# The Effects of Neighbourhood and Individual Deprivation on Well-Being Trajectories During the First Lockdown of the Covid-19 Pandemic in England

Insights from the UK Household Longitudinal Study

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## Abstract

**Background** Neighbourhood and individual deprivation and their interplay have been found to play a substantial role in determining well-being. This study examined the trajectories of well-being during the first Covid-19 lockdown in England and investigated the role of neighbourhood deprivation and individual income as predictors. A double disadvantage hypothesis was suggested, where people with a lower individual socioeconomic status living in deprived neighbourhoods experience a dual burden and worse well-being.

**Methods** Longitudinal data from waves 9 (2017-2019) and Covid-19 waves 1 (April 2020) and 3 (June 2020) from the UK Household Longitudinal Study were utilised. Due to the UK"s constituent nations having different lockdown regulations, the current sample only included participants residing in England. Participants with missing items or those who relocated between waves were excluded. Neighbourhood deprivation, assessed using the 2019 English Index of Multiple Deprivation quintiles, and individual deprivation, determined by income above or below the poverty line, were examined. Double deprivation was defined as residing in one of the two lowest neighbourhood quintiles and having a household income below the poverty line. Trajectories of well-being, based on changes measured by the General Health Questionnaire between survey waves, were classified as deteriorating, improving, or stable. Binary logistic regression analyses were used to investigate the association between neighbourhood deprivation, individual deprivation, and well-being trajectories.

**Results** Of the 6,841 participants, 236 (2.5%) experienced double deprivation. Those experiencing moderate double deprivation were over twice as likely to be part of the deteriorating trajectory compared to those without double deprivation (OR = 2.36, 95% CI = [1.35, 4.12], p = .003). Individuals with incomes below the poverty line were more likely to experience deteriorating (*OR* = 1.64, *CI* = [1.35, 1.99], $p < .001$) and improving well-being (*OR* = 1.30, *CI* = [1.02, 1.64], $p = .031$). None of the neighbourhood deprivation quintiles were associated with the deteriorating or improving well-being trajectory.

**Conclusions** This study found limited evidence for the double deprivation hypothesis. Experiencing moderate double deprivation or an income below the poverty line affected individuals' well-being during the first Covid-19 lockdown in England.


**Keywords** well-being, covid-19, deprivation

# The Effects of Neighbourhood and Individual Deprivation on Well-Being Trajectories During the First Lockdown of the Covid-19 Pandemic in England

The UK's first Covid-19 lockdown, starting on March 23rd, 2020, significantly disrupted everyday life due to various lockdown measurements and profoundly impacted people's well-being (Brown et al., 2021; O'Connor et al., 2021; Patel et al., 2022). In the present paper, *well-being* is defined as "the combination of feeling good and functioning effectively" (Huppert, 2009, p. 137). Importantly, well-being is a subjective evaluation of one's life (Diener et al., 2011). Due to this subjectiveness, individuals experienced and evaluated the pandemic differently, leading to different changes in well-being. Generally, most studies found a worsening of well-being at the onset of the pandemic (Salanti et al., 2022). However, due to different measurement characteristics, the degree and time in which well-being decreased varies substantially across studies (Gao et al., 2021; Manchia et al., 2022; Salanti et al., 2022; Patel et al., 2022). Overall, the general population's mental health worsened at the onset of the pandemic but later on, showed resilience and quickly recovered to pre-pandemic levels (Fancourt et al., 2021; Manchia et al., 2022; Murphy & Elliot, 2022). *Resilience* refers to successfully coping with challenging life events (American Psychological Association, n.d. b).

Examining the UK's population, Pierce et al. (2021) and Ellwardt and Präg (2021) identified multiple latent well-being trajectories during the Covid-19 pandemic. According to Pierce et al. (2021), most individuals showed resilient well-being, while 12% of participants displayed a worsening of well-being followed by a "bounce-back", and 11% showed a consistent worsening of their well-being. Ellwardt and Präg (2021) found similar trajectories; however, according to their analyses, two-fifths of the population experienced worsened well-being. These differences in percentages stem from their different study designs.

While the mental health of the average UK population remained stable, some individuals did experience a worsening of their well-being (Ellwardt & Präg, 2021; Pierce et al., 2021). Most at risk of experiencing worsening well-being were younger people, women, those unemployed or struggling financially, people living alone, and those with pre-existing health conditions (Ellwardt & Präg, 2021; Pierce et al., 2020, 2021). Furthermore, an individual's pre-pandemic well-being significantly influenced their mental health during the crisis, with those initially high in well-being more likely to experience a decline, while those with lower well-being levels saw minimal changes (Danielsen et al., 2022; Joensen et al., 2022; Murphy & Elliot, 2022). These findings highlight the necessity for a nuanced understanding of individual vulnerability in the face of global health crises.

Besides the subjective evaluation of the pandemic and despite governmental claims that 'we are in this together' (Department for International Development, 2020; Foster et al., 2020), the effects of the pandemic were not evenly distributed across the population. The pandemic disproportionately affected economically and socially disadvantaged groups, exacerbating social inequalities (Munford et al., 2022; Witteveen, 2020). *Socioeconomic status* (SES) refers to a person's position in society based on social and economic factors that affect their access to resources (American Psychological Association, n.d. a). At the individual level, SES is determined by an individual's income, education, and occupation. At the area or neighbourhood level, SES focuses on the resources available to a group of people living in a particular area.

In the UK, a deprived neighbourhood is characterised by a group of individuals facing poverty and a lack of investment in the area's infrastructure (Rae et al., 2016). Even before the pandemic, individuals living in deprived neighbourhoods experienced worse health and well-being outcomes (Blair et al., 2014; Fone et al., 2014; Schüle & Bolte, 2015; Visser et al., 2021). In 2019, 12% of the urban population and 1% of the rural population in England lived within the 10% most deprived areas (*Rural Deprivation Statistics*, 2019). Importantly, not everyone living in a deprived area is necessarily individually deprived, and vice versa (Ministry of Housing, Communities & Local Government, 2019). Thus, the question of the interplay between both forms of deprivation and their influence on mental health arises. While some pre-pandemic studies identified neighbourhood-level deprivation to be associated with worse health outcomes, independently of individual SES (Jordan et al., 2014; Li et al., 2014; Poortinga et al., 2008), other research found individual SES to be more detrimental for mental health outcomes than neighbourhood SES (Jokela, 2015; Mann et al., 2022). Thus, further research on the interplay between individual and neighbourhood SES is necessary.

Theoretical models suggest that the contradicting findings on the interplay between individual and neighbourhood SES stem from the notion that neighbourhood SES affect wealthy and poor individuals differently (Stafford & Marmot, 2003). Two similar frameworks, the collective resource model (Stafford & Marmot, 2003) and the deprivation amplification hypothesis (Macintyre, 2007), suggest that those with a lower individual-level SES depend more on local services and amenities than those with higher individual-level SES. While the collective resource model focuses on how collective resources in a neighbourhood can enhance health outcomes, the deprivation amplification hypothesis emphasises how the lack of resources in deprived neighbourhoods can exacerbate individual deprivation. The former is about how good environments can benefit everyone, while the latter is about how poor environments can make individual disadvantages even worse. According to both frameworks,

individuals in less deprived neighbourhoods have better health than those in more deprived neighbourhoods due to the higher availability of resources (e.g., jobs, services, social support) (Stafford & Marmot, 2003). Individuals with limited financial resources may be less able to purchase goods and services, relying more on locally available facilities. However, these services and amenities are often scarce and of lesser quality in more disadvantaged neighbourhoods (Macintyre, 2007; Stafford & Marmot, 2003). As a result, the more affluent residents can contribute to the availability of premium amenities and services that improve the overall quality of life for everyone in the community (Stafford & Marmot, 2003). These frameworks are supported by studies finding worse environments and less or lower quality resources, such as green spaces, in more deprived areas (Mears et al., 2019; Mouratidis, 2020; Hoffimann et al., 2017). Based on these frameworks, a 'double disadvantage effect' is proposed, where people who are deprived on the individual level and also live in a deprived neighbourhood have worse health outcomes, as they not only have fewer personal resources, but their surroundings also offer fewer resources (Boylan & Robert, 2017; Ejlskov et al., 2023; Mann et al., 2022).

Covid-19 lockdown measures enhanced the influence of neighbourhood environments on residents' well-being by limiting mobility and increasing the time spent within these areas (Teo et al., 2021). Thus, the importance of the neighbourhood environment might have increased substantially. This is supported by Bezzo et al. (2021), who reported a more significant decrease in well-being among individuals living in deprived neighbourhoods during the pandemic. However, other studies found no correlation between deprivation and decline in well-being (Davillas & Jones, 2021; Murphy & Elliot, 2022). Thus, further research on the interplay between individual and neighbourhood SES is necessary.

