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Understanding coastal public health: Employment, behavioural and psychosocial factors associated with geographical inequalities. The HUNT study, Norway

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ABSTRACT

Recent decades have shown an international trend of decline in small-scale fishing; a longstanding and vital industry for numerous coastal populations. The decline has resulted in a loss of livelihoods in many coastal communities, potentially afflicting public health. Still, knowledge about the health situation of these areas is limited. Former studies on coastal health have primarily defined coastal areas based solely on their proximity to the coast, therefore not targeting the traditional coastal communities with longstanding coastal involvement through small-scale fishing. In this paper, we aim to illuminate the health situation in these areas by introducing a more fine-grained classification of the coastal study population; considering both geographical proximity to the coast, population density and employment in fishing. Using data from the Norwegian population-based HUNT Study, we perform individual and simultaneous adjustments for employment, behavioural and psychosocial factors to assess the contributions of these factors to the association between geographical affiliation and self-rated general health. The rural coastal areas with a history of small-scale fishing show a poorer health situation compared to urban coastal, rural inland and rural fjord populations, and behavioural factors contribute the most to the observed health disparities. Our findings encourage greater focus on societal differences between coastal communities when studying coastal health.

1. Introduction

Population statistics of England, Wales and Norway reveal populations of coastal areas to be more likely to report poor health compared to inland populations (ONS, 2014; Aase, 1996). Coastal areas, which are extensive and heterogeneous regions, have been of substantial historical and economic importance to numerous nations; inhabiting vital and bearing industries ranging from long traditions of small-scale fishing and shipping to recent upscale fisheries, fish farming and oil exploration (Hundstad, 2014; Urquhart et al., 2011; Johnson et al., 2012). However, recent decades have shown an international trend of considerable decline in small-scale fishing, a long-standing and widespread coastal industry tightly entangled with both social and economic relations of coastal communities (Johnson et al., 2018; Urquhart et al., 2011). This decline is also apparent in Norway, a sea nation where many coastal communities, often rural, have faced major drops in fish stocks from the mid twentieth century, some places combined with booming new industries of oil and fish farming (Onsager et al., 2015; Christensen and Zachariassen, 2014). Many coastal communities have experienced loss of livelihoods and outmigration, and not all have transitioned to new coastal industries (Iversen et al., 2020). Considering the well-established association between area characteristics and several health outcomes, and the intertwinement of public health and economic and social changes operating over decades (Pickett and Pearl, 2001; Men et al., 2003; Hanlon and McCartney, 2008), the downturn in small-scale fishing might compromise the health of coastal populations.

Existing literature on coastal health provides valuable insights about potential health effects of both biological aspects of marine life (Stewart

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et al., 2008) and physical proximity to coastal areas and bluespaces (Wheeler et al., 2012; White et al., 2013; Garrett et al., 2019; Pasanen et al., 2019). However, there is limited attention on the health situation of coastal areas historically characterized by small-scale fishing and long-standing involvement in the surrounding coast, and how these areas might differ from other coastal-adjacent areas. In this study, we aim to assess the health situation of rural coastal areas with a history of coastal involvement, with an emphasis on the contribution of employment, behavioural and psychosocial factors.

1.1. Defining the coastal population

Existing research on coastal health, while providing knowledge about coastal living and health, shares two delimiting traits preventing further insight into the health situation of coastal areas with a history of small-scale fishing. Firstly, and importantly, the definition of coastal populations in former studies is mainly based on proximity to the coast without further consideration to variations in demography and coastal involvement. Considering that coastal areas can be characterized as extensive and heterogeneous regions (Neumann et al., 2015), a geographical classification based solely on coastal proximity risks covering up potential health variations within the coastal population itself. This can include health variations between urban and rural areas (Eberheardt and Pamuk, 2004). This aspect is scarcely assessed in coastal health, but captured by Wheeler et al. (2012) through their urban-rural stratified analyses on health effects of coastal living. However, a mere urban-rural classification of the coastal population does not consider the distinction of coastal communities with or without coastal-involved industries and employment, thus providing limited insight into the health situation of coastal settlements with a tradition of small-scale fishing compared to other coastal and non-coastal areas (Urquhart et al., 2011).

Therefore, we propose a more fine-grained classification of coastal areas, which could aid in capturing the hypothesised heterogeneity of the coastal population. In addition to a distinction between rural and urban coastal areas, as seen in Wheeler et al. (2012), we propose a further classification of the rural coastal areas based on coastal-involved industries. This entails including a rural aquatic coastal category, consisting of rural coastal areas with a history of small-scale fishing. As the loss of livelihoods in these areas may pose potential population health hazards differing from other coastal-adjacent areas without the same coastal industry involvement, a distinction between traditional rural coastal-based areas and other coastal areas might be fruitful when assessing coastal public health.

1.2. Context and composition in coastal health

In addition to a largely proximity-based approach in defining the coastal population, the majority of existing research on coastal health is heavily revolved around *contextual* aspects of geographical inequalities in health; focusing on how physical traits and closeness of the coast itself affects health. Contextual factors often appear as obvious explanations for geographical dispersion of health (Shaw et al., 2002), yet, they are often mediated and heavily intertwined with the composition of the population, including individual traits of the inhabitants (Shaw et al., 2002; Diez-Roux, 1998; Macintyre et al., 2002). In addition, studies suggest that little geographical variance in health remains after controlling for compositional factors (Duncan et al., 1993; Fogelholm et al., 2006). Some studies on coastal health have substantiated the importance of compositional factors by revealing a positive association between coastal proximity and health after controlling for both potential area and individual level confounders (Wheeler et al., 2012; White et al., 2013; Garrett et al., 2019). These findings contradict population statistics showing higher prevalence of poor health in coastal populations compared to inland populations (ONS, 2014; Aase, 1996), therefore implying that poor coastal health could be related to the composition and traits of the coastal population.

Still, these studies have not primarily targeted the *relative* contribution of compositional predictors. In the field of social inequalities of health, several studies have investigated mechanisms underlying the social gradient of health, revealing both individual and combined effects of numerous predictors of health, such as material, behavioural, psychosocial and biomedical factors (Skalická et al., 2009; van Oort et al., 2005). Here, the literature of geographical inequalities of health, and hereunder also coastal health, is limited in exploring the relative contribution of relevant health predictors. This leaves uncertainty of potential compositional mechanisms underlying the association between coastal proximity and health. In this paper, we examine the relative contributions of employment, behavioural and psychosocial factors in coastal health - three potentially intertwined factors.

Understanding the contribution of employment factors may be crucial when assessing coastal health. In Norway, the decline in small-scale fishing has affected many workers and their families (Onsager et al., 2015; Hundstad, 2014). Older inhabitants may have experienced this decline first-hand through loss of work and livelihood for themselves or their family provider. By extension, the failure of a bearing industry and the subsequent unemployment and outmigration may have reached further than the directly inflicted employees and families. Considering that health risks of area characteristics are found to afflict differently according to occupational class (Pickett and Pearl, 2001), some groups may be more vulnerable to the societal restructuring of coastal communities. Moreover, potential health hazards of coastal occupations should be considered. The fishing industry involves greater physical burdens and hardship compared to other occupations, despite fishers reporting good health and high job satisfaction (Thorvaldsen et al., 2016). Therefore, both current and former employees of the primary sector in coastal areas may have been exposed to health risks through their profession. Nevertheless, emerging industries of oil and aquaculture (Giskeødegård, 2014) may provide new occupational opportunities and lessened health hazards in coastal occupations.

