DATA NOTE

CovidLife: a resource to understand mental health, well-being and behaviour during the COVID-19 pandemic in the UK

[version 1; peer review: 2 approved]

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Abstract

CovidLife is a longitudinal observational study designed to investigate the impact of the COVID-19 pandemic on mental health, well-being and behaviour in adults living in the UK. In total, 18,518 participants (mean age = 56.43, SD = 14.35) completed the first CovidLife questionnaire (CovidLife1) between April and June 2020. To date, participants have completed two follow-up assessments. CovidLife2 took place between July and August 2020 (n = 11,319), and CovidLife3 took place in February 2021 (n = 10,386). A range of social and psychological measures were administered at each wave including assessments of anxiety, depression, well-being, loneliness and isolation. Information on sociodemographic, health, and economic circumstances was also collected. Questions also assessed information on COVID-19 infections and symptoms, compliance to COVID-19 restrictions, and opinions on the UK and Scottish Governments' handling of the pandemic.

CovidLife includes a subsample of 4,847 participants from the Generation Scotland cohort (N~24,000, collected 2006-2011); a well-characterised cohort of families in Scotland with pre-pandemic data.
on mental health, physical health, lifestyle, and socioeconomic factors, along with biochemical and genomic data derived from biological samples. These participants also consented to their study data being linked to Scottish health records. CovidLife and Generation Scotland data can be accessed and used by external researchers following approval from the Generation Scotland Access Committee. CovidLife can be used to investigate mental health, well-being and behaviour during COVID-19; how these vary according to sociodemographic, health and economic circumstances; and how these change over time. The Generation Scotland subsample with pre-pandemic data and linkage to health records can be used to investigate the predictors of health and well-being during COVID-19 and the future health consequences of the COVID-19 pandemic.

**Keywords**
COVID-19, psychological, mental health, well-being, longitudinal study, observational study

This article is included in the Generation Scotland gateway.

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Introduction
The COVID-19 pandemic and the mitigation measures to reduce its spread resulted in substantial changes to everyday life in the UK and globally. Early 2020 saw rising COVID-19 infection rates and deaths in the UK and a national lockdown was announced on 23rd March 2020, requiring everyone to stay at home at all times, with very limited exceptions.

Throughout 2020 and 2021, COVID-19 mitigation measures have eased and tightened as the number of cases, hospitalisations and deaths have reduced and increased. However, some form of restrictions have remained in place since the first stay at home order was announced on 23rd March 2020. While mitigation measures successfully reduce the number of COVID-19 infections, hospitalisations, and deaths, they may negatively impact mental health and well-being. Concerns about the impact of COVID-19 on mental health led leading health journals to call for research into the effect of COVID-19 on mental health.

Longitudinal studies have reported that rates of psychological distress increased during the early stages of the COVID-19 pandemic. A rapid review and meta-analysis of 12 longitudinal studies with pre-pandemic data found small but significant increases in the rates of depressive symptoms (Hedge’s $g = 0.15$, SE = 0.07, 95% CI 0.01 to 0.30, $p = .037$) and anxiety ($g = 0.17$, SE = 0.05, 95% CI 0.07 to 0.27, $p < .001$) during lockdown (January to June 2020), when compared to before the pandemic.

The psychological impact of the COVID-19 mitigation measures may not affect everyone equally. Female participants and younger adults have consistently shown higher rates of psychological distress and loneliness during the COVID-19 pandemic, and show larger increases in psychological distress compared to pre-pandemic levels. Different sociodemographic characteristics have been associated with higher rates of psychological distress during COVID-19, including people from Asian minority ethnic groups, people with pre-existing health conditions, caregivers, people who are unemployed or economically inactive, those who report experiencing abuse or low social support, those with children under five years, and parents doing 20+ hours of childcare or home schooling a week.

The degree to which COVID-19 and its mitigation measures affect the daily lives of people in the UK may change over time. CovidLife is a longitudinal study that uses online questionnaires to assess the psychological impact of COVID-19 during the first lockdown and how this changes over time as the pandemic progresses. Sociodemographic, economic and health indicators were measured to determine the cross-sectional and longitudinal correlates of mental health, well-being and behaviour during COVID-19. We also measured the degree of adherence and attitudes towards the mitigation measures to understand their associations with mental health and behaviour.

CovidLife consists of 18,518 adults aged 18 years and older resident in the UK who completed the first (baseline) online questionnaire between April and June 2020. In addition to recruiting anyone resident in the UK, invitations were sent to members of the Generation Scotland cohort, a well-characterised cohort of Scottish families with data on health and lifestyle collected between 9 and 14 years before the onset of the COVID-19 pandemic. Biological samples were also collected from Generation Scotland participants and consent for linkage to Scottish health records was obtained. This subsample can therefore be used to investigate the health, lifestyle and biological predictors of mental health, well-being and behaviour during the COVID-19 pandemic.

CovidLife was designed to be a resource for researchers investigating the impact of the COVID-19 pandemic on health and well-being. Researchers can apply to access the CovidLife data. This paper describes the development of the CovidLife questionnaires, characterises the cohort, and describes the data collected in the first three waves.

Methods
Development of the CovidLife questionnaire
The CovidLife questionnaires were developed by the Generation Scotland Team using Qualtrics survey software, a survey development tool. Data collection was limited to remote online assessment due to the COVID-19 restrictions. Online data collection also enabled quick data capture during the COVID-19 pandemic. The questionnaires were designed to be suitable for completion on various devices, including desktop computers, tablets and smartphones.

Questionnaire content
The questionnaire was developed primarily to understand how participants were feeling and behaving during the COVID-19 pandemic. The topics assessed in the first three CovidLife questionnaires are shown in Table 1. All three CovidLife questionnaires administered to date are available in the Extended data (also available at www.ed.ac.uk/generation-scotland/for-researchers/covidlife).

Validated scales were used to assess a range of psychological variables including anxiety and depressive symptoms, well-being, personality, stress and resilience. Selected items from other COVID-19 questionnaires were also used. To assess COVID-19 knowledge and attitudes, questions from the Chicago COVID-19 Comorbidities survey were adapted for use with UK participants. The second CovidLife questionnaire included a section on childcare during COVID-19, using questions adapted from the Gender Division of Childcare during the COVID-19 Pandemic survey. Where possible, questions aligned with those administered in other longitudinal population studies. Many of the questions used in CovidLife also form part of the Wellcome Trust’s COVID-19 questionnaire. The Wellcome Trust’s COVID-19 questionnaire was co-developed by Generation Scotland as part of the Wellcome Trust.
| Table 1. Topics assessed in CovidLife1, CovidLife2, and CovidLife3. |
|---------------------------------------------------------------|
| **Sociodemographic**                                          |
| Date of birth                                                | X |
| Sex and gender identity                                      | X |
| Country of residence                                         | X |
| Ethnicity                                                     | X |
| Household make-up                                            | X |
| Relationship status                                          | X |
| Educational qualifications                                   | X |
| Accommodation type and tenure                                | X |
| Caring responsibilities                                      | X |
| Disabilities                                                 | X |
| **Health**                                                   |
| Self-reported health                                         | X |
| Self-reported height and weight                              | X |
| Self-reported health conditions                              | X |
| Self-reported mental health conditions                       | X |
| Currently pregnant                                           | X |
| Shielding status                                             | X |
| COVID-19 status (suspected, tested positive)                 | X |
| COVID-19 symptoms                                            | X |
| COVID-19 testing                                             | X |
| Long-COVID                                                   | X |
| COVID-19 status of others in household                       | X |
| Had COVID-19 vaccine                                         | X |
| Smoking                                                      | X |
| Alcohol consumption                                          | X |
| Physical activity                                            | X |
| Diet                                                         | X |
| Sleep                                                        | X |
| Postponed healthcare                                         | X |
| COVID-19 vaccine hesitancy                                   | X |
| Vaccine hesitancy                                            | X |
| **Psychological measures**                                   |
| Depressive symptoms                                          | X |
| Anxiety                                                      | X |
| Well-being                                                   | X |
|                                | CovidLife1 | CovidLife2 | CovidLife3 |
|--------------------------------|------------|------------|------------|
| Life satisfaction              | X          | X          | X          |
| Perceived Stress               |            | X          | X          |
| Resilience                     |            |            | X          |
| Personality                    | X          |            |            |
| Health literacy                | X          |            |            |
| Worries during COVID-19        | X          | X          | X          |

**Social support and relationships**

|                                | CovidLife1 | CovidLife2 | CovidLife3 |
|--------------------------------|------------|------------|------------|
| Loneliness                     | X          | X          | X          |
| Isolation                      | X          | X          | X          |
| Whether someone could provide support if had COVID-19 | X | | |
| Quality of relationships with family and friends | X | X | X |
| Keeping in touch with family and friends | X | X | X |
| Childcare during COVID-19       | X          |            |            |
| Home schooling during COVID-19  |            | X          |            |
| Pets                           |            | X          |            |
| Social media use               | X          | X          | X          |
| Know anyone who has died from COVID-19 | X | X | |