**The Present Study**

The COVID-19 pandemic's impact on well-being in the UK has been the subject of extensive research. The present study seeks to contribute to the existing literature by examining the interplay between neighbourhood-level and individual-level deprivation in shaping well-being trajectories during this critical period. Besides that, instead of solely focusing on identifying at-risk groups, this study additionally focused on who stayed resilient and who might have even been able to thrive. The aim was built upon the double disadvantage hypothesis and addressed through the following research question:

RQ: Are neighbourhood-level deprivation, measured by the English Index of Multiple Deprivation 2019, and household income impacting well-being trajectories (i.e., stable,

deteriorating, improving), measured by the General Health Questionnaire 12, during the first Covid-19 lockdown in England?

The present study focused on analysing well-being trajectories during the initial onset of the pandemic to understand the immediate impact of the pandemic on individuals' well-being. As a result, the focus was on well-being trajectories that were either stable, deteriorating, or improving during this initial phase. The present study's findings will hopefully offer valuable insights into the immediate and early responses to the pandemic's onset, which could inform further research on the long-term effects in the future. Furthermore, the present study solely focused on England due to the different governmental responses in the UK nations. It was hypothesised that:

H1: In comparison to living in neighbourhoods with average socio-economic status (SES), living in more deprived neighbourhoods increased the odds of displaying deteriorating well-being during the first Covid-19 lockdown compared to pre-pandemic well-being. Correspondingly, the odds of displaying improving well-being during the same time frame increased for those living in less deprived neighbourhoods compared to those in average SES neighbourhoods.

H2: In comparison to having a household income above the poverty line, having an income below the poverty line increased the odds of displaying deteriorating well-being during the first Covid-19 lockdown compared to pre-pandemic well-being. Correspondingly, the odds of displaying improving well-being during the same time frame increased for those with a household income above the poverty line compared to the ones below.

H3: In comparison to individuals who experienced no double deprivation, those who do experience both neighbourhood and income deprivation had higher odds of belonging to the sub-population who deteriorated in well-being levels during the first Covid-19 lockdown compared to pre-pandemic well-being, and, vice versa, individuals who did not experience double deprivation had higher odds of belonging to the sub-population who improved in well-being levels during the first Covid-19 lockdown compared to pre-pandemic well-being.

This study aims to contribute to the understanding of how neighbourhood-level deprivation and household income are associated with the well-being trajectories of individuals during the Covid-19 pandemic. Additionally, the findings will shed light on the complex interplay between individual and neighbourhood-level factors and their influence on well-being during times of crisis.

## Method

### Data and Participants

The data come from the *Understanding Society*: UK Household Longitudinal Study (UKHLS). It is a nationally representative panel study that has been collecting data since 2009 (Institute for Social and Economic Research [ISER], 2022; Lynn, 2009). The current analysis was undertaken on a merged dataset built on wave 9 (hereafter referred to as 'baseline'; collected 2017-2019) from the annual main survey (University of Essex, ISER, 2023) and wave 1 (collected in April 2020) and 3 (collected in June 2020) of the COVID-19 special release survey (University of Essex, ISER, 2021). Participants who did not reside in England, had missing survey waves, missing well-being items, or changed their residential address were excluded from the present study. Further details about the sample design and survey can be found elsewhere (Burton et al., 2020; ISER, 2021, 2022; Lynn, 2009). The data from the UKHLS main survey (SN6614) and Covid-19 study (SN8644) were available under End User License from the UK data service (University of Essex, ISER, 2021, 2023). All data collection, including data linkage, has been approved by the University of Essex Ethics Committee (ISER, 2022).

## Measures

### *Well-being*

The outcome variable was well-being, which was measured using the General Health Questionnaire (GHQ-12), administered in all three survey waves. The GHQ-12 is a validated measure widely used within non-clinical populations and is considered robust in longitudinal data samples (Goldberg et al., 1997; Pevalin, 2000). It assesses general symptoms of depression, anxiety, and other mental health domains (Thorpe & Gutman, 2022) on a 4-point Likert scale ranging from 0 (not at all) to 3 (much more than usual) (Understanding Society, n.d.; see Appendix A for the full questionnaire). Responses were computed in a total score, which was reverse coded for simplicity, ranging from 0 (lowest well-being) to 36 (highest well-being). The internal consistency reliability of the GHQ-12 was assessed separately for each time wave, yielding Cronbach's alpha coefficients of $\alpha = 0.91$ for baseline, $\alpha = 0.90$ for Covid-19 wave 1, and $\alpha = 0.92$ for Covid-19 wave 3. Additionally, based on the reverse coded GHQ-12, a *well-being change* variable was created to reflect the change in reported psychological distress symptoms across survey waves (baseline to Covid-19 wave 1; Covid-19 wave 1 to Covid-19 wave 3).

### *Deprivation*

All deprivation variables were collected at baseline. Due to excluding any participants who moved in between the waves, these independent measures were treated as time-invariant for the study.

**Neighbourhood Deprivation.** The Index of Multiple Deprivation 2019 (IMD2019) measured relative levels of deprivation in England's 32,844 small areas (Lower-layer Super Output Areas [LSOA]) (Ministry of Housing, Communities & Local Government, 2019). The IMD2019 was derived by combining the following seven domains of deprivation: income, employment, education, health, crime, barriers to housing and services, and living environment (Noble et al., 2019). Importantly, with the IMD being a relative measure of deprivation, there is no absolute threshold above which a neighbourhood counts as "deprived" (Ministry of Housing, Communities & Local Government, 2019). To assess participants' *neighbourhood deprivation,* the present study used IMD2019 quintiles ranging from 1 (most deprived) to 5 (least deprived).

**Household Income.** A binary variable indicating whether an individual's household income was (0) below or (1) above the poverty line was included to measure individual socioeconomic status. Monthly net household income was adjusted by the OECD-modified equivalence scale (ISER, 2022). A relatively low income refers to people living in households with income below 60% of the yearly median (£29,600 in 2019) (Office for National Statistics, 2020). Thus, the poverty line was set at £1,480 monthly net household income.

**Double Deprivation.** To measure whether individuals experienced double deprivation, that is, living in a deprived neighbourhood and below the poverty line, the IMD2019 quintiles and household poverty measurement were combined. With the IMD2019 being a relative measure, no clear deprivation threshold is available. Thus, two binary double deprivation variables were created. The first variable, *high double deprivation*, included participants who lived in the most deprived neighbourhood quintile (Q1) and whose household income was below the poverty line. The second variable, *moderate double deprivation*, included participants who lived in either the most deprived neighbourhood quintile (Q1) or the second most deprived one (Q2) and whose household income was below the poverty line. This variable represents a somewhat less extreme form of double deprivation compared to the high double deprivation variable.

***Covariates***

The pandemic affected women's and younger people's well-being more (Dotsikas et al., 2023; Santomauro et al., 2021). Thus, binary variables for *sex* (male vs female), *ethnicity* (British/other white background vs non-white/other ethnic background), and a continuous variable for *age* were included. All three demographic indicators were collected at baseline and treated as time-invariant. Due to the sample's predominantly white/British makeup, participants' ethnicity was simplified to a binary variable for the current analysis.

To reduce the transmission of Covid-19, lockdown measures such as social distancing and stay-at-home orders were implemented. Due to these measures, the form and frequency of social interactions and individual's mobility changed (Devaraj & Patel, 2021; Lampraki et al., 2022; Nouvellet et al., 2021). Furthermore, the role and importance of the immediate neighbourhood area on well-being and quality of life has changed (Mouratidis, 2021). A continuous measure of individual *neighbourhood cohesion* was included, adapted from Buckner's Neighbourhood Cohesion Instrument, short version, $\alpha = .89$ (Buckner, 1988). It was measured at baseline and computed as the total mean score (rounded to 1-decimal point) of 8 questions, ranging from lowest cohesion (1) to highest cohesion (5). Additionally, a binary variable measuring *area type* (urban vs rural) was included to enhance the understanding of neighbourhood resources further. Similarly to the independent variables, neighbourhood cohesion and area type were treated as time-invariant.

