# Trajectories of mental health among university staff and postgraduate students during the pandemic

## Supplementary Materials





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## Supplementary Table 1

Schedule of follow-up assessment periods

| Date of follow-up assessment[1] | | | Type of survey | Number responding | Response rate[2] % |
|---|---|---|---|---|---|
| 2020 | April | 15th | Two-monthly | 2241 | 100 |
| | May | 8th | Fortnightly | 1772 | 79 |
| | | 22nd | Fortnightly | 1924 | 86 |
| | June | 5th | Fortnightly | 1918 | 86 |
| | | 19th | Two-monthly | 1958 | 87 |
| | July | 3rd | Fortnightly | 1927 | 86 |
| | | 17th | Fortnightly | 1812 | 81 |
| | | 31st | Fortnightly | 1759 | 78 |
| | August | 14th | Two-monthly | 1641 | 73 |
| | | 28th | Fortnightly | 1741 | 78 |
| | September | 11th | Fortnightly | 1757 | 78 |
| | | 25th | Fortnightly | 1773 | 79 |
| | October | 9th | Two-monthly | 1664 | 74 |
| | | 23rd | Fortnightly | 1686 | 75 |
| | November | 6th | Fortnightly | 1703 | 76 |
| | | 20th | Fortnightly | 1696 | 76 |
| | December | 4th | Two-monthly | 1749 | 78 |
| | | 18th | Fortnightly | 1542 | 69 |
| 2021 | January | 1st | Fortnightly | 1564 | 70 |
| | | 15th | Fortnightly | 1661 | 74 |
| | | 29th | Two-monthly | 1662 | 74 |
| | February | 12th | Fortnightly | 1607 | 72 |
| | | 26th | Fortnightly | 1625 | 73 |
| | March | 12th | Fortnightly | 1598 | 71 |

| | | | | | |
|---|---|---|---|---|---|
| | | 26th | Two-monthly | 1554 | 69 |
| | April | 9th | Fortnightly | 1492 | 67 |
| | | 23rd | Fortnightly | 1442 | 64 |

*Notes.*

[1] Surveys were sent out in two batches over a two week period. This date represents the midpoint of the period.

[2] Response rate (%) relative to the number of participants in the analytical sample who responded at baseline (n = 2241).

## Supplementary Table 2

Model fit statistics for different numbers of latent classes; GMM models (n=2241)

| Outcome | No. classes | -2LL | Δ | AIC | Δ | SABIC | Δ[b] | LMR p-value |
|---|---|---|---|---|---|---|---|---|
| Anxiety (GAD-7) | 3 | 216537 | . | 216631 | . | 216750 | . | 0.630 |
| | 4 | 216225 | -312 | 216329 | -302 | 216461 | -289 | 0.815 |
| | 5 | 215980 | -245 | 216094 | -235 | 216239 | -222 | 0.374 |
| | 6 | 215758 | -222 | 215882 | -212 | 216040 | -199 | 0.755 |
| | 7 | 215541 | -217 | 215675 | -207 | 215845 | -195 | 0.738 |
| Depression (PHQ-9) | 3 | 216614 | . | 216708 | . | 216827 | . | 0.285 |
| | 4 | 216264 | -350 | 216368 | -340 | 216500 | -327 | 0.757 |
| | 5 | 215957 | -307 | 216071 | -297 | 216215 | -285 | 0.788 |
| | 6 | 215686 | -271 | 215810 | -261 | 215967 | -248 | 0.759 |
| | 7 | 215476 | -210 | 215610 | -200 | 215780 | -187 | 0.808 |

*Notes.*

AIC = Akaike information criterion

aBIC = sample size adjusted

SABIC = sample size adjusted Bayesian information criterion

-2LL = -2 × log-likelihood (-2LL), where lower values indicate better relative model fit

**Δ** = Change in relative model fit between the current model and a model with one fewer classes

LMR p-value = P-value for the Vong-Lo-Mendell-Rubin likelihood ratio test, where a value of $p < 0.05$ indicates an improvement in model fit compared to a model with one fewer classes

## Supplementary Table 3

This table describes the number of respondents who left King's College London (KCL) during the fieldwork period. This was assessed by asking participants about their current role and counting responses of "I no longer work or study at King's College London". For staff and PGR students separately, the table presents (A) the total number of respondents, and of these, the number and percentage who reported leaving KCL during the fieldwork period; (B) the total number of observations, and of these, the number and percentage that were collected from participants after leaving KCL.

| | A | | B | |
|---|---|---|---|---|
| | Total respondents | Number leaving KCL during fieldwork period (% of total) | Total observations* | Number of observations collected after leaving KCL (% of total) |
| PGR students | 390 | 24 (6.2%) | 38,229 | 187 (2.6%) |
| Staff | 1851 | 107 (5.8%) | 7081 | 920 (2.4%) |

* Number of baseline and follow-up assessments where respondent provides outcome information.



