Supplemental material

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*J Epidemiol Community Health*

**SUPPLEMENTARY MATERIAL**

**Last updated August 25th, 2021**

1. GHQ-12 item labels
2. Sample size per wave
3. Sample characteristics across waves 1, 10, and the pooled COVID sample
4. Re-analysis I – Trends in GHQ scores
5. Re-analysis II – Changes in GHQ scores before/during COVID
6. Re-analysis III – Differences in GHQ scores during the pandemic
7. Supplementary Figures of trends in GHQ score between UKHLS Waves 1 through 10

**SUPPLEMENTARY TABLE 1**
**GHQ-12 item labels**

| # | Full item |
|---|-----------|
| 1 | Have you recently been able to concentrate on whatever you're doing? |
| 2 | Have you recently lost much sleep over worry? |
| 3 | Have you recently felt that you were playing a useful part in things? |
| 4 | Have you recently felt capable of making decisions about things? |
| 5 | Have you recently felt constantly under strain? |
| 6 | Have you recently felt you couldn't overcome your difficulties? |
| 7 | Have you recently been able to enjoy your normal day-to-day activities? |
| 8 | Have you recently been able to face up to problems? |
| 9 | Have you recently been feeling unhappy or depressed? |
| 10 | Have you recently been losing confidence in yourself? |
| 11 | Have you recently been thinking of yourself as a worthless person? |
| 12 | Have you recently been feeling reasonably happy, all things considered? |

GHQ items are introduced with the preamble: "The next questions are about how you have been feeling over the last few weeks".

**SUPPLEMENTARY TABLE 2**
**Sample size**

| Survey | Cycle | Date | Sample size with valid cross-sectional weight | Sample size with valid cros—sectional weight and valid GHQ score |
|---|---|---|---|---|
| | | | *N* | *N* |
| Main | Wave 1 | 2009-10 | 4,731 | 4,587 |
| | Wave 2 | 2010-11 | 4,217 | 4,178 |
| | Wave 3 | 2011-12 | 3,803 | 3,797 |
| | Wave 4 | 2012-13 | 3,485 | 3,481 |
| | Wave 5 | 2013-14 | 3,187 | 3,186 |
| | Wave 6 | 2014-15 | 2,879 | 2,859 |
| | Wave 7 | 2015-16 | 3,475 | 3,451 |
| | Wave 8 | 2016-17 | 2,997 | 2,961 |
| | Wave 9 | 2017-18 | 2,615 | 2,554 |
| | Wave 10 | 2018-19 | 2,397 | 2,333 |
| COVID | Wave 1 | April 2020 | 743 | 575 |
| | Wave 2 | May 2020 | 483 | 457 |
| | Wave 3 | June 2020 | 419 | 402 |
| | Wave 4 | July 2020 | 397 | 378 |
| | Wave 5 | Sept. 2020 | 319 | 307 |
| | Wave 6 | November 2020 | 286 | 263 |

Universe: Participants aged 16-24 at current wave

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**SUPPLEMENTARY TABLE 3**
**Sample characteristics.**