**Employment and financial circumstances**

|                                | CovidLife1 | CovidLife2 | CovidLife3 |
|--------------------------------|------------|------------|------------|
| Current employment status      | X          | X          | X          |
| Employment status before COVID-19 | X | X | |
| Type of work                   | X          |            |            |
| Whether furloughed             | X          | X          | X          |
| Working from home              | X          | X          | X          |
| Key worker status              | X          |            |            |
| Confidence in employment post-COVID-19 | X | | |
| PPE available at work          | X          | X          |            |
| Applied for/received support for self-employed | X | X | X |
| Spouse/partner employment      |            |            | X          |
| Household income               | X          |            |            |
| Receiving benefits             | X          | X          | X          |
| Change to financial situation  | X          | X          | X          |

**COVID-19 knowledge, attitudes and behaviour**

|                                | CovidLife1 | CovidLife2 | CovidLife3 |
|--------------------------------|------------|------------|------------|
| Perceived public health threat of COVID-19 | X | X | |
| Attitudes towards following Government COVID-19 restrictions | X | X | X |
| Adherence to COVID-19 restrictions | X | X | X |
Table 2. Validated scales and questionnaires used in CovidLife.

| Topic | Measure |
|-------|---------|
| Validated scales | |
| Anxiety symptoms | Generalised Anxiety Disorder 7-item questionnaire (GAD-7)\(^{20}\) |
| Depressive symptoms | Patient Health Questionnaire 9-item version (PHQ-9)\(^{21}\) |
| Well-being | Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS)\(^{22,23}\) |
| Personality | 50-item International Personality Item Pool (IPIP)\(^{24}\): Extraversion, Conscientiousness, and Emotional Stability items only |
| Perceived Stress | Perceived Stress Scale (PPS) 4-item version\(^{25,26}\) |
| Resilience | Brief Resilience Scale (BRS)\(^{27}\) |
| Questionnaires | |
| COVID-19 knowledge and attitudes, health literacy* | Chicago COVID-19 Comorbidities Survey\(^{18}\) |
| Childcare during COVID-19* | The Gender Division of Childcare during the COVID-19 Pandemic survey\(^{19}\) |

*Items adapted for use in CovidLife

Longitudinal Population Study COVID-19 Steering Group and Secretariat and is freely available to population health researchers to use to investigate the impact of the COVID-19 pandemic (www.bristol.ac.uk/alspac/researchers/wellcome-covid-19/). Using the same or similar items as other studies enables harmonisation, replication and collaboration with other population health studies. Where necessary, new questions were developed to understand participants’ circumstances during the COVID-19 pandemic.

Before launching the first CovidLife questionnaire, feedback on the questionnaire was sought from collaborators and other research groups. The questionnaire was piloted on a small sample of participants and was then edited following feedback from test participants before being formally launched.

Given the sensitivity of some of the questions, and possible reservations about providing personal and sensitive information in an online study, no question required an answer. Many sensitive questions had a “prefer not to answer” option. Following feedback during the piloting phase, options to skip certain sensitive sections were added. Skip options were added to the social support, mood, and employment sections. These were introduced to enable participants to provide as much information
as they felt comfortable sharing while also encouraging them to continue.

**Sample and recruitment**

**CovidLife1.** Anyone aged 18 years and over and resident in the UK could take part in CovidLife. Adults who were resident in the UK but were temporarily elsewhere in the world were also eligible. Due to the online nature of the study, individuals without access to the internet were not able to take part. Multiple methods were used to invite participants into CovidLife.

*Generation Scotland:* Generation Scotland ([www.generation-scotland.org](http://www.generation-scotland.org)) is a family-based health study in which 23,960 adults living in Scotland aged 18 to 100 years from 6,973 families were recruited between 2006 and 2011. Most Generation Scotland participants attended a clinic visit where biological samples were collected, physical measurements were taken, and participants completed cognitive function and mental health assessments. Prior to the clinic visit, participants answered a self-completion questionnaire assessing sociodemographic information, health and lifestyle. Participants consented to linkage with Scottish medical records. In 2015–2016, a subsample of 9,618 Generation Scotland participants took part in a detailed assessment of mental health and resilience as part of the Stratifying Resilience and Depression Longitudinally (STRADL) study.

Generation Scotland participants with a known email address (n = 9,030) were invited to take part in CovidLife. The email included a link to the CovidLife1 questionnaire. Postal invites were sent to Generation Scotland participants for whom no email address was known (n = 13,766).

**General public:** Traditional media (television and radio news programs), organic social media (Facebook, Twitter, and Instagram), and targeted social media (Facebook and Instagram) were used to advertise the study to the general public. In addition to general targeting, Facebook and Instagram were also used to specifically target recruitment of male participants, those who did not have at least a bachelor degree level qualification, and those aged 18–30 years. Specific targeting of these groups was used to try and make the sample more representative of the general population.

**Other research groups:** Researchers from the Aberdeen Children of the 1950s (ACONF) study shared the CovidLife1 questionnaire link with a subsample of their volunteers via social media and email. ACONF consists of 12,150 individuals born in Aberdeen between 1950 and 1956 who completed the Aberdeen Child Development Survey when in primary school and who have been followed up in adulthood.

Two health research registers were also used to recruit participants. The Scottish Health Research Register (SHARE) includes people aged 11 and over who are interested in taking part in health research in Scotland. SHARE emailed a total of 80,000 members of the register with information about the CovidLife study and a link to take part. We also used the North West London Health Research Register to advertise CovidLife. This register consists of adults aged 18 years and older living in North West London who consented to being contacted about health research opportunities. A total of 6,000 members of the North West London Health Research Register were sent emails inviting them to take part in CovidLife with two reminder emails sent in the following two weeks.

To start CovidLife1 potential participants use the questionnaire web link in either the email, letter, website, or social media post. Participants read through the Volunteer Information Sheet (VIS), and they gave their consent to taking part by ticking their agreement to each of the 8 consent statements (the VIS and consent are available in the Extended Data). Participants consented to be re-contacted to take part in future studies. Only after consenting were participants able to start the CovidLife1 questionnaire.

Data collection for CovidLife1 commenced on Friday 17th April 2020 and closed to new responses on Sunday 7th June 2020. Participants had 72 hours to complete CovidLife1 after starting it. For most of the time that CovidLife1 was open to participants, the four nations of the UK were under strict “stay at home” orders. The “stay at home” order was lifted in May (ranging from 10th May in England to 29th May in Scotland); however, restrictions remained in place, including limits on the number of people who could meet up outdoors, a ban on meeting people indoors, and the continued closure of non-essential businesses. A timeline of the COVID-19 restrictions during the each wave of CovidLife is available in the Extended data.

**CovidLife2.** Email addresses were available for 15,256 CovidLife1 participants. These participants were emailed an invite containing a personalised link to CovidLife2. The CovidLife2 questionnaire consisted of two sections: 1) a core section, containing many of the same questions asked in CovidLife1; and 2) an optional section, consisting of new topics. These new topics incorporated some suggested by participants in the free-text question at the end of CovidLife1. They included cancelled or postponed healthcare during COVID-19, cancelled events, changes to childcare responsibilities and home-schooling during COVID-19.

Data collection for CovidLife2 began on 21st July 2020 and closed on 16th August 2020. Participants had 7 days to complete CovidLife2 after starting. More time was given to completing CovidLife2 because participants were sent a personalised link which allowed them to partially complete the questionnaire, stop, and return later to their saved responses by clicking back on their personalised link. Participants who had not completed CovidLife2 were sent up to two reminder emails on 31st July 2020 (n = 7,483) and on 14th August 2020 (n = 5,063). CovidLife2 was carried out when the COVID-19 cases in the UK were relatively low, and the restrictions in place were less strict than during CovidLife1, though some local restrictions remained in place. Most people in the UK could meet up with a small number of individuals both outdoors and indoors, non-essential shops and restaurants were open, and travel restrictions had been lifted.
**CovidLife3.** All CovidLife1 participants who provided an email address were invited to participate in CovidLife3 (n = 15,192). Participants who did not complete CovidLife2 were still eligible to take part in CovidLife3. Slightly fewer participants were invited to CovidLife3 than were invited to CovidLife2 because some participants had inactive email addresses and others asked that we do not contact them again. The CovidLife3 invite email contained a personalised link to the CovidLife3 questionnaire.

