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# Risk of diagnosed and undiagnosed mental distress in coastal and inland English residents: A pooled cross-sectional analysis of adult UKHLS respondents

Claire Wicks [a,*], Susan McPherson [b], Cara Booker [c], Antonella Trotta [a], Meena Kumari [c], Emily T Murray [a,b]

[a] School of Health and Social Care, University of Essex, Colchester, CO4 3SQ, UK
[b] Institute of Public Health and Wellbeing, University of Essex, Colchester, CO4 3SQ, UK
[c] Institute of Social and Economic Research, University of Essex, Colchester, CO4 3SQ, UK

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ABSTRACT

Recent research in the United Kingdom (UK) has highlighted a potential 'coastal effect', whereby residents of coastal areas may be subject to poorer health outcomes, including mental health. This study sought to investigate the coastal effect by comparing the risk of experiencing diagnosed and undiagnosed mental distress in both coastal and inland English adult residents. Data from waves 10–13 (2018–2023) of Understanding Society, a nationally representative population study, were extracted for analysis. Respondents were categorised by residential area (coastal or inland), mental health status (no mental distress, diagnosed mental distress, and undiagnosed mental distress), and age category (young adult (16–24 years) (n = 3,615), working age adult (25–65 years) (n = 18,011) and older adult (66+ years) (n = 6,923)). The results of multinomial regression revealed that after adjusting for sex, ethnicity, tenure and household income, young adults residing in the most deprived coastal areas had three times the risk of experiencing undiagnosed mental distress compared to young adults from equally deprived inland areas (RRR: 3.42, 95%CI: 1.24, 9.36). In contrast, older adults in the most deprived coastal areas had approximately one-third of the risk of experiencing undiagnosed mental distress compared with their inland peers (RRR: 0.13, 95%CI: 0.13, 0.95). This research highlights the striking mental health inequality in coastal young adults and calls for investment in both short-term interventions to support mental health and long-term investment in coastal infrastructure and youth mental health services to prevent future generations from experiencing similar mental health disparities.

## 1. Introduction

In 2021, the United Kingdom's (UK's) Chief Medical Officer (CMO) released a report highlighting the inequitable health outcomes of coastal compared with inland residents in England (Whitty, 2021). In addition to a range of physical health conditions, the report identified worse mental health outcomes for coastal neighbourhoods compared with inland neighbourhoods. This was more evident in areas with a greater proportion of residents aged 65 years and above. The report also highlighted increased risk of mental health burden for coastal youth, with a 35 % higher rate of hospital admission due to self-harm in 10- to 24-year-olds relative to non-coastal youth.

Since 2021, a growing body of research has sought to explain the "coastal effect" and to understand the apparent contradiction with research highlighting the health enhancing effects of exposure to natural blue space (Garrett et al., 2019; White et al., 2020). Some explanations for the negative coastal effect on mental health include higher levels of deprivation in coastal compared with inland areas, slower population and employment growth compared with the national average between 2009 and 2018, and a lower ratio of health and social care professionals per person (Barton et al., 2025; Buchanan et al., 2024). Other potential factors include internal migration, precarious income via seasonal employment, lower educational attainment and poor housing quality (Communities and Local Government Committee, 2007; Matin et al., 2021). Recent analyses using population data finds that the coastal effect for mental health is only replicated when narrowing the analysis

* Corresponding author.
*E-mail address:* cwicks@essex.ac.uk (C. Wicks).

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down to individuals who grew up in the 20% most deprived coastal areas of England versus those who grew up in the 20% most deprived inland areas, indicating that deprivation plays a significant role (Murray et al., 2024).

The "Levelling Up" White Paper (Gov.uk, 2022) issued by the UK Government in 2022 (led by the Conservative Party), aimed to tackle regional inequalities and increase opportunities across the UK. In addition, the CMO's report spurred Government funded research bodies (e.g. National Institute for Health and Care Research) to grow the limited body of research exploring coastal inequalities, including mental health outcomes. Nevertheless, the most recent data from the UK Office for National Statistics (ONS) on suicide rates indicates that rates continue to increase nationally (from 10.7 in 2022 to 11.4 per 100,000 in 2023) and some of the highest rates are still seen in coastal areas e.g. West Devon, Lincoln, Lancaster, Preston, Blackpool (respectively 20.5, 20.1, 17.8, 17.8, 16.7 per 100,000)(Office for National Statistics, 2024).

Whilst the analyses in the CMO report drew attention to an inland-coastal mental health gap, they were based on disease prevalence data submitted by General Practitioners (GPs) to the GP Quality and Outcomes Framework and analysed by Lower Layer Super Output Areas (LSOAs), a statistical geography of between 400 and 1,200 households (1,000 and 3,000 persons) (Office for National Statistics, n.d.). In the case of mental health this would include, for example, diagnoses of depression or other formal psychiatric diagnoses. Therefore, the findings were based on individuals who had presented to their GP. This does not take account of segments of the population who experience clinical levels of mental distress but have not presented to their GP or other healthcare provider.