Working from home leads people to spend more time in their neighbourhoods and surroundings (Teo et al., 2021). Besides that, working from home during the pandemic has been associated with positive and negative impacts on an individual's well-being (Hobbs, 2023; Parry et al., 2021). Participants were asked at both Covid-19 waves (1 and 3) to indicate how often they *worked from home* during the last four weeks on a 4-point Likert scale ranging from always (1) to never (4). Additionally, in Covid-19 wave 1, participants were asked to retrospectively indicate how often they *worked from home* during January and February.

**Data Analysis**

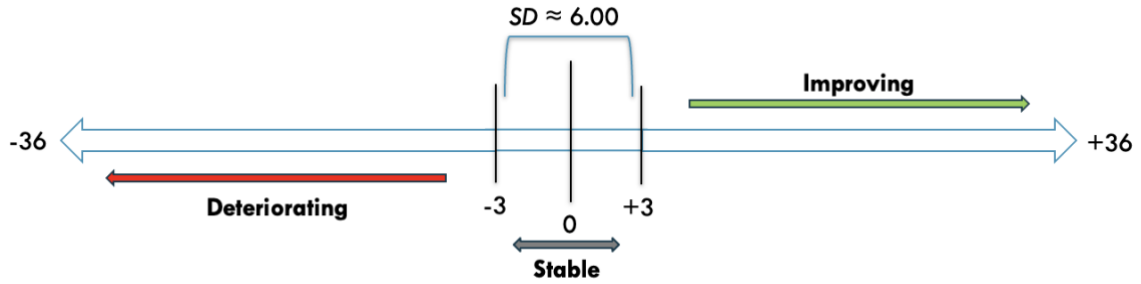
All data was prepared and analysed using IBM SPSS version 28. It is important to note that the UKHLS is a probability survey with a complex sample design where not all population subsamples were selected with the same probability (ISER, 2022). Statistical programs like SPSS, however, assume data to be sampled randomly with all sub-populations having equal selection probability, random attrition, and non-response (ISER, 2022). Thus, weighting and adjusting the UKHLS data is necessary to ensure that the results are unbiased estimates of population statistics (ISER, 2022). UKHLS provides specific weighting guidelines, primary sampling units, and stratification variables for different types of analysis. Thus, SPSS' complex sample command, based on the weighting variable i_indscui_lw and primary sampling unit and stratification variable from baseline, was used in the present study (Appendix B).

Participants' well-being trajectories were grouped into five categories based on changes in their well-being scores over time (Figure 1). These categories help understand how participants' well-being changed during the study. After recoding the GHQ-12 variable, a negative well-being change score between waves indicated deteriorating well-being, while a

positive change indicated improving well-being. The sample's standard deviation of the overall (baseline to wave 3) well-being change variable (SD = 5.46) represents the typical variation in well-being change scores across the entire sample. The trajectories were categorised as follows:

**Figure 1**

*Well-Being Trajectory Building based on the GHQ-12 Change Score.*




1. **Stable Well-being:** Participants in this category had little to no change in their well-being scores between baseline and subsequent waves. Their well-being change scores fell between -2 and +2 points. Using the ±2 threshold relative to the sample's standard deviation (SD = 5.46), "stability" was defined as participants whose well-being change scores did not deviate significantly from the average change in the dataset.
2. **Deteriorating Well-being:** Participants in this category experienced a decline in well-being levels. They either experienced a noteworthy decrease (a change score of ≤ -3) in their well-being scores at both waves compared to baseline or, at one wave, while the other change score remained stable.
3. **Improving Well-being:** Participants in this category experienced an overall improvement in well-being levels. They either experienced an increase (a change score of ≥ +3) in their well-being scores at both waves compared to baseline or, at one wave, while the other change score remained stable.
4. **Recovering Well-being:** Participants in this category experienced a decrease in well-being initially (a change score of ≤ -3) but later saw an improvement (a change score of ≥ +3), indicating a rebound in their well-being. Given the present study's research aim and study period, this category was not included in the analyses.
5. **Delayed Effect:** Participants in this category initially had an increase in well-being (a change score of ≥ +3) but later experienced a decline (a change score of ≤ -3), indicating a delayed negative impact on their well-being. Again, given the present study's research aim and study period, this category was not included in the analyses.

For the present study's hypotheses, only the deteriorating and improving trajectories were examined, using the stable trajectory as a reference group. Descriptive statistics (mean, standard deviation, frequency) for the dependent variable (well-being change) and independent variables (neighbourhood deprivation, household income, double deprivation), as well as the covariates (sex, ethnicity, age, neighbourhood cohesion, area type, worked from home) were conducted. A significance level of $p = 0.05$ was employed. Estimated variance inflation factors (VIF) revealed no multicollinearity between the independent variables and covariates. This supports the stability and interpretation of the regression coefficients in the current model.

To test whether neighbourhood-level deprivation and household income impact well-being trajectories, that is, deteriorating (a) or improving (b) well-being during the first Covid-19 lockdown in England, logistic regression models for each hypothesis were performed. For each predictor variable, that is, neighbourhood deprivation (H1), household income (H2), double deprivation (H3), deteriorating (a) and improving (b) well-being were examined using separate binary logistic regression models. Each predictor variable was examined with an unadjusted model, a minimally adjusted model, and a fully adjusted model as described below. In all models, the stable trajectory was treated as the reference group. Thus, the presence or absence of the deteriorating (a) or improving (b) trajectory was compared to individuals whose well-being remained stable.

First, for each hypothesis, an unadjusted model only including the predictor variable (neighbourhood deprivation, household income, or double deprivation) was conducted to serve as a baseline to compare the following regressions to. Second, minimally adjusted models were used for the initial exploration of data and associations. Minimally adjusted models are simplified regressions that focus on the relationship between a predictor and a binary outcome without considering the influence of other potentially confounding variables. The variables chosen for minimal adjustment may substantially confound unadjusted results while remaining conservative and not including all possible relevant factors (which will be covered in subsequent models). The variables chosen were age and sex because younger people and women were at higher risk of experiencing a worsening of their mental health during the pandemic (e.g., Ellward & Präg, 2021; Pierce et al., 2020, 2021; Santomauro et al., 2021). Last, fully adjusted models adding the remaining covariates (i.e., ethnicity, neighbourhood cohesion, area type, worked from home) were conducted to control for their potential confounding and more accurately assess the independent effect of deprivation on well-being.

## Results

### Descriptive Statistics

After excluding participants who did not fulfil the present study's criteria, the final sample consisted of 9,379 participants. However, due to the sample being clustered and stratified with unequal selection probabilities, the complex sample command excluded participants of overrepresented sub-groups, leaving 6,841 participants for analysis. Descriptive Statistics (mean, standard deviation, frequencies) of the sample's characteristics can be seen in Table 1. The number of residents below the poverty line was similar in all neighbourhood quintiles (Figure 2). However, due to more individuals residing in the less deprived neighbourhoods compared to the more deprived ones, the overall percentage of residents below the poverty line was lower in less deprived neighbourhoods.

Table 1. Descriptive Statistics for Independent Variables and Covariates. *N* = 6,841

| | *N* | *%* |
|---|---|---|
| IMD2019 quintile (*Wave 9)* | | |
| Q1 Most deprived | 842 | 12.3 |
| Q2 | 1,143 | 16.7 |
| Q3 | 1,398 | 20.4 |
| Q4 | 1,697 | 24.8 |
| Q5 Least deprived | 1,762 | 25.7 |
| Household income (*Wave 9)* | | |
| Below poverty line | 587 | 8.6 |
| Above poverty line | 4,145 | 60.6 |
| Missing | 2,109 | 30.8 |
| Double deprivation (*Wave 9)* | | |
| High double deprivation | 108 | 1.6 |
| Moderate double deprivation | 128 | 1.9 |
| No double deprivation | 6,053 | 88.5 |
| Missing | 552 | 8.1 |
| Age [*M(SD)*] [a] | | |
| *Wave 9* | 51.6 | 16.1 |
| *Wave 1* | 54.0 | 16.1 |
| *Wave 3* | 54.1 | 16.1 |
| Sex (*Wave 9)* | | |
| Male | 3,026 | 44.2 |
| Female | 3,816 | 55.8 |
| Ethnicity (*Wave 9)* | | |
| White British/white other | 6,545 | 95.7 |
| Non-white | 296 | 4.3 |
| Area type (*Wave 9)* | | |
| Urban | 5,219 | 76.3 |
| Rural | 1,622 | 23.7 |
| Neighbourhood cohesion [*M(SD)*] (*Wave 9)* [b] | 3.5 | 0.8 |
| Worked from home | | |
| *Wave 9* | | |
| Always | 299 | 4.4 |
| Often | 281 | 4.1 |
| Sometimes | 849 | 12.4 |
| Never | 2,720 | 39.8 |
| Missing | 2,693 | 39.4 |
| *Wave 1* | | |
| Always | 1,468 | 21.5 |
| Often | 303 | 4.4 |
| Sometimes | 397 | 5.8 |
| Never | 1,866 | 27.3 |
| Missing | 2,807 | 41.0 |
| *Wave 3* | | |
| Always | 1,362 | 19.9 |

Table 1. Descriptive Statistics for Independent Variables and Covariates. *N* = 6,841

| | | |
|---|---|---|
| Often | 349 | 5.1 |
| Sometimes | 399 | 5.8 |
| Never | 1,943 | 28.4 |
| Missing | 2,788 | 40.8 |

*Note.* Adjusted using weighting variable i_indscui_lw. Wave: 9 = pre-pandemic baseline measure; 1 = Covid-19 wave 1; 3 = Covid-19 wave 3. IMD2019 = Index of Multiple Deprivation 2019.

