1995). A frequently suggested social determinant and pathway concerns employment and working conditions. People with less formal education typically have fewer employment opportunities and lower expected wages, and are more vulnerable to economic fluctuations and subsequent unemployment and financial instability (Braveman and Gottlieb, 2014; Egerter et al., 2011). Numerous studies have documented the association between unemployment and poor physical health (Suhrcke and Stuckler, 2012), also within Scandinavian welfare state regimes (Bambra and Eikemo, 2009). Job insecurity, which often involves pessimism and a lack of financial security, has been found to be associated with poor self-rated health, as well as depression (Ferrie et al., 2005). Furthermore, workers with less formal education are more likely to hold jobs that include occupational hazards and poor working conditions, which puts them at higher risk of injury, illness and fatality (Egerter et al., 2011; Kaikkonen et al., 2009).

On an aggregated level, the restructuring of labour markets has likely entailed an overall shift in employment and working conditions in the rural coastal population, which was formerly comprised of many fishers and associated families with low educational attainment, hazardous working conditions, and vulnerability to sudden changes in ocean resources. However, the rural coastal population has increasingly become employed in the professionalised and largely non-manual public sector. Moreover, the great expansion in aquaculture since the mid-1980s has provided new occupations in manual labour, and the technological progress of the remaining fishing fleet has provided safer conditions for workers at sea, in contrast to the formerly hazardous occupations in small-scale fishing (Petursdottir et al., 2001; Sønvisen et al., 2011).

It remains unclear how educational inequalities in health have developed in formerly fishery-dependent communities during the process of restructuring. We do not know whether the restructuring of local labour markets has been accompanied by a widening in educational inequalities in health, which has been the general trend observed in European countries over the last decades (Mackenbach et al., 2018). Considering the pathway between working conditions and health, the decline and restructuring of a widespread, hazardous and vulnerable occupation traditionally conducted by coastal inhabitants of lower educational attainment may have altered the gap in health levels between inhabitants with lower and higher educational attainment in rural coastal areas. Therefore, we aim to examine the development in educational inequalities in health in rural coastal areas during decades of restructuring.

In this study, we examine trends in absolute and relative educational inequalities in self-rated health in a coastal area with a history of collapse in small-scale fishing and a transition to new industries, which can be considered a natural experiment at the population level. We use repeated cross-sectional population health data from Norwegian rural coastal municipalities, which were collected over four decades. In this observational study, we describe and discuss the development in educational inequalities in health against the backdrop of societal restructuring. Our methodological design does not aim to demonstrate causality between the restructuring of coastal labour markets and changes in educational inequalities in health. Based on earlier findings indicating poorer health in rural coastal areas compared with both inland and other coastal-adjacent areas (Hjorthen et al., 2020, 2021), in this study, we compare results from rural coast with urban coastal, inland and fjord areas to assess whether educational inequalities in self-rated health have developed differently between these geographical areas over time.

2. Methods

2.1. Study population

Our study was based on data from the Trøndelag Health Study (HUNT), a Norwegian adult population-based cross-sectional health survey conducted four times: 1984–1986 (HUNT1), 1995–1997 (HUNT2), 2006–2008 (HUNT3) and 2017–2019 (HUNT4) (Krokstad et al., 2013). All inhabitants 20 years and older in the now former county of Nord-Trøndelag were invited to participate. The total participation rates in the four survey rounds were 89%, 70%, 54% and 54% of the invited population, respectively. Nord-Trøndelag county has been found to have somewhat lower education and income levels compared to the national Norwegian average (Krokstad et al., 2004). Considering that the county does not constitute an extreme, in combination with the general government involvement in all Norwegian regions, we considered this population to be adequate for the purpose of studying trends in health.