In England, unrecognised mental health need is reported to be as large as two-thirds of adults experiencing a common mental health disorder (McManus et al., 2016). Data from national datasets indicate the sharpest rise in mental health problems during the past decade has been among young adults aged 16–34 years (Vriend et al., 2025). Furthermore, recent analysis of population level data has also identified high rates of undiagnosed distress in the UK general population and highlighted that certain groups within the population are at higher risk than other groups of experiencing undiagnosed mental distress, including young adults (aged 16–24 years), people living with a disability and LGBT populations (Wicks et al., 2024).

The current study is concerned with whether the coastal effect for mental health observed in relation to GP records of diagnosed mental illness can also be observed in relation to undiagnosed distress in the community. Specifically, this study seeks to answer, firstly, does the risk of diagnosed and undiagnosed mental distress differ between UK residents residing in inland or coastal areas? Secondly, is area deprivation associated with risk of diagnosed mental distress? Thirdly, do compositional factors explain risk of diagnosed or undiagnosed mental distress? Finally, does risk of undiagnosed distress differ across stages of adulthood? Our hypotheses are: i) Study members residing in coastal communities have a higher risk of undiagnosed and diagnosed mental health distress than inland residents; ii) The association between coastal residence and diagnosed mental distress will only be apparent in the most deprived quintile of local areas (as measured by Townsend index of deprivation); iii. The area level association will be explained by socio-demographic characteristics of the study members that reside in these areas; iv) Young adults residing in the most deprived coastal areas will have the highest risk of undiagnosed mental distress.

## 2. Methodology

### 2.1. Study sample

Understanding Society: The UK Household Longitudinal Study (UKHLS) is a nationally representative population longitudinal study that collects data from household members of approximately 25,000 households across the UK every year. The study asks respondents a range of questions on subjects including health, work, education, income, family, and social life. Data for the study was drawn from the household level questionnaire completed by one adult in the household on behalf of everyone (income variables & tenure) and the individual adult self-completion questionnaire completed by all respondents aged 16 years or older (all other UKLHS variables).

The study sample consisted of data collected from 28,549 adult respondents across waves 10–13 of the UKHLS (January 2018 to May 2023). These waves were chosen as prior to wave 10 UKHLS only asked respondents about diagnosis of clinical depression. From wave 10 onwards, respondents are asked about a broader range of mental health conditions (see below: Measures, mental distress). A total of 11,153 respondents were excluded from the analyses due to missing data in one or more of the variables or zero weighting in the Understanding Society weighting variable (area data n = 8,272, mainly due to the LSOA data not covering Wales, Scotland and Northern Ireland, zero weighting n = 1,834, tenure n = 1,490, income n = 1,327, age n = 2, sex n = 1). Respondents' most recent observation within the study timeframe was included the in the analyses: wave 10, n = 2,143 (7.5%), wave 11 n = 2,532 (8.9%), wave 12 n = 3,126 (11.0%), wave 13 n = 20,748 (72.7%).

### 2.2. Measures

#### 2.2.1. Coastal community status

Respondents were dichotomised as either a "coastal" or "inland" resident. The classification was determined using the 2011 Lower Layer Super Area Output (LSOA) codes provided under a special user licence agreement with UKHLS and cross-referenced with the Appendix of the CMO of England's 2021 report and provided by the University of Plymouth's Centre for Coastal Communities. The report defined "coastal" LSOAs as those that included or overlapped with built-up areas, which lay within 500 m of the "Mean High Water Mark" (excluding tidal rivers). All other LSOAs in England were classified as "inland" (Asthana et al., 2023). LSOAs are designed to have similar population sizes rather than being based on land area. Therefore within England, some major metropolitan cities such as Newcastle, may include both "coastal" and "inland" communities.

#### 2.2.2. Mental distress

Three categories of mental distress were derived using the General Health Questionnaire 12 (GHQ-12) measure of mental distress (Goldberg and Williams, 1988) and history of mental health diagnosis. Both variables were extracted from the UKHLS dataset. The GHQ-12 caseness score is available as a derived variable from the UKHLS dataset and ranges from 0 to 12 and a score of four or higher is indicative of potential mental distress. History of a diagnosed mental health condition was identified via questions asking respondents "Has a doctor or other health professional ever told you that you have an emotional, nervous or psychiatric problem" (wave 10), "Has a doctor or other health professional newly diagnosed you as having an emotional, nervous or psychiatric problem" (waves 11–13), and "Has a doctor or other health professional ever told you that you have any of these conditions; a list of 15 disorders including depression, post-traumatic stress disorder, and panic attacks was provided. Two additional response options "Any other anxiety disorder" and "Any other mental, emotional or neurological problem or condition" were also available.

The mental distress categories generated for analyses are as follows.

i. No mental distress: GHQ-12 caseness score of <4 and no history of a mental health diagnosis.
ii. Undiagnosed mental distress: GHQ-12 caseness score of ≥4 and no history of mental health diagnosis.
iii. Diagnosed mental distress: GHQ-12 caseness score of ≥4 and a history of mental health diagnosis.