| Variables | W1 2009-10 W% Full N = 4,587 | W% CC N = 3,811 | W10 2018-19 W% Full N = 2,333 | W% CC N = 2,062 | Pooled COVID 2020 W% Full N = 2,382 | W% CC N = 2,240 |
|---|---|---|---|---|---|---|
| **GHQ-12** | | | | | | |
| Score out of 36 (Mean) | 10.4 | 10.3 | 12.1 | 11.9 | 14.0 | 14.0 |
| *Missing* (N) | 0 | | 0 | | 0 | |
| **Sex** | | | | | | |
| M | 49.3 | 49.1 | 50.8 | 51.1 | 55.1 | 54.3 |
| F | 50.7 | 50.9 | 49.2 | 48.9 | 44.9 | 45.7 |
| *Missing* (N) | 0 | | 0 | | 0 | |
| **Age** | | | | | | |
| 16-18 | 33.0 | 37.4 | 34.8 | 37.5 | 8.2 | 8.0 |
| 19-21 | 32.8 | 31.8 | 34.5 | 35.4 | 42.6 | 42.8 |
| 22-24 | 34.1 | 30.8 | 30.7 | 27.1 | 49.2 | 49.2 |
| *Missing* (N) | 0 | | 0 | | 0 | |
| **Economic activity** | | | | | | |
| FT employed | 25.3 | 25.2 | 23.3 | 21.7 | 24.5 | 24.7 |
| PT employed | 14.3 | 14.2 | 15.4 | 15.3 | 33.3 | 33.0 |
| Unemployed | 12.2 | 11.9 | 10.3 | 10.5 | 5.9 | 5.5 |
| FT education | 42.3 | 44.3 | 44.9 | 48.5 | 20.3 | 21.1 |
| Other | 5.6 | 4.5 | 3.8 | 4.0 | 15.2 | 15.6 |
| *Missing* (N) | 0 | | 3 | | 0 | |
| **Living arrangements** | | | | | | |
| With parent(s) | 63.1 | 73.1 | 88.9 | 91.6 | 84.1 | 85.2 |
| Not with parent(s) | 36.9 | 26.9 | 11.1 | 8.4 | 15.9 | 14.8 |
| *Missing* (N) | 0 | | 0 | | 0 | |
| **Parent education** | | | | | | |
| Degree | 27.7 | 27.7 | 37.3 | 37.5 | 38.0 | 37.6 |
| No degree | 72.3 | 72.3 | 62.7 | 62.5 | 62.0 | 62.4 |
| *Missing* (N) | 691 | | 110 | | 46 | |
| **Area deprivation** | | | | | | |
| Most deprived | 22.2 | 23.8 | 26.0 | 26.7 | 31.9 | 32.7 |
| 2nd most deprived | 25.2 | 25.6 | 26.7 | 27.2 | 26.2 | 26.3 |
| 2nd least deprived | 27.3 | 26.3 | 24.7 | 24.2 | 21.0 | 20.8 |
| Least deprived | 25.2 | 24.3 | 22.6 | 21.9 | 21.0 | 20.2 |
| *Missing* (N) | 0 | | 0 | | 5 | |
| **Ethnicity** | | | | | | |
| White UK | 78.9 | 80.5 | 79.5 | 80.2 | 74.9 | 75.5 |
| White Other | 3.5 | 2.8 | 2.7 | 2.6 | 2.3 | 2.1 |
| Mixed | 2.6 | 2.7 | 4.1 | 4.0 | 5.8 | 5.8 |
| Indian | 4.1 | 3.8 | 2.9 | 2.8 | 5.1 | 5.2 |
| Pakistani & Bangladeshi | 4.2 | 4.3 | 4.8 | 4.6 | 8.9 | 8.7 |
| Black | 3.6 | 3.4 | 3.6 | 3.4 | 2.1 | 1.9 |
| Other | 3.0 | 2.4 | 2.5 | 2.4 | 0.9 | 0.9 |
| *Missing* (N) | 70 | | 83 | | 50 | |

*Universe: UKHLS participants ages 16-24 in England with no missing data on GHQ and a valid cross-sectional weight. CC = Complete-case samples for analyses in the main text's Table 2. Proportions are weighted using the wave-specific cross-sectional weight.*

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**SUPPLEMENTARY TABLE 4**

**Testing changes in psychological distress over time among young adults aged 16-24 living in England, by different sub-groups. Understanding Society, 2009-10 to 2018-19.**