The former Nord-Trøndelag County consisted of 24 municipalities. The primary interest of this study was rural coastal areas with a predominant history of small-scale fishing; five municipalities met this criterion. These municipalities share three coastal characteristics. Firstly, they have a substantial historical employment proportion of employment in fishing, which is mainly small-scale. In 1960, the proportions of employment in fishing ranged from about 10% to 27% of the total workforce in these municipalities, with an overall proportion of 17% for all five municipalities combined. In the remaining municipalities, employment in fishing was below 5% (NSD, 2020) (Data were obtained from the Norwegian Centre for Research Data's (NSD) municipality database. NSD is not responsible for analyses or interpretations in this study). Our definition of rural coastal municipalities is therefore in line with former analyses of fishery-dependent municipalities in Norway, which have operated with a cut-off of 5% employment in fishing (Iversen et al., 2016; Riksrevisjonen, 2020). Secondly, these five municipalities border an ocean, and they have provided long-standing coastal trading points along historical coastal shipping routes (Herje et al., 1999). Thirdly, the five municipalities have a low land-to-coast ratio, with an area average of 0.46 km^2 land per km of coastline, which implies greater physical proximity to the coast for the inhabitants of these municipalities compared with other areas or municipalities in the county.

Data on rural coastal areas have been compared with data on the

Table 1
Unadjusted characteristics of the study samples from the HUNT Study, Norway. Adult population 30+.

	HUNT1 (1984–86)	HUNT2 (1995–97)	HUNT3 (2006–08)	HUNT4 (2017–19)
Rural coast				
Response rate	90.4	68.9	52.6	55.6
Final N	6670	5363	3928	4363
Prevalence of poor self-rated health	2801 (42)	2096 (39.1)	1395 (35.5)	1404 (32.2)
Missing self-rated health	37 (0.6)	29 (0.5)	149 (3.7)	77 (1.7)
Educational level				
Primary	4776 (71.6)	2921 (54.5)	1111 (28.3)	795 (18.2)
Secondary	849 (12.7)	1712 (31.9)	1741 (44.3)	2209 (50.6)
Tertiary	340 (5.1)	615 (11.5)	804 (20.5)	1341 (30.7)
Missing	705 (10.6)	115 (2.1)	272 (6.9)	18 (0.4)
Urban (coast)				
Response rate	87.8	68.7	52.2	51.8
Final N	38710	34723	28366	31748
Prevalence of poor self-rated health	11115 (29)	9903 (28.5)	7366 (26.0)	7766 (24.5)
Missing self-rated health	174 (0.5)	364 (1)	793 (2.7)	474 (1.5)
Educational level				
Primary	22253 (57.5)	13687 (39.4)	4979 (17.6)	3480 (11)
Secondary	8218 (21.2)	13611 (39.2)	12502 (44.1)	14675 (46.2)
Tertiary	4123 (10.7)	6940 (20)	8817 (31.1)	13494 (42.5)
Missing	705 (10.6)	485 (1.4)	2068 (7.3)	99 (0.3)
Rural inland				
Response rate	93.1	71.2	62.88	63
Final N	9287	7471	5950	6210
Prevalence of poor self-rated health	2651 (28.6)	2200 (29.5)	1656 (27.8)	1633 (26.3)
Missing self-rated health	69 (0.7)	39 (0.5)	284 (4.6)	120 (1.9)
Educational level				
Primary	6199 (66.8)	3679 (49.2)	1436 (24.1)	992 (16)
Secondary	1657 (17.8)	2656 (35.6)	2779 (46.7)	3035 (48.9)
Tertiary	597 (6.4)	1083 (14.5)	1456 (24.5)	2165 (34.9)
Missing	834 (9)	53 (0.7)	279 (4.7)	18 (0.3)
Rural fjord				
Response rate	91.5	71.9	54.6	56.8
Final N	9682	8096	6158	6442
Prevalence of poor self-rated health	3346 (34.6)	2752 (34)	1898 (30.8)	1749 (27.2)
Missing self-rated health	19 (0.2)	31 (0.4)	227 (3.6)	107 (1.6)
Educational level				
Primary	6262 (64.7)	3840 (47.4)	1423 (23.1)	942 (14.6)
Secondary	1775 (18.3)	3008 (37.2)	2850 (46.3)	3290 (51.1)
Tertiary	756 (7.8)	1180 (14.6)	1509 (24.5)	2194 (34.1)
Missing	889 (9.2)	68 (0.8)	376 (6.1)	16 (0.3)

