**Pre-pandemic mental and physical health as predictors of COVID-19 vaccine hesitancy: evidence from a UK-wide cohort study**

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Contributions: GDB generated the idea for the present manuscript. DA built the dataset, conducted all analyses, and prepared the displayable items. All authors developed the analytical plan and commented on a manuscript drafted by GDB.

**Abstract**

*Background*: Although several predictors of COVID-19 vaccine hesitancy have been identified, the role of physical health is unclear and influence of mental health, if any, is untested.

*Objective*: To examine the association of mental and physical health with self-reported vaccine hesitancy after the announcement of the successful testing of the Oxford University/AstraZeneca vaccine.

*Design, Setting, and Participants*: We used individual-level data from a pandemic-focused investigation (COVID Survey), a prospective cohort study nested within Understanding Society (Main Survey). In the week immediately following the announcement of successful testing of the first efficacious inoculation (November/December 2020), data on vaccine intentionality were collected in 12,035 individuals aged 16-95. Pre-pandemic, study members responded to enquiries about prior diagnoses of mental and physical health, and also completed the general health questionnaire (version 12) for symptoms of psychological distress (anxiety and depression).

*Measurements*: Self-reported intention to take up a vaccination for COVID-19. To summarise our results, we computed odds ratios with accompanying 95% confidence intervals for indices of mental and physical health adjusted for selected covariates.

*Results*: In an analytical sample of 11,955 people (6741 women), 15.4% indicated that they were vaccine hesitant. After adjustment for a range of covariates which included age, education, and ethnicity, **selected physical but not psychiatric morbidities were related to a lower likelihood of vaccine hesitancy. Thus, both a pre-pandemic diagnosis of anxiety (odds ratio; 95% confidence interval: 1.11; 0.79, 1.52) or depression (1.12; 0.81, 1.53) was unrelated to the willingness to take up a vaccine. There was also no relationship for symptoms of psychological distress. Having someone in the household who had been advised to shield owing to a serious physical illness was associated with XXXXX. Study members with cardiometabolic disease were 22% less likely (0.78; 0.64, 0.95) to be vaccine hesitant than their disease-free counterparts, and the equivalent result for respiratory disease was 26% (0.74; 0.59, 0.93). There was little evidence that a cancer diagnosis was related to vaccine intention (0.95; 0.62, 1.39), however.**

*Conclusions*: XXXXXX.

**Introduction**

There is growing evidence from cohort studies that people with a serious mental illness and those with a higher prevalence of distress symptoms (anxiety and depression) experience elevated rates of hospitalisation for, and death from, coronavirus 2019 (COVID-19).1-3 In a few selected countries, vaccination against COVID-19, central to attaining herd immunity,4 has therefore been prioritised for people with existing mental health problems, although this is by no means as universal as it is for physical disorder.5

There are several reasons to anticipate vaccine hesitancy in people with mental health problems. First, people with severe mental illness tend to perform less well educationally, and have lower levels of health literacy and cognitive function,6 itself link to greater hesitancy.7 Such characteristics may mean that people with mental health problems are less able to source and synthesis information about vaccination. Second, individuals with psychiatric morbidity tend to have a lower prevalence of health-protecting behaviours. Relative to their unaffected counterparts, for instance, they are more likely to smoke, take less exercise, have an imprudent diet, and be obese.8,9 Third, people with mental health issues also appear to be less likely to take up the offer of health screening.[ref] Lastly, of most relevance, in a study of influenza inoculation, users of an outpatient psychiatry clinic had markedly lower take up than the general population.10

Collectively, these observations provide a *prima facie* case that people with mental health problems may be hesitant when offered a vaccination against COVID-19. In an absence of any empirical data, there have been recent calls for an examination of this relationship.11 Accordingly, in a large, general-population based UK sample we examine the predictive capacity, if any, of mental health problems, for vaccine hesitancy. In doing so, we draw direct comparison with somatic illness which, in the few relevant studies, has recently been shown to be consistently associated with lower levels of hesitancy.12,13 Importantly, data collection on vaccine intention took place following the announcement of successful testing of the Oxford University/AstraZeneca vaccine, rendering as no longer theoretical the future offer of a vaccination. To the best of our knowledge, these are the first UK data on the role of mental and physical health as predictors of vaccine hesitancy.