### 2.3. Covariates

Socio-demographic characteristics extracted from UKHLS included sex, age, ethnicity, income, and tenure. Age was included in the analyses both as a continuous variable and squared to allow for a non-linear relationship with the mental health categories (models 1, 2 & 3) and categorised into 'young adult' (ages 16–24), 'working adult' (ages 25–65) and 'older adult' (ages 66+) (models 4, 5 & 6). Age categories are informed by the Office for National Statistics age classifications (Office for National Statistics, 2021) with the older adult category adjusted to 66+ years to reflect the age at which adults currently receive their state pension in the UK. Sex is a dichotomous variable: male or female (the UKHLS question asks "are you male or female?"). Ethnicity was dichotomised into "British/English/Scottish/Welsh/Northern Irish" or "other ethnic background" for analysis. Net income was adjusted for household composition and inflation and transformed using the inverse hyperbolic sine which allows for zeros and negative values. Tenure was re-categorised into "home owner", "social renter", and "private renter/other". Area deprivation was measured by the 2011 Townsend Index, a z-score summary variable of four census variables (unemployment, non-car ownership, non-home ownership and overcrowding) at the LSOA level, that had been split into quintiles by the Office for National Statistics (Office for National Statistics, 2011).

### 2.4. Ethical approval

UKHLS has ethical approval from the University of Essex Ethics Committee. Additional ethical approval was not required for the secondary data analysis conducted in this study.

### 2.5. Statistical analyses

Analyses were conducted using Stata v.18 via pooled multinomial regression analysis. Cross-sectional adult self-completion weights provided by UKHLS were applied and analyses were adjusted for clustering by LSOA using the clustered sandwich estimator. Results are presented as Relative Risk Ratios (RRR) and 95% Confidence Intervals (95%CI). The derived measure of mental distress was included as the outcome variable (reference category: no mental distress) in all models.

To test Hypothesis 1, the coastal status variable (reference category: inland) was included in the model as the predictor variable, with age and age square included as covariates using the formula:

$$Y = b0 + b1X1 + b2X2 + b3X3 + e$$

To test hypothesis 2, area deprivation (reference category: least deprived quintile) and an interaction term coastal status x area deprivation were included using the formula:

$$Y = b0 + b1X1 + b2X2 + b3X3 + b4X4 + b5(X1X4) + e^*$$

To test hypothesis 3, income, tenure (reference category: homeowner), sex (reference category: male) ethnicity (reference category: White British) were added as additional covariates using the formula:

$$Y = b0 + b1X1 + b2X2 + b3X3 + b4X4 + b5X5 + b6X6 + b7X7 + b8X8 + b9(X1X4) + e^*$$

To test hypothesis 4, subgroup analysis by age was conducted using the age category variable to group the sample. This generated three models each using the coastal status variable, area deprivation and an interaction term included as predictors, using the formula:

$$Y = b0 + b1X1 + b2X2 + b3(X1X2) + e^*$$

## 3. Results

Of the 28,549 adults who responded to one or more questionnaires during waves 10 to 13, 83.4% resided in an inland area. More females than males completed questionnaires (54.6%) with larger percentage of respondents reporting their ethnicity as White British (74.0%), this percentage was larger in coastal (91.7%) compared with inland areas (70.4%). Approximately three quarters of respondents reported being homeowners (73.1%), with a slightly lower percentage of social renters in coastal areas (12.5 %) compared with inland areas (15.6%). Characteristics of the study sample are shown in Table 1.

Model 1 revealed that after adjusting for age and age-squared, coastal study members had a 19% higher risk (RRR = 1.19, 95%CI: 1.07, 1.33) of having diagnosed mental distress than inland study members. However, there was no association between coastal residence and undiagnosed mental distress. See Table 2.

Model 2 revealed that participants who resided in the top 20% most deprived coastal areas had a 75% (RRR = 1.75, 95%CI: 1.15, 2.67) higher risk of diagnosed mental distress than those who resided in equivalently deprived inland areas. See Table 2 and Fig. 1.

Model 3 revealed that after controlling for socio-demographic variables (sex, household income, tenure, ethnicity) there were no associations between coastal or inland residence and undiagnosed or diagnosed mental distress. See Table 2, Fig. 2, and Supplementary Table S1.

Models 4 to 6 revealed that when the sample was stratified by age group, there were differences in associations between coastal residence and undiagnosed mental distress. Older adults who resided in the top 20% most deprived coastal areas experienced one-third of the risk of experiencing of undiagnosed mental distress compared with residents from equally deprived inland areas (RRR = 0.35, 95%CI: 0.13, 0.90). Young adults who resided in the top 20 % most deprived coastal areas had over three times (341%) higher risk of undiagnosed mental distress (RRR = 3.41, 95%CI: 1.35, 9.45) compared with participants from similarly deprived inland areas. See Table 3 and Fig. 3.