[a] Age minimum = 16, maximum 93. [b] Neighbourhood cohesion minimum = 1, maximum = 5.

**Figure 2**

***Count of individuals below and above the poverty line residing in each neighbourhood deprivation quintile.***

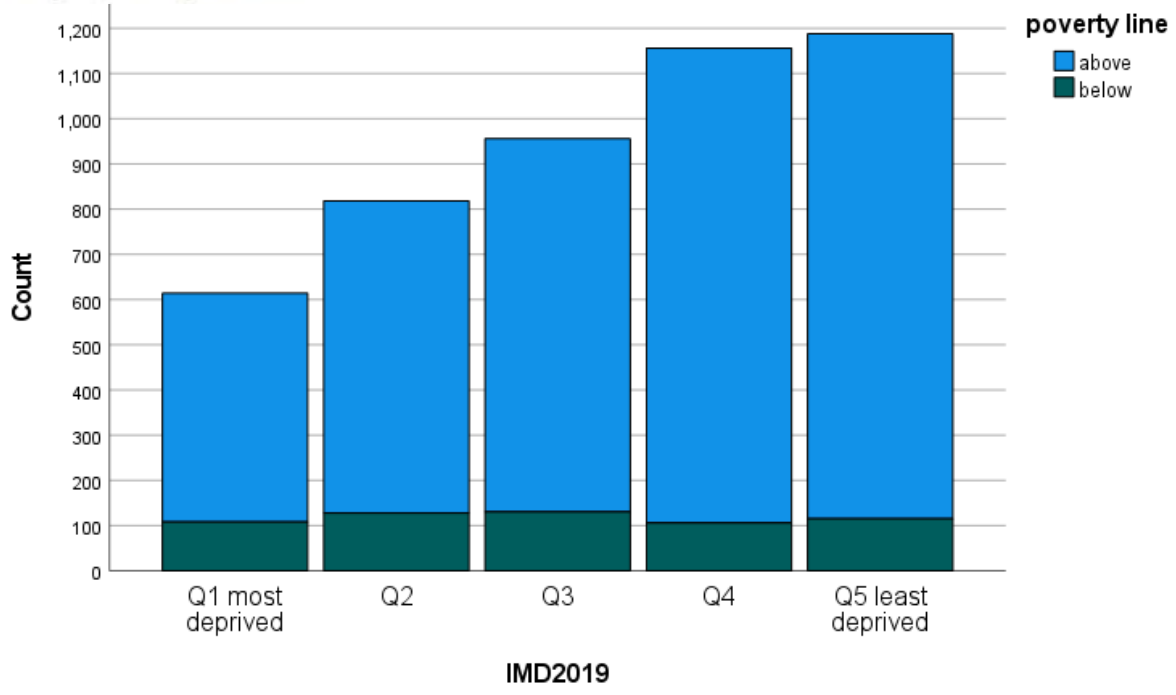


Table 2. Descriptive Statistics, Well-being per Survey Wave by Trajectory.

| | | Well-being [a] | | |
|---|---|---|---|---|
| | | Baseline | Wave 1 | Wave 3 |
| | *N* (%) | *M (SD)* | *M (SD)* | *M (SD)* |
| Stable Trajectory | 2,110 (30.9) | 26.6 (3.8) | 26.4 (3.8) | 26.4 (3.9) |
| Deteriorating Trajectory | 1,888 (27.6) | 26.5 (4.3) | 22.5 (5.6) | 19.9 (6.4) |
| Improving Trajectory | 1,155 (16.9) | 20.6 (6.1) | 24.8 (5.2) | 26.6 (4.5) |
| Recovering Trajectory | 611 (8.9) | 20.9 (6.4) | 27.6 (4.8) | 21.0 (6.4) |
| Delayed Effect Trajectory | 1,078 (15.8) | 26.0 (4.1) | 17.4 (6.1) | 24.1 (5.0) |
| Collapsed Mean (SD) | 6,841 (100) | 24.9 (5.3) | 23.8 (6.0) | 23.8 (5.9) |

*Note.* [a] Well-being minimum = 0, maximum = 36.

Table 2 presents descriptive well-being statistics (mean and standard deviation) for each trajectory at each survey wave. For the general population, well-being remained stable across the waves. The stable trajectory was the most prominent, with around one-third (~31%) of sample participants, followed by ~28% of the participants belonging to the deteriorating trajectory. Individuals in the improving and recovering trajectory showed below-average well-being at baseline compared to the other trajectories.

**Logistic Regression Analyses**

Multiple complex sample binary logistic regressions were performed to ascertain the effects of neighbourhood deprivation (H1), household income (H2), and double deprivation (H3) on the likelihood of individuals experiencing deteriorating/improving well-being versus stable well-being during the first lockdown of the Covid-19 pandemic. Sex, age, ethnicity, area type, neighbourhood cohesion, and working from home were included in the analyses as covariates.

Regarding the unadjusted models, solely household income statistically significantly predicted the deteriorating trajectory ($X^2(1, N = 696) = 14.67$, $p < .001$). Thus, for all other unadjusted models, there is insufficient evidence to conclude that there is a significant association between the predictor and the outcome variables.

Regarding the fully adjusted models, which included all covariates, all models show statistical significance. However, compared to the minimally adjusted models described below, the explained variance and correct classification rates decreased, indicating that the added covariates did not substantially improve the model's ability to account for variability in the data, nor increased the model's predictive accuracy.

***Impact of Neighbourhood Deprivation***

The minimally adjusted model included both sex and age as covariates. Both the deteriorating ($X^2(4, N = 710) = 46.58$, $p < .001$) and improving ($X^2(4, N = 574) = 35.59$, $p < .001$) well-being trajectories were statistically significantly predicted by neighbourhood deprivation (Table 3). The explained variance in well-being increased to between 4.2% (Cox and Snell $R^2$) and 5.6% (Nagelkerke $R^2$) for the deteriorating trajectory and 3.5% (Cox and Snell $R^2$) and 4.9% (Nagelkerke $R^2$) for the improving one. The correctly classified cases improved to 58.5% and 65%, respectively.

Females were 72% more likely to experience deteriorating well-being (OR = 1.72, 95% CI = [1.54, 1.93], $p < .001$) and 43% more likely to experience improving well-being (OR = 1.43, 95% CI = [1.27, 1.63], $p <.001$) than males. Additionally, with each unit increase in age, the odds of experiencing either deterioration (*OR* = 0.98, 95% *CI* = [0.98, 0.99], *p* <.001) or improvement (*OR* = 0.98, 95% *CI* = [0.98, 0.98], *p* <.001) in well-being decreased. None of the IMD2019 quintiles were associated with an increased likelihood of belonging to either trajectory.