**Methods**

Understanding Society, also known as the UK Household Longitudinal Study, is a nationally-representative, on-going, open, cohort study (hereinafter, the ‘Main Survey’). Based on a clustered-stratified probability sample of households, participants have been interviewed annually since 2009.14 Households who had participated in at least one of the two most recent waves of data collection (wave 8, 2016-18; wave 9, 2017-19) comprised the target sample for a pandemic-focused study initiated in April 2020 (hereinafter, the ‘COVID Survey’).15,16 The derivation of the present analytical sample from the Main and COVID Surveys, including the wave for specific data collection, is given in figure 1. The University of Essex Ethics Committee gave approval for the COVID-orientated surveys (ETH1920-1271); no further ethical permissions were required for the present analyses of anonymised data.

The COVID Surveys took place monthly/bimonthly between April (wave 1) and November 2020 (wave 6), with questions on vaccine intention first administered in latest tranche of data collection when study members were aged 16-95 years (mean 53).16 Data collection in wave 6 (starting 24th November) commenced the day immediately following the announcement of the efficacy of the Oxford University/AstraZeneca vaccine17 and continued for one week, comprising a total of 12,035 individuals of 19,294 invitations issued (response proportion 62%).16

*Assessment of mental and physical morbidity*

Study members indicated if a physician or other health professional had ever informed them that they had a psychiatric problem, which included anxiety, depression, psychosis or schizophrenia, bipolar disorder or manic depression, an eating disorder, post-traumatic stress disorder, or any other mental illness (wave 10, Main Survey). With a low prevalence hesitancy for selected conditions, the latter five mental health groups were aggregated. Self-reports of a physician diagnosis of mental illness, in particular depression, shows reasonable agreement with structured clinical interviews.18

Psychological distress (wave 6, COVID Survey) was ascertained using administration of the 12-item version of the General Health Questionnaire. Validated against standardised psychiatric interviews,19,20 this is a widely used measure of distress in population-based studies. Consistent with published analyses,21-23 we used the following classifications: asymptomatic (score 0), sub-clinically symptomatic (score 1-3), symptomatic (score 4-6), and highly symptomatic (score 7-12).

A history of physical morbidity was also captured (wave 10, Main Survey) and again based on self-report of physician diagnosis for a cardiometabolic condition (congestive heart failure, coronary heart disease, angina, heart attack or infarction, stroke, diabetes, and/or hypertension); respiratory disease (respiratory disease comprised bronchitis, emphysema, chronic obstructive pulmonary disease, and/or asthma); or cancer of any type. In other studies, these data reveal moderate to high agreement with clinical records.24

Lastly, based on their physical medical history, people judged as extremely clinically vulnerable to COVID-19 were contacted by the UK National Health Service or their general practitioner during the early stages of the pandemic and recommended to stay at home. Conditions that met the criteria for shielding included selected cancers, severe respiratory disorders such as cystic fibrosis, severe asthma, organ transplant recipients, and people with a disability such as Down’s syndrome.[nhs site] Study members were asked about the shielding status for themselves or a household member (waves 1-5, COVID Surveys; denoted by yes/no).

*Assessment of covariates*

Covariates were self-reported and included age; sex (both wave 10, Main Survey); ethnicity (wave 10, Main Survey; denoted as white or non-white); and highest education level (wave 10, Main Survey; categorised as degree & other higher degree, A’ level or equivalent [Advanced Placement in the USA], GCSE or equivalent [Grade 10 in the USA], other qualification, and none). In the third wave of data collection in the Main Survey (2011-2013), six cognitive function tests were administered: immediate word recall and delayed word recall tasks; semantic verbal fluency; cognitive impairment; numerical reasoning skills; and fluid reasoning.7 Representing a range of cognitive skills, these tests have been repeatedly deployed in large-scale, population-based studies.25-29 Using scores from the six tests, we generated a single general cognitive function variable (*g*) for use in the present analyses.

*Assessment of vaccine hesitancy*

At wave 6 in the COVID Survey, study members were asked “Imagine that a vaccine against COVID-19 was available for anyone who wanted it. How likely or unlikely would you be to take the vaccine?”. Possible responses were “Very likely”, “Likely”, “Unlikely” and “Very unlikely”. The latter two categories were combined to denote vaccine hesitancy.