## 4. Discussion

This study aimed to investigate whether the risk of diagnosed or undiagnosed mental distress differed between English adults who reside

**Table 1**
Social-demographic characteristics of study sample.

| | Total (n = 28,549) Frequency (%) | Coastal (n = 4,752) Frequency (%) | Inland (n = 23,797) Frequency (%) |
|---|---|---|---|
| **Age (mean, SD)** | 49.8, 19.4 | 51.7, 19.4 | 49.5, 19.3 |
| 16–24-year-olds (young adults) | 3,615 (24.2) | 523 (11.0) | 3,092 (13.0) |
| 25–65-year-olds (working age adults) | 18,011 (63.1) | 2,912 (61.3) | 15,099 (63.4) |
| 66 years and above (older adults) | 6,923 (12.7) | 1,317 (27.7) | 5,606 (23.6) |
| **Gender** | | | |
| Male | 12,953 (45.4) | 2,163 (45.6) | 10,790 (45.3) |
| Female | 15,596 (54.6) | 2,589 (54.4) | 13,007 (54.7) |
| **Ethnicity** | | | |
| White British | 21,112 (74.0) | 4,357 (91.7) | 16,755 (70.4) |
| Other Ethnicity | 7,437 (26.0) | 395 (8.3) | 7,042 (29.6) |
| **Income[a] (mean, SD)** | 7.9, 0.95 | 7.9, 0.9 | 8.0, 1.0 |
| **Tenure** | | | |
| Homeowner | 20,876 (73.1) | 3,561 (74.9) | 17,315 (72.8) |
| Social renter | 4,308 (15.1) | 592 (12.5) | 3,716 (15.6) |
| Private renter/other | 3,365 (11.8) | 599 (12.6) | 2,766 (11.6) |
| **Mental health category** | | | |
| No mental distress | 18,998 (66.6) | 3,093 (65.1) | 15,905 (66.8) |
| Undiagnosed mental distress | 4,772 (16.7) | 738 (15.5) | 4,034 (17.0) |
| Diagnosed mental distress | 4,779 (16.7) | 921 (19.4) | 3,858 (16.2) |

[a] Net income adjusted for household composition and inflation, and transformed using the inverse hyperbolic sine.

**Table 2**
Adjusted prevalence ratios of mental distress (both undiagnosed and diagnosed) by coastal (vs inland) residence, UKHLS 2018–2023 (n = 28,549).

| | Model 1: Adjusted for age and age-squared | Model 2: + area deprivation & deprivation*coastal | Model 3: + demographics |
|---|---|---|---|
| **(A) Undiagnosed mental distress (vs No mental distress)** | | | |
| Coastal community status (ref = inland) | 1.04 (0.93, 1.17) | 0.99 (0.82, 1.20) | 0.98 (0.81, 1.19) |
| Area deprivation | | | |
| 1 (ref) | – | – | – |
| 2 | – | 1.10 (0.97, 1.25) | 1.05 (0.92, 1.20) |
| 3 | – | **1.37 (1.18, 1.58)*** | **1.21 (1.04, 1.40)*** |
| 4 | – | **1.38 (1.19, 1.61)*** | 1.16 (0.99, 1.36) |
| 5 | – | **1.51 (1.29, 1.77)*** | **1.21 (1.00, 1.45)*** |
| Area deprivation* Coastal community status | | | |
| 1 (ref) | – | – | – |
| 2 | – | 1.17 (0.86, 1.59) | 1.17 (0.86, 1.59) |
| 3 | – | 0.99 (0.71, 1.38) | 1.03 (0.74, 1.44) |
| 4 | – | 1.07 (0.75, 1.50) | 1.09 (0.77, 1.54) |
| 5 | – | 1.05 (0.67, 1.68) | 1.08 (0.68, 1.70) |
| **(B) Diagnosed distress (vs No** mental distress) | | | |
| Coastal community status (ref = inland) | **1.19 (1.07, 1.33)*** | 1.16 (0.97, 1.38) | 1.14 (0.96, 1.36) |
| Area deprivation | | | |
| 1 (ref) | – | – | – |
| 2 | – | **1.19 (1.06, 1.35)*** | 1.13 (1.00, 1.28) |
| 3 | – | **1.33 (1.18, 1.53)*** | 1.16 (1.01, 1.34) |
| 4 | – | **1.20 (1.03, 1.40)*** | 1.03 (0.87, 1.22) |
| 5 | – | 1.16 (0.97, 1.40) | 1.07 (0.87, 1.32) |
| Area deprivation* Coastal community status | | | |
| 1 (ref) | – | – | – |
| 2 | – | 0.91 (0.69, 1.20) | 0.88 (0.66, 1.16) |
| 3 | – | 0.90 (0.65, 1.23) | 0.88 (0.64, 1.21) |
| 4 | – | 1.09 (0.77, 1.53) | 0.97 (0.69, 1.37) |
| 5 | – | **1.75 (1.15, 2.67)*** | 1.33 (0.87, 2.04) |

Note: * indicates statistical significance at 0.05 level.

in inland or coastal areas. In addition, it sought to understand whether the relationships identified were associated with area deprivation, were driven by contextual (e.g. area of residence) or compositional factors (e.g. sex, ethnicity, tenure, household income), or differed across stages of adulthood.