Following employment factors, we also aim to examine the contribution of behavioural and psychosocial factors to coastal health. Occupations within the fishing industry are found to be related to behavioural factors such as poor lifestyle habits, including a history of great alcohol intake in the Norwegian fishing culture (Koren, 2017), in addition to a higher prevalence of smoking in fishers in several European countries, including Norway (Matheson et al., 2001; Thorvaldsen et al., 2016). Additionally, behavioural factors may also be related to the societal changes of the rural Norwegian coastal areas, as unemployment and social disintegration might induce habits of health risk behaviours (Men et al., 2003). Relatedly, the restructuring of coastal industries may affect the psychosocial health of the population. The traditional involvement of the whole family in the day to day life, in addition to the flat and democratic structure of many coastal communities, has been challenged (Johansen, 2014; Hundstad, 2014), potentially resulting in lessened reliance and social interaction between inhabitants and a subsequent social disintegration. In all, compositional factors related to the employment, lifestyle and psychosocial surroundings of coastal areas might be of crucial importance in understanding coastal public health.

In this study, using population health data from Norwegian coastal and inland municipalities, we aim to deepen the understanding of public health in areas with a tradition of small-scale fishing. By introducing a more fine-grained definition of coastal populations, based on rurality and historical coastal involvement, we want to compare the health situation of traditional rural coastal areas to other coastal-adjacent areas, as well as to inland areas. By stepwise and simultaneous adjustment for employment, behavioural and psychosocial factors, we will assess the relative contributions of these factors to the association between geographical affiliation and self-rated general health; subsequently comparing underlying compositional mechanisms of rural coastal health to other areas.

2. Methods

2.1. Data

We based our study on data from the third round of the total adult population-based cross-sectional Nord-Trøndelag Health Study (HUNT3, 2006–2008) (Krokstad et al., 2013). The HUNT Study is conducted in the now former county of Nord-Trøndelag, Norway, which consisted of 24 municipalities. The level of education and income in Nord-Trøndelag was somewhat lower than the national Norwegian average, but the area was still considered representative of the general Norwegian population (Krokstad et al., 2004). All adults in the county were invited to participate, and the response rate was 54%. The participants completed two questionnaires, the first before attending health examination stations, the second afterwards. About 80% of participants returned the last questionnaire, resulting in a greater proportion of missing on certain variables. The sample in this study was 49,237 with a mean age at 53 years and 55% female respondents.

2.2. Geographical categorisation: Rural coast, urban coast, rural inland and rural fjord

We established geographical affiliation based on respondent's registered municipality. The 24 municipalities were classified into four geographical categories; rural coast, urban coast, rural inland and rural fjord. The classification of areas, and hereunder especially the rural coastal areas, was mainly based on municipality statistics from 1960 (supplementary material, Tables 1 and 3), collected from the Norwegian Centre for Research Data's (NSD) municipality database. These statistics show employment in fishing for each municipality before several substantial collapses in fish stocks and subsequent downturn in small-scale fishing in the later decades of last century (Christensen, 2014). Numbers from 2006 are obtained from the Norwegian Directorate of Fisheries, if not else specified. NSD and the Directorate of Fisheries are not responsible for analyses or interpretations in this study.

The primary interest of this study is rural coastal areas with a history of small-scale fishing, and five municipalities were classified as such areas. These municipalities share three coastal characteristics: Firstly, and most importantly, all five municipalities had a substantial proportion of inhabitants with their main occupation in fishing in 1960, ranging from 10 to 27 percent. This does not include employment in fisheries, such as fish conservation. The numbers are considerably higher if fishing as a side occupation is included (supplementary material, Table 2) (SSB, 1962a). In total, 17 percent of the workforce in these municipalities had their main occupation in fishing. Following the decline in small-scale fishing, this was reduced to 7 percent in 2006 (SSBa). Similarly, the number of vessels was reduced from 1575 to 198 (SSB, 1962b). While all coastal municipalities have shown a decrease in both employment in fishing and vessels, the size of landings has increased in one municipality (supplementary material, Table 2) (SSB, 1962c). The rural coastal population had a decline in inhabitants of 18.4 percent from 1960 to 2006.

It should be noted that many Norwegian coastal communities with long-standing small-scale fishing also have been, and still are, relying on larger scale fleets and fisheries (Vik et al., 2011). The Nord-Trøndelag county has however been an area with small vessels and few fisheries employees (supplementary material, Table 2) (Hovland, 2014; SSB, 1962b; SSB, 1962c; SSBb). The recent emergence of aquaculture has provided new coastal-related employment opportunities, and amounted to 315 out of the 529 employees in fishing in the county at the time of HUNT3. As for oil industries, Nord-Trøndelag County has close to no local employment in oil exploitation.

Secondly, these five municipalities all border to the big ocean instead of the county fjord, located by historical coastal shipping routes, and subsequent posing as long-standing coastal trading posts (Herje, 1999). Thirdly, the five municipalities have a low land-to-coast ratio, with an

Table 1
Characteristics of the study population and prevalence of employment, behavioural and psychosocial factors in geographical areas. The HUNT Study 2006–08 (HUNT3), adults 20+ years.

	Geographical affiliation				Total
	Rural coast	Urban coast	Rural inland	Rural fjord	
Population ≥20 years	8465	61,582	11,113	12,512	93,672
N	6449 (76)	31,282 (51)	6421 (58)	6650 (53)	48,583 (52)
Mean age	54	53	54	54	53
Men (%)	2908 (45)	14,243 (46)	2991 (47)	3069 (46)	22,211 (46)
Self-rated poor health (%)	34	24	26	29	26
Employment factors					
Class					
I	506 (12)	5156 (16)	759 (12)	760 (11)	7181 (15)
II	619 (15)	6183 (20)	1010 (16)	1110 (17)	8922 (18)
III	1293 (31)	9199 (29)	1792 (28)	1819 (27)	14,103 (29)
IV	583 (14)	2067 (7)	859 (13)	850 (13)	4359 (9)
V+VI	366 (9)	3267 (10)	621 (10)	709 (11)	4963 (10)
VII	630 (15)	3806 (12)	948 (15)	980 (15)	6364 (13)
Missing	233 (6)	1604 (5)	432 (7)	422 (6)	2691 (6)
Job sector					
Primary + secondary	1283 (30)	7636 (24)	1872 (29)	1970 (30)	12,761 (27)
Tertiary	2623 (62)	21,214 (68)	4020 (63)	3653 (55)	31,510 (65)
Missing	324 (8)	2432 (8)	529 (8)	1027 (15)	4312 (9)
Employment status					
Employed	2545 (60)	20,100 (64)	4025 (63)	4067 (61)	30,737 (63)
Retired	907 (21)	5878 (19)	1453 (23)	1468 (22)	9706 (20)
Student	136 (3)	1317 (4)	185 (3)	190 (3)	1828 (4)
Unemployed	593 (14)	3711 (12)	670 (10)	878 (13)	5852 (12)
Missing	49 (1)	276 (1)	88 (1)	47 (1)	460 (1)
Behavioural factors					
Smoking					
Never smoked	1611 (38)	12,953 (41)	2781 (43)	2936 (44)	20,281 (42)
Former smoker	1303 (31)	10,285 (33)	1934 (30)	2043 (31)	15,565 (32)
Daily smoker	909 (21)	5173 (17)	1074 (17)	1105 (17)	8261 (17)
Occasional smoker	279 (7)	2297 (7)	479 (8)	416 (6)	3471 (7)
Missing	128 (3)	574 (2)	153 (2)	150 (2)	1005 (2)
Alcohol					
Abstinent	1030 (24)	5936 (19)	1426 (22)	1608 (24)	10,000 (21)
Moderate	2670 (63)	21,860 (70)	4326 (67)	4291 (65)	33,147 (68)
Excessive	169 (4)	1666 (5)	226 (4)	243 (4)	2304(5)
Missing	361 (9)	1820 (6)	443 (7)	508 (8)	3132 (6)
Physical activity					
Inactive	455 (11)	2871 (9)	687 (11)	629 (9)	4642 (10)
Moderately active	1850 (44)	15,003 (48)	3113 (49)	3223 (48)	23,189 (48)
Active	820 (19)	6603 (21)	1373 (21)	1366 (21)	10,162 (21)
Missing	1105 (26)	6805 (22)	1248 (19)	1432 (22)	10,590 (22)
Psychosocial factors					
Help from friends					
No	210 (5)	1191 (4)	273 (4)	274 (4)	1948 (4)