remaining population of the county. Similar to previous studies (Hjorthen et al., 2020, 2021), the remaining municipalities were classified into three geographical categories: urban coast, rural inland and rural fjord. Five municipalities were classified as urban coastal areas. Historically, these municipalities comprise town areas. All urban coastal municipalities border the coast, four of which are in fjord areas, with an area total land-to-coast ratio of 6.39 km^2 land per km of coastline. The two remaining categories, rural inland municipalities (eight municipalities) and rural fjord municipalities (from six to five municipalities at HUNT 4 because of municipality mergers), have no pronounced history of fishing (1.6 and $<$ 1% of the total workforce in 1960, respectively). However, the fjord and inland categories differed significantly in land-to-coast ratio (with 4.88 km^2 and no coastline, respectively). Considering that previous studies have revealed potentially positive effects of coastal proximity on residents' health (Wheeler et al., 2012; White et al., 2013), the validity of our study was likely strengthened by differentiating between these two areas.

We limited our analyses to data on participants aged 30 years or older to ensure the attainment of education. Educational attainment was requested in all HUNT surveys except HUNT3. If the respondents had participated in several surveys in the HUNT Study, any missing data on educational level were imputed if available. The remaining missing regarding education were handled through multiple imputation in all four surveys. Following methodological recommendations, available responses on all variables were included in the imputation modelling, including the dependent variable of self-rated health (Von Hippel, 2007). Respondents with missing values of self-rated health were then excluded from the final analyses, as there were few missing cases (all below 5%) and therefore unlikely to introduce bias (Jakobsen et al., 2017). The final sample sizes and missing responses on self-rated health in each geographical category are presented in Table 1.

2.2. Measurement of health

The outcome in this study is self-rated general health, which is a widely studied and validated measurement of health that has been shown to have strong predictive ability regarding mortality, morbidity and work-related disability (DeSalvo et al., 2006; Fosse and Haas, 2009). In the HUNT Study, the original variable of self-rated general health was measured by the question "How is your health at the moment?" with four response alternatives: "Poor", "Not so good", "Good" and "Very good". The responses "Poor" and "Not so good" were merged into "Poor self-rated health", while the responses "Good" and "Very good" were merged into "Good self-rated health", functioning as a reference category.

2.3. Educational level

Educational level was chosen as the indicator of socioeconomic position in this study. Educational level is a stable measurement which is attained early, and is also maintained if respondents have left the labour market. The original set of variables on educational level consisted of eight (HUNT1), five (HUNT2) and six (HUNT4) categories, which were collapsed into three levels based on the educational classifications of ISCED11 and NUS 2000 (Barrabés and Østli, 2016): primary (primary and lower secondary school), secondary (upper secondary and post-secondary school) and tertiary (first and second stage of tertiary education).

2.4. Statistical analysis

Age-standardised prevalences of poor self-reported health were calculated using 10-year age groups, using the direct method and only available observations. The standard population used in the standardisation was the total population of Nord-Trøndelag County aged 30 years or older on January 1st, 2000. A standard population based on the total population, in contrast to disaggregation by gender, enables the comparison of prevalences between genders (Pace et al., 2013). Analyses stratified by gender are available in the supplementary material.

Educational inequalities in self-rated health were measured using the slope index of inequality (SII) and the relative index of inequality (RII). These are regression-based absolute and relative measurements of inequalities in health, providing absolute and relative differences in the prevalence of outcomes between respondents with the lowest and highest educational level (Regidor, 2004). Absolute measures, such as SII, are sensitive to changes in the frequency of the health problem being studied, which limits comparisons of socioeconomic inequality in health across populations or over time (Regidor, 2004). By also calculating RII, we achieve a better assessment of educational inequalities in self-rated health across the four rounds of the HUNT surveys. Educational levels were assigned a ridit score ranging from 0 (highest level of education) to 1 (lowest level of education). The ridit score was based on the midpoint of the range in the cumulative distribution of the population of participants in the given category. Values of SII greater than 0 and RII values greater than 1 indicate that the outcome is more prevalent among individuals with lower education than among individuals with higher education.