| Sub-groups | Between 2009-10 and 2018-19 (N = 28,356) | | |
|---|---|---|---|
| | AME of time on GHQ | 95%CI | Interaction *p* |
| **Sex** | | | |
| M (ref) | **0.12** | **0.08; 0.17** | --- |
| F | **0.23** | **0.18; 0.28** | **< 0.001** |
| **Age** | | | |
| 16-18 (ref) | **0.25** | **0.20; 0.30** | --- |
| 19-21 | **0.16** | **0.10; 0.21** | **0.003** |
| 22-24 | **0.10** | **0.04; 0.17** | **< 0.001** |
| **Economic activity** | | | |
| FT employed (ref) | **0.11** | **0.06; 0.17** | --- |
| PT employed | **0.19** | **0.11; 0.27** | 0.094 |
| Unemployed | **0.24** | **0.11; 0.37** | 0.074 |
| FT education | **0.18** | **0.13; 0.22** | 0.088 |
| Out of labor force | **0.34** | **0.12; 0.55** | **0.046** |
| **Living arrangements** | | | |
| With parent(s) | **0.18** | **0.07; 0.25** | 0.705 |
| Not with parent(s) (ref) | **0.16** | **0.14; 0.22** | --- |
| **Parent education** | | | |
| Degree | **0.17** | **0.11; 0.22** | 0.690 |
| No degree (ref) | **0.18** | **0.14; 0.22** | --- |
| **Area deprivation** | | | |
| Most deprived | **0.14** | **0.06; 0.21** | 0.449 |
| 2$^{nd}$ most deprived | **0.22** | **0.15; 0.29** | 0.376 |
| 2$^{nd}$ least deprived | **0.17** | **0.11; 0.24** | 0.977 |
| Least deprived (ref) | **0.17** | **0.12; 0.23** | --- |
| **Ethnicity** | | | |
| White UK (ref) | **0.21** | **0.17; 0.25** | --- |
| White Other | 0.09 | -0.10; 0.28 | 0.225 |
| Mixed | 0.11 | -0.07; 0.28 | 0.253 |
| Indian | 0.08 | -0.07; 0.22 | 0.084 |
| Pakistani & Bangladeshi | -0.04 | -0.17; 0.09 | **< 0.001** |
| Black | 0.05 | -0.17; 0.08 | **< 0.001** |
| Other ethnic groups | 0.05 | -0.25; 0.35 | 0.311 |

Estimates are from linear models regressing GHQ on time-varying characteristics in the ten UKHLS main waves from Wave 1 (2009-10) to Wave 10 (2018-19) and a time variable. The estimates are from pooled OLS clustering on individuals using cross-sectional weights. Estimates represent the average increase in GHQ between any two waves. Interactions were included in separate models, one at a time.
AME = Average marginal effect. CI = Confidence interval. We bolded significant AMEs at *p* < .05.
Interactions *p*-values reported in the row with the variable names refer to test of differences in AMEs across categories, and those reported next to variable categories refer to test of differences in AMEs with respect to the reference group.
AMEs are based on complete-case models adjusted for all other predictors.

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**SUPPLEMENTARY TABLE 5**

**Testing changes in psychological distress over time among young adults aged 16-24 living in England, by different sub-groups. Understanding Society, 2017-19 to 2020.**

| Sub-groups | Between Waves 9-10 and Apr.-Nov. 2020 (*N* = 6,534) | | |
|---|---|---|---|
| | AME of time on GHQ | 95%CI | Interaction *p* |
| **Sex** | | | |
| M (ref) | **1.52** | **0.58; 2.45** | --- |
| F | **2.12** | **1.26; 2.98** | 0.355 |
| **Age** | | | |
| 16-18 (ref) | 1.17 | -0.79; 3.13 | --- |
| 19-21 | **2.00** | **1.11; 2.88** | 0.412 |
| 22-24 | **1.86** | **0.93; 2.80** | 0.529 |
| **Economic activity** | | | |
| FT employed (ref) | **1.81** | **0.94; 2.68** | --- |
| PT employed | **1.90** | **0.89; 2.90** | 0.885 |
| Unemployed | 1.99 | -0.50; 4.49 | 0.887 |
| FT education | **1.95** | **0.75; 3.16** | 0.837 |
| Out of labor force | 0.95 | -1.77; 3.67 | 0.558 |
| **Living arrangements** | | | |
| With parent(s) | **1.94** | **1.25; 2.63** | 0.200 |
| Not with parent(s) (ref) | 1.05 | -0.18; 2.27 | --- |
| **Parent education** | | | |
| Degree | **1.56** | **0.73; 2.40** | 0.446 |
| No degree (ref) | **1.99** | **1.77; 2.81** | --- |
| **Area deprivation** | | | |
| Most deprived | **4.08** | **2.44; 5.72** | **0.003** |
| 2nd most deprived | 1.02 | -0.02; 2.07 | 0.628 |
| 2nd least deprived | **1.53** | **0.24; 2.82** | 0.803 |
| Least deprived (ref) | **1.34** | **0.51; 2.18** | --- |
| **Ethnicity** | | | |
| White UK (ref) | **1.57** | **0.82; 2.31** | --- |
| White Other | 3.36 | -0.52; 7.24 | 0.373 |
| Mixed | **4.00** | **1.32; 6.60** | 0.086 |
| Indian | **2.92** | **0.16; 5.69** | 0.361 |
| Pakistani & Bangladeshi | **2.59** | **1.41; 3.77** | 0.147 |
| Black | 0.63 | -1.71; 2.96 | 0.445 |
| Other ethnic groups | **3.07** | **0.10; 6.04** | 0.337 |