(continued on next page)

Table 1 (*continued*)

	Geographical affiliation				Total
	Rural coast	Urban coast	Rural inland	Rural fjord	
Yes	3043 (72)	23,924 (76)	5051 (79)	5102 (77)	37,120 (76)
Missing	977 (23)	6167 (20)	1097 (17)	1274 (19)	9515 (20)
Sense of community					
Uncertain/ disagree	716 (17)	6756 (22)	1072 (17)	1044 (16)	9588 (20)
Agree	2523 (60)	18,346 (59)	4244 (66)	4319 (65)	29,432 (61)
Missing	991 (23)	6180 (20)	1105 (17)	1287 (19)	9563 (20)
Anxiety symptoms					
< 8	2643 (62)	20,994 (67)	4370 (68)	4370 (66)	32,377 (67)
≥ 8	479 (11)	3264 (10)	794 (12)	785 (12)	5322 (11)
Missing	1108 (26)	7024 (22)	1257 (20)	1495 (22)	10,884 (22)
Depression symptoms					
< 8	2846 (67)	22,261 (71)	4610 (72)	4654 (70)	34,371 (71)
≥ 8	316 (7)	2133 (7)	589 (9)	562 (8)	3600 (7)
Missing	1068 (25)	6888 (22)	1222 (19)	1434 (22)	10,612 (22)

area average of 0.46 km^2 land per km of coastline. This implies greater physical proximity to the coast for the inhabitants compared to other areas.

Five municipalities were classified as urban areas. These municipalities had town areas in both 1960 and 2006, and these municipalities have experienced significant growth in inhabitants from 1960 to 2006 (31 percent increase in total). All urban municipalities border to the coast, four of them in fjord areas, with a total land-to-coast ratio of 24.7 km^2 land per km of coastline.

The remaining rural municipalities were divided into two categories; rural fjord and rural inland. These municipalities are inland and fjord areas with no pronounced history of coastal involvement through fishing (1.6 and < 1 percentage of the total workforce in 1960, respectively). Still, the fjord and inland areas differ significantly in land-to-coast ratio (4.88 km^2 and no coastline, respectively). Considering former studies revealing possible health effects of coastal proximity (Wheeler et al., 2012; White et al., 2013; Garrett et al., 2019; Pasanen et al., 2019), our study validity most likely benefits from differentiating between these areas.

2.3. Measurement of health

The outcome in this study is self-rated general health. Self-rated health is a widely used and recommended health measure in a number of studies; it has been validated numerous times and has been shown to have strong predictive ability on mortality, morbidity and work-related disability (DeSalvo et al., 2005; Fosse and Haas, 2009; Schou et al., 2006).

The original variable for self-rated 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". Due to a highly skewed distribution of this variable, with only 1.46 percent responding "Poor", 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 the reference group.

2.4. Employment, behavioural and psychosocial factors

We included employment factors indicating different aspects of respondent's current or former connections to the labour market. As restructuring of societies may afflict differently according to occupational class (Pickett and Pearl, 2001), class affiliation was included as an indicator of socioeconomic position. Class was derived from respondents' occupations and classified into a six-level scale based on the Erikson Goldthorpe class scheme (Erikson and Goldthorpe, 1992) (I: Administrative leaders and politicians, and academic occupations; II: Occupations with shorter college or university degrees; III: Office and customer service workers, and sale-, service- and caring professions; IV: Occupations within farming and fishing; V+VI: Skilled craftsmen; VII: Process- and machine operators, and occupations with no required training or education). As the original employment variable provided no distinction of self-employed workers in primary production, all employment in farming, forestry and fishing was categorised as class "IV". This was set as the reference group to provide comparisons to this group. Considering the great decline of jobs in fishing and the potential increased risk of unemployment in coastal areas, we included an indicator of employment status (employed, retired, in education and unemployed). Employed is set as the reference group, as it represents a perceived standard state. Job sector (primary + secondary and tertiary sector) was included as an indicator of physical strain in the work place, as the physically challenges of fishing (Thorvaldsen et al., 2016) may suggest harder jobs outside the tertiary sector in coastal areas. All employment variables included respondents who are no longer employed, which to some extent averts the healthy worker effect (Shah, 2009).

Behavioural factors included smoking, alcohol consumption and physical activity. These are all associated with several measurements of health (Jepson et al., 2010), and reported to be more prevalent in fishing occupations (Koren, 2017; Matheson et al., 2001; Thorvaldsen et al., 2016). Smoking included categories of never smoked, former smoker, daily smoker and occasional smoker. Daily smoking, even at very low quantities, is associated with a substantial increased risk of developing coronary heart disease and stroke (Hackshaw et al., 2018). Alcohol consumption is an aggregate of three variables where respondents reported the units consumed of beer, wine and spirits over the last two weeks. Based on the total sum, categories of abstinent, moderate (1–14 drinks in two weeks) and excessive (>14 drinks in two weeks) were derived. Physical activity was derived from two questions asking the respondent to report number of hours per week spent on light and hard physical activity. Hard physical activity was given twice as much weight as light physical activity, and the combined aggregate was classified into three categories (inactive 0–1 h per week, moderately active 2–5 h a week, active 6–9 h per week). To aid in an intuitive interpretation, reference groups are set to the unexposed category, regardless of whether the factor is anticipated to have negative or positive affect on health.

To capture social integration and support of the society, we included questions regarding whether the respondents felt they had friends who could help them in times of need (yes, no), and whether the respondents had a strong sense of community with the people where they live (originally five categories dichotomised: disagree/uncertain and yes). In addition, we included symptoms of anxiety and depression. These were measured by The Hospital Anxiety and Depression (HAD) rating scale, an established self-rating instrument consisting of 14 four-point Likert-scaled items; 7 for anxiety (HADS-A) and 7 for depression (HADS-D) (Mykletun et al., 2001; Stern, 2014). The scores were dichotomised at the recommended cut-off at ≥8 (Stern, 2014). One might anticipate that people to some degree take their mental health into account when reporting their self-assessed health (Au and Johnston, 2014), challenging the role as predictor of self-rated health. Still, as applicable to the widely used measurements of physical activity, the causal relationship is complicated. As symptoms of anxiety and depression have been found to play a mediating role between community characteristics and health, the inclusion can aid us in illuminating the underlying mechanisms of geographical affiliation and self-rated health; the coastal population might be more exposed to psychosocial distress, which is recognised as an important factor in major physical health outcomes (Matthews and Gallo, 2011).