Data collection for CovidLife3 began on 1st February 2021 and closed on 21st February 2021. Participants had 7 days to complete CovidLife3 after starting. A reminder email was sent to participants who had not responded to CovidLife3 between 12th February and 15th February 2021 (n = 6,340). CovidLife3 was carried out during another “stay at home” order, following a large increase in COVID-19 cases and deaths in the UK during December 2020 and January 2021.

**Ethical considerations**

The CovidLife study was reviewed and given a favourable opinion by the East of Scotland Research Ethics Committee (Reference: 20/ES/0021, AM02, AM04, AM05, AM11).

Participants read through the VIS and they gave their consent to taking part by ticking their agreement to each of eight consent statements (VIS and consent are available in the *Extended data*). Participants consented to be re-contacted to take part in future studies.

**Dataset description**

**Demographic characteristics**

**CovidLife1.** A total of 23,118 individuals clicked on the CovidLife1 questionnaire link and were recorded as a response in Qualtrics. The following responses were removed:

1. Responses collected before the official launch time of 11:45pm on 17th April 2020 (n = 160)
2. Responses who completed <8% of the questionnaire. Qualtrics saves responses on a given page only after the participant presses “Next”, therefore anyone who did not press “Next” on the first page of the questionnaire did not have any saved data (n = 4,006)
3. Participants who completed the questionnaire more than once were identified based on matching name and email address. Where there was >1 response per participant, the most complete or first response was retained and all others were removed (n = 380)
4. Participants aged under 18 years (n = 3)
5. Participants who did not answer any questions (n = 51).

Therefore, 18,518 participants make up the CovidLife sample. A flow chart of how we derived the CovidLife analytic sample is shown in Figure 1.

**Figure 2** shows the number of participants who completed CovidLife on any given day during recruitment. The large peak (n = 3,386) seen on 29th April 2020 corresponds to when SHARE invited 50,000 of their members to take part in CovidLife. Demographic and socioeconomic characteristics of CovidLife participants are reported in Table 3. The mean age of participants was 56.43 (SD = 14.35). Two-thirds were female (12,375 female, 6,016 male). The age distribution of the CovidLife sample grouped by sex is shown in Figure 3. There were more female than male participants at every age band until the mid-70s, when there were comparable, but low, numbers of male and female participants. Most participants were white (n = 16,960, 97.7%). Although CovidLife1 was open to anyone living in the UK, most (n = 16,995; 92.2%) reported living in Scotland, reflecting the use of mainly Scottish resources for recruitment (i.e., Generation Scotland, ACONF, and SHARE). The sample was highly educated, with over half (n = 8,730, 51.9%) reporting having an undergraduate degree.

For participants living in Scotland who provided a postcode, Scottish Index of Multiple Deprivation deciles were derived, which rank levels of deprivation based on the amount of employment, income, health, education, housing, access, and crime in the area where the participant lives4. Scottish participants tended to live in less deprived locations, with 22.7% (n = 3,834) living in the least deprived decile. Most Scottish participants lived in urban areas (large urban n = 7,474, 44.2%; other urban n = 3,903, 23.1%).

**CovidLife2.** In total, 11,552 participants clicked on the CovidLife2 questionnaire link. After removal of participants with <5% progress (the first point in the questionnaire where data is saved; n = 112), multiple responses from the same participants (n = 89), participants who had been removed from the CovidLife sample (n = 31), and participants who did not answer any questions (n = 1), data were available from 11,319 participants. This is 61.1% of all those in CovidLife1 and 74.2% of those invited to take part in CovidLife2. The demographic and socioeconomic characteristics of participants who took part in CovidLife2 are shown in Table 3. Generally, CovidLife2 participants were similar to CovidLife1 participants in terms of demographic and socioeconomic characteristics.

**CovidLife3.** A total of 10,593 participants clicked on the CovidLife3 questionnaire link. The following responses were removed: responses with <6% progress (the first point in the questionnaire where data is saved; n = 118), multiple responses from the same participant (n = 61), participants who were removed from the CovidLife sample (n = 26), and participants who did not answer any questions (n = 2). Therefore, data is available from 10,386 participants. This is 56.1% of those in CovidLife1, and 68.4% of those invited to CovidLife3. In total, 9,116 participants completed all three CovidLife questionnaires (49.2% of the CovidLife sample). The demographic and socioeconomic characteristics of participants who completed CovidLife3 are reported in Table 3.
Indicators of health
A range of general health and COVID-19-related health questions were included in CovidLife, and descriptive statistics for some of these reported at baseline are shown in Table 4. Most of the CovidLife sample reported very good (n = 7,435, 40.4%) or excellent (n = 3,053, 16.6%) general health. In total, 7.8% (n = 1,432) reported that they had been instructed to shield because they were at risk of serious illness from COVID-19. Participants self-reported whether they had a range of different physical and mental health conditions (Table 4). One-fifth (n = 3,681, 20.2%) of participants reported having hypertension, 12.6% (n = 2,300) reported asthma, and 6.3% (n = 1,156) reported having type 2 diabetes. Nearly one-quarter (n = 4,293, 23.6%) reported having depression and 16.2% (n = 2,955) reported having anxiety.

Social and psychological measures
A range of social and psychological measures were included in CovidLife. Current anxiety and depressive symptoms were assessed in all three questionnaires using the Generalised Anxiety Disorder 7-item scale (score range = 0–21) and Patient Health Questionnaire 9-item scale (score range = 0–27), respectively. Subjective well-being, which was assessed using the 7-item Short Warwick-Edinburgh Mental Well-being Scale (score range = 7–35), was also measured in all questionnaires. Current life satisfaction, isolation and loneliness

Figure 1. CovidLife participant flow chart.
Figure 2. Completion dates for (a) CovidLife1, (b) CovidLife2, and (c) CovidLife3.
Table 3. Demographic and socioeconomic characteristics reported at baseline for participants in CovidLife1, CovidLife2 and CovidLife3.