*Statistical analyses*

To summarise the relation between the mental morbidity, physical morbidity, and vaccine hesitancy, we used logistic regression to compute odds ratios with accompanying 95% confidence intervals. The most basic analyses were adjusted for age, sex, and ethnicity. Retaining these covariates, we then explored the impact of controlling separately and collectively for education, shielding status, and cognition. Depending on the exposure of interest, we mutually adjusted for a diagnosis of mental illness or physical illness.

**Results**

In table 1 we show study member characteristics according to vaccine intention in unadjusted analyses. In a sample of 11,955 individuals (6741 women) who responded in full to the enquiry regarding COVID-19 vaccine intentionality, 15.4% indicated that they were hesitant (table 1). Relative to the group who indicated a willingness to have the vaccine, those who were hesitant were more likely to be younger, female, from an ethnic minority background, be less well educated, and have a lower general cognitive function score. The hesitant were also less likely to have an existing somatic morbidity, as indexed by cardiometabolic disease and cancer. Related, there was also a lower prevalence of shielding in the hesitant category (correlation between any physical morbidity and shielding: *ρ*=0.12, p<0.0001, N=10916). There was, however, little evidence of a difference in prevalence of specific mental health condition across the hesitant groups; only ‘other’ conditions was more common in study members expressing hesitancy but the difference was marginal and statistical significance was generated from the large numbers. People who declared themselves reticent in taking the vaccine when offered had slightly higher levels of distress symptoms, however.

In table 2 we used multiple regression analyses to explore the independent role, if any, of am existing diagnosis of a morbidity as a predictor of vaccine hesitancy. After adjustment for age, sex, and ethnicity, relative to people without a physical condition, those with a diagnosis of cardiometabolic disease (odds ratio; 95% confidence interval: 0.82; 0.67, 0.99) or respiratory disease (0.71; 0.57, 0.88) were less like to decline an offer of vaccination. People with cancer were also less likely to decline vaccination but this observation was not statistically significant. Adjusting for a range of covariates (table 2 and figure 2) had little impact on these relationships. For a demonstration of the lack of impact of control for individual covariates see table a1 (appendix).

In analyses in which mental illness diagnosis was the exposure of interest, none of the individual psychiatric conditions were related to vaccine hesitancy (table 2). Using the standard four category schema for symptoms of psychological distress, there was a suggestion of a ‘U’-shaped effect such that people who had either low or high scores on the distress scale were marginally more likely to be vaccine hesitant, and those with moderate symptoms had the lowest risk (p-value for quadratic relationship after multiple adjustment: 0.003). We further explored this association by using raw scores from the 12 item distress scale (range 0-12). Based on this disaggregation, there was no support for any relationship, linear or quadratic (figure 3).

**Discussion**

**Our main finding was that, in data collected immediately following the announcement of the successful evaluation of the Oxford University/AstraZeneca vaccine, selected existing physical but not psychiatric morbidities were related to a higher likelihood of vaccine hesitancy. The results for mental health – hitherto untested – run counter to our expectations given that people with such morbidities are, as described, less likely to engage in health-protecting behaviours such as a healthy lifestyle**8,9 **and screening for somatic disorder.[ref].**

***Comparison with existing studies***

**The notion people with a long-standing physical condition are less likely to be hesitant has been reported elsewhere.**12,13 **That we also recapitulated known associations with hesitancy such as being female,30-32 being younger,30,32 and from an ethnic minority group,16,32,33 gives us some confidence in our novel results for mental health. To the best of our knowledge, there has been one prior examination of the relationship between mental health and vaccine hestinacy.**34 **Comprising two small cross-sectional studies where data collection took place prior to the announcement of the successful testing of the first efficacious vaccination, study members were administered a very brief and unvalidated enquiry as to whether they had experience of mental health problems. In that study, there was no clear evidence of a link.**34 **Studies using data based on other vaccination programmes offer limited insights. For instance, in a cross-sectional study of patients with schizophrenia which took place during the 2009 H1N1 influenza pandemic in Australia, three-quarters indicated that they were willing to be vaccinated;35 however, in keeping with similar studies,36 the absence of a general population comparison group renders interpretation problematic. In a small cohort of socioeconomically disadvantaged mothers, those with mental health problems were seemingly less likely to have children with up-to-date vaccine coverage, although the association was weak and the study underpowered.37**