2.5. Statistical analysis

Although we have depicted the change of coastal involvement over time, it should be noted that this is a cross-sectional study aiming to assess the health in coastal areas at a specific time point succeeding several important changes in coastal industries. Logistic regression models were specified to examine associations between self-rated health and geographic affiliation. Specifically, we regressed poor self-rated health on geographic affiliation (ref = urban coastal population), adjusting for age and gender. Missing responses were handled through full information maximum likelihood, an adequate alternative to multiple imputation (Peyre et al., 2010). Odds ratios (OR) were calculated for categories of geography, adjusted for age and gender in the reference model. This model was further adjusted for employment, behavioural and psychosocial factors separately, adjusted for combinations of two groups, and finally adjusted for all factors simultaneously. Analyses stratified by gender and age group are available in the supplementary material (Tables 4–7). The percentage change in OR between models were calculated for each geographical category: [100 x (OR reference model – OR individual factors)/(OR reference model – 1)]. We will report changes in OR's in percentages, as these express how much of the excess likelihood of poor self-rated health is reduced.

The method of stepwise adjustment of factors and assessment of change in measure of association has been used to study several measurements of health (van Oort et al., 2005; Skalická et al., 2009; van Hedel et al., 2018; Stronks et al., 1996). It allows us to assess both independent and overlapping contributions of factors. Independent effects of each factor were calculated by comparing models with two groups of factors and the corresponding two models with each one group of factors; we subtracted the percentage reduction of OR of the model without a specific factor from a model including this factor. Example: The independent contribution of psychosocial factors is calculated as the percentage reduction of the odds ratios of model 5 minus the percentage reduction of the odds ratios of model 2. Overlapping effects were derived similarly, by subtracting the independent contribution of a specific factor from the total contribution that factor. Example: For psychosocial factors, the total contribution equals model 4. The calculation of overlapping effects has in several former studies been used to assess potential indirect effects between factors (Skalická et al., 2009; van Oort et al., 2005; Stronks et al., 1996). In this study, we define overlapping effects as indirect contributions of one factor through another. If the overlap is ignored, this could lead to an overestimation of individual effects of factors. However, it should be noted that this is a cross-sectional study, and although our calculations may indicate potential indirect contributions, causation and mediation is not proved through this methodology. Analyses were performed in Mplus (version 8) (Muthén and Muthén, 1998–2017). All effects are reported as odds ratios with 95 percent confidence intervals (95% CI). Relative measures of fit are reported by values of Akaike information criterion (AIC) and Bayesian information criterion (BIC).

3. Results

Table 1 shows general characteristics of the study population. Rural coast had the highest participation in the HUNT Study. There was no apparent skewness regarding age and gender between the geographical categories. The proportion of self-rated poor health was highest in the rural coastal population (34%) and lowest in the urban coastal population (24%). Factors such as daily smoking, unemployment, and lack of support from friends were more prevalent in the rural coastal population compared to the other geographical categories, but the differences were modest. Compared to the two rural populations of inland and fjord, the rural coastal population had a lower prevalence of sense of community. All factors except job sector were statistically associated with poor self-rated health when adjusting for geographical affiliation (Table 2).

Table 3 exhibits calculated odds for each geographical category, with the urban coastal population set as reference. Compared to the urban coastal population the odds for poor self-rated health were higher in all rural categories. The odds for the rural inland population were only slightly increased and not statistically significant. The non-overlapping confidence intervals of the rural coastal and rural fjord odds ratios indicate statistically significant differences between these groups (Fig. 1; Table 3, Model 1).

Each model with further adjustments is represented by the new calculated odds ratio for each geographical category, as well as changes in odds ratio from model 1 in percent. For the rural coastal population, Table 3 shows that adjustment for behavioural factors lowered the odds ratio most (17%, Model 3), followed by employment factors (13%, Model 2), whereas adjustment for psychosocial factors had no impact on the odds ratio (Model 4). The increased odds of poor self-rated health in the rural coastal population remained statistically significant after each adjustment for individual factors. Stratified analyses (Supplementary tables 4-7) showed that behavioural factors resulted in the biggest independent change in odds in the rural coastal population for both genders and the older population. For the younger population, employment factors resulted in a slightly greater change inn odds compared to

Table 2
Age and gender adjusted effects on poor self-rated health of employment, behavioural, psychosocial factors, controlling for geographical affiliation.

	OR	95% CI
Employment factors		
Class		
I	0.69	(0.61–0.77)
II	0.73	(0.65–0.82)
III	1.03	(0.92–1.15)
IV	-	
V+VI	1.01	(0.91–1.12)
VII	0.92	(0.83–1.02)
Job sector		
Primary + secondary	–	
Tertiary	0.98	(0.91–1.06)
Employment status		
Employed	–	
Retired	1.34	(1.23–1.46)
Education	1.08	(0.92–1.25)
Unemployed	3.00	(2.80–3.20)
Behavioural factors		
Smoking		
Never smoked	–	
Former smoker	1.37	(1.30–1.45)
Daily smoker	1.58	(1.48–1.69)
Occasional smoker	1.15	(1.04–1.27)
Alcohol		
Abstinent	–	
Moderate	0.72	(0.68–0.76)
Excessive	0.64	(0.56–0.72)
Physical activity		
Inactive	–	
Moderately active	0.60	(0.56–0.65)
Active	0.42	(0.38–0.46)
Psychosocial factors		
Help from friends		
Yes	–	
No	1.49	(1.34–1.65)
Feeling of community		
Agree	–	
Uncertain/disagree	1.22	(1.15–1.29)
Anxiety symptoms		
< 8	–	
≥ 8	2.40	(2.24–2.58)
Depression symptoms		
< 8	–	
≥ 8	2.33	(2.15–2.53)

Table 3
ORs and proportional change for poor self-rated health by geographical affiliation. The HUNT Study 2006–08 (HUNT3), adults 20+ years.

	Model	Rural coast			Rural inland			Rural fjord			Urban coast	AIC/BIC
		OR	95% CI	Change	OR	95% CI	Change	OR	95% CI	Change	OR	
1	Age and gender	**1.53**	(1.43–1.65)		1.05	(0.99–1.12)		**1.23**	(1.15–1.30)		1.00 (Ref.)	615,837 616,066
2	Employment	**1.46**	(1.36–1.57)	13	1.03	(0.97–1.10)	40	**1.18**	(1.11–1.26)	22	1.00 (Ref.)	771,500 772,680
3	Behavioural	**1.44**	(1.34–1.55)	17	1.03	(0.97–1.10)	40	**1.21**	(1.14–1.29)	9	1.00 (Ref.)	817,773 818,680
4	Psychosocial	**1.53**	(1.42–1.64)	0	1.01	(0.94–1.08)	80	**1.21**	(1.13–1.29)	9	1.00 (Ref.)	683,571 684,134
5	Employment + psychosocial	**1.46**	(1.35–1.58)	13	1.00	(0.93–1.07)	100	**1.17**	(1.10–1.25)	26	1.00 (Ref.)	838,636 840,467
6	Employment + behavioural	**1.40**	(1.30–1.51)	25	1.03	(0.96–1.10)	40	**1.18**	(1.11–1.26)	22	1.00 (Ref.)	969,593 972,006
7	Behavioural + psychosocial	**1.45**	(1.34–1.56)	15	0.99	(0.93–1.06)	100	**1.20**	(1.12–1.28)	13	1.00 (Ref.)	884,764 886,252
8	Employment + behavioural + psychosocial	**1.41**	(1.31–1.52)	23	0.99	(0.93–1.06)	100	**1.17**	(1.10–1.25)	18	1.00 (Ref.)	1036088 1039399

Values in bold does not include the OR 1.00.
Overlapping CI intervals indicate no statistically significant difference between groups.