Table 3. Test of Hypothesis 1: Binary Logistic Regression Analyses Separately for Deteriorating and Improving Trajectory with Neighbourhood Deprivation as the Independent Variable.

| | Deteriorating [a] Trajectory | | | | | Improving [a] Trajectory | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | B | *SE* | OR | 95% CI for OR | *p* | B | *SE* | OR | 95% CI for OR | *p* |
| **Unadjusted Model** | | | | | | | | | | |
| Intercept | -.08 | .06 | 0.92 | [0.81, 1.05] | .215 | -.53 | .07 | 0.59 | [0.51, 0.68] | <.001*** |
| IMD quintile | | | | | | | | | | |
| Q1 Most deprived | .07 | .11 | 1.07 | [0.87, 1.31] | .529 | .04 | .12 | 1.04 | [0.82, 1.32] | .738 |
| Q2 | -.02 | .09 | 0.98 | [0.82, 1.18] | .855 | -.02 | .10 | 0.98 | [0.80, 1.20] | .836 |
| Q3 | .00 [b] | . | 1.00 | . | . | .00 [b] | . | 1.00 | . | . |
| Q4 | -.05 | .09 | 0.96 | [0.81, 1.13] | .592 | -.12 | .10 | 0.89 | [0.73, 1.08] | .236 |
| Q5 Least deprived | -.10 | .09 | 0.91 | [0.76, 1.08] | .278 | -.19 | .10 | 0.83 | [0.69, 1.00] | .044* |
| **Minimally Adjusted Model** | | | | | | | | | | |
| Intercept | .69 | .14 | 1.97 | [1.50, 2.60] | <.001*** | .48 | .15 | 1.61 | [1.19, 2.18] | .002** |
| IMD quintile | | | | | | | | | | |
| Q1 Most deprived | -.04 | .11 | 0.96 | [0.78, 1.18] | .685 | -.07 | .12 | 0.93 | [0.73, 1.19] | .560 |
| Q2 | -.08 | .09 | 0.92 | [0.77, 1.10] | .375 | -.10 | .10 | 0.90 | [0.74, 1.11] | .320 |
| Q3 | .00 [b] | . | 1.00 | . | . | .00 [b] | . | 1.00 | . | . |
| Q4 | -.02 | .09 | 0.98 | [0.82, 1.17] | .814 | -.113 | .10 | 0.89 | [0.74, 1.09] | .258 |
| Q5 Least deprived | -.06 | .09 | 0.94 | [0.79, 1.12] | .486 | -.143 | .10 | 0.87 | [0.79, 1.05] | .141 |
| Sex (female) [c] | .54 | .06 | 1.72 | [1.54, 1.93] | <.001*** | .36 | .06 | 1.43 | [1.27, 1.63] | <.001*** |
| Age [d] | -.02 | .00 | 0.98 | [0.98, 0.99] | <.001*** | -.02 | .00 | 0.98 | [0.98, 0.98] | <.001*** |
| **Fully Adjusted Model** | | | | | | | | | | |
| Intercept | .96 | .27 | 2.62 | [1.54, 4.43] | <.001*** | .49 | .26 | 1.63 | [0.97, 2.73] | .064 |
| IMD quintile | | | | | | | | | | |
| Q1 Most deprived | -.03 | .12 | 0.98 | [0.77, 1.24] | .833 | -.11 | .14 | 0.90 | [0.68, 1.19] | .460 |
| Q2 | .02 | .11 | 1.02 | [0.82, 1.25] | .888 | -.03 | .11 | 0.97 | [0.78, 1.21] | .813 |
| Q3 | .00 [b] | . | 1.00 | . | . | .00 [b] | . | 1.00 | . | . |
| Q4 | -.05 | .11 | 0.95 | [0.77, 1.17] | .650 | -.00 | .12 | 1.00 | [0.79, 1.25] | .976 |
| Q5 Least deprived | -.07 | .11 | 0.93 | [0.75, 1.16] | .525 | -.02 | .12 | 0.98 | [0.78, 1.24] | .877 |

Table 3. Test of Hypothesis 1: Binary Logistic Regression Analyses Separately for Deteriorating and Improving Trajectory with Neighbourhood Deprivation as the Independent Variable.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sex (female) [c] | .45 | .07 | 1.57 | [1.36, 1.80] | <.001*** | .45 | .08 | 1.57 | [1.35, 1.83] | <.001*** |
| Age [d] | -.02 | .00 | 0.98 | [0.97, 0.98] | <.001*** | -.01 | .00 | 0.99 | [0.98, 1.00] | <.001*** |
| Ethnicity (non-white) [e] | .09 | .12 | 1.09 | [0.86, 1.39] | .457 | .03 | .16 | 1.04 | [0.76, 1.42] | .823 |
| Neighbourhood cohesion [f] | .04 | .05 | 1.04 | [0.94, 1.15] | .483 | -.24 | .05 | 0.79 | [0.71, 0.87] | <.001*** |
| Area type (rural) [g] | -.08 | .09 | 0.92 | [0.77, 1.10] | .363 | .06 | .10 | 1.07 | [0.87, 1.30] | .534 |
| Worked from home [h] | -.07 | .04 | 0.94 | [0.87, 1.00] | .055 | .05 | .04 | 1.05 | [0.97, 1.14] | .190 |

*Note.* IMD = Index of Multiple Deprivation; CI = Confidence Interval.

[a] reference group: stable trajectory. [b] redundant (reference category). [c] female vs male (reference). [d] age minimum = 16, maximum = 93. [e] non-white vs white (reference). [f] neighbourhood cohesion minimum = 1, maximum = 5. [g] rural vs urban (reference). [h] worked from home minimum = 1, maximum = 4.

* $p < .05$. ** $p < .01$. *** $p < .001$.

**Impact of Individual Deprivation**

Table 4 presents the results of the impact of individual deprivation on well-being. Regarding the minimally adjusted model, the deteriorating trajectory was statistically significantly predicted by individual deprivation ($X^2(3, N = 694) = 59.55$, $p < .001$), explaining 4.9% (Cox and Snell $R^2$) to 6.6% (Nagelkerke $R^2$) of the variance in well-being and correctly classifying 61% of cases. Similarly, the improving trajectory was statistically significantly predicted by individual deprivation ($X^2(3, N = 547) = 34.81$, $p < .001$), explaining 3.7% (Cox and Snell $R^2$) to 5.3% (Nagelkerke $R^2$) of the variance. However, the correctly classified cases decreased to 71.8% compared to the unadjusted model, indicating that model's predictive accuracy decreased.

Individuals with household incomes below the poverty line were 64% more likely to experience deteriorating well-being (*OR* = 1.64, *CI* = [1.35, 1.99], $p < .001$), and 30% more likely to experience improving well-being (*OR* = 1.30, *CI* = [1.02, 1.64], $p = .031$). Females were 74% more likely to experience deterioration (*OR* = 1.74, *CI* = [1.53, 1.98], $p < .001$) and 44% more likely to experience improvement (*OR* = 1.44, *CI* = [1.23, 1.69], $p < .001$). Additionally, with each unit increase in age, the odds of experiencing deteriorating or improving well-being decreased (*OR* = 0.98, 95% *CI* = [0.97, 0.98], $p < .001$).

Table 4. Test of Hypothesis 2: Binary Logistic Regression Analyses Separately for Deteriorating and Improving Trajectory with Household Income as the Independent Variable.

| | Deteriorating [a] Trajectory | | | | | Improving [a] Trajectory | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | B | *SE* | OR | 95% CI for OR | *p* | B | *SE* | OR | 95% CI for OR | *p* |
| **Unadjusted Model** | | | | | | | | | | |
| Intercept | -.36 | .03 | 0.70 | [0.65, 0.75] | <.001*** | -.97 | .04 | 0.38 | [0.35, 0.41] | <.001*** |
| Poverty line | | | | | | | | | | |
| Below | .38 | .10 | 1.46 | [1.20, 1.78] | <.001*** | .12 | .12 | 1.13 | [0.90, 1.41] | .291 |
| Above | .00 [b] | . | 1.00 | . | . | .00 [b] | . | 1.00 | . | . |
| **Minimally Adjusted Model** | | | | | | | | | | |
| Intercept | .50 | .15 | 1.64 | [1.22, 2.21] | .001** | .203 | .18 | 1.23 | [0.87, 1.72] | .251 |
| Poverty line | | | | | | | | | | |
| Below | .49 | .10 | 1.64 | [1.35, 1.99] | <.001*** | .26 | .12 | 1.30 | [1.02, 1.64] | .031* |
| Above | .00 [b] | . | 1.00 | . | . | .00 [b] | . | 1.00 | . | . |
| Sex (female) [c] | .56 | .07 | 1.74 | [1.53, 1.98] | <.001*** | .37 | .08 | 1.44 | [1.23, 1.69] | <.001*** |
| Age [d] | -.02 | .00 | 0.98 | [0.97, 0.98] | <.001*** | -.03 | .00 | 0.98 | [0.97, 0.98] | <.001*** |
| **Fully Adjusted Model** | | | | | | | | | | |
| Intercept | .61 | .29 | 1.84 | [1.04, 3.26] | .038* | .16 | .32 | 1.17 | [0.63, 2.18] | .625 |
| Poverty line | | | | | | | | | | |
| Below | .56 | .14 | 1.75 | [1.33, 2.30] | <.001*** | .31 | .15 | 1.36 | [1.02, 1.81] | .039* |
| Above | .00 [b] | . | 1.00 | . | . | .00 [b] | . | 1.00 | . | . |
| Sex (female) [c] | .48 | .08 | 1.61 | [1.38, 1.88] | <.001*** | .42 | .09 | 1.53 | [1.28, 1.82] | <.001*** |
| Age [d] | -.03 | .00 | 0.98 | [0.97, 0.98] | <.001*** | -.02 | .00 | 0.99 | [0.98, 0.99] | <.001*** |
| Ethnicity (non-white) [e] | .17 | .13 | 1.18 | [0.91, 1.52] | .207 | .02 | .18 | 1.02 | [0.72, 1.46] | .898 |
| Neighbourhood cohesion [f] | .07 | .06 | 1.07 | [0.96, 1.20] | .217 | -.23 | .06 | 0.80 | [0.71, 0.90] | <.001*** |
| Area type (rural) [g] | -.05 | .10 | .95 | [0.79, 1.14] | .582 | -.02 | .11 | 0.98 | [0.79, 1.21] | .825 |
| Worked from home [h] | -.05 | .04 | .96 | [0.88, 1.03] | .258 | .09 | .05 | 1.10 | [1.00, 1.21] | .062 |

*Note.* CI = Confidence Interval.