Both SII and RII were calculated using robust Poisson regression with identity and log link functions, respectively. Poisson regression is considered an adequate method for handling binary outcomes, especially when the prevalence is low and the model contains continuous covariates (Chen et al., 2018; Huang, 2019). Multiple imputation was used. The SII can be interpreted as prevalence differences, whereas the RII can be interpreted as prevalence ratios. SII and RII were obtained by regressing self-rated health on the ridit-score. All models were adjusted for age and gender and estimated with 95% confidence intervals. Estimations were calculated separately for each HUNT survey. Trends were assessed by pooling the four surveys and including a two-way interaction term ridit score by survey, as done by Ernstsen et al. (2012) and Mondor et al. (2018). Similarly, to test for gender differences in RII and SII at each survey, we included a two-way interaction term ridit score by gender at each survey. To test for gender differences in RII and SII trends over time, we included a three-way interaction term ridit score by gender by survey (Ernstsen et al., 2012).

3. Results

Unadjusted prevalence of poor self-rated health decreased from HUNT1 to HUNT4 in all geographical categories. Educational level increased over time in all geographical categories, leaving primary education the smallest group in all categories at HUNT4 (Table 1). The age-standardised prevalence of poor self-rated health in all educational groups was the largest in the rural coastal population compared with all other geographical regions at both HUNT1 and HUNT4. Age-standardized prevalences increased from HUNT1 to HUNT4 in all education groups in all geographical categories, except for tertiary education in the rural fjord population (Table 2).

The rural coastal population exhibited the largest absolute (SII) educational inequalities in self-rated health compared with all other geographical regions at HUNT1. The absolute inequalities in rural coastal areas increased from HUNT1 to HUNT2 and decreased from HUNT2 to HUNT4. The test for trend indicated a statistically significant trend of narrowing absolute inequalities ($p < 0.001$) (Fig. 1). Stratified analyses showed that rural coastal men exhibited a substantial decline in absolute inequalities, while rural coastal women exhibited a substantial increase (Supplementary material, Tables 1 and 2). All geographical regions exhibited increased absolute educational inequalities in health (SII) at HUNT4 compared with HUNT1. The smallest increase was in the rural coastal population (19.7%), and the biggest increase was in the rural fjord population (83.7%). At HUNT4, absolute educational inequalities in self-rated health in the rural coastal areas were smaller than in the rural fjord areas.

Table 2
Age-standardised prevalence of poor self-rated health and absolute (Slope index of inequality, SII) and relative (Relative index of inequality, RII) educational inequalities (95% CI in brackets) in poor self-rated health. The HUNT Study, Norway. Adult population 30+.

	HUNT1 (1984–86)	HUNT2 (1995–97)	HUNT3 (2006–08)	HUNT4 (2017–19)	Change HUNT1-HUNT4	P for trend
Rural coast						
Primary	41.6	43.2	43.0	43.4		
Secondary	27.6	32.3	31.6	31.5		
Tertiary	21.7	24.9	24.9	23.6		
SII	19.19 (13.65–24.73)	26.10 (20.58–31.62)	24.61 (18.28–30.93)	22.95 (17.54–28.36)	+19.7%	**<0.001**
Gender*	0.673	0.996	0.090	**0.005**		**0.022**
RII	2.68 (2.09–3.43)	2.41 (2.01–2.88)	2.17 (1.80–2.62)	2.07 (1.73–2.48)	−22.8%	**<0.001**
Gender*	0.575	0.065	0.265	0.252		0.158
Urban (coast)						
Primary	31.0	35.1	36.4	39.1		
Secondary	23.1	26.8	26.1	26.2		
Tertiary	16.3	20.2	18.8	18.5		
SII	14.03 (12.14–15.93)	19.62 (17.78–21.47)	19.52 (17.35–21.69)	20.71 (18.91–22.52)	+47.6%	**<0.001**
Gender*	0.597	0.498	0.138	0.104		0.495
RII	2.30 (2.09–2.53)	2.15 (2.00–2.33)	2.10 (1.93–2.29)	2.30 (2.12–2.48)	0%	**<0.001**
Gender*	0.094	**<0.001**	**<0.001**	**0.023**		0.361
Rural inland						
Primary	28.7	32.6	32.0	32.2		
Secondary	18.7	26.4	26.2	25.4		
Tertiary	14.7	17.4	20.1	19.3		
SII	11.77 (7.73–15.81)	18.21 (13.81–22.61)	20.00 (15.13–24.86)	16.99 (12.72–21.26)	+44.4%	0.865
Gender*	0.434	0.219	0.218	0.194		0.898
RII	2.44 (1.95–3.06)	2.11 (1.78–2.49)	1.99 (1.65–2.38)	1.86 (1.57–2.21)	−23.8%	**0.002**
Gender*	0.948	0.800	**0.013**	0.380		0.427
Rural fjord						
Primary	34.8	36.9	42.6	39.2		
Secondary	25.3	31.3	29.1	28.2		
Tertiary	19.3	21.0	21.2	18.0		
SII	12.94 (8.63–17.25)	19.45 (15.01–23.88)	22.51 (17.63–27.38)	23.77 (19.56–27.98)	+83.7%	0.104
Gender*	0.520	0.303	0.234	0.060		**0.041**
RII	2.22 (1.84–2.67)	1.97 (1.70–2.27)	2.04 (1.73–2.40)	2.43 (2.06–2.87)	+9.5%	0.128
Gender*	0.837	**0.049**	0.816	0.249		0.924