The results partially supported hypothesis 1. Descriptive data revealed that 17% of inland and 15% of coastal residents were living with undiagnosed mental distress. Although there was no statistical association between coastal residence and undiagnosed mental distress, these statistics highlight the large population of English residents who have an unrecognised mental health need. The analysis revealed that coastal residents had a 19% higher risk of diagnosed mental distress compared with inland residents. These findings are broadly supported by those of the UK's CMO's report based on GP reporting which suggest coastal residents are subject to an 11% increase in risk of having a diagnosed mental health condition, when adjusting for age and area deprivation (Whitty, 2021). The current study focussed mainly on adults (16 years old and above) and used the GHQ-12 as an indicator of potential mental distress in combination with history of mental health diagnosis. Despite methodological differences, both studies indicate higher levels of mental health need in UK coastal communities.

The results of model 2 confirmed our second hypothesis, with coastal residents of the most deprived quintile at 75% higher risk of diagnosed mental distress than those who resided in equivalently deprived areas inland. This finding supports previous research indicating that the coastal effect for mental health is only replicated at the population level when examining coastal effects by strata of area deprivation (Murray et al., 2024). This may be explained by precarious, low paid employment in coastal communities, with local economies being reliant on seasonal trade and specific industries, e.g. fishing, which are also governed by wider policies, for example, fisheries management plans (Fiorentino et al., 2023; Wenham, 2022). Furthermore, proximity to opportunities for education, employment and cultural/leisure activities may have greater impact on young adults, with inland areas being closer to larger cosmopolitan areas (Wenham, 2022). Deprived coastal communities may also be more vulnerable to climate change, with climate anxiety more likely to affect young people (Hickman et al., 2021; Zsamboky et al., 2011). Although coastal communities share similar geographic characteristics, they also have unique social, economic and environmental characteristics and variances in these factors should be considered. For example, quality of the environment, water or air pollution, may be negatively impacted by industry. Investigating mental health in coastal communities at a granular level that can account for these differences should be a future research priority.

Our third hypothesis was supported by the findings of model 3. When sex, ethnicity, tenure, and household income were included in the analysis as covariates, the relationships between coastal or inland residence and undiagnosed or diagnosed mental distress were no longer evident. These findings suggest that compositional factors (e.g. sex, ethnicity, tenure, household income) rather than contextual factors (area of residence) explain the association found in model two. Previous research has shown that these variables are all independently associated with poorer mental health outcomes (Li et al., 2022; Wicks et al., 2024; Zhang et al., 2023). However, these compositional factors may result in greater or lesser risk when intersecting with each other and contextual factors. The intersectional profiles of inland and coastal residents may determine level of risk of both diagnosed and undiagnosed mental distress and require further research.

So far, the findings may suggest that any coastal effect of mental health observed in the CMO report can be explained by other variables already known to be associated with mental health (age, deprivation, sex, ethnicity, housing tenure and income). However, the sub-group analysis by age group (addressing hypothesis 4) revealed opposite associations between older and young adults and these opposite associations may have led to the main analysis showing no effect of coast when controlling for known risk factors. The results show that young adults residing in coastal areas have the highest risk of undiagnosed mental distress, with over three times the risk of undiagnosed mental distress compared to young adults in inland areas – when examining the 20% most deprived areas. This would suggest that in addition to deprivation