***Study strengths and weaknesses***

**While the present study has its strengths, including its size, national representativeness, and timing, there are also some weaknesses. First, we used vaccine intentionality as an indicator vaccine uptake but the correlation is imperfect. In a small scale longitudinal study conducted during the period of the 2009 H1N1 pandemic in Hong Kong, less than 10% of people who expressed a commitment to being inoculated reported that they had received a vaccination two months later.38 Elsewhere, in a US adult population at high risk of seasonal influenza, around half of those intending to be vaccinated had received the inoculation within the following 5 months.39 Second, there was inevitably some loss to follow-up (figure 1). While this attrition may have impacted upon the estimation of the prevalence vaccine hesitancy which is likely to be lower in our select sample relative to the general population,40 it is unlikely to have influenced our estimation of its relationship with mental and physical health. Thus, in other contexts, we have shown that highly select cohorts reveal very similar risk factor–outcome associations to those seen in studies with conventionally high response.41**

**In conclusion,** **we found that some somatic medical conditions but not mental health problems were related to a lower likelihood of being vaccine hesitant against COVID-19. Nonetheless, that people with mental health problems experience an elevated risk of this disease is justification for such conditions to feature as criteria for both shielding and as a priority group for vaccination.**

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**Figure 1. Flow of cohort members into the analytical sample:**

**Main Survey and COVID Survey in Understanding Society**

50,994 participants in Wave 1 of Main Survey (2009-11)

Wave 3 (N=14,123) COVID Survey

Household shielding

(June 2020)

Wave 6 (N=12,035) of COVID Survey

(Nov 2020)

*(vaccine hesitancy, psychological distress)*

40,730 participants in Wave 3 of Main Survey (2011-13)

(*cognitive function*)

N=7361 with full data on mental and physical health, vaccine hesitancy, and covariates

N=11,955 with full data on vaccine hesitancy

Wave 1 (N=17,761) COVID Survey

(April 2020)

34,318 participants in Wave 10 of Main Survey

(*educational level, ethnicity, history of morbidity*)

42,330 participants in Waves 8 (2016-18) and 9 (2017-19) of Main Survey

**Figure 2. Odds ratios (95% confidence intervals) for the relation of mental and physical health with later COVID-19 vaccine hesitancy in Understanding Society (N=7361)**

(Drew: Here and in the relevant tables, after ‘any physical condition’, please add the result for ‘Shielding in household’ which is a proxy for serious physical illness. Here, suggest dropping the ‘health conditions(s)’ label as it’s self-explanatory)

**Chart

Description automatically generated**

Numbers of study members in this sample corresponds to those with complete data on all variables in the analyses (N=7361). Physical morbidity and psychiatric morbidity were mutually-adjusted. For each morbidity, the referent group is those study members without the condition.

**Figure 3. Multiply-adjusted odds ratios (95% confidence intervals) for the relation of psychological distress with later COVID-19 vaccine hesitancy in Understanding Society (N=7361)** (Drew: can you add a column for the number of people who were hesitant in each of the 13 distress categories? Drop ‘variable and ‘ghq.fact’)

|  |
| --- |
|  |
|  |
| All covariates are: age, sex, ethnicity, education, somatic comorbidity, shielding, and cognitive function. |

**Table 1. Study member characteristics according to**

**COVID-19 vaccine hesitancy in Understanding Society**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Vaccine hesitant** | | **P value** |
|  | **Yes** | **No** |  |
| Numbers of people | 1842 (15.4) | 10113 (84.6) |  |
| **Demographic factors** |  |  |  |
| Age, yr, mean (SD) | 45.0 (14.5) | 54.6 (15.6) | < 0.0001 |
| Female | 1162 (63.1) | 5530 (54.7) | < 0.0001 |
| Non-white ethnicity | 406 (22.7) | 698 (7.0) | < 0.0001 |
| **Socioeconomic factors** |  |  |  |
| No university education | 939 (22.0) | 4298 (6.9) | < 0.0001 |
| **Psychiatric morbidities** |  |  |  |
| Anxiety | 85 (4.0) | 404 (4.6) | 0.153 |
| Depression | 92 (5.0) | 466 (4.6) | 0.352 |
| Other mental disorder | 36 (1.9) | 121 (1.2) | 0.007 |
| Psychological distress symptoms, mean (SD) | 2.82 (3.9) | 2.34 (3.4) | < 0.0001 |
| **Physical morbidities** |  |  |  |
| Cardiometabolic disease | 268 (15.0) | 2513 (25.2) | < 0.0001 |
| Respiratory disease | 219 (12.3) | 1372 (13.8) | 0.144 |
| Any cancer | 45 (2.5) | 525 (5.3) | < 0.0001 |
| Shielding in the household | 196 (10.6) | 1187 (11.7) | < 0.0001 |
| **Cognitive function** |  |  |  |
| *g* factor, mean (SD) | 96.6 (15.7) | 100.5 (14.8) | < 0.0001 |
|  |  |  |  |