*P-values of interaction term.
Values in bold indicate p-values <0.05.

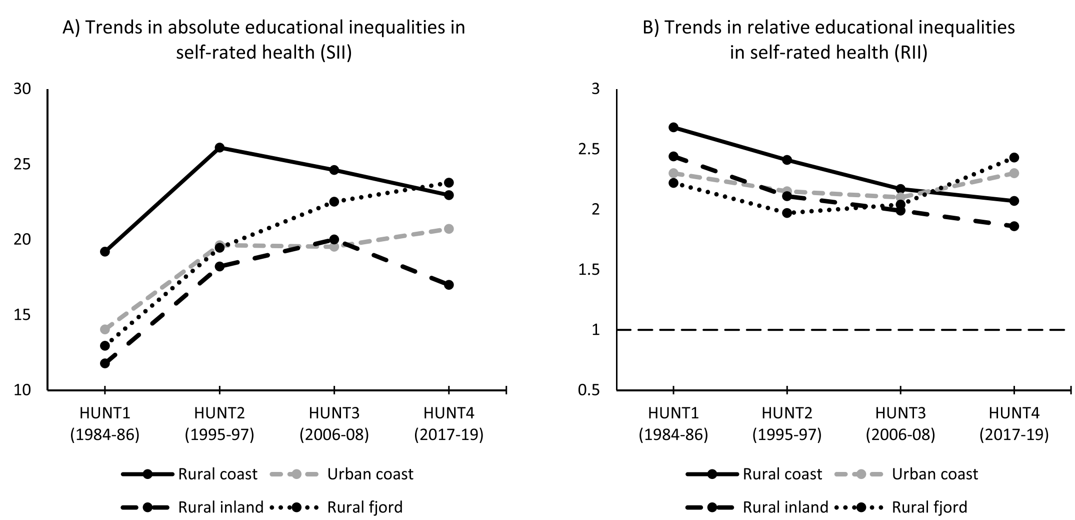

Fig. 1. Trends in slope index of inequality (SII) and relative index of inequality (RII) in poor self-rated health in the rural coastal, urban coastal, rural inland and rural fjord population from HUNT1 (1984–86) to HUNT4 (2017–19), the HUNT Study Norway.

The rural coastal population exhibited the largest relative (RII) educational inequalities in self-rated health compared to all other geographical regions at HUNT1. Relative inequalities decreased steadily in the rural coastal population from HUNT1 to HUNT4, and test for trend showed a statistically significant trend of narrowing relative inequalities ($p < 0.001$) (Fig. 1). Stratified analyses show rural coastal men to exhibit a substantially larger decline in relative inequalities compared to rural coastal women (Supplementary material, Tables 1 and 2). This was also the case in the rural inland population ($p = 0.002$). The urban coast and rural fjord population exhibited an initial decrease in relative educational inequalities in self-rated health following HUNT1, but they exhibited relative inequalities at HUNT4 equal to and higher than at HUNT1, respectively. At HUNT4, relative educational inequalities in self-rated health in rural coastal areas were smaller than in rural inland and rural fjord areas.