Estimates are from linear models regressing GHQ on time-varying characteristics in UKHLS Wave 9 (2017-18) and Wave 10 (2018-19), and UKHLS COVID waves 1-6 (April-November 2020), and a time (0/1) variable. The estimates are from pooled OLS clustering on individuals using cross-sectional weights. Estimates represent the average increase in GHQ between 2017-19 and 2020. Interactions were included in separate models, one at a time.
AME = Average marginal effect. CI = Confidence interval. We bolded significant AMEs at *p* < .05.
Interactions *p*-values reported next to variable categories refer to test of differences in AMEs with respect to the reference group. AMEs are based on complete-case models adjusted for all other predictors.

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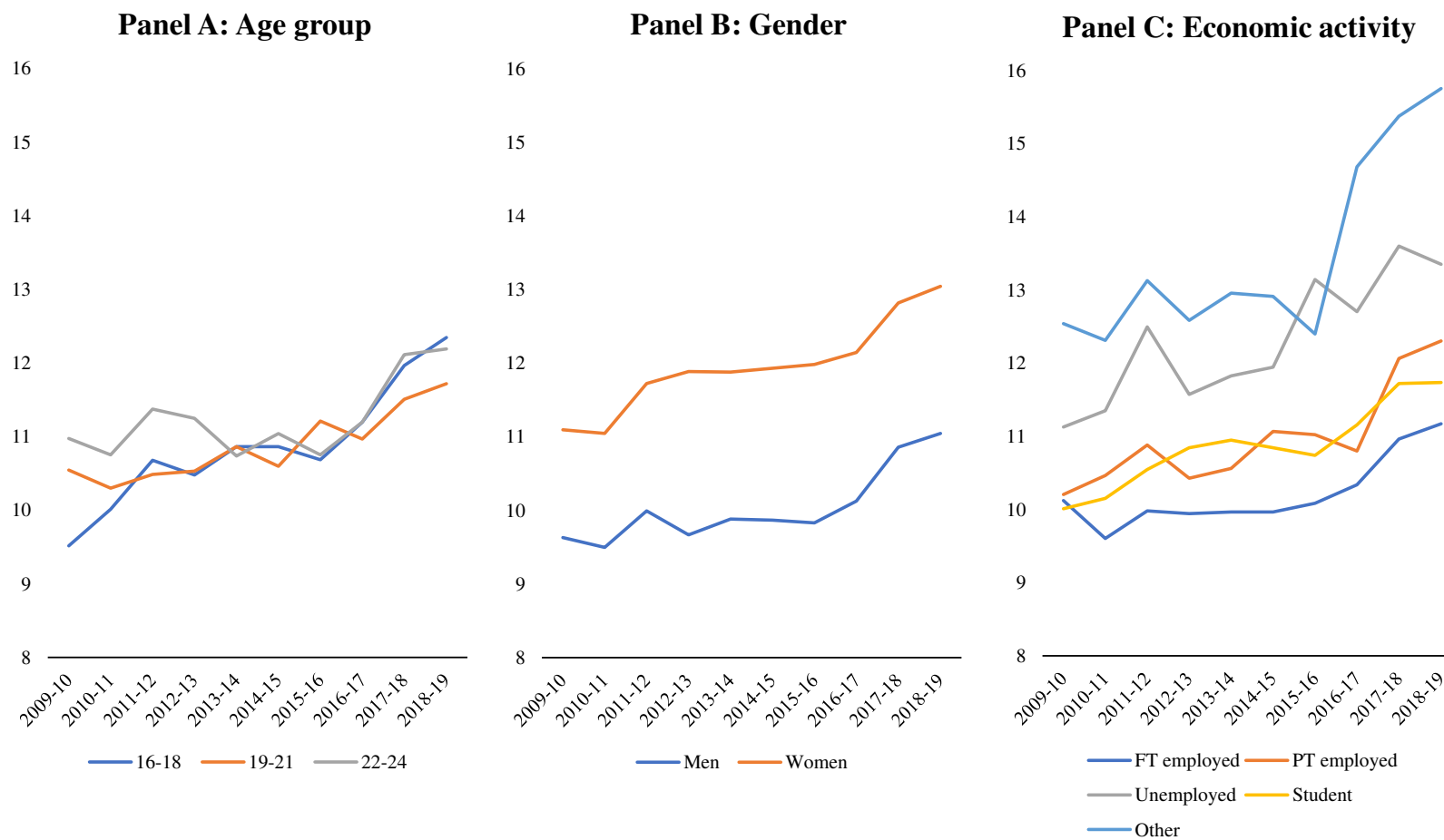*J Epidemiol Community Health*