Numbers of study members corresponds to those with complete data

on vaccine intentionality only. Results are N (%) unless otherwise indicated.

**Table 2. Odds ratios (95% confidence intervals) for the relation of mental and physical health with later COVID-19 vaccine hesitancy in Understanding Society (N=7361)**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Number hesitant / Total at risk** | **Age, sex, & ethnicity** | **All covariates** |
| **Psychiatric morbidity** |  |  |  |
| Anxiety | 50/324 | 1.00 (0.72, 1.36) | 1.11 (0.79, 1.52) |
| Depression | 54/368 | 0.99 (0.72, 1.33) | 1.12 (0.81, 1.53) |
| Other mental health condition(s) | 20/111 | 1.08 (0.64, 1.75) | 1.21 (0.71, 1.97) |
| Any mental health condition | 71/491 | 0.99 (0.75, 1.29) | 1.14 (0.86, 1.41) |
|  |  |  |  |
| **Psychological distress** |  |  |  |
| Asymptomatic (score 0) | 443/3339 | 1.0 (ref) | 1.0 (ref) |
| Subclinically symptomatic (1-3) | 247/2256 | 0.77 (0.64, 0.91) | 0.81 (0.63, 0.98) |
| Symptomatic (4-6) | 90/750 | 0.77 (0.59, 0.98) | 0.82 (0.56, 1.07) |
| Highly symptomatic (7-12) | 173/1016 | 1.05 (0.85, 1.28) | 1.12 (0.92, 1.33) |
| P for quadratic association |  | < 0.0001 | 0.003 |
| P for linear trend |  | 0.251 | 0.075 |
| Per SD (3.5 points) decrease | 953/7361 | 0.93 (0.81, 1.06) | 0.88 (0.75, 1.02) |
|  |  |  |  |
| **Physical morbidity** |  |  |  |
| Cardiometabolic disease | 147/1905 | 0.82 (0.67, 0.99) | 0.78 (0.58, 0.98) |
| Respiratory disease | 107/1034 | 0.71 (0.57, 0.88) | 0.74 (0.52, 0.97) |
| Any cancer | 29/389 | 0.87 (0.58, 1.28) | 0.95 (0.55, 1.34) |
| Any physical health condition | 225/2389 | 0.72 (0.61, 0.85) | 0.71 (0.54, 0.88) |
| Shielding in household | 196/1383 | 0.81 (0.63, 1.03) | 0.76 (0.59, 0.96) |
|  |  |  |  |

All covariates are: age, sex, ethnicity, education, shielding status, and cognitive function. Physical morbidity and psychiatric morbidity were mutually-adjusted

***Appendix***

*Batty GD, Deary IJ, Altschul D. Pre-pandemic mental and physical Health as predictors of*