Table 4. Test of Hypothesis 2: Binary Logistic Regression Analyses Separately for Deteriorating and Improving Trajectory with Household Income as the Independent Variable.

[a] reference group: stable trajectory. [b] redundant (reference category). [c] female vs male (reference). [d] age minimum = 16, maximum = 93. [e] non-white vs white (reference). [f] neighbourhood cohesion minimum = 1, maximum = 5. [g] rural vs urban (reference). [h] worked from home minimum = 1, maximum = 4.

* $p < .05$. ** $p < .01$. *** $p < .001$.

**Impact of Double Deprivation**

Regarding the minimally adjusted model, both the deteriorating ($X^2(4, N = 710) = 46.58, p < .001$) and improving ($X^2(4, N = 574) = 35.59, p < .001$) well-being trajectories were statistically significantly predicted by double deprivation (Table 5). The explained variance increased to between 4.3% (Cox and Snell $R^2$) and 5.8% (Nagelkerke $R^2$) for the deteriorating trajectory and to between 3.6% (Cox and Snell $R^2$) and 5% (Nagelkerke $R^2$) for the improving one. The correctly classified cases increased to 59% and 66.1%, respectively.

Females were 73% more likely to experience deteriorating well-being (OR = 1.73, 95% CI = [1.54, 1.95], p <.001) and 44% more likely to experience an improvement in well-being (OR = 1.44, 95% CI = [1.26, 1.64], p <.001). Age had a negative association with both deteriorating (OR = 0.98, 95% CI = [0.98, 0.99], p <.001) and improving well-being (OR = 0.98, 95% CI = [0.97, 0.98], p <.001), meaning that with each unit increase in age, the odds of experiencing these well-being changes decreased. None of the double deprivation variables were associated with an increased likelihood of either trajectory.

Table 5. Test of Hypothesis 3: Binary Logistic Regression Analyses for Deteriorating and Improving Trajectory with Double Deprivation as the Independent Variable.

| | Deteriorating [a] Trajectory | | | | | Improving [a] Trajectory | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | B | *SE* | OR | 95% CI for OR | *p* | B | *SE* | OR | 95% CI for OR | *p* |
| **Unadjusted Model** | | | | | | | | | | |
| Intercept | -.16 | .03 | 0.86 | [0.81, 0.91] | <.001*** | -.67 | .03 | 0.52 | [0.49, 0.55] | <.001*** |
| Double Deprivation | | | | | | | | | | |
| High | -.08 | .24 | 0.93 | [0.58, 1.50] | .757 | .01 | .25 | 1.01 | [0.62, 1.64] | .978 |
| Moderate | .34 | .20 | 1.41 | [0.94, 2.10] | .094 | -.71 | .35 | 0.49 | [0.25, 0.97] | .039* |
| None | .00 [b] | . | 1.00 | . | . | .00 [b] | . | 1.00 | . | . |
| **Minimally Adjusted Model** | | | | | | | | | | |
| Intercept | .62 | .13 | 1.87 | [1.44, 2.42] | <.001*** | .38 | .14 | 1.46 | [1.10, 1.93] | .008* |
| Double Deprivation | | | | | | | | | | |
| High | -.03 | .24 | 0.97 | [0.61, 1.56] | .912 | .078 | .25 | 1.08 | [0.66, 1.77] | .758 |
| Moderate | .37 | .19 | 1.45 | [0.99, 2.12] | .054 | -.63 | .34 | 0.53 | [0.27, 0.1.05] | .067 |
| None | .00 [b] | . | 1.00 | . | . | .00 [b] | . | 1.00 | . | . |
| Sex (female) [c] | .55 | .06 | 1.73 | [1.54, 1.95] | <.001*** | .36 | .07 | 1.44 | [1.26, 1.64] | <.001*** |
| Age [d] | -.02 | .00 | 0.98 | [0.98, 0.99] | <.001*** | -.02 | .00 | 0.98 | [0.97, 0.98] | <.001*** |
| **Fully Adjusted Model** | | | | | | | | | | |
| Intercept | .88 | .27 | 2.41 | [1.42, 4.09] | .001** | .23 | .28 | 1.26 | [0.73, 2.17] | .504 |
| Double Deprivation | | | | | | | | | | |
| High | .27 | .33 | 1.31 | [0.69, 2.50] | .422 | .11 | .32 | 1.12 | [0.60, 2.10] | .728 |
| Moderate | .86 | .28 | 2.36 | [1.35, 4.12] | .003** | -.17 | .44 | 0.84 | [0.35, 2.00] | .694 |
| None | .00 [b] | . | 1.00 | . | . | .00 [b] | . | 1.00 | . | . |
| Sex (female) [c] | .44 | .08 | 1.56 | [1.34, 1.81] | <.001*** | .43 | .08 | 1.53 | [1.31, 1.79] | <.001*** |
| Age [d] | -.03 | .00 | 0.98 | [0.97, 0.98] | <.001*** | -.01 | .00 | 0.99 | [0.98, 1.00] | <.001*** |
| Ethnicity (non-white) [e] | .07 | .12 | 1.07 | [0.84, 1.37] | .563 | .08 | .17 | 1.08 | [0.77, 1.51] | .661 |
| Neighbourhood cohesion [f] | .06 | .05 | 1.06 | [0.96, 1.18] | .269 | -.21 | .05 | 0.81 | [0.73, 0.90] | <.001*** |

Table 5. Test of Hypothesis 3: Binary Logistic Regression Analyses for Deteriorating and Improving Trajectory with Double Deprivation as the Independent Variable.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Area type (rural) [g] | -.05 | .09 | 0.95 | [0.80, 1.13] | .566 | .10 | .10 | 1.10 | [0.91, 1.34] | .326 |
| Worked from home [h] | -.06 | .04 | 0.94 | [0.87, 1.01] | .088 | .09 | .04 | 1.10 | [1.01, 1.19] | .036* |

*Note.* CI = Confidence Interval. High double deprivation refers to individuals living in the most deprived neighbourhoods (Q1) and having a household income below the poverty line; Moderate double deprivation refers to individuals living in the second most deprived neighbourhoods (Q2) and having a household income below the poverty line.

[a] reference group: stable trajectory. [b] redundant (reference category). [c] female vs male (reference). [d] age minimum = 16, maximum = 93. [e] non-white vs white (reference). [f] neighbourhood cohesion minimum = 1, maximum = 5. [g] rural vs urban (reference). [h] worked from home minimum = 1, maximum = 4.

* $p < .05$. ** $p < .01$. *** $p < .001$.

## Discussion

The present study investigated the impact of neighbourhood-level deprivation, individual-level deprivation, and the interaction between these two factors on the well-being trajectories of individuals during the first Covid-19 lockdown in England. The results highlight the complex relationship between deprivation and well-being, with individual-level deprivation and moderate double deprivation being significant predictors of well-being change. More specifically, individual-level deprivation increased individuals' chances of experiencing deteriorating or improving well-being. Besides that, moderate double deprivation increased an individual's chance of experiencing deteriorating well-being and simultaneously decreased an individual's chance of experiencing improving well-being. At the same time, no such association was found between neighbourhood-level deprivation or high double deprivation and well-being change. These results provide valuable insights into the multifaceted relationship between socioeconomic factors and mental well-being during a crisis, shedding light on how different aspects of deprivation can influence individual well-being.