Test for gender differences at each survey revealed statistically significant differences between genders only in SII at HUNT4 in the rural coastal population, where men exhibited smaller absolute inequalities in poor self-rated health compared with women ($p = 0.005$) (Table 2). Regarding the remaining geographical regions, gender differences were found in RII at HUNT2, HUNT3 and HUNT4 in the urban coastal population and at HUNT2 in the rural fjord population. Gender differences in trends were found in the rural coastal population ($p = 0.022$) and in the rural fjord population ($p = 0.041$), where the development in absolute inequalities over time was significantly smaller for men compared to women.

4. Discussion

In this study, we examined absolute and relative educational inequalities in self-rated health over four decades in a rural coastal population that has faced a substantial restructuring of its local labour market, particularly in relation to declines in small-scaled fishing, in a Norwegian welfare state setting.

We found statistically significant trends of declining absolute and relative educational inequalities in self-rated health in this rural coastal population. Relative educational inequalities declined steadily from HUNT1 to HUNT4, while absolute educational inequalities declined following an initial increase from HUNT1 to HUNT2. This resulted in larger absolute educational inequalities at HUNT4 compared with HUNT1. Overall, our findings indicate narrowing educational inequalities in health during a period of labour market restructuring. Our findings suggest that rural coastal inhabitants with higher educational attainment have not benefitted more greatly health-wise from the societal restructuring, despite this being a period characterized by the loss of primary sector livelihoods and a substantial increase in professionalised employment opportunities in public sector. The educational level in this rural coastal population increased over the survey period, leaving the lowest educational group the smallest at HUNT4. This was expected, as the general level of education has increased in the total Norwegian population over the same period (SSB, 2019a). The findings showed that age-adjusted prevalences of poor self-rated health in both the lowest and highest educational levels were fairly stable, which was somewhat unexpected because of the substantial change in the distribution of these groups.

As we are not aware of similar studies on developments in educational inequalities in self-rated health in rural populations experiencing substantial restructuring of their local labour market, the comparison of our findings with existing literature is limited. Similarly, existing literature limits comparisons with restructuring coastal areas with less generous or absent welfare schemes. Still, widening or overall stable absolute educational inequalities in self-assessed health have been observed in European countries over the last decades (Hu et al., 2016; Mackenbach et al., 2018). Moreover, our findings from this rural coastal population add nuances to the findings of larger national and cross-national studies pointing to a general trend of persisting or widening relative educational inequalities in self-assessed health in Western Europe (Hu et al., 2016; Mackenbach, 2012; Mackenbach et al., 2018).

Compared with the other geographical areas of the county, the rural coastal population exhibited a decrease in relative education inequalities in self-rated health, which was matched only by the rural inland population. The rural coastal population changed from exhibiting the largest relative educational inequalities in self-rated health at the first HUNT survey to exhibiting smaller relative inequalities compared with both the rural fjord and urban coast populations at the fourth HUNT survey.

In all geographical areas examined in this study, absolute inequalities in self-rated health were greater at HUNT4 compared with HUNT1. Although changes in absolute inequalities in health are overall less emphasized compared to relative inequalities in health literature, the importance of monitoring their development has been advocated (Houweling et al., 2007; Mackenbach, 2015). Ignoring absolute measures incurs the risk of overlooking developments in overall population health and in the absolute rates of disease for each group (Harper et al., 2010). The increase in absolute educational inequalities in self-rated health could indicate that inequality is worsening, which is often caused by a greater absolute increase in the rate of poor health of the disadvantaged (Harper et al., 2010). The initial increase in absolute inequalities in rural coastal areas could be seen in light of a great decline in cod-fishing in the late 1980s (Bjørndal et al., 2004). However, our findings indicate that this was a general development in Norwegian society at the time. Overall, the rural coastal areas exhibited the smallest increase in absolute inequalities among the four geographical regions, and the results of the stratified analyses showed a decrease among rural coastal men. This finding indicates that although the prevalence of poor self-rated health in all educational groups increased in rural coastal areas during this period, they increased at more similar rates compared with the remaining geographical regions. Considering the age-adjusted prevalences, rural coastal inhabitants with primary education exhibited a smaller increase in the prevalence of poor self-rated health compared with inhabitants with primary education in the remaining areas. Rural coastal inhabitants with tertiary education exhibited a higher prevalence of poor self-rated health compared with the tertiary groups in the remaining areas.