*COVID-19 vaccine hesitancy: evidence from a UK cohort study*

**Table a1. Odds ratios (95% confidence intervals) for the relation of mental and physical health with later COVID-19 vaccine hesitancy in Understanding Society – with models featuring individual covariates (N=7361)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Number hesitant / Total at risk** | **Age, sex, & ethnicity** | **Age, sex, ethnicity, & comorbidity** | **Age, sex, ethnicity, & shielding** | **Age, sex, ethnicity, & education** | **Age, sex, ethnicity, and cognition** | **All covariates** |
| **Psychiatric morbidity** |  |  |  |  |  |  |  |
| Anxiety | 50/324 | 1.00 (0.72, 1.36) | 1.04 (0.75, 1.43) | 0.98 (0.70, 1.34) | 1.02 (0.73, 1.40) | 1.00 (0.72, 1.38) | 1.11 (0.79, 1.52) |
| Depression | 54/368 | 0.99 (0.72, 1.33) | 1.04 (0.76, 1.41) | 0.98 (0.71, 1.32) | 1.01 (0.73, 1.36) | 1.02 (0.74, 1.38) | 1.12 (0.81, 1.53) |
| Other mental health condition(s) | 20/111 | 1.08 (0.64, 1.75) | 1.17 (0.69, 1.89) | 1.08 (0.64, 1.75) | 1.06 (0.62, 1.73) | 1.15 (0.68, 1.87) | 1.21 (0.71, 1.97) |
| Any mental health condition | 71/491 | 0.99 (0.75, 1.29) | 1.05 (0.86, 1.49) | 0.99 (0.72, 1.26) | 1.04 (0.76, 1.31) | 1.05 (0.78, 1.32) | 1.14 (0.86, 1.41) |
|  |  |  |  |  |  |  |  |
| **Psychological distress** |  |  |  |  |  |  |  |
| Asymptomatic (score 0) | 443/3339 | 1.0 (ref) | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Subclinically symptomatic (1-3) | 247/2256 | 0.77 (0.64, 0.91) | 0.77 (0.68, 0.96) | 0.77 (0.60, 0.94) | 0.79 (0.62, 0.97) | 0.79 (0.62, 0.96) | 0.81 (0.63, 0.98) |
| Symptomatic (4-6) | 90/750 | 0.77 (0.59, 0.98) | 0.78 (0.63, 1.05) | 0.77 (0.52, 1.02) | 0.78 (0.53, 1.04) | 0.78 (0.53, 1.04) | 0.82 (0.56, 1.07) |
| Highly symptomatic (7-12) | 173/1016 | 1.05 (0.85, 1.28) | 1.08 (0.91, 1.38) | 1.06 (0.86, 1.26) | 1.07 (0.87, 1.27) | 1.07 (0.86, 1.27) | 1.12 (0.92, 1.33) |
| P for quadratic |  | < 0.0001 | 0.017 | 0.028 | 0.034 | 0.036 | 0.003 |
| P for linear trend |  | 0.251 | 0.099 | 0.148 | 0.147 | 0.145 | 0.075 |
| Per SD (3.5 points) decrease | 953/7361 | 0.93 (0.81, 1.06) | 1.12 (0.98, 1.28) | 1.10 (0.96, 1.26) | 1.10 (0.96, 1.26) | 1.10 (0.97, 1.26) | 0.88 (0.75, 1.02) |
|  |  |  |  |  |  |  |  |
| **Physical morbidity** |  |  |  |  |  |  |  |
| Cardiometabolic disease | 147/1905 | 0.82 (0.67, 1.00) | 0.82 (0.64, 0.95) | 0.83 (0.63, 1.03) | 0.80 (0.60, 1.00) | 0.78 (0.58, 0.98) | 0.78 (0.58, 0.98) |
| Respiratory disease | 107/1034 | 0.71 (0.57, 0.88) | 0.71 (0.59, 0.92) | 0.72 (0.50, 0.94) | 0.73 (0.51, 0.95) | 0.72 (0.50, 0.94) | 0.74 (0.52, 0.97) |
| Any cancer | 29/389 | 0.87 (0.58, 1.28) | 0.87 (0.62, 1.39) | 0.89 (0.49, 1.28) | 0.90 (0.50, 1.30) | 0.92 (0.52, 1.31) | 0.95 (0.55, 1.34) |
| Any physical health condition | 225/2389 | 0.72 (0.61, 0.85) | 0.72 (0.60, 0.85) | 0.73 (0.56, 0.89) | 0.72 (0.55, 0.89) | 0.71 (0.54, 0.87) | 0.71 (0.54, 0.88) |
| Shielding in household | 196/1383 | 0.81 (0.63, 1.03) | 0.81 (0.63, 1.03) |  | 0.78 (0.61, 1.00) | 0.76 (0.59, 0.97) | 0.76 (0.59, 0.96) |

All covariates are: age, sex, ethnicity, education, shielding, and cognitive function. Physical morbidity and psychiatric morbidity were mutually-adjusted