|                          | Full sample (n = 18518) | CovidLife2 (n = 11319) | CovidLife3 (n = 10386) |
|--------------------------|-------------------------|------------------------|------------------------|
|                          | N (%) with data         | N (%) or Mean (SD)     | N (%) with data         | N (%) or Mean (SD)     | N (%) with data         | N (%) or Mean (SD)     |
| Age in years, mean (SD)  | 18308 (98.9%)           | 56.43 (14.35)          | 11296 (99.8%)           | 58.57 (13.25)          | 10358 (99.7%)           | 58.99 (12.90)          |
| Age categories, n (%)    | 18308 (98.9%)           | 11296 (99.8%)          | 10358 (99.7%)           |                        |                        |                        |
| 18 to 29 years           | 987 (5.4%)              | 373 (3.3%)             | 287 (2.8%)              |                        |                        |                        |
| 30 to 39 years           | 1798 (9.8%)             | 820 (7.3%)             | 719 (6.9%)              |                        |                        |                        |
| 40 to 49 years           | 2567 (14.0%)            | 1379 (12.2%)           | 1241 (12.0%)            |                        |                        |                        |
| 50 to 59 years           | 4054 (22.1%)            | 2558 (22.6%)           | 2309 (22.3%)            |                        |                        |                        |
| 60 to 69 years           | 5528 (30.2%)            | 3846 (34.0%)           | 3649 (35.2%)            |                        |                        |                        |
| 70 to 79 years           | 2994 (16.4%)            | 2072 (18.3%)           | 1931 (18.6%)            |                        |                        |                        |
| 80 years and older       | 380 (2.1%)              | 248 (2.2%)             | 222 (2.1%)              |                        |                        |                        |
| Sex, n (%)               | 18422 (99.5%)           | 11319 (100.0%)         | 10386 (100.0%)          |                        |                        |                        |
| Female                   | 12375 (67.2%)           | 7601 (67.2%)           | 6954 (67.0%)            |                        |                        |                        |
| Male                     | 6016 (32.7%)            | 3706 (32.7%)           | 3424 (33.0%)            |                        |                        |                        |
| Prefer not to answer     | 31 (0.2%)               | 12 (0.1%)              | 8 (0.1%)                |                        |                        |                        |
| Gender¹, n (%)           | 16452 (88.8%)           | 9936 (87.8%)           | 9127 (87.9%)            |                        |                        |                        |
| Female                   | 10815 (65.7%)           | 6516 (65.6%)           | 5978 (65.5%)            |                        |                        |                        |
| Male                     | 5542 (33.7%)            | 3378 (34.0%)           | 3113 (34.1%)            |                        |                        |                        |
| Non-binary               | 38 (0.2%)               | 18 (0.2%)              | 17 (0.2%)               |                        |                        |                        |
| Prefer not to answer     | 57 (0.3%)               | 24 (0.2%)              | 19 (0.2%)               |                        |                        |                        |
| Country, n (%)           | 18423 (99.5%)           | 11319 (100.0%)         | 10386 (100.0%)          |                        |                        |                        |
| Scotland                 | 16995 (92.2%)           | 10740 (94.9%)          | 9883 (95.2%)            |                        |                        |                        |
| England                  | 1312 (7.1%)             | 532 (4.7%)             | 467 (4.5%)              |                        |                        |                        |
| Wales                    | 42 (0.2%)               | 23 (0.2%)              | 23 (0.2%)               |                        |                        |                        |
| Northern Ireland         | 41 (0.2%)               | 19 (0.2%)              | 12 (0.2%)               |                        |                        |                        |
| Elsewhere                | 33 (0.2%)               | 5 (0.04%)              | 1 (0.01%)               |                        |                        |                        |
| Ethnicity, n (%)         | 17354 (93.7%)           | 11094 (98.0%)          | 10167 (97.9%)           |                        |                        |                        |
| White                    | 16960 (97.7%)           | 10925 (98.5%)          | 10019 (98.5%)           |                        |                        |                        |
| Asian                    | 124 (0.7%)              | 39 (0.4%)              | 33 (0.3%)               |                        |                        |                        |
| Black                    | 22 (0.1%)               | 4 (0.04%)              | 1 (0.01%)               |                        |                        |                        |
| Arab                     | 7 (0.04%)               | 1 (0.01%)              | 2 (0.02%)               |                        |                        |                        |
| Mixed                    | 105 (0.6%)              | 50 (0.5%)              | 45 (0.4%)               |                        |                        |                        |
| Other                    | 43 (0.2%)               | 21 (0.2%)              | 16 (0.2%)               |                        |                        |                        |
| Prefer not to answer     | 93 (0.5%)               | 54 (0.5%)              | 51 (0.5%)               |                        |                        |                        |
|                        | Full sample (n = 18518) | CovidLife2 (n = 11319) | CovidLife3 (n = 10386) |
|------------------------|-------------------------|------------------------|------------------------|
| **Education, n (%)**   | 16805 (90.7%)           | 10754 (95.0%)          | 9867 (95.0%)           |
| Undergraduate degree   | 8730 (51.9%)            | 5627 (52.3%)           | 5121 (51.9%)           |
| No undergraduate degree| 8075 (48.1%)            | 5127 (47.7%)           | 4746 (48.1%)           |
| **Employment status at baseline, n (%)** | 14473 (78.2%) | 9171 (81.0%) | 8359 (80.5%) |
| Employed               | 6937 (47.9%)            | 4146 (45.2%)           | 3670 (43.9%)           |
| Self-employed          | 981 (6.8%)              | 596 (6.5%)             | 551 (6.6%)             |
| Retired                | 4469 (30.9%)            | 3246 (35.4%)           | 3046 (36.4%)           |
| Other                  | 2086 (14.4%)            | 1183 (12.9%)           | 1092 (13.1%)           |
| **SIMD deciles2, n (%)** | 16915 (91.3%) | 10726 (94.8%) | 9873 (95.1%) |
| 1 – most deprived      | 504 (3.0%)              | 226 (2.1%)             | 201 (2.0%)             |
| 2                      | 713 (4.2%)              | 387 (3.6%)             | 344 (3.5%)             |
| 3                      | 861 (5.1%)              | 521 (4.9%)             | 498 (5.0%)             |
| 4                      | 1139 (6.7%)             | 693 (6.5%)             | 632 (6.4%)             |
| 5                      | 1302 (7.7%)             | 790 (7.4%)             | 717 (7.3%)             |
| 6                      | 1558 (9.2%)             | 1002 (9.3%)            | 886 (9.0%)             |
| 7                      | 2045 (12.1%)            | 1344 (12.5%)           | 1203 (12.2%)           |
| 8                      | 2384 (14.1%)            | 1537 (14.3%)           | 1395 (14.1%)           |
| 9                      | 2575 (15.2%)            | 1674 (15.6%)           | 1591 (16.1%)           |
| 10 – least deprived    | 3834 (22.7%)            | 2552 (23.8%)           | 2406 (24.4%)           |
| **SIMD Urban Rural Classification, n (%)** | 16915 (91.3%) | 10726 (94.8%) | 9873 (95.1%) |
| Large Urban            | 7474 (44.2%)            | 4548 (42.4%)           | 4218 (42.7%)           |
| Other Urban            | 3903 (23.1%)            | 2544 (23.7%)           | 2407 (24.4%)           |
| Accessible Small Towns | 1411 (8.3%)             | 957 (8.9%)             | 897 (9.1%)             |
| Remote Small Towns     | 440 (2.6%)              | 275 (2.6%)             | 256 (2.6%)             |
| Accessible Rural       | 2832 (16.7%)            | 1851 (17.3%)           | 1622 (16.4%)           |
| Remote Rural           | 855 (5.1%)              | 551 (5.1%)             | 473 (4.8%)             |

1Question added to questionnaire on 21st April 2020. 2Only available for participants providing Scottish postcode
SIMD, Scottish Index of Multiple Deprivation.
were each assessed using a single item in all questionnaires. Participants were asked to rate how satisfied with life they were using an 11-point scale from (0) “not at all satisfied” to (10) “extremely satisfied”. To measure isolation, participants were asked to indicate how much they felt isolated from others on an 11-point scale from (0) “not at all” to (10) “a lot”. Loneliness was assessed by asking participants how lonely they felt during the past week. Participants selected one of four options, ranging from “none or almost none of the time” to “all, or almost all of the time”. To estimate pre-pandemic life satisfaction, loneliness and isolation, CovidLife1 also asked participants to report how satisfied with life, how lonely and how isolated they felt “before COVID-19 measures were introduced (i.e., January 2020)”. In each questionnaire, a four-option question was used to assess how often participants had felt nervous or stressed because of COVID-19 in the last two weeks (ranging from none to all of the time). Perceived stress was measured in CovidLife2 and CovidLife3 using the 4-item version of the Perceived Stress Scale (score range = 0–16).

**Figure 3.** Age distribution of (a) CovidLife participants, and (b) Generation Scotland participants who took part in CovidLife, grouped by sex.
Table 4. Self-reported health variables reported at baseline.

|                                | Full sample (n = 18518) | Generation Scotland (n = 4847) |
|--------------------------------|-------------------------|--------------------------------|
|                                | N (%) with data         | N (%) or Mean (SD)             | N (%) with data | N (%) or Mean (SD) |
| General health, n (%)          | 18424 (99.5%)           | 4847 (100.0%)                  |
| Excellent                      | 3053 (16.6%)            | 966 (19.9%)                    |
| Very good                      | 7435 (40.4%)            | 2248 (46.4%)                   |
| Good                            | 5162 (28.0%)            | 1219 (25.1%)                   |
| Fair                            | 2101 (11.4%)            | 337 (7.0%)                     |
| Poor                            | 673 (3.7%)              | 77 (1.6%)                      |
| Instructed to shield, n (%)    | 18418 (99.5%)           | 4847 (100.0%)                  |
| Yes                             | 1432 (7.8%)             | 208 (4.3%)                     |
| No                              | 16986 (92.2%)           | 4639 (95.7%)                   |
| COVID-19 status, n (%)         | 18207 (98.3%)           | 4823 (99.5%)                   |
| Positive test                   | 70 (0.4%)               | 12 (0.2%)                      |
| Suspected                       | 1871 (10.3%)            | 375 (7.8%)                     |
| No                              | 16266 (89.3%)           | 4436 (92.0%)                   |
| BMI, mean (SD)                 | 18159 (98.1%)           | 4814 (99.3%)                   |
| Current smoker                 | 1317 (7.4%)             | 259 (5.4%)                     |
| Former smoker                  | 5468 (30.8%)            | 1499 (31.5%)                   |
| Never smoker                   | 10944 (61.7%)           | 3002 (63.1%)                   |
| Asthma                          | 18231 (98.5%)           | 4825 (99.5%)                   |
| COPD                            | 18231 (98.5%)           | 4825 (99.5%)                   |
| Chronic heart disease          | 18231 (98.5%)           | 4825 (99.5%)                   |
| Type 1 diabetes                | 18231 (98.5%)           | 4825 (99.5%)                   |
| Type 2 diabetes                | 18231 (98.5%)           | 4825 (99.5%)                   |
| Hypertension                   | 18231 (98.5%)           | 4825 (99.5%)                   |
| Anxiety                         | 18217 (98.4%)           | 4819 (99.4%)                   |
| Depression                     | 18217 (98.4%)           | 4819 (99.4%)                   |
| Panic attacks                  | 18217 (98.4%)           | 4819 (99.4%)                   |

*Calculated using self-reported height and weight.

COPD, Chronic Obstructive Pulmonary Disease. BMI, Body Mass Index.