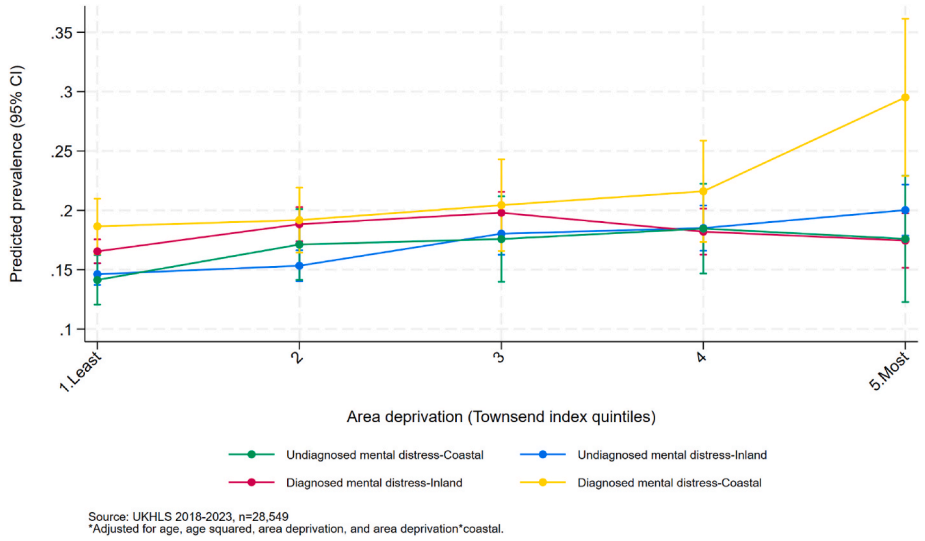


**Fig. 1.** Adjusted predicted prevalence of undiagnosed and diagnosed mental distress by area type (Model 2).

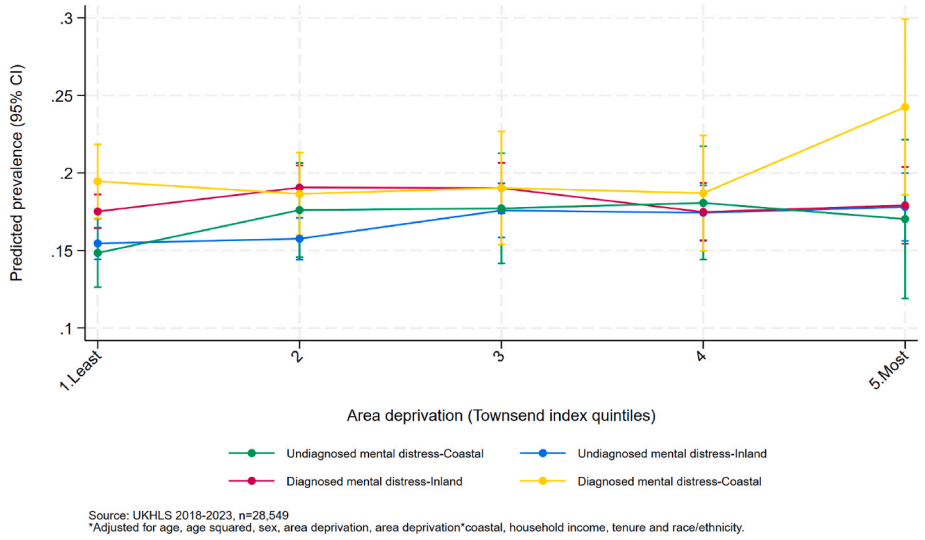


**Fig. 2.** Fully adjusted predicted prevalence of undiagnosed and diagnosed mental distress by area type (Model 3).

being a key determinant of any coastal effect on mental health, young people are at particular risk in these deprived coastal areas of experiencing mental distress and not having their distress identified (and therefore not supported) by healthcare professionals. This aligns with previous research which has indicated that living in the most deprived coastal communities during adolescence is associated with poor health outcomes, including mental distress in young adulthood, regardless of whether a person continues to live in a coastal community or moves inland (Murray et al., 2024).

Coastal communities are characterised by poorer educational outcomes, weak-labour markets, and digital exclusion due to poor internet and mobile signal coverage (House of Lords Select Committee, 2019). These contextual factors likely impact the mental health of young adults through lack of prospects for the future. The high level of outward migration of young adults from coastal areas may be indicative of this desire for increased opportunity to achieve personal and professional ambitions and can leave those who cannot or do not leave due to economic, cultural, or social resources, feeling "stuck" (Wenham, 2022). Previous research has also highlighted that coastal young people can feel marginalised by their own communities. A combination of feeling unsafe in public spaces and towns prioritising amenities for tourists rather than local young people can result in feelings of exclusion and being "pushed out". In contrast, local social networks strengthened through support and shared experience of the unique and complex hardships of coastal living could also bind young people to place (Keating et al., 2024; Wenham, 2022). An assessment of social connectedness and sense of belonging may be effectual unmeasured variables which are relevant to the analyses undertaken,

The high risk of undiagnosed mental distress may also be caused by lack of and closure of youth mental health services (Davies, 2019), resulting in adolescents moving into young adulthood with poor mental health. Coastal adolescents who do receive support through child services may later fall victim to the disconnection between youth and adult services resulting in lack of ongoing support (Health Services Safety Investigation Body, 2024).

The lower risk of undiagnosed mental distress for older adults revealed in the current study was unexpected. The CMO's report highlighted mental health rates are higher in coastal LSOAs, however, they found this difference was greatest in LSOAs with older populations. This study, which used population data rather than GP records, found no significant association in older adults for diagnosed mental distress by area deprivation or inland versus coastal areas. Indeed, this study

**Table 3**
Fully adjusted[†] prevalence ratios of mental distress (both undiagnosed and diagnosed) by coastal (vs inland) residence, UKHLS 2018–2023 (n = 28,549).