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## Supplementary methodological details

### Variables measured at baseline

Variables reported by participants in the baseline questionnaire include: (1) demographic characteristics (age, gender, ethnicity, partnership status, living arrangements); (2) health status (chronic health conditions, shielding, previous mental health diagnosis), (3) caring roles (children at home, young children, other caring responsibilities); and (4) occupational role and key worker status.

1. **Demographic characteristics** included continuous age, gender, ethnicity, partnership status, living arrangements, and housing tenure. Gender was reported as 'Female', 'Male', 'Other', or 'Prefer not to say'. Due to small cell counts (<0.5%), responses of 'Other' and 'Prefer not to say' were randomly allocated to 'Female' or 'Male', based on sample proportions. Ethnicity was coded into five categories following recommendations of the Office for National Statistics [1]: White, Mixed, Asian ('Asian' or 'Asian British'), Black ('Black', 'African', 'Caribbean', 'Black British') or Other ('Other ethnic group'). Partnership status was categorised as 'Single', 'Divorced, separated, widowed', or 'Civil partnership, married, cohabiting, non-cohabiting'. Living arrangements ("Which of the following best describes your current living arrangement?") were dichotomised as 'Living alone' vs. 'living with others.' Housing tenure was dichotomised as any 'renting' category vs. all other categories ('Privately owned', 'Buying with the help of a mortgage or loan', 'Live rent-free', or 'Shared ownership').

2. **Health status** included self-reported chronic health conditions (at least one reported condition vs. none); whether or not the participant was 'Currently shielding' (defined as "a type of self-isolation, which involves not leaving your home for any reason for at least 12 weeks to reduce your risk of contracting COVID-19"; Yes/No); and prior diagnosis by health professional of (4) depression ('Depression') or anxiety disorder ('Generalised anxiety disorder,' 'Panic attacks' or 'Post-traumatic stress disorder') (Yes/No).

3. **Caring roles** included the number of children living at home (0, 1, 2, 3+), having children under the age of 6 (Yes/No), and whether the participant had any other dependents or caring responsibilities ("Do you have any other dependents or caring responsibilities?"; Yes/No).



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4. **Occupational factors** included role and key worker status. Occupational role was categorised as 'Academic, specialist and management', 'Research, clerical and technical', 'Teaching, facilities and clinical', or 'PGR student'. These categories were chosen to reflect seniority and the degree of contact with the public. A small number of participants (≈4%) reported both staff and PGR roles. These participants were categorised based on their staff role. Key workers were identified with a binary variable ("Are you currently fulfilling a 'key worker' role as identified by the government?").

## Derivation of survey weights

### Baseline weights

A baseline weight was derived to adjust for differences in age, gender, and ethnicity between the baseline cohort and the target population (all KCL staff and PGRs). Information on age group, gender, and ethnicity for the target population were extracted from centrally-held administrative records. For staff and PGR students separately:

1. We harmonised the categories in administrative records with those measured in the survey.
2. Missing information in the survey data (for age group, gender, and ethnicity) was imputed with k-nearest neighbours (with k=5 nearest neighbours) using the kNN function from the VIM [2] package for R [3].
3. Weights (W) were derived based on age group, gender, and ethnicity using raking (iterative proportional fitting) using the rake function of the survey package [4] for R.
4. Extreme weights were trimmed to $W_T$, such that any weight larger than $W_T$ was replaced with $W_T$, where $W_T$ = median(W) + (5 * IQR(W)) and IQR = inter quartile range.

To combine weights for staff and PGR students, we scaled the trimmed weights such that the weights had a mean of 1 and summed to the total sample size (of staff and PGR students, respectively).

### Longitudinal weights

Longitudinal weights were derived to adjust for differences in non-response at each follow-up survey by clinical and sociodemographic variables. Separately at each follow-up survey, we:

1. Derived an indicator of response status (1 = responded to this survey; 0 = did not respond).
2. Fitted a multivariable binary logistic regression model with LASSO (least absolute shrinkage and selection operator) regularisation. The model included as features: baseline measures of continuous age, gender (female/male), ethnic group (five categories, as in the main paper), relationship status (as in the main paper), presence of a chronic condition (yes/no), housing tenure (renting vs. other), whether the respondent had any children at home (yes/no), and role (staff vs. PGR student). Optimal lambda was selected with 10-fold cross-validation. Models were estimated using the glmnet [5] package in R.
3. Extracted the model predicted probability of responding to the survey, P, and derived an inverse probability weight as 1/P × R, where R is the proportion responding in this survey period.

This procedure resulted in a longitudinal weight for each respondent at each survey period. We then derived a combined weight as 'baseline weight' × 'longitudinal weight'. These weights were applied as follows:

- Baseline statistics were weighted using the baseline weight only;
- Longitudinal statistics weighted using the combined weight ('baseline weight' × 'longitudinal weight');
- GMM models were weighted with the baseline weight only,

All code used to prepare these weights can be found in the online repository[1].

[1] https://osf.io/7d9ts