Health literacy, resilience, and the personality traits extraversion, conscientiousness, and emotional stability were measured once. Health literacy – the ability to understand and process health information – was measured using a 10-item self-report scale (score range = 10–40). The 6-item Brief Resilience Scale (score range = 1–6) was administered in CovidLife2 to measure a participant’s ability to bounce back after an adverse event. Thirty questions from the 50-item IPIP were used to...
measure personality. Ten-items each were used to assess extraversion, consciousness, and emotional stability (score range for each personality trait = 10–50).

Summary statistics for these social and psychological variables measured in CovidLife1, CovidLife2 and CovidLife3 are reported in Table 5 and Table 6.

**Generation Scotland subsample**

Of the 18,518 participants who make up the CovidLife sample, 4,847 (26.2%) were members of the Generation Scotland cohort. The demographic and socioeconomic characteristics of the Generation Scotland subsample are reported in Table 7, and health characteristics are reported in Table 4. The age distribution grouped by sex is shown in Figure 3. The age distribution for the Generation Scotland subsample was slightly older than for the CovidLife sample owing to the fact that Generation Scotland participants were all aged over 18 at recruitment (2006–2011). For this subsample, researchers can link CovidLife responses with a wealth of data collected in Generation Scotland. The number and percentage of the CovidLife sample with different types of linkable Generation Scotland data is reported in Table 8.

The Generation Scotland baseline assessment (2006–2011) consisted of a pre-clinical questionnaire and a clinic visit.

The pre-clinical questionnaire collected information on socio-demographic characteristics, medical history, family history, mood, and health behaviours. During the clinic visit, physical measurements including height, weight, blood pressure, and ankle-brachial pressure index were taken. Psychological measurements included tests of cognitive function, personality, psychological distress, and screening for emotional and psychiatric problems using the structured clinical interview for the Diagnostic and Statistical Manual IV disorders. Biological samples were also collected. A total of 4,739 (25.6%) CovidLife participants had data collected as part of the Generation Scotland baseline clinical assessment.

Samples collected during the Generation Scotland baseline have been used to derive genotype and DNA methylation data. A total of 4,359 (23.5%) CovidLife participants have genotype data and 2,701 (14.6%) currently have DNA methylation data available. At the time of writing, DNA methylation data is being processed for approximately 10,000 additional Generation Scotland participants, and proteomic data will also be available on a sub-sample of Generation Scotland participants in the future.

Most Generation Scotland participants consented to their study data being linked with Scottish medical records, using their Community Health Index numbers. Generation Scotland study

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**Table 5. Descriptive statistics (mean and standard deviation) for psychological and social variables.**

|                      | CovidLife1 (n = 18518) |                      |                      |                      |                      |
|----------------------|------------------------|----------------------|----------------------|----------------------|----------------------|
|                      | N (%) with data        | N (%) with data      | N (%) with data      | N (%) with data      | N (%) with data      |
|                      | N                    | %                    | Mean                 | SD                   | N                    | %                    | Mean                 | SD                   | N                    | %                    | Mean                 | SD                   |
| GAD-7                | 16728 (90.3%)         | 4.79 (5.26)          | 10634 (93.9%)        | 3.65 (4.66)          | 9613 (92.6%)         | 4.67 (5.16)          |
| PHQ-9                | 16391 (88.5%)         | 5.29 (5.60)          | 10434 (92.2%)        | 4.54 (5.20)          | 9444 (90.9%)         | 5.69 (5.67)          |
| SWEMWBS              | 17712 (95.6%)         | 24.23 (8.00)         | -                    | -                    | 11112 (98.2%)        | 24.81 (8.44)         |
| Extraversion         | 17528 (94.7%)         | 30.58 (8.00)         | -                    | -                    | -                    | -                    |
| Conscientiousness    | 17461 (94.3%)         | 37.85 (6.16)         | -                    | -                    | -                    | -                    |
| Emotional stability  | 17530 (94.7%)         | 33.55 (8.44)         | -                    | -                    | -                    | -                    |
| Health literacy      | 17483 (94.4%)         | 37.69 (2.78)         | -                    | -                    | -                    | -                    |
| Life satisfaction:   | 17739 (95.8%)         | 7.90 (1.80)          | -                    | -                    | -                    | -                    |
| Before COVID-19      |                        |                      |                      |                      |                      |                      |
| Life satisfaction:   | 17737 (95.8%)         | 5.81 (2.46)          | 11137 (98.4%)        | 6.71 (2.17)          | 10174 (98.0%)        | 5.76 (2.35)          |
| Now                  | 17806 (96.2%)         | 1.60 (2.45)          | -                    | -                    | -                    | -                    |
| Isolation: Before   | 17806 (96.2%)         | 6.17 (3.10)          | 11192 (98.9%)        | 3.61 (2.96)          | 10220 (98.4%)        | 5.59 (2.92)          |
| COVID-19             |                        |                      |                      |                      |                      |                      |
| Isolation: Now       | 17806 (96.2%)         | 6.17 (3.10)          | 11192 (98.9%)        | 3.61 (2.96)          | 10220 (98.4%)        | 5.59 (2.92)          |
| Perceived Stress     | -                     | -                    | 11159 (98.6%)        | 5.01 (3.20)          | 10207 (98.3%)        | 5.41 (3.20)          |
| Scale                |                        |                      |                      |                      |                      |                      |
| Brief Resilience     | -                     | -                    | 11136 (98.4%)        | 3.56 (0.82)          | -                    | -                    |

GAD-7, Generalised Anxiety Disorder 7-item questionnaire; PHQ-9, Patient Health Questionnaire 9-item version; SWEMWBS, Short Warwick-Edinburgh Mental Well-being Scale.
Table 6. Descriptive statistics (n and percent) for psychological and social variables.

|                          | CovidLife1 (n = 18518) |                              | CovidLife2 (n = 11319) |                              | CovidLife3 (n = 10386) |                              |
|--------------------------|------------------------|------------------------------|------------------------|------------------------------|------------------------|------------------------------|
|                          | N (%) with data        | N (%)                       | N (%) with data        | N (%)                       | N (%) with data        | N (%)                       |
| **GAD-7**                | 16728 (90.3%)          |                              | 10634 (93.9%)          |                              | 9613 (92.6%)            |                              |
| None to Mild             | 13881 (83.0%)          |                              | 9444 (88.8%)           |                              | 8025 (83.5%)            |                              |
| Moderate to Severe       | 2847 (17.0%)           |                              | 1190 (11.2%)           |                              | 1588 (16.5%)            |                              |
| **PHQ-9**                | 16391 (88.5%)          |                              | 10434 (92.2%)          |                              | 9444 (90.9%)            |                              |
| None to Mild             | 13283 (81.0%)          |                              | 8933 (85.6%)           |                              | 7537 (79.8%)            |                              |
| Moderate to Severe       | 3108 (19.0%)           |                              | 1501 (14.4%)           |                              | 1907 (20.2%)            |                              |
| **Loneliness: Before COVID-19** | 17752 (95.9%)     |                              | -                      | -                            | -                      | -                            |
| None or almost none of the time | 13626 (76.8%)    |                              | -                      | -                            | -                      | -                            |
| Some of the time         | 3813 (21.5%)           |                              | -                      | -                            | -                      | -                            |
| Most of the time         | 240 (1.4%)             |                              | -                      | -                            | -                      | -                            |
| All or almost all of the time | 73 (0.4%)            |                              | -                      | -                            | -                      | -                            |
| **Loneliness: Now**      | 17767 (95.9%)          | 11164 (98.6%)                | 10198 (98.2%)          |                              |                          |                              |
| None or almost none of the time | 10109 (56.9%)      |                              | 7980 (71.5%)           |                              | 6034 (59.2%)            |                              |
| Some of the time         | 6056 (34.1%)           |                              | 2708 (24.3%)           |                              | 3458 (33.9%)            |                              |
| Most of the time         | 1097 (6.2%)            |                              | 334 (3.0%)             |                              | 504 (4.9%)              |                              |
| All or almost all of the time | 505 (2.8%)           |                              | 142 (1.3%)             |                              | 202 (2.0%)              |                              |
| **Stress because of COVID-19** | 17803 (96.1%)     | 11155 (98.6%)                | 10188 (98.1%)          |                              |                          |                              |
| Never                   | 4937 (27.7%)           | 4524 (40.6%)                 | 3331 (32.7%)           |                              |                          |                              |
| Some of the time         | 10548 (59.2%)          | 5968 (53.5%)                 | 5766 (56.6%)           |                              |                          |                              |
| Most of the time         | 1884 (10.6%)           | 564 (5.1%)                   | 908 (8.9%)             |                              |                          |                              |
| All of the time          | 434 (2.4%)             | 99 (0.9%)                    | 183 (1.8%)             |                              |                          |                              |

GAD-7, Generalised Anxiety Disorder 7-item questionnaire; PHQ-9, Patient Health Questionnaire 9-item version
### Table 7. Demographic and socioeconomic characteristics reported at baseline for Generation Scotland participants in CovidLife.