| | Young adults:16-24y (n = 4,430, obs = 3,615) | Working age adults: 25-65y (n = 8,760, obs = 18,011) | Older adults:66y+ (n = 3,617, obs = 6,923) |
|---|---|---|---|
| **(A) Undiagnosed mental distress (vs No** mental distress) | | | |
| Coastal community status (ref = inland) | 1.15 (0.69, 1.89) | 0.886 (0.66, 1.12) | 1.14 (0.83, 1.57) |
| Area deprivation | | | |
| 1 (ref) | – | – | – |
| 2 | 1.23 (0.88, 1.73) | 1.00 (0.85, 1.18) | 1.09 (0.86, 1.39) |
| 3 | 1.42 (0.94, 2.16) | 1.20 (0.99, 1.44) | 1.17 (0.88, 1.55) |
| 4 | 1.36 (0.93, 2.00) | 1.20 (0.99, 1.45) | 0.91 (0.65, 1.28) |
| 5 | 1.04 (0.87, 1.61) | 1.24 (0.99, 1.55) | **1.60 (1.04, 2.45)*** |
| Area deprivation* Coastal community status | | | |
| 1 (ref) | – | – | – |
| 2 | 0.83 (0.36, 1.93) | 1.38 (0.92, 2.07) | 1.04 (0.63, 1.72) |
| 3 | 0.94 (0.40, 2.23) | 1.29 (0.84, 1.98) | 0.65 (0.35, 1.21) |
| 4 | 0.59 (0.25, 1.43) | 1.28 (0.80, 2.02) | 1.31 (0.66, 2.63) |
| 5 | **3.41 (1.24, 9.36)*** | 1.14 (0.64, 2.03) | **0.35 (0.13, 0.95)*** |
| **(B) Diagnosed distress (vs No mental distress)** | | | |
| Coastal community status (ref = inland) | 1.23 (0.69, 2.20) | 1.18 (0.94, 1.47) | 0.98 (0.71, 1.35) |
| Area deprivation | | | |
| 1 (ref) | – | – | – |
| 2 | 1.20 (0.83, 1.75) | **1.19 (1.02, 1.39)*** | 0.96 (0.74, 1.24) |
| 3 | 1.22 (0.80, 1.87) | **1.19 (1.01, 1.41)*** | 1.13 (0.82, 1.54) |
| 4 | 0.71 (0.40, 1.24) | 1.17 (0.96, 1.41) | 0.86(0.58, 1.27) |
| 5 | 0.74 (0.42, 1.32) | 1.15 (0.91, 1.44) | 1.29 (0.74, 2.26) |
| Area deprivation* Coastal community status | | | |
| 1 (ref) | – | – | – |
| 2 | 1.14 (0.48, 2.69) | 0.81 (0.57, 1.15) | 1.05 (0.61, 1.81) |
| 3 | 1.00 (0.40, 2.55) | 0.94 (0.63, 1.39) | 0.47 (0.22, 1.01) |
| 4 | 1.10 (0.36, 3.34) | 0.89 (0.59, 1.35) | 1.29 (0.64, 2.64) |
| 5 | 2.29 (0.59, 8.92) | 1.36 (0.83, 2.25) | 0.78 (0.31, 1.92) |

Note. [†]Adjusted for sex, area deprivation, area deprivation*Coastal community status, household income, tenure and race/ethnicity. * indicates statistical significance at 0.05 level.

revealed that residing on the coast offered protective effects against undiagnosed distress in older adults in the most deprived quintile, with no significant associations for diagnosed distress. This may suggest that older adults with mental health needs are already able to navigate healthcare systems and get access to support whereas younger adults are less able to do this or are less likely to come forward for help. Alternatively, it might reflect that older adults migrating into coastal areas have and are able to maintain good mental health. The categorisation of 25–65-year-old respondents into the 'working age adult' cohort resulted in a large subgroup which likely contains several distinct groups within it, e.g., respondents from different generations, and at various life and career stages. Breaking down this subgroup further could uncover trends hidden by the current analyses given the differences in the perspectives, behaviours and expectations of the different groups within this cohort.

Research into benefits of exposure to the natural environment indicate that natural blue spaces (such as coastal areas) can promote a range of health benefits, including mental health (White et al., 2021). Older adults may be better positioned to benefit from the health enhancing

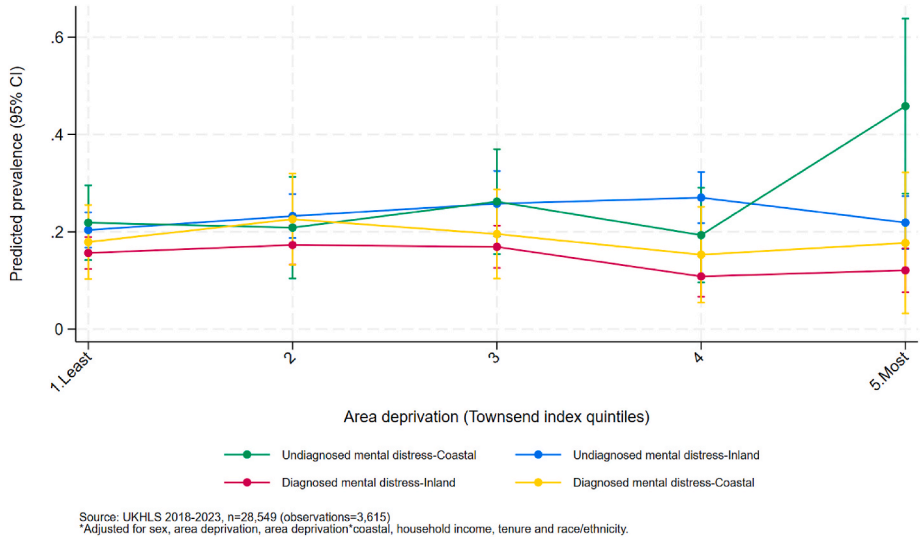


**Fig. 3.** Predicted prevalence of undiagnosed and diagnosed mental distress by area type in subsample of young adults (16–24 years).

effects of living on the coast, e.g. more settled compared with young adults, less likely to be single, greater availability of social connection opportunities aimed at older people (e.g. societies, clubs, walking groups, churches, etc.), greater opportunities for leisure activities that take advantage of proximity to the natural environment (e.g. time, transport and greater disposable income). The latter is supported by previous research finding that older adults and people from lower socio-economic groups are more likely to take coastal walks (Elliott et al., 2018).