### Well-being Change

In line with Sun et al. (2023), the results of the present study show that when considering the whole sample, well-being remained relatively stable during the first lockdown. However, a more nuanced picture is revealed when examining well-being trajectories, as previously demonstrated by Pierce et al. (2021) and Ellwardt and Präg (2021). While around one-third of the sample experienced stable well-being during the onset of the pandemic, 28% of participants experienced deteriorating well-being, and 17% experienced improving well-being. The presence of different trajectories indicates that the pandemic was not a universal experience and that sub-group analyses are necessary.

These different well-being trajectories are essential findings since most psychological research during the Covid-19 pandemic has been deficit-focused, with only 1% of research looking at positive outcomes (Burke & Arslan, 2020). Thus, far more is known about risk factors than protective health factors (Morganstein, 2022). This extremely negative focus limits our understanding of the pandemic while denying us possible interventions (Waters et al., 2021).

### Deprivation Effect

As evidenced by the logistic regression analyses, the deprivation effect demonstrated statistical significance but, notably, weak explanatory power. This underlines the complexity of the interplay between socioeconomic factors and well-being trajectories, urging a cautious

interpretation of the results. While the models captured certain aspects, the limited explanatory capacity suggests unexplored factors that merit attention in future investigations.

The finding that most unadjusted models were not statistically significant suggests a lack of a direct association between the included predictor variables and well-being trajectories. However, as the subsequent minimally and fully adjusted models became statistically significant, it indicates that the impact of neighbourhood and individual deprivation on well-being trajectories might depend on additional factors.

The decrease in explanatory power in the fully adjusted models suggests that too many covariates have been included. Despite this, preliminary tests found no multicollinearity issues, providing confidence in the reliability of parameter estimates.

In light of these considerations, the minimally adjusted models, which include only essential covariates like age and sex, offer a more straightforward and interpretable representation of the relationship between predictor variables and well-being trajectories. This approach strikes a balance between capturing meaningful associations and avoiding unnecessary complexity, providing a clearer understanding of the influence of deprivation on well-being. Further analyses and model validations can help refine and strengthen the chosen modelling strategy.

***Impact of Neighbourhood Deprivation***

Hypothesis 1 predicted that individuals living in more deprived neighbourhoods would have higher odds of displaying deteriorating well-being during the first lockdown while those living in less deprived neighbourhoods would have higher odds of displaying improved well-being during the same timeframe. The findings of the present study do not support this hypothesis. While the unadjusted model for the improving trajectory suggested that individuals in the least deprived quintile were less likely to experience improving well-being, this effect did not hold in the fully adjusted model. Thus, the analysis revealed that neighbourhood deprivation was not a significant predictor of deteriorating or improving well-being during the first lockdown. This suggests that neighbourhood deprivation may not play a significant role in shaping well-being trajectories during times of crisis and that other individual characteristics and contextual factors may play a more significant role in determining mental well-being during a crisis.

This is contrary to other longitudinal analyses, in which individuals from lower SES backgrounds reported lower well-being (Bezzo et al., 2021; O'Connor et al., 2021). This difference might stem from different research questions and statistical approaches. While the present study grouped the sample based on individuals' well-being trajectories and then

examined the association with deprivation for each trajectory, Bezzo et al. (2021) grouped the sample by deprivation tercile and compared their well-being trajectories afterwards.

***Impact of Individual Deprivation***

Hypothesis 2 posited that individuals with household incomes below the poverty line had increased odds of displaying deteriorating well-being during the lockdown, while individuals with household incomes above the poverty line would have higher odds of displaying improving well-being during the same period. The results partially support this hypothesis, showing that, after adjusting for covariates, individuals with incomes below the poverty line were more likely to experience deteriorating well-being. However, they were also more likely to experience improving well-being, highlighting the multifaceted nature of individual deprivation.

These findings suggest that household income is a significant predictor of well-being during crises, but the direction of its impact is not unidirectional. The relationship between income and well-being during the lockdown is more nuanced, with individuals experiencing both deteriorating and improving well-being. Further research is needed to understand the underlying mechanisms.

***Impact of Double Deprivation***

Hypothesis 3 explored the combined impact of neighbourhood deprivation and individual income on well-being. It was hypothesized that individuals who experience double deprivation had higher odds of displaying deteriorating well-being compared to pre-pandemic and that those who did not experience double deprivation had higher odds of displaying increasing well-being. The findings of the present study partially supported this. Considering the unadjusted model, individuals facing moderate double deprivation (living in the second most deprived neighbourhoods and having a household income below the poverty line) were less likely to experience improving well-being. However, this effect did not hold in the minimally nor the fully adjusted model. The impact of moderate double deprivation might be influenced by covariates. Additionally, after adjusting for covariates, individuals facing moderate double deprivation were more likely to experience deteriorating well-being. Thus, the included covariates affected the relationship between double deprivation and well-being change differently for the improving and the deteriorating trajectory.

Importantly, the initial examination of the unadjusted models did not yield statistical significance, suggesting that, when considering the broad categorisation of double deprivation (high, moderate, none), there was insufficient evidence to conclude a significant association with changes in well-being during the initial Covid-19 lockdown. However, when specifically

focusing on individuals experiencing moderate double deprivation, there is a meaningful and statistically significant association with improving well-being. This finding suggests that the impact on well-being may not be uniform across all levels of double deprivation and that the moderate level plays a distinctive role in influencing outcomes.

The findings for moderate double deprivation highlight the compounding effect of experiencing both neighbourhood and income deprivation. This suggests that individuals facing multiple forms of deprivation may be particularly vulnerable to declines in well-being during crises. The lack of a significant effect for high double deprivation may indicate that extreme levels of both forms of deprivation are less common and that other factors may mediate the relationship.

**Additional Effects**

Sex and age were found as significant predictors of well-being change. Females were consistently found to be more likely to experience both deteriorating and improving well-being, while age had a negative association with both trajectories, meaning that the older individuals were, the less likely they were to experience either deteriorating or improving well-being. Thus, while females and younger people were more likely to experience deteriorating or improving well-being, males' and older people's well-being was more likely to remain stable. On the one hand, the finding that females and younger people were more likely to experience deteriorating well-being is in line with other studies (e.g., Patel et al., 2022; O'Connor et al., 2021; Sun et al., 2023). On the other hand, however, the finding that females and younger people were also more likely to experience improving well-being is counterintuitive and contrary to previous research findings that suggest males and older people to be more resilient (Hale et al., 2023; O'Connor et al., 2021; Schäfer et al., 2022). These gender and age effects suggest that women and younger individuals may have unique experiences and responses to the challenges posed by the lockdown, which can either lead to worsening well-being or resilience. Conducting further research assessing possible coping mechanisms is advised.

Next, neighbourhood cohesion was negatively associated with the improving well-being trajectory for all three predictor variables (i.e., neighbourhood deprivation, household income, double deprivation), indicating that individuals who perceived their neighbourhoods as more cohesive were less likely to experience well-being improvement. This is contrary to pre-covid research, which found the neighbourhood social environment to be even more detrimental to mental health than the neighbourhood-level SES (Fone et al., 2014; Schüle & Bolte, 2015; Visser et al., 2021). The change in social interactions during lockdown periods might explain why residents in cohesive neighbourhoods might have experienced decreased

contact and support. In contrast, residents of less cohesive neighbourhoods never experienced that neighbourliness and thus did not miss it.

Additionally, individuals who worked less often or never from home were more likely to experience improving well-being than those who always worked from home. Nevertheless, this association was only found in the present analysis with moderate double deprivation as the predictor variable and not for either single deprivation variable. This may reflect the benefits of maintaining a sense of normalcy and routine during times of crisis and the difficulty of maintaining a healthy work-life balance when working from home (Ružojčić et al., 2020). However, other remote workers described an improvement in their work-life balance (Hobbs, 2023). The findings of previous studies examining the impact of working from home on well-being are mixed. While Wels et al. (2023) found no clear evidence of an association between working from home and well-being, other studies found that whether working from home had a positive or negative impact on worker's well-being depended on factors such as their SES, character traits, work satisfaction, and personal circumstances (Hobbs, 2023; Parry et al., 2021). Increased working from home during the pandemic may have reduced the stress of commuting and exposure to the Covid-19 virus, but it also increased social isolation (Hobbs, 2023; Parry et al., 2021). These mixed findings by other studies might explain why the present study found evidence of the impact of working less often from home on improving well-being but not deteriorating well-being.