|                          | N (%) with data | N (%) or Mean (SD) |
|--------------------------|-----------------|-------------------|
| **Age in years, mean (SD)** | 4844 (99.9%) | 59.44 (12.12) |
| **Age categories, n (%)** | 4844 (99.9%) |                  |
| 18 to 29 years           | 43 (0.9%)      |                  |
| 30 to 39 years           | 362 (7.5%)     |                  |
| 40 to 49 years           | 595 (12.3%)    |                  |
| 50 to 59 years           | 1107 (22.9%)   |                  |
| 60 to 69 years           | 1706 (35.2%)   |                  |
| 70 to 79 years           | 959 (19.8%)    |                  |
| 80 years and older       | 72 (1.5%)      |                  |
| **Sex, n (%)**           | 4847 (100.0%)  |                  |
| Female                   | 3060 (63.1%)   |                  |
| Male                     | 1787 (36.9%)   |                  |
| Prefer not to answer     | 0 (0.0%)       |                  |
| **Gender, n (%)**        | 4081 (84.2%)   |                  |
| Female                   | 2556 (62.6%)   |                  |
| Male                     | 1521 (37.3%)   |                  |
| Non-binary               | 2 (0.05%)      |                  |
| Prefer not to answer     | 2 (0.05%)      |                  |
| **Country of residence, n (%)** | 4846 (100.0%) |                  |
| Scotland                 | 4816 (99.4%)   |                  |
| England                  | 23 (0.5%)      |                  |
| Wales                    | 1 (0.02%)      |                  |
| Northern Ireland         | 1 (0.02%)      |                  |
| Elsewhere                | 5 (0.1%)       |                  |
| **Ethnicity, n (%)**     | 4707 (97.1%)   |                  |
| White                    | 4663 (99.1%)   |                  |
| Asian                    | 11 (0.2%)      |                  |
| Black                    | 1 (0.02%)      |                  |
| Arab                     | 1 (0.02%)      |                  |
| Mixed                    | 16 (0.3%)      |                  |
| Other                    | 3 (0.1%)       |                  |
| Prefer not to answer     | 12 (0.3%)      |                  |
| **Education, n (%)**     | 4532 (93.5%)   |                  |
| Undergraduate degree     | 2154 (47.5%)   |                  |
| No undergraduate degree  | 2378 (52.5%)   |                  |
| Employment status  | N (%) with data | N (%) or Mean (SD) |
|-------------------|----------------|------------------|
| Employed          | 3812 (78.6%)   |                  |
| Self-employed     | 1780 (46.7%)   | 314 (8.2%)       |
| Retired           | 1314 (34.5%)   |                  |
| Other             | 404 (10.6%)    |                  |

| SIMD deciles, n (%) | N (%) with data | N (%) or Mean (SD) |
|---------------------|----------------|------------------|
| 1 – most deprived   | 152 (3.1%)     |                  |
| 2                   | 195 (4.0%)     |                  |
| 3                   | 203 (4.2%)     |                  |
| 4                   | 278 (5.7%)     |                  |
| 5                   | 354 (7.3%)     |                  |
| 6                   | 398 (8.2%)     |                  |
| 7                   | 602 (12.4%)    |                  |
| 8                   | 773 (15.9%)    |                  |
| 9                   | 842 (17.4%)    |                  |
| 10 – least deprived | 1050 (21.7%)   |                  |

| SIMD Urban Rural Classification, n (%) | N (%) with data | N (%) or Mean (SD) |
|---------------------------------------|----------------|------------------|
| Large Urban                           | 2359 (48.7%)   |                  |
| Other Urban                           | 1059 (21.8%)   |                  |
| Accessible Small Towns                | 319 (6.6%)     |                  |
| Remote Small Towns                    | 74 (1.5%)      |                  |
| Accessible Rural                      | 871 (18.0%)    |                  |
| Remote Rural                          | 165 (3.4%)     |                  |

1Question added to questionnaire on 21st April 2020.
SIMD, Scottish Index of Multiple Deprivation.

**Table 8. Number and percentage of CovidLife participants with different types of linkable Generation Scotland data.**

| Data Type                                      | N   | %    |
|-----------------------------------------------|-----|------|
| Detailed phenotyping at baseline (2006–2011)  | 4739| (25.6%)|
| Linkage with Scottish medical records         | 4845| (26.2%)|
| Genotype data                                 | 4359| (23.5%)|
| DNA methylation data                          | 2701| (14.6%)|
| STRADL mental health questionnaire (2015–2016)| 4031| (21.8%)|
| STRADL clinic visit (2015–2016)               | 634 | (3.4%)|

CHI, Community Health Index; STRADL, Stratifying Resilience and Depression Longitudinally.
data has been linked with a range of different routinely collected health datasets, including morbidity records (SMR 01, 02, 04, 06, 11), GP records, death records, prescribing data, and routine lab tests. This includes regular updates on COVID-19 testing, diagnoses and vaccination records. Data from 4,845 (26.2%) CovidLife participants can be linked with medical records.

In the 2015–2016 Generation Scotland mental health follow-up study (STRADL), a subsample of Generation Scotland participants were sent a questionnaire assessing demographic information, medical history, resilience, self-reported psychiatric symptoms, psychological distress, threatening experiences, and coping strategies. In total, 4,031 (21.8%) CovidLife participants completed the STRADL questionnaire. Some of these participants also attended a STRADL clinic visit, where participants underwent brain magnetic resonance imaging, blood samples were collected, and tests of mental health and cognitive functioning were administered. In total, 634 (3.4%) CovidLife participants attended the STRADL clinic visit.

More detailed information on the measures collected in Generation Scotland and STRADL are available elsewhere. Strengths and limitations

CovidLife has a number of strengths, one being the size of the cohort, which stands at over 18,000 participants. The cohort is well characterised, including the collection of demographic, health, social, psychological, and economic information. COVID-19 specific information on infections, symptoms, compliance and opinions of the handling of COVID-19 in the UK was also collected. In particular, this study included many psychological measures, most of which have been assessed on three occasions throughout the COVID-19 pandemic. This means that CovidLife can be used to understand how people were feeling and behaving early in the COVID-19 pandemic, and how this has changed over time.

Three waves of CovidLife have been carried out, and these waves coincide with important milestones in the COVID-19 pandemic in the UK (see the CovidLife timeline in Extended data). CovidLife1 was carried out during the first UK “stay at home” order shortly after COVID-19 cases had peaked (in wave 1) in the UK. CovidLife2 took place when the rates of COVID-19 infections and deaths were relatively low and restrictions had eased considerably. During this time, most people living in the UK were able to meet up with family and friends both outdoors and indoors, though some places were under tighter local restrictions. Many people had returned to work, cafés, restaurants and retail were open, and schools were planning to fully reopen after the summer holidays.

COVID-19 cases and deaths began to rise in autumn and winter 2020, and another stay at home order was implemented in all four UK nations by 4th January, 2021. COVID-19 cases peaked in early January 2021. CovidLife3 data collection took place in February 2021 during this stay at home order. COVID-19 cases and deaths were higher in this period of lockdown compared to the first. However, the UK mass COVID-19 vaccination programme began on 8th December 2020 and was well underway during the second lockdown. By collecting data during these important milestones in the COVID-19 pandemic, CovidLife can be used to understand the health, well-being and behaviour of people in the UK, and how these change as the restrictions have eased and tightened, and as individual circumstances have changed throughout the pandemic.

The ability to link responses with data collected in Generation Scotland for 4,847 participants is one of the key advantages of CovidLife. Responses can be linked with a wide range of demographic, health, and lifestyle information, collected many years before the pandemic. Genetic and biological sample data can also be linked with responses. Importantly, CovidLife responses can be linked with medical records. Regular releases of NHS Scotland health record data make it possible to examine both retrospective and prospective associations with health outcomes.

The CovidLife questionnaires were designed to harmonise with other research studies in the UK and around the world. Many of the measures included in the CovidLife study align with those used in other longitudinal population health studies. Subsequently, it has been possible to collaborate with other research groups to investigate the mental health impact of COVID-19. Using data from CovidLife and the Avon Longitudinal Study of Parents and Children, anxiety and depression during the early stages of the pandemic were found to be greater in young participants, women, those with pre-existing physical and mental health conditions, and those with lower socioeconomic status. A recent pre-print combined the results from 12 longitudinal studies (n = 59,482), including the Generation Scotland subsample of CovidLife, to test whether pre-pandemic psychological distress was associated with healthcare, economic, and housing disruption during the COVID-19 pandemic. Higher pre-pandemic psychological distress was associated with increased odds of healthcare disruption, loss of employment and income, and reduced working hours or being furloughed, but it was not associated with housing disruption during the pandemic. Another pre-print using data from over 65,000 individuals in 12 longitudinal studies, including CovidLife, found that healthcare disruption during COVID-19 was greater in female participants, older people, ethnic minorities, and those from more disadvantaged social classes.