Additional research is required to explore intersectional profiles of coastal and inland residents and the relationship with risk of diagnosed and undiagnosed mental distress. Establishing how best to harness the assets of individual communities to support the mental health of residents is also essential, as is understanding barriers and facilitators for specific groups, e.g. is exposure to natural blue spaces more beneficial for coastal older adults or do they just have greater access and opportunity to benefit? Furthermore, additional research should investigate how other factors such as health behaviours, social connections and environmental factors including pollution might influence undiagnosed mental distress in both inland and coastal residents.

In the short-term, investment in and delivery of interventions to support the mental health of coastal young adults in most deprived areas of the UK should be a priority. This should include facilitating access to services with a focus on the most at-risk groups, e.g. how can services be brought closer to coastal young adults or how can barriers be overcome, for example, digital solutions (Asthana and Prime, 2023) or transport to inland services. At national level, the government should reinvest in youth mental health services, which have been dramatically reduced in recent years (Davies, 2019). Mental health care policy should insist on joined up working between adolescent and adult mental health services for continuity of care to protect young people from falling victim to the service gap.

Longer-term investment in deprived coastal communities is required to tackle the drivers of poor mental health. This includes improving opportunities for education, employment, housing and social connection with improved public transport essential for all of these. As with mental health interventions, investment should be considered on an individual basis with the needs and assets of each community at the heart of developments, e.g. new opportunities should not threaten existing income streams, opportunities for health or the natural environment, such as windfarm developments providing employment opportunities, but damaging or reducing access to the local natural environment, and/or negatively affecting tourism or fishing industries. Furthermore, appropriate investment provides the UK Government opportunity to achieve Sustainable Development Goals (Gov.uk, n.d.).

The strengths of this study include drawing data from a nationally representative study and investigating mental health need of coastal and inland residents through the lens of both diagnosed and undiagnosed mental distress. Limitations include the inclusion of data collected both during and post-coronavirus pandemic. Whilst nearly three quarters of the data points were from wave 13 of the UKHLS (January 2021 to May 2023), some data were collected during the peak of the Coronavirus pandemic, which had a considerable adverse effect on population level mental health. This data may have inflated the number of participants reported to be experiencing undiagnosed mental distress. However, we recognise there are multiple ongoing national and global events which extend to before the pandemic (e.g. financial crisis, austerity politics, cost of living and climate crises) which have negatively impacted population mental health. There is also potential for selection bias, e.g. people choosing where they live. However, moving into less deprived area is reliant on upward social mobility and not solely based on choice. Further, history of diagnosis is self-report, and some people may be more reluctant to report diagnoses in a survey context. In addition, the history of diagnosis question used in wave 10 of the UKHLS asks whether the respondent has "ever" received a mental health diagnosis. As such, there are issues with temporality in this wave as the measures of mental distress and diagnosis may potentially relate to different points in time. This study used LSOAs to identify inland and coastal areas in the UK. However, the small LSOA sample sizes did not permit investigation of how diagnosed and undiagnosed distress is experienced by residents of individual LSOAs. Selection bias may also occur through specific groups choosing to participate (or not) in the Understanding Society study. However, sampling weights were applied to all analyses to try and make population level inference.

In conclusion, the findings of this study present a coastal paradox, whereby young adults residing in the most deprived coastal areas in the UK have three times greater risk of experiencing undiagnosed mental distress compared with equally deprived young adults living in inland areas. However, residing in the most deprived coastal areas may protect coastal older adults from experiencing undiagnosed mental distress, when compared to the risk associated with their inland peers. Immediate investment in coastal areas should be directed towards improving the mental health of young adults, through appropriate and accessible services and support. Longer-term investment in coastal infrastructure more broadly, including mental health services, may help prevent future generations experiencing similar mental health disparities.

## CRediT authorship contribution statement

**Claire Wicks:** Writing – original draft, Visualization, Methodology, Formal analysis, Conceptualization. **Susan McPherson:** Writing – original draft, Methodology, Funding acquisition, Conceptualization. **Cara Booker:** Writing – review & editing, Methodology, Conceptualization. **Antonella Trotta:** Writing – review & editing, Methodology, Conceptualization. **Meena Kumari:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **Emily T Murray:** Writing – original draft, Visualization, Methodology, Formal analysis, Conceptualization.

## Data statement

The UKHLS data described in this article can be freely and openly accessed from the UKDS website: https://www.understandingsociety.ac.uk/documentation/access-data. Data relating to LSOAs is available via special licence application to the UK Data Service.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.healthplace.2025.103501.

## Data availability

UKHLS data can be freely and openly accessed via the UKDS website. LSOA data is available via special licence request. The authors do not have permission to share coastal classification data.

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