Neither ethnicity nor area type were associated with well-being change in the present study. Generally, considering other studies, the findings of an association between ethnicity or area type and well-being were mixed, with some studies identifying associations and others not (e.g., Burger et al., 2020; Hubbard et al., 2021; Patel et al. 2022; Pierce et al., 2021; Proto & Quintana-Domeque, 2021). Given that some of these other studies use the same data set as the present study, these differences in the findings probably stem from the different focus points and use of statistical analyses.

To conclude, moderate double deprivation, a household income below the poverty line, sex, age, neighbourhood cohesion, and, in some instances, working from home are essential factors that can influence well-being during a pandemic. Furthermore, males, older people, and individuals rating their neighbourhood as less cohesive were more likely to experience well-being resilience during the first Covid-19 lockdown. This suggests that those individuals made use of different coping strategies. However, while those individuals were less likely to experience deteriorating well-being, they were also less likely to experience improving ones. Further research is needed to understand this unique phenomenon.

**Limitations and Strengths**

The present study used separate binary logistic regressions to examine the associations between deprivation and well-being trajectories. While this approach allowed the focus on the unique predictors associated with the deteriorating and the improving trajectory, it is essential to acknowledge its limitations, mainly that it does not allow for direct group-to-group comparisons. Moreover, the separate regressions do not account for potential interactions or complex relationships that might exist between the predictor variables and different trajectories. This lack of direct comparisons may limit our ability to understand the relative importance of these predictors in influencing well-being trajectories during the lockdown. Despite these limitations, the analysis of separate binary logistic regressions did provide valuable insights into the unique associations between neighbourhood-level deprivation, individual income, and each well-being trajectory. However, it is essential to interpret the results cautiously and consider the restricted scope of comparison when drawing conclusions from these findings.

Furthermore, the fully adjusted regression models explained less variance and correctly classified fewer cases than the minimally adjusted models. A possible reason is that the fully adjusted models are too complex and overfitting the data. Even though the estimated variance inflation factors (VIF) revealed no multicollinearity, other factors could contribute to model instability. Thus, future analyses could benefit from careful consideration of model complexity, variable selection, and robustness checks that can contribute to more reliable and generalizable results.

Additionally, deprived individuals were underrepresented in the present sample**.** In 2019/20, more than 2 in 10 people of the UK population suffered from financial poverty (Joseph Rowntree Foundation, 2020). However, in the current sample, only less than 1 in 10 people was identified as financially poor. Similarly, the IMD2019 quintiles were skewed, with more participants residing in the less deprived neighbourhoods (Q1 ≈ 12% vs. Q5 ≈ 26%). Connected to the small number of individuals living in households below the poverty line, the high and moderate double deprivation variables only encompass a small percentage of the sample (1.6% and 1.9%, respectively). Thus, caution is necessary when interpreting and generalising the present study's findings.

Despite those limitations, the added value of the present study lies in its focus on neighbourhood and individual deprivation both separately and simultaneously, thus supporting the disentanglement of deprivation and its effect during a crisis. Further, the studies focus on

the positive aspects of resilience and well-being improvements instead of solely looking at adverse effects is an important contribution (Burke & Arslan, 2020). Only when understanding what factors enable individuals to remain resilient or even experience improving well-being during a crisis can we effectively promote well-being and coping strategies for suffering individuals. Another major strength of the present study is its use of a nationally representative panel study and its specific Covid sub-survey, allowing the quantification of well-being trajectories during the first Covid-19 lockdown period.

**Future research**

There are multiple possible focus points that future research could add to the idea of the present study to enhance its understanding and contribution. Firstly, adding subsequent survey waves would facilitate a more comprehensive exploration of well-being trajectories during the Covid-19 pandemic. This temporal extension would provide a nuanced perspective, capturing the dynamic nature of well-being over time and individual's capability to adapt to outer circumstances. Similarly, the presence of more complex trajectories (i.e., recovering trajectory) requires examining a more extended period in order to thoroughly capture the long-term consequences and potential recovery processes due to the increased well-being fluctuations during the pandemic (Schlechter et al., 2023). Secondly, employing multinomial logistic regression analyses could enhance the analytical framework by concurrently examining all identified trajectories. This methodological approach has the potential to identify interaction effects among different trajectories, addressing a limitation inherent in the current analyses. Thirdly, obtaining the classified data of the Index of Multiple Deprivation 2019 would enable researchers to treat the variable as continuous instead of categorial and test for more nuanced insights. This shift in methodology would allow for a finer examination of the gradient effect. By treating deprivation as a continuous variable, researchers could uncover subtler variations in well-being outcomes, informing targeted interventions to address specific levels of deprivation more effectively.

Furthermore, based on the present studies' results, multiple interventions are proposed. The results highlight the importance of economic assistance programs aimed at individuals with lower household incomes and especially those suffering from double deprivation, recognizing the significant impact of income levels on well-being. Economic assistance programs could include financial relief measures, job placement services, and training programs to enhance employability and income-earning opportunities. Additionally, policies aimed at reducing socioeconomic inequalities and promoting equal opportunities for persons from disadvantaged neighbourhoods can also reduce the double deprivation effects. Finally,

targeted mental health interventions specifically designed for individuals with a household income below the poverty line or those experiencing double deprivation are suggested. Besides educating and promoting resilience, these programs should focus on making counselling services as accessible as possible for the target group.

## Conclusion

This study examined the association between neighbourhood-level SES and individual-level SES on changes in well-being during the initial phase of the Covid-19 pandemic in England. The findings revealed complex relationships between these factors and the well-being trajectories. Both household income and double deprivation were significant predictors of well-being change. These findings highlight the need for targeted interventions to address mental health disparities and support vulnerable populations during and after global crises like the Covid-19 pandemic. This research contributes to our understanding of how socioeconomic factors interact to shape well-being trajectories during a crisis. The findings emphasise the need for targeted support for individuals facing neighbourhood and income deprivation and highlight the role of sex and age as well as of community cohesion and working arrangements in promoting well-being during challenging times. Future research is needed to unravel the underlying factors promoting resilience and thriving in times of crisis.

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## Appendix A

**UKHLS GHQ-12 Self-Completion Module**

Concentration

Have you recently been able to concentrate on whatever you are doing?

1. Better than usual
2. Same as usual
3. Rather more than usual
4. Much more than usual

Loss of sleep

Have you recently lost much sleep over worry?

1. Not at all
2. No more than usual
3. Rather more than usual
4. Much more than usual

Playing a useful role

Have you recently felt that you were playing a useful part in things?

1. More so than usual
2. Same as usual
3. Less so than usual
4. Much less than usual

Capable of making decisions

Have you recently felt capable of making decisions about things?

1. More so than usual
2. Same as usual
3. Less so than usual
4. Much less than usual

Constantly under strain

Have you recently felt constantly under strain?

1. Not at all
2. No more than usual
3. Rather more than usual
4. Much more than usual

Problem overcoming difficulties

Have you recently felt you couldn’t overcome your difficulties?

1. Not at all
2. No more than usual
3. Rather more than usual
4. Much more than usual

Enjoy day-to-day activities

Have you recently been able to enjoy your normal day-to-day activities?

1. More so than usual
2. Same as usual
3. Less so than usual
4. Much less than usual

Ability to face problems

Have you recently been able to face up to problems?

1. More so than usual
2. Same as usual
3. Less so than usual
4. Much less than usual

Unhappy or depressed

Have you recently been feeling unhappy or depressed?

1. Not at all
2. No more than usual
3. Rather more than usual
4. Much more than usual

Losing confidence

Have you recently been losing confidence in yourself?

1. Not at all
2. No more than usual
3. Rather more than usual
4. Much more than usual

Believe worthless

Have you recently been thinking of yourself as a worthless person?

1. Not at all
2. No more than usual
3. Rather more than usual
4. Much more than usual

General happiness

Have you recently been feeling reasonably happy, all things considered?

1. More so than usual
2. Same as usual
3. Less so than usual
4. Much less than usual

## Appendix B

IBM SPSS Syntax preparing the complex analysis:

```
*Analysis Preparation Wizard.
CSPLAN ANALYSIS
  /PLAN FILE='/Users/lina/Downloads/UKHLS data '+
    'set/main_UKDA-6614-spss/spss/spss25/ukhls/complexsampleplan_wave9.csaplan'
  /PLANVARS ANALYSISWEIGHT=i_indscui_lw
  /SRSESTIMATOR TYPE=WOR
  /PRINT PLAN
  /DESIGN STRATA=i_strata CLUSTER=i_psu
  /ESTIMATOR TYPE=WR.
```

Where “PLAN FILE” specifies the location and name of the plan to be created.