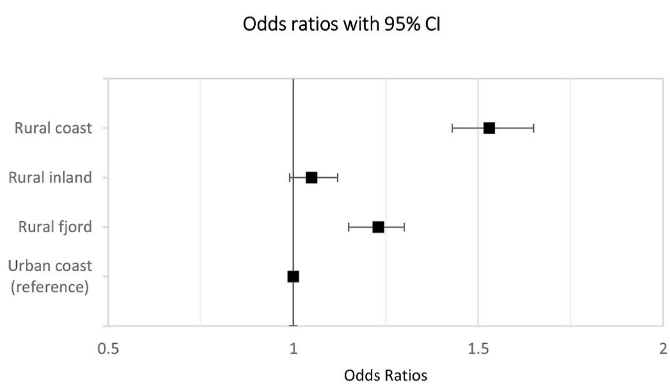

Fig. 1. Age- and gender-adjusted ORs for poor self-rated health by geographical affiliation. Urban coastal population as reference category. The HUNT Study 2006–08 (HUNT3), adults 20+ years.

behavioural factors.

For the rural inland population, psychosocial factors contributed to the biggest change in odds ratio (80%, Model 4), followed by employment and behavioural factors (40%, Model 2 and 3). The odds for the rural inland population remained not statistically significant after each adjustment. For the rural fjord population, the adjustment for employment factors contributed with the biggest change in odds (22%, Model 2), followed by behavioural and psychosocial factors (9%, Model 3 and 4). The odds for the rural fjord population remained statistically significant after each adjustment.

Simultaneous adjustment for individual factors revealed differing independent and indirect contributions between the geographical populations. Because of the small and exclusively non-significant differences between the rural inland population and the reference group, the independent and indirect contributions of individual factors for the inland population are reported as illustrations in the supplementary material (Fig. 1).

For the rural coastal population, simultaneous adjustment for employment and psychosocial factors (Table 3, Model 5) had the same impact on the odds as adjustment for employment factors only, whereas the rural fjord population showed an increase of odds by 4 percentage points. Our findings indicate that none of the contribution of employment factors was through psychosocial factors for the rural coastal population, but partly for the rural fjord population (5 percentage points) (Fig. 2). Simultaneous adjustment for employment factors and behavioural factors lowered the odds more than adjustment for employment factors only for the rural coastal population (12 percentage points), but not for the fjord population. As shown in Fig. 2, this points to that 5 percentage points of the contribution of employment factors was through behavioural factors in the rural coastal population. Simultaneous adjustment for behavioural factors and psychosocial factors lowered the odds less than individual adjustment for behavioural factors for the rural coastal population (2 percentage points), whereas it lowered the odds more for the rural fjord population (4 percentage points). Our findings indicate a small contribution of behavioural factors through psychosocial factors for the rural coastal population (2 percentage points), and a higher indirect contribution for the rural fjord population (5 percentage points) (Fig. 2). Finally, adjustment for all individual factors simultaneously lowered the odds for the rural coastal and fjord population by 23% and 18%, respectively. AIC and BIC values indicated that model 1 provided the best model for our data. Of the individual factors, psychosocial factors provided the best fit.

4. Discussion

Our aim was to examine the contribution of employment, behavioural and psychosocial factors in the explanation of geographical inequalities in health, with special emphasis on understanding coastal public health in rural areas with a history of small-scale fishing. When adjusting for age and gender, the rural coastal population showed the highest odds of poor self-rated health compared to the urban coastal population, followed by the fjord population. The rural inland population showed no significant difference in odds of poor self-rated health compared to the urban coastal population. Our findings indicate health differences between populations in close proximity to the coast, and provide additional insights and nuances to former studies indicating a positive association between coastal proximity and health (Wheeler et al., 2012; White et al., 2013). Adjustments for employment, behavioural and psychosocial factors had varying effects on the odds of poor self-rated health in different geographical populations. Nonetheless, they contributed to explain some of the increased risk of poor self-rated health between all geographical affiliations and the urban coastal population.

Employment factors contributed to a smaller change in likelihood of poor self-rated health in the rural coastal population compared to the rural fjord population. This finding is somewhat unexpected, considering their differing historical employment related to their coastal surroundings; the rural coastal areas of Nord-Trøndelag, as opposed to the

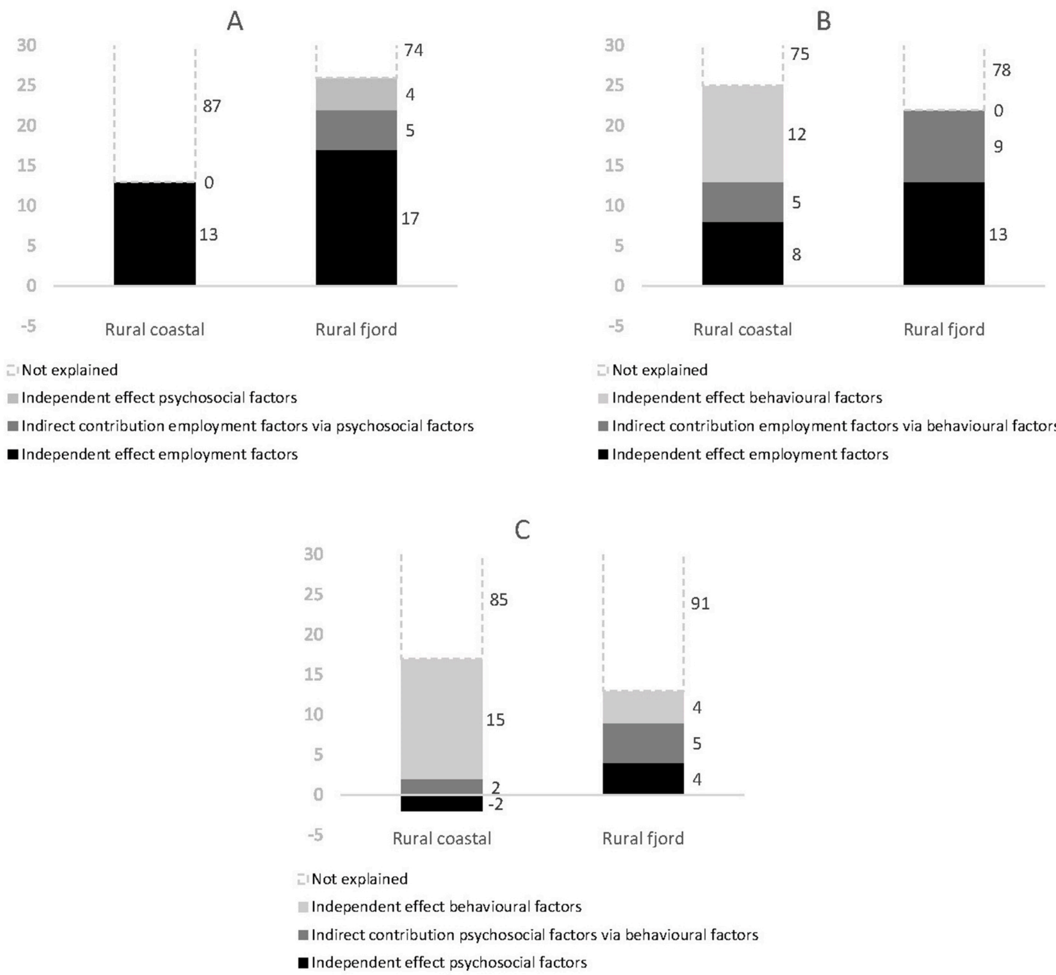

Fig. 2. (A) Independent and indirect contributions of (A) employment factors and psychosocial factors, (B) employment factors and behavioural factors, and (C) psychosocial factors and behavioural factors to the explanation of the odds ratio of geographical categories. The urban coastal population is reference group.