There are some limitations to CovidLife. Questionnaires were administered online and therefore this study was restricted to those with internet access. The sample consists mostly of people who have previously shown interest in health research, either by being a member of a health study or by signing up to a health research register. Therefore the sample was not fully representative of those living in the UK, and consisted mostly of participants who were relatively highly educated, white, and from less deprived areas. Although there was a large number of Scottish participants, the other three nations of the UK were less well represented. Like all longitudinal
studies, CovidLife suffers from attrition. In total, 49.2% of those in CovidLife1 completed all three CovidLife questionnaires. Due to these limitations, any conclusions drawn from CovidLife data may not generalise to all groups in society.

To conclude, the CovidLife study allows us to understand: 1) the mental health, well-being and behaviour of people living in the UK during the COVID-19 pandemic; 2) how these vary according to demographic, health and economic circumstances; and 3) how mental health, well-being and behaviour change over time as the COVID-19 pandemic progresses and as mitigation measures ease and tighten. The subsample of Generation Scotland participants in CovidLife enables the investigation of both pre-pandemic predictors of health and well-being during COVID-19 and the long-term health consequences of the pandemic. Researchers can apply to access the CovidLife and Generation Scotland data to investigate the determinants, correlates, and consequences of health and well-being during COVID-19.

Data availability

Underlying data
CovidLife and Generation Scotland data are available to researchers through managed access. Non-identifiable data will be made available to approved researchers in the UK and internationally.

Researchers wanting to access the CovidLife data can apply using the CovidLife Access Request Form, available in the Extended data. Once completed, this form should be emailed to access@generationscotland.org.

Researchers wanting to link CovidLife data with Generation Scotland data can apply for access to the Generation Scotland data using the standard Generation Scotland Access Request Form, available in the Extended data. Once completed, this form should be emailed to access@generationscotland.org.

Up to date information about how to apply to access CovidLife and Generation Scotland data is available on the Generation Scotland website: http://www.generationscotland.org/for-researchers/access

Generation Scotland’s withdrawal policy allows participants to request that their data no longer be available for research. Therefore when data is released, the sample size for CovidLife and Generation Scotland may vary slightly than that reported here.

Extended data

Zenodo: Extended Data for “CovidLife: A resource to understand mental health, well-being and behaviour during the COVID-19 pandemic in the UK”. https://doi.org/10.5281/zenodo.4967815

The project contains the following extended data:
- 2021-06-15_CovidLife1_Questionnaire.docx (CovidLife1 questionnaire)
- 2021-06-15_CovidLife2_Questionnaire.docx (CovidLife2 questionnaire)
- 2021-06-15_CovidLife3_Questionnaire.docx (CovidLife3 questionnaire)
- 2021-06-17_CovidLife_VIS_Consent.docx (CovidLife volunteer information sheet and consent form)
- 2021-06-17_CovidLife_Timeline_v1.0.tiff (Timeline of the COVID-19 restrictions in the UK during CovidLife data collection)
- CovidLife_Access_Request_Form_V3.1_March_2021.docx (CovidLife Data Access Request Form)
- Generation_Scotland_Access_Request_Form_V1.2_March_2021.docx (Generation Scotland Data Access Request Form)
- 2021-06-17_STROBE_checklist_CovidLife_DataNote_v1.0.docx (Completed STROBE checklist)

Data are available under the terms of the Creative Commons Attribution 4.0 International license (CC-BY 4.0).

Acknowledgements

We thank the participants who took part in the CovidLife study.

Recruitment to this study was facilitated by SHARE - the Scottish Health Research Register and Biobank. SHARE is supported by NHS Research Scotland, the Universities of Scotland and the Chief Scientist Office of the Scottish Government.

SHARE also facilitated a link to the North West London Health Research Register, who emailed register members to inform them about CovidLife. The North West London Health Research Register is designed to empower more patients and members of the public to take part in health research. It consists of any adults (18 and over) living in North West London who have consented to be contacted about health research opportunities relevant to them and enabled by Discover-NOW, Health Data Research Hub for Real World Evidence, hosted by Imperial College Health Partners.

Generation Scotland recruited approximately 600 participants from the ACONF cohort (https://www.abdn.ac.uk/birth-cohorts/1950s/) in 2011 and, for this study ACONF investigators alerted remaining members by email and Facebook about the CovidLife study.
References

1. Davies NG, Kucharski AJ, Eggo RM, et al.: Effects of non-pharmaceutical interventions on COVID-19 cases, deaths, and demand for hospital services in the UK: a modelling study. Lancet Public Health. 2020; 5(7): e375-e85. PubMed Abstract | Publisher Full Text | Free Full Text

2. Flaxman S, Mishra S, Gandy A, et al.: Estimating the effects of non-pharmaceutical interventions on COVID-19 in Europe. Nature. 2020; 584(7820): 257-61. PubMed Abstract | Publisher Full Text

3. Keep mental health in mind. Nat Med. 2020; 26(5): 631. PubMed Abstract | Publisher Full Text | Free Full Text

4. Holmes EA, O'Connor RC, Perry VH, et al.: Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. Lancet Psychiatry. 2020; 7(6): 547-560. PubMed Abstract | Publisher Full Text | Free Full Text

5. Daly M, Sutin AR, Robinson E: Longitudinal changes in mental health and the COVID-19 pandemic: evidence from the UK Household Longitudinal Study. Psychol Med. 2020; 1-10. PubMed Abstract | Publisher Full Text | Free Full Text

6. Niedzwiedz CL, Green MJ, Benzeval M, et al.: Mental health and health behaviours before and during the initial phase of the COVID-19 lockdown: longitudinal analyses of the UK Household Longitudinal Study. J Epidemiol Community Health. 2021; 75(3): 224-31. PubMed Abstract | Publisher Full Text | Free Full Text

7. Kwong ASF, Pearson RM, Adams MJ, et al.: Mental health before and during the COVID-19 pandemic in two longitudinal UK population cohorts. Br J Psychiatry. 2020; 1-10. PubMed Abstract | Publisher Full Text | Free Full Text

8. Pierce M, Hope H, Ford T, et al.: Mental health before and during the COVID-19 pandemic: a longitudinal probability sample survey of the UK population. Lancet Psychiatry. 2020; 7(10): 883-892. PubMed Abstract | Publisher Full Text | Free Full Text

9. Prati G, Mancini AD: The psychological impact of COVID-19 pandemic lockdowns: a review and meta-analysis of longitudinal studies and natural experiments. Psychol Med. 2021; 51(2): 201-211. PubMed Abstract | Publisher Full Text | Free Full Text

10. Bu F, Stepnose A, Fancourt D: Loneliness during lockdown: trajectories and predictors during the COVID-19 pandemic in 35,712 adults in the UK. medRxiv. 2020. Publisher Full Text

11. Frank P, Job E, Stepnose A, et al.: Trajectories of depressive symptoms among vulnerable groups in the UK during the COVID-19 pandemic, medRxiv. 2020. Publisher Full Text

12. Gallagher S, Wetherell MA: Risk of depression in family caregivers: unintended consequence of COVID-19. BJPsych Open. 2020; 6(5): e119. PubMed Abstract | Publisher Full Text | Free Full Text

13. Cheng Z, Mendola S, Paloyo AR, et al.: Working parents, financial insecurity, and childcare: mental health in the time of COVID-19 in the UK. Rev Econ Humanit. 2021; 1-22. PubMed Abstract | Publisher Full Text | Free Full Text

14. Smith BH, Campbell A, Linksted P, et al.: Cohort profile: Generation scotland: Scottish family health study (GSS:SFHS). The study, its participants and their potential for genetic research on health and illness. Int J Epidemiol. 2013; 42(3): 689-700. PubMed Abstract | Publisher Full Text

15. Smith BH, Campbell H, Blackwood D, et al.: Generation Scotland: The Scottish Family Health Study: A new resource for researching genes and heritability. BMC Med Genet. 2006; 7: 74. PubMed Abstract | Publisher Full Text | Free Full Text

16. Qualtrics. Qualtrics (software). Provo, Utah 2019.

17. Fawns-Ritchie C: Extended Data for "CovidiLife: A resource to understand mental health, well-being and behaviour during the COVID-19 pandemic in the UK". 2022. http://www.doii.org/10.5281/zenodo.4967815

18. O'Connor R, Opsomnick L, Benavente JF, et al.: Knowledge and Behaviors of Adults with Underlying Health Conditions During the Onset of the COVID-19 U.S. Outbreak: The Chicago COVID-19 Comorbidity Survey. J Community Health. 2020; 45(6): 1149-1157. PubMed Abstract | Publisher Full Text | Free Full Text