Although it showed the largest prevalence of poor self-rated health among the four geographical regions, the development of educational inequalities in health was generally more favourable in the rural coastal population compared with the remaining areas in the county. In light of the potential pathway of employment in educational health inequalities, the narrowing relative educational health gap in rural coastal areas, as well as the smaller widening in absolute inequalities compared to the remaining county, can suggest that differences in employment-related health hazards have decreased between educational groups in this rural coastal population. In contrast to the remaining areas in the county, rural coastal areas have experienced labour market shifts that are strongly linked to the downturn and transformation of a local and coastal-based industry. This transformation has likely entailed a narrowing gap in working conditions and economic vulnerability between manual and professionalised non-manual jobs. Although our analysis does not prove causality between the labour market restructuring and narrowing educational inequalities in health, our findings can suggest that the general shift in employment conditions may have contributed to the narrowing in relative educational inequalities in health. And although the pathways linking educational level and health are complex and highly debated (Braveman and Gottlieb, 2014), our findings provide insights into the potential effects of working conditions on the relation between educational levels and inequalities in health (Egerter et al., 2011), suggesting that this pathway may be affected by structural changes in society.

Correspondingly, the role of welfare expenditures should be emphasized. In Norway, the established welfare services, which were strengthened during the same period as the restructuring of fishing industries (Ellingsæter et al., 2020), might have benefitted groups leaving manual coastal occupations because of unemployment or work-related injuries. Because welfare benefits are found to lessen the potential health hazards of economic recession and unemployment (Abebe et al., 2016; Stuckler et al., 2009), rural coastal inhabitants affected by the decline in small-scale fishing have likely benefitted from extensive social expenditures. Nonetheless, public spending does not guarantee educational equality in health. Although Nordic welfare regimes have been assumed to buffer the growth in social inequalities in health rates during times of economic recession (Lahelma et al., 2002), they have not been found to outperform other European welfare regimes in preventing social inequalities in health (Eikemo et al., 2008).

Our findings should also be considered in the context of the study area. Central Norway is a region with some of the lowest educational inequalities in daily smoking, physical activity and alcohol consumption on both relative and absolute scales (Elstad and Koløen, 2009). Findings from previous research on this study population have indicated decreasing relative educational inequalities in self-rated health in the total county population (Krokstad et al., 2002), where levels of inequality have been shown to be lower than the national average (Mackenbach et al., 1997). The lack of a big city in the region has been presented as a possible explanation (Krokstad et al., 2002), as larger cities typically demonstrate greater inequalities compared with rural areas (Elstad and Koløen, 2009). Considering the rurality of our study area, smaller inequalities in rural coastal areas compared to both national and European averages are expected.

We found no statistically significant differences in relative inequalities in self-rated health between genders in the cross-sectional and trend results. We found a statistically significant trend of smaller absolute educational inequalities in men compared with women over time in the rural coastal and rural fjord areas. In sum, these findings give no clear reason to suggest that the transformation of rural coastal local labour markets has benefitted one gender over the other. During the decades spanned by the HUNT Study, more women entered the labour market (Ellingsæter et al., 2020; SSB, 2019b) and were likely to have benefitted from the national investment in the public sector in rural areas.

4.1. Limitations

Some limitations of our study should be noted. Firstly, education was used as a proxy for socioeconomic status. Alternatively, considering the pronounced egalitarian nature of Norwegian society, occupational class might be an adequate measure of social position or placement in the occupational hierarchy (Elstad and Koløen, 2009). Social class based on occupation is often shaped by the local labour market (Macintyre et al., 2002), and it may provide a suitable measure of socioeconomic status in rural areas. Nevertheless, information about former occupations was not collected in all HUNT surveys, excluding participants who had left the labour because of retirement or illness. Moreover, only one occupation was registered per participant, which potentially left out information on former and long-lasting occupations. Considering the stability, early attainment, and extensive research on educational inequalities in health, the use of educational level as a proxy for socioeconomic status provided more opportunities for comparisons both over time and with the findings of similar studies.