rural fjord areas, are communities with a long tradition of coastal-based industries and occupations through fishing. Therefore, the smaller contribution of class affiliation, employment and work sector in the rural coastal population challenges the assumption of greater health hazards related to the physical hardship or significant decline in fishing. Considering that new coastal industries, such as aquaculture, have provided a heterogeneity to the occupations in fishing-related activities (Iversen et al., 2020), the physical hardship of the traditional fisher may not be transferrable to new occupations in the fishing industry, therefore perhaps posing less health risks. There has also been a formidable technological development in fishing methods (Vik et al., 2011), potentially lessening the workload for those currently employed in fishing.

Simultaneous adjustments indicated no indirect contribution of employment factors through psychosocial factors for the rural coastal population, whereas they did indicate such indirect contribution for the rural fjord population. This finding suggests smaller psychosocial health hazard connected to the employment in rural coastal areas. The independent effect of employment factors was still larger for the rural fjord population, further challenging the assumption of more health hazards inflicted *directly* by the physical coastal-based employment (Hundstad, 2014). This is further supported by the simultaneous adjustment for employment and behavioural factors, which also indicated a smaller remaining effect of employment factors for the rural coastal population compared to the rural fjord population. This adjustment also signals a smaller indirect contribution of employment factors through behavioural factors for the rural coastal population. This suggests that the coastal-based employment situation may have some, but no outstanding, infliction on health through subsequent lifestyle choices (Thorvaldsen et al., 2016; Koren, 2017).

Behavioural factors contributed with the biggest change in odds of poor self-rated health for the rural coastal population. This finding is not unexpected, as the contribution of lifestyle factors on health has been studied immensely and indisputably acknowledged (Jepson et al., 2010). Nonetheless, the smaller contribution of behavioural factors in the rural fjord population suggests that poor rural coastal health to a greater extent is related to lifestyle compared to its fjord counterpart. Of the behavioural factors, the prevalence of daily smoking is higher in the rural coastal population compared to the other geographical categories (Table 1). On average, the prevalence of smoking is declining in Norway (FHI, 2018). Lifestyle trends are generally found to change more slowly in rural areas (Elstad and Koløen, 2009), but the higher prevalence of smoking in the rural coastal areas compared to fjord and inland points to a potential distinct relation between smoking and traits of the coastal communities. As daily smoking has been found to be more prevalent in active fishers compared to the general population (Thorvaldsen et al., 2016), the stronger association between lifestyle factors and self-rated health in rural coastal areas might be related to a maintaining of former lifestyle habits related to such activities.

However, as mentioned, the simultaneous adjustments for individual factors indicated a smaller indirect contribution of employment factors through behavioural factors for the rural coastal population compared to the fjord population, suggesting no outstanding behavioural effects on rural coastal health related to employment in the coastal industry. Our findings indicated a considerable independent effect of behavioural factors in the rural coastal population, a trait not shared by the rural fjord population. This is further supported by the simultaneous adjustment of psychosocial and behavioural factors, which also indicated a considerably greater independent effect of behavioural factors in the rural coastal population.

The individual adjustment of psychosocial factors had no effect on the odds of poor self-rated health for the rural coastal population, a finding that was somewhat unexpected considering the potential negative impact of the lessened social reliance in many Norwegian coastal communities (Johansen, 2014; Hundstad, 2014). Nevertheless, our data show small differences in prevalence of anxiety and depression symptoms between all populations, the two psychosocial factors strongest associated with poor self-rated health (Table 2). Our findings challenge the assumption of potential health-impairing psychosocial burdens of dissolving rural coastal communities due to recent decades' decline in small-scale fishing and subsequent outmigration and potential changes in social dependence. Considering the emergence of new coastal industries, such as the growing aquaculture (Giskeødegård, 2014), one might argue that the psychosocial stress of a societal transition is hampered by new alternatives of employment and livelihoods. Contrarily, the rural fjord population had a reduction in likelihood of poor self-rated health, and the simultaneous adjustments indicated small, but stronger, independent effects of psychosocial factors.

In all, our findings indicate a poorer health situation in both the rural coastal and rural fjord population compared to the urban coastal population. This urban-rural health divergence between the coastal populations is partly in line with former research, which found a weaker association between coastal proximity and general health in rural areas compared to more urbanised areas (Wheeler et al., 2012). Moreover, our findings indicate differing health situations between the rural coastal-involved areas and rural fjord areas, despite sharing the trait of rurality and physical proximity to the coastline. The individual and simultaneous adjustments for employment, behavioural and psychosocial factors imply differing compositional mechanisms underlying the association between self-rated health and rural coastal and rural fjord areas. These findings can be seen as augmentations to existing research on coastal health (Pasanen et al., 2019; Garrett et al., 2019; White et al., 2013), as our proposed categorisation of coastal populations provides a tool to assess health-related differences between different coastal-based populations. In addition, our findings suggest that the rural inland population exhibits a different health situation compared to its rural coastal and fjord counterparts, contesting assumptions of poor self-rated health being solely attributed to rurality.

The narrowing gap in self-rated health between the geographical categories after adjusting for employment, behavioural and psychosocial factors indicates that the underlying mechanisms of poor coastal health to some extent are compositional in nature. Still, there is no straightforward classification of compositional and contextual effects, as they can be intertwined and are often applicable to both individual and structural levels (Macintyre et al., 2002). The increased prevalence of a behavioural factor, such as smoking in rural coastal areas, can be considered as an individual trait of the respondents. Nonetheless, they can also be intertwined with larger scale unemployment, the history of coastal-based occupations and potentially associated health risk behaviours (Shaw et al., 2002; Diez-Roux, 1998). Considering that most of the association between geographical affiliation and self-rated health remains unexplained, a potential overlapping between compositional and contextual effects should be considered and studied further. Nevertheless, our results are relevant to public health and preventive medicine. Since lifestyle had the biggest independent effect on likelihood of poor self-rated health in rural coastal areas, it is theoretically possible to improve the health of the coastal population through measures influencing health behaviour.