**SUPPLEMENTARY TABLE 6**
**Differences in psychological distress by area deprivation among young adults aged 16-24 living in England, considering economic changes since before the outbreak. UKHLS, Apr-Nov 2020.**

| | Baseline model (N = 2,049) | | Model + Job loss (N = 2,049) | |
|---|---|---|---|---|
| | *B* | 95%CI | *B* | 95%CI |
| **Area deprivation** | | | | |
| Most deprived | 1.72 | -0.38; 5.17 | 1.46 | -0.66; 3.59 |
| 2nd most deprived | 0.52 | -1.21; 1.38 | 0.31 | -0.89; 1.52 |
| 2nd least deprived | 0.31 | -1.54; 0.94 | 0.02 | -1.27; 1.30 |
| Least deprived (ref.) | --- | --- | --- | --- |
| **Change since before outbreak** | | | | |
| Did not lose job or ≥ 50% hours (ref.) | --- | --- | --- | --- |
| Lost job or ≥ 50% hours | --- | --- | **1.32** | **0.05; 2.58** |
| Started job | --- | --- | -1.64 | -3.67; 0.38 |
| Did not work at both points | --- | --- | 0.26 | -0.92; 1.44 |

Estimates represent betas from pooled OLS models clustering on individuals using the wave-specific UKHLS COVID cross-sectional weights. Models controlled for wave, age, sex, ethnic group, parental education, living arrangements with parents, and GHQ score at Wave 10. We bolded significant estimates at $p < .05$. CI = Confidence interval.