Secondly, some aspects of the rural coastal study population should be commented. Based on a total population study, our results reflected the development of educational inequalities in health in entire communities, not only in those inhabitants directly affected by the restructuring of labour markets. Nonetheless, many rural coastal inhabitants were probably directly or indirectly affected by both the decline in a long-standing industry and growth in the public sector, which made these structural changes important for the greater developments in the area. Moreover, the response rate declined throughout the four HUNT surveys, stabilising at 54% of the invited population in HUNT4. The lower response rate might have increased the risk of sampling bias. However, a nonparticipant study following HUNT3 revealed no significant differences in poor self-rated health between participants and nonparticipants (Langhammer et al., 2012). Relatedly, groups with weaker ties to the community may have been difficult to recruit for participation in research. Although the rural coastal area in this study has a lower portion of migrant workers compared with other fish-farming municipalities in Central Norway (IMDi, 2021), varying experiences of integration into the area (Rye, 2018) may have resulted in lower participation in this group. In addition, selective migration is an unknown factor when studying geographical disparities in health. Because selective migrants have been found to exhibit better health (Riva et al., 2011), outmigration from rural coastal areas should not be dismissed as a potential factor in interpreting findings.

Third, our findings may not be fully generalised to other rural coastal areas that have been affected by the international decline in small-scale fishing. The characteristics of Norwegian rural coastal areas, such as high welfare expenditures, advanced fishing technology and new employment opportunities in the public sector and aquaculture, may have contributed into the trend of narrowing educational inequalities in health. Therefore, one cannot automatically expect narrowing social inequalities in rural coastal communities that have not experienced the same societal restructuring. Findings from the UK indicated lower rates of employment in coastal areas and that coastal employment tended to involve low-skilled and seasonal labour (Depledge et al., 2017). Additionally, concerns have been raised that many potential growth sectors in marine technology are not based in coastal areas (Morrissey, 2017). Such conditions may result in increased vulnerability of rural coastal inhabitants with less formal education compared with this Norwegian setting, and they should be considered in cross-national comparisons. Nonetheless, the findings of the present study are relevant to both coastal and non-coastal areas that have experienced the restructuring of local industries, especially those industries with a history of employing inhabitants with low educational attainment.

Finally, it should be noted that we did not have access to health data in the decades preceding and during the initial drops in fish stocks starting in the late 1950s (Christensen, 2014). Considering the vulnerability of the fishing workforce to stock changes, there may have been an increase in educational inequalities in health during the early declines, which were not captured in the data of this study. Nevertheless, the timespan of the HUNT Study has allowed for tracking health levels during substantial industrial restructuring, including milestones such as the cod crisis in the 1980s, the introduction of quota regulations and the emergence of fish farming, which provide valuable insights into the developments of educational inequalities in self-rated health following an industry decline and the transition to new employment opportunities.

5. Conclusion

The shift in the rural coastal labour market, as a natural experiment at the population level, has entailed both a transition from large-scale employment in small-scale fishing to bigger and safer fishing vessels and parallel growth in employment opportunities in the public sector and aquaculture. The findings of this study showed that rural coastal areas exhibited the largest prevalence of poor self-rated health compared with other geographical regions across four decades. Nevertheless, relative educational inequalities in self-rated health decreased in the rural coastal areas. There is reason to believe that earlier, there were greater differences in both working conditions and employment vulnerability between educational levels, as people in the dominant primary sector of small-scale fishing, who had little formal schooling, were exposed to both hazardous working conditions and unemployment following stock crises. Our findings contrast to national and European overall trends of increasing or stable relative educational inequalities in self-assessed health. In this study population, absolute educational inequalities in self-rated health increased in all geographical areas, where rural coastal areas exhibited the smallest increase. Compared with other geographical areas, the rural coastal areas exhibited more stability in the prevalence of poor self-rated health in participants with primary education and a slight increase in the prevalence of poor self-rated health in participants with tertiary education. Hopefully, as existing literature on regional differences in inequalities in self-rated health is limited, our findings encourage comparisons to be made among smaller areas to explore regional differences in educational inequalities in health in future studies. Our findings also indicated that the mechanisms underpinning health in rural coastal areas may differ from those in other rural areas. Therefore, further studies on the health of coastal areas should be conducted. Furthermore, we recommend exploring trends using a wide range of health measurements, including both lifestyle habits and specific diseases, to attain nuanced knowledge on educational inequalities in health in societies that undergo restructuring.

Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2021.114541.

Credit author statement

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