4.1. Limitations

There are some limitations with our study that should be noted. Firstly, the limitations of the cross-sectional design must be emphasised. Our study is descriptive, thus providing limited information about potential causal and mediating relationships between geographical affiliation and self-rated health. Our results show changes in odds for poor self-rated health when adjusting for employment, behavioural and psychosocial factors, however we cannot conclude that these factors are mediators in a causal relationship between coastal living and poor self-rated general health. As we have limited information about whether rural coastal communities attract people of poorer health or if coastal communities provide a context or culture in which risk factors are more prominent, our study is ultimately a description of what lies within the association between coastal settlements and health. Relatedly, our methodological design does not provide clear indications of whether the individual factors constitute potential confounders, nor whether there are reverse causal effects between them.

Secondly, we have limited the empirical foundation of this study to the wide and general measurement of self-rated health. It is not in the scope of this article to assess a wide range of illnesses, and it should be noted that the results reported for self-rated health might differ from other measurements of health. Further research on the underlying mechanisms in coastal health would benefit from including other health outcomes, providing further knowledge on the topic.

Thirdly, our study could have benefitted from inclusion of other compositional factors in our analyses, especially regarding employment factors. Educational level was considered as a substitute for class affiliation. This could have provided a greater foundation of comparison, as the effects of education on health has been studied extensively (Elstad and Koløen, 2009; Gerdtham and Johannesson, 2001). Still, considering the pronounced egalitarian nature of Norwegian society, educational level is not necessarily a valid measure or reflection of social position or placement in the occupational hierarchy (Elstad and Koløen, 2009). This might be especially relevant in smaller places, as social class based on occupation might be shaped by the local labour market (Macintyre et al., 2002). Employment factors could also have been extended to include traits of the respondents work situation, giving us the opportunity to study the association between individual experience of physical hardship at work and self-rated health. Still, this was excluded from the analyses due to the potential healthy worker effect (Shah, 2009), as the available measurements were from currently employed respondents only.

Finally, our study involves geographical definitions not solely based on coastal proximity, as seen in former studies and population statistics (White et al., 2013; ONS, 2014; Garrett et al., 2019). This limits the opportunity for direct comparison with existing literature. Still, we argue that our geographical classification is a substantial methodological strength of our study, enabling the assessment of coastal health while also accounting for both coastal involvement and the urban-rural dimension. Relatedly, the coastal-revolved demographics of our total study region do not provide the opportunity of including an urban inland category in our analyses. This limits a comparable illumination of the urban-rural aspect of health in coastal and inland populations. By extension, the urban category of our study contains municipalities that might have been classified as towns or suburban areas in countries with a different demography.

5. Conclusion

By introducing a more fine-grained classification of coastal areas, we found a statistically significant higher likelihood of poor self-rated health in both rural coastal and rural fjord areas compared to urban coastal areas. Rural coastal areas, with a long-standing history of coastal involvement through small-scale fishing, also had a considerably higher likelihood of reporting poor health compared to rural fjord areas, which are areas with no substantial fishing activity. Stepwise and simultaneous adjustments for employment, behavioural and psychosocial factors indicated differences in underlying compositional mechanisms between the rural coastal and rural fjord population, despite sharing the trait of coastal proximity. Considering the international trend of decline in small-scale fishing potentially affecting many rural coastal communities, our findings hopefully encourage further reflections regarding the definition of coastal areas when assessing geographical inequalities in health. The contribution of behavioural factors was more prominent in the rural coastal areas with a long-standing history of coastal involvement, and further research could therefore also benefit from examining lifestyle habits in coastal populations.

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Author statement

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Declaration of competing interest

None.

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Appendix ASupplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2020.113286.