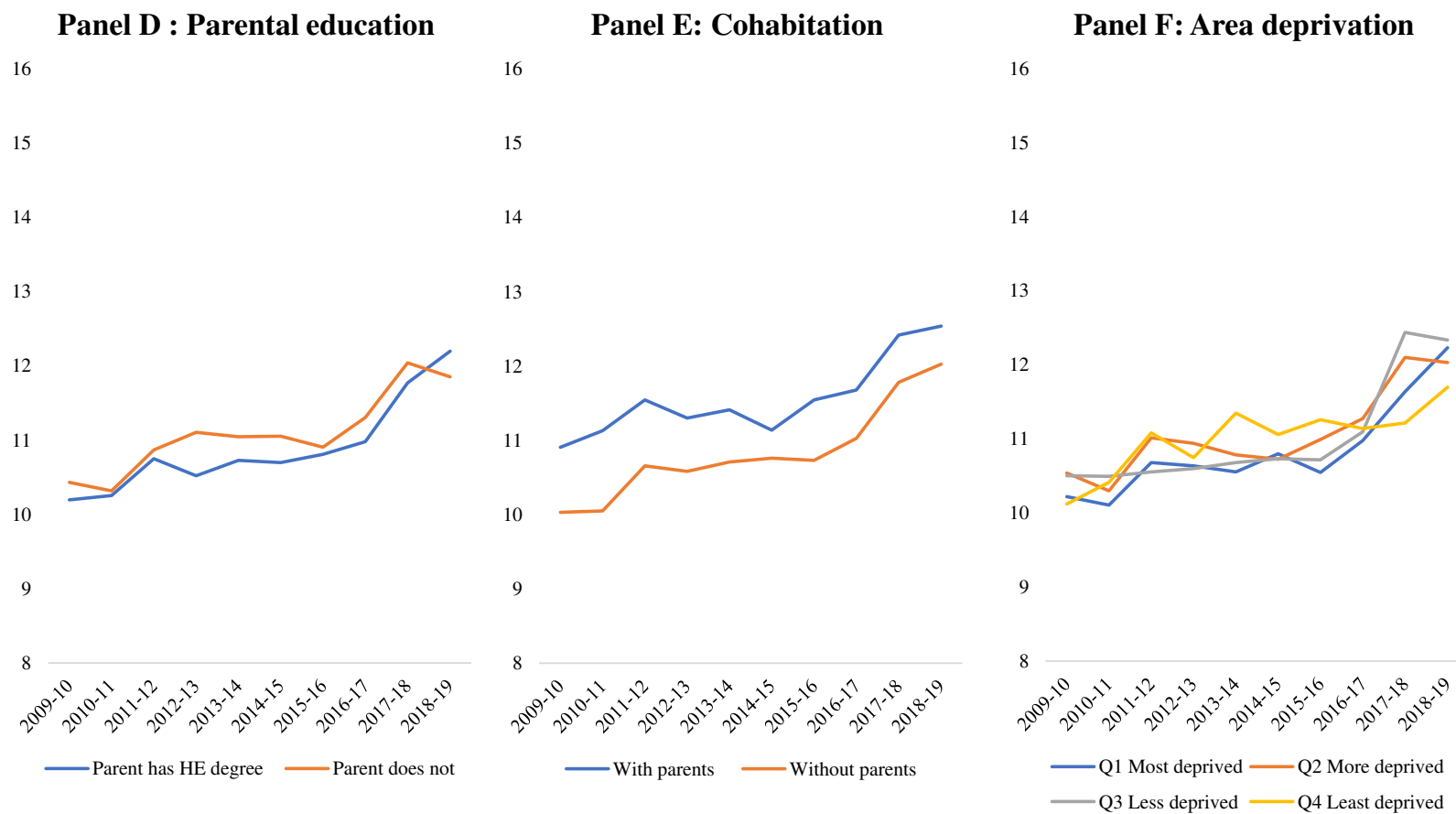
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**SUPPLEMENTARY FIGURES**
**GHQ-12 mean scores (range 0-36) among young adults aged 16-24 living in England. UKHLS, 2009-10 to 2018-2019.**



Panel A: Age group

Panel B: Gender

Panel C: Economic activity

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**SUPPLEMENTARY FIGURES**
**GHQ-12 mean scores (range 0-36) among young adults aged 16-24 living in England. UKHLS, 2009-10 to 2018-2019.**



Panel D : Parental education — Parent has HE degree, Parent does not

Panel E: Cohabitation — With parents, Without parents

Panel F: Area deprivation — Q1 Most deprived, Q2 More deprived, Q3 Less deprived, Q4 Least deprived

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**SUPPLEMENTARY FIGURES**
**GHQ-12 mean scores (range 0-36) among young adults aged 16-24 living in England. UKHLS, 2009-10 to 2018-2019.**

## Panel G: Ethnicity



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