References

Aase, A., 1996. Helsetilstand. In: Nilsen, S. (Ed.), Nasjonalatlas for Norge: Helse. Statens kartverk, Hønefoss, pp. 11–114.
Au, N., Johnston, D., 2014. Self-assessed health: what does it mean and what does it hide? Soc. Sci. Med. 121, 21–28.
Christensen, P., 2014. Silda: fra kanonfiske til katestrofe. In: Christensen, P. (Ed.), Norges Fiskeri- Og Kysthistorie Bind IV: Havet, Fisken Og Oljen 1970-2014. Fagbokforlaget, Bergen, pp. 15–31.
Christensen, P., Zachariassen, K., 2014. Det nye kyst-Norge. In: Christensen, P. (Ed.), Norges Fiskeri- Og Kysthistorie Bind IV: Havet, Fisken Og Oljen 1970-2014. Fagbokforlaget, Bergen, pp. 135–184.
DeSalvo, K.B., Bloser, N., Reynolds, K., He, J., Muntner, P., 2005. Mortality prediction with a single general self-rated health question. J. Gen. Intern. Med. 21, 267–275.
Diez-Roux, A.V., 1998. Bringing context back into epidemiology: variables and fallacies in multilevel analysis. Am. J. Pub. Health 88, 216–222.
Duncan, C., Jones, K., Moon, G., 1993. Do places matter? A multi-level analysis of regional variations in health-related behaviour in Britain. Soc. Sci. Med. 31, 725-133.
Eberheardt, M.S., Pamuk, E.R., 2004. The importance of place of residence: examining health in rural and nonrural areas. Am. J. Pub. Health 94, 1682–1686.
Elstad, J.I., Koløen, K., 2009. Utdanningsforskjeller I Helserelatert Atferd – like Store over Hele Landet? Oslo. NOVA – Norsk institutt for forskning om oppvekst, velferd og aldring.
Erikson, R., Goldthorpe, J., 1992. The Constant Flux: A Study of Class Mobility in Industrial Societies. Claredon, Oxford.
FHI, 2018. t. Røyking Og Social Ulikhe. https://www.fhi.no/nettpub/tobakkinorge/bruk-av-tobakk/royking-og-sosial-ulikhet/.
Fogelholm, M., Valve, R., Absetz, P., Heinonen, H., Uutela, A., et al., 2006. Rural-urban differences in health and health behaviour: a baseline description of a community health-promotion programme for the elderly. Scand. J. Publ. Health 34, 632–640.
Fosse, N.E., Haas, S.A., 2009. Validity and stability of self-reported health among adolescents in a longitudinal, nationally representative survey. Pediatrics 123, e496.
Garrett, J.K., Clitherow, T.J., White, M.P., Wheeler, B.W., Fleming, L.E., 2019. Coastal proximity and mental health among urban adults in England: the moderating effect of household income. Health Place 59, 102200.
Gerdtham, U.-G., Johannesson, M., 2001. The relationship between happiness, health, and social economic factors: results based on Swedish microdata. J. Soc. Econ. 30, 553–557.
Giskeødegård, K., 2014. Norske sjømatselskaper som investeringsobjekt. Praktisk økonomi finans 30, 143–159.
Hackshaw, A., Morris, J.K., Boniface, S., Tang, J., Milenković, D., 2018. Low cigarette consumption and risk of coronary heart disease and stroke: meta-analysis of 141 cohort studies in 55 study reports. BMJ 360, j5855.
Hanlon, P., McCartney, G., 2008. Peak oil: will it be public health's greatest challenge? Publ. Health 122, 647–652.
Herje, T., 1999. Kysten Vår: Namdalskysten Gjennom 10000 År. Kystbok, Namsos.
Hovland, E., 2014. Kontrastfylt næringsutvikling. In: Kolle, N. (Ed.), En Næring I Omforming. 1880-1970. Fagbokforlaget, Bergen, pp. 265–306.
Hundstad, D., 2014. Kystsamfunn i endring. In: Kolle, N. (Ed.), En Næring I Omforming. 1880-1970. Fagbokforlaget, Bergen, pp. 581–607.
Iversen, A., Asche, F., Buck, M., Henriksen, E., Stein, J., Svalestuen, S., 2020. The growth and decline of fisheries communities: explaining relative population growth at municipality level. Mar. Pol. 112, 103776.
Jepson, R., Harris, F., Platt, S., Tannahill, C., 2010. The effectiveness of interventions to change six health behaviours: a review of reviews. BMC Publ. Health 10, 538–554.
Johansen, K.E., 2014. Levestandard, likskap og livssyn. In: Kolle, N. (Ed.), En Næring I Omforming. 1880-1970. Fagbokforlaget, Bergen, pp. 135–162.
Johnson, K., Kerr, S., Side, J., 2012. Marine renewables and coastal communities—experiences from the offshore oil industry in the 1970s and their relevance to marine renewables in the 2010s. Mar. Pol. 38, 491–499.
Johnson, D., 2018. The values of small-scale fisheries. In: Johnson, D., Acott, T., Stacey, N., Urquhart, J. (Eds.), Social Wellbeing and the Values of Small-Scale Fisheries. Springer, Cham, pp. 1–22.
Koren, E.S., 2017. Sjøfolk og velferdsstaten. Arbeiderhistorie 21, 107–123.
Krokstad, S., Langhammer, A., Hveem, K., Holmen, T.L., Midthjell, K., Stene, T.R., Bratberg, G., Heggland, J., Holmen, J., 2013. Cohort Profile: the HUNT Study, Norway. Int. J. Epidemiol. 42, 968–977.
Krokstad, S., Magnus, P., Skrondal, A., Westin, S., 2004. The importance of social characteristics of communities for the medically based disability pension. Eur. J. Publ. Health 14, 406–412.
Macintyre, S., Ellaway, A., Cummins, S., 2002. Place effects on health: how can we conceptualise, operationalise and measure them? Soc. Sci. Med. 55, 125–139.
Matheson, C., Morrison, S., Murphy, E., Lawrie, T., Ritchie, L., Bond, C., 2001. The health of fishermen in the catching sector of the fishing industry: a gap analysis. Occup. Med. 51, 305–311.
Matthews, K.A., Gallo, L.C., 2011. Psychological perspectives on pathways linking socioeconomic status and physical health. Annu. Rev. Psychol. 62, 501–530.
Men, T., Brennan, P., Boffetta, P., Zaridze, D., 2003. Russian mortality trends for 1991–2001: analysis by cause and region. BMJ 327, 964–966.
Muthén, L.K., Muthén, B.O., 1998-2017. Mplus User's Guide, eighth ed. Muthén & Muthén, Los Angeles, CA.
Mykletun, A., Stordal, E., Dahl, A.A., 2001. Hospital Anxiety and Depression (HAD) scale: factor structure, item analyses and internal consistency in a large population. Br. J. Psychiatry 179, 540–544.
Neumann, B., Vafeidis, A.T., Zimmermann, J., Nicholls, R.J., 2015. Future coastal population growth and exposure to sea-level rise and coastal flooding - a global assessment. PloS One 10, e0118571.
Office for National Statistics, 2014. 2011 Census: Coastal Communities in England and Wales. ONS, London.
Onsager, K., Schmidt, L., Stokke, K.B., Vestby, G.M., 2015. Utvikling og livskraft i små kystkommuner. Plan 47, 38–43.
Pasanen, T.P., White, M.P., Wheeler, B.W., Garrett, J.K., Elliott, L.R., 2019. Neighbourhood blue space, health and wellbeing: the mediating role of different types of physical activity. Environ. Int. 131, 105016.
Peyre, H., Leplège, A., Coste, J., 2010. Missing data methods for dealing with missing items in quality of life questionnaires. A comparison by simulation of personal mean score, full information maximum likelihood, multiple imputation, and hot deck techniques applied to the SF-36 in the French 2003 decennial health survey. Qual. Life Res. 20, 287–300.
Pickett, K.E., Pearl, M., 2001. Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review. Epidemiol. Commun. Health 55, 111–122.
Schou, M.B., Krokstad, S., Westin, S., 2006. How is self-rated health associated with mortality? Tidsskrift for Den norske Legeforening 126, 2644–2647.
Shah, D., 2009. Healthy worker effect phenomenon. Indian J. Occup. Environ. Med. 13, 77–79.
Shaw, M., Dorling, D., Mitchell, R., 2002. Health, Place and Society. Pearson, London.
Skalická, V., van Lenthe, F., Bambra, C., Krokstad, S., Mackenbach, J., 2009. Material, psychosocial, behavioural and biomedical factors in the explanation of relative socio-economic inequalities in mortality: evidence from the HUNT study. Int. J. Epidemiol. 38, 1272–1284.
SSB, 1962a. Fiskeritelling 1. November 1960. Første hefte, Oslo.
SSB, 1962b. Fiskeritelling 1. November 1960. Annet hefte, Oslo.

SSB, 1962c. Norges Fiskerier 1960. https://www.ssb.no/a/histstat/nos/nos_xii_089.pdf.
SSBa. Employed persons per 4th quarter, by place of residence, place of work, industry division and sex. https://www.ssb.no/en/statbank/table/08545.
SSBb. Establishments, employed persons, value added etc. in fish processing industry, by industrial subclass. https://www.ssb.no/en/statbank/table/08288/.
Stern, A.F., 2014. The hospital Anxiety and depression scale. Occup. Med. 64, 393–394.
Stewart, J.R., Gast, R.J., Fujioka, R.S., Solo-Gabriele, H.M., Meschke, J.S., Amaral-Zettler, L.A., Holland, A.F., 2008. The coastal environment and human health: microbial indicators, pathogens, sentinels and reservoirs. Environ. Health 7, S3.
Stronks, K., van de Mheen, H.D., Looman, C.W.N., Mackenbach, J.P., 1996. Behavioural and structural factors in the explanation of socio- economic inequalities in health: an empirical analysis. Sociol. Health Illness 18, 653–674.
Thorvaldsen, T., Sønvisen, S., Holmen, I.M., Øren, A., 2016. Fiskerhelseundersøkelsen. Trondheim: Sintef.
Urquhart, J., Acott, T., Reed, M., Courtney, P., 2011. Setting an agenda for social science research in fisheries policy in Northern Europe. Fish. Res. 108, 240–247.
van Hedel, K., van Lenthe, F.J., Oude Groeniger, J., Mackenbach, J.P., 2018. What's the difference? A gender perspective on understanding educational inequalities in all-cause and cause-specific mortality. BMC Publ. Health 18, 1105.
van Oort, F.V., van Lenthe, F.J., Mackenbach, J.P., 2005. Material, psychosocial, and behavioural factors in the explanation of educational inequalities in mortality in The Netherlands. Epidemiol. Commun. Health 59, 214–220.
Vik, J., Johnsen, J.P., Sønvisen, S.A., 2011. Kysten i endring: om fiskeripolitikken som distrikts- og lokalsamfunnspolitikk. In: Haugen, M.S., Stræte, E.P. (Eds.), Rurale Brytninger. Tapir, Trondheim, pp. 405–425.
Wheeler, B.W., White, M., Stahl-Timmins, W., Depledge, M.H., 2012. Does living by the coast improve health and wellbeing? Health Place 18, 1198–1201.
White, M.P., Alcock, I., Wheeler, B.W., Depledge, M.H., 2013. Coastal proximity, health and well-being: results from a longitudinal panel survey. Health Place 23, 97–103.