19. Stancanelli A, Smith SK, et al.: Monetizing the costs of self-isolation during COVID-19. J Gen Intern Med. 2020; 35(9): 2610-2617. PubMed Abstract | Publisher Full Text | Free Full Text

20. Spitzer RL, Kroenke K, Williams JBW, et al.: A brief measure for assessing generalized anxiety disorder: The GAD-7. Arch Intern Med. 2006; 166(10): 1092-7. PubMed Abstract | Publisher Full Text

21. Kroenke K, Spitzer RL, Williams JBW: The PHQ-9 Validity of a Brief Depression Severity Measure. J Gen Intern Med. 2001; 16(9): 606-13. PubMed Abstract | Publisher Full Text | Free Full Text

22. Ng Fat L, Scholles S, Boniface S, et al.: Evaluating and establishing national norms for mental wellbeing using the short Warwick-Edinburgh Mental Well-being Scale (SWEMWS): findings from the Health Survey for England. Qual Life Res. 2017; 26(5): 1129-44. PubMed Abstract | Publisher Full Text | Free Full Text

23. Tennant R, Hiller L, Fishwick R, et al.: The Warwick-Edinburgh mental well-being scale (WEMWS): Development and UK validation. Health Qual Life Outcomes. 2007; 5: 63. PubMed Abstract | Publisher Full Text | Free Full Text

24. Goldberg LR: The development of markers for the Big-Five factor structure. Psychol Assess. 1992; 4: 26. Publisher Full Text

25. Cohen S, Kamarck T, Mermelstein R: A global measure of perceived stress. J Health Soc Behav. 1983; 24(4): 385-96. PubMed Abstract

26. Herrero J, Menejes J: Short Web-based versions of the perceived stress (PSS) and Center for Epidemiological Studies Depression (CESD) Scales: a comparison to pencil and paper responses among Internet users. Computers in Human Behavior. 2006; 22(5): 830-46. Publisher Full Text

27. Smith BW, Dalen J, Wiggins K, et al.: The brief resilience scale: Assessing the ability to bounce back. Int J Behav Med. 2008; 15(3): 194-200. PubMed Abstract | Publisher Full Text

28. Navrady LB, Wolters MK, Macintyre DJ, et al.: Cohort Profile: Stratifying Resilience and Depression Longitudinally (STRADL): a questionnaire follow-up of Generation Scotland: Scottish Family Health Study (GSS:SFHS). Int J Epidemiol. 2018; 47(1): 13-40. PubMed Abstract | Publisher Full Text | Free Full Text

29. Habota T, Sandu AL, Waider GD, et al.: Cohort profile for the STRatifying Resilience and Depression Longitudinally (STRADL) study: A depression-focused investigation of Generation Scotland, using detailed clinical, cognitive, and neuromaging assessments (version 1; peer review: 1 approved, 1 not approved). Wellcome Open Res. 2019; 4: 185. Publisher Full Text

30. Batt GD, Morton SMB, Campbell D, et al.: The Aberdeen Children of the 1950s cohort study: Background, methods and follow-up information on a new resource for the study of life course and intergenerational influences on health. Paediatr Perinat Epidemiol. 2004; 18(3): 221-39. PubMed Abstract | Publisher Full Text

31. Leon DA, Lawlor DA, Clark H, et al.: Cohort Profile: The Aberdeen Children of the 1950s Study. Int J Epidemiol. 2006; 35(3): 549-52. PubMed Abstract | Publisher Full Text

32. McKinstry B, Sullivan PM, Vaisshi S, et al.: Cohort profile: the Scottish Research register SHARE. A register of people interested in research participation linked to NHS data sets. BMJ Open. 2017; 7(2): e013351. PubMed Abstract | Publisher Full Text | Free Full Text

33. Bottle A, Cohen C, Lucas A, et al.: How an electronic health record became a real-world research resource: comparison between London's Whole Systems Integrated Care database and the Clinical Practice Research Datalink. BMC Med Inform Decis Mak. 2020; 20(1): 71. PubMed Abstract | Publisher Full Text | Free Full Text

34. Scottish Government: Scottish Index of Multiple Deprivation 2016. Scotland 2016. Reference Source

35. Baker DW: The meaning and the measure of health literacy. J Gen Intern Med. 2006; 21(8): 878-83. PubMed Abstract | Publisher Full Text | Free Full Text

36. Goldberg LR, Johnson JA, Eber HW, et al.: The international personality item pool and the future of public-domain personality measures, Journal of Research in Personality. 2006; 40(1): 84-96. Publisher Full Text

37. Baranuik C: Covid-19: How the UK vaccine rollout delivered success, so far. BMJ. 2021; 372: n421. PubMed Abstract | Publisher Full Text

38. Di Gessa G, Maddock J, Green MJ, et al.: Mental health inequalities in healthcare, economic, and housing disruption during COVID-19: an investigation in 12 longitudinal studies. medRxiv. 2021. Publisher Full Text

39. Maddock J, Parsons S, Di Gessa G, et al.: Inequalities in healthcare disruptions during the Covid-19 pandemic: Evidence from 12 UK population-based longitudinal studies. medRxiv. 2021.
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Joel W Hughes
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Thank you for the opportunity to review this article describing the CovidLife resource. The data collected as part of the CovidLife study should yield valuable information and insights for years. The dataset is large, and the first wave of data was collected very early in the Covid-19 pandemic. As the article was published in 2021, my comments should be considered suggestions and commentary.

I do not recommend any changes, but increasing the value of subsequent reports may be possible if researchers can employ a few analytic techniques.

The data were collected using Qualtrics survey software. It may be possible to examine the data for quality using recommendations that were recently published:

Belliveau, J., & Yakovenko, I. (2022). Evaluating and improving the quality of survey data from panel and crowd-sourced samples: A practical guide for psychological research. Experimental and Clinical Psychopharmacology, 30(4), 400.

Eyal, P., David, R., Andrew, G., Zak, E., & Ekaterina, D. (2021). Data quality of platforms and panels for online behavioral research. Behavior Research Methods, 1-20.

For example, it is possible to check for “speeders” who may not have provided reliable data (i.e., completing the survey in less than 1/3 the median time). For some measures, checking for “straight lining” (i.e., selecting the same option for many consecutive items) may reveal any participants using a response style that could have provided invalid data. Given that respondents may have been motivated to provide accurate information, I suspect there will be very little invalid data.

Some missing data are inevitable. Depending on the analysis, it may be possible to use multiple imputation procedures to preserve the sample size.
Many of the respondents resided in Scotland. Is it possible to weight the data of the subsample residing in Scotland using known population values for Scotland? Perhaps the representativeness of the sample could be improved in this manner.

When interpreting the findings of future reports, is there anything about Scottish culture that researchers should know?

Is there a bibliography of studies published (or planned) using the CovidLife dataset?

Is it possible to calculate a response rate for the respondents from the Generation Scotland study?

The CovidLife is understandably linked to the Covid-19 pandemic. The enthusiasm of some researchers and journal reviewers may wane as that global infectious disease pandemic recedes into history. That is a sentiment I do not share because the COVID-19 pandemic was just one example of a shared stressor. There will be outbreaks of diseases in the future, and understanding how people cope, respond, and are affected should help us prepare.

Is the rationale for creating the dataset(s) clearly described?
Yes

Are the protocols appropriate and is the work technically sound?
Yes

Are sufficient details of methods and materials provided to allow replication by others?
Yes

Are the datasets clearly presented in a useable and accessible format?
Yes

Compelling Interests: No competing interests were disclosed.

Reviewer Expertise: Clinical Health Psychology

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 27 October 2021

https://doi.org/10.21956/wellcomeopenres.18755.r46181
Margarita Panayiotou
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I appreciate the invitation to review this work. The current project clearly involves a massive undertaking by the team and this paper provides a very clear and detailed guide of the data. The tables and figures are particularly useful. I make some suggestions below, which hopefully the authors will find useful:

1. It is great that the questionnaire pack was piloted with a smaller sample ahead of data collection. Could the authors provide some more information about that sample?

2. What was the target recruitment based on (i.e. how were these gaps in the sample identified)?

3. Suggestion for a table: I wonder if it would be useful to have a table with the data collection time points and under each time point note the key COVID-19 events.

Dataset description:
1. It would be useful to have the % of the sample alongside the Ns.

2. Were there any differences in terms of demographics between those agreeing to participate in time 2 and 3 and those that dropped out?

Social & psychological measures:
1. A justification is needed about the 11-point scale for quality of life/loneliness items.

2. I’d suggest renaming the first column of Table 3 to CovidLife1.

3. Were the psychometric properties of measures assessed (e.g. internal consistency)?

Is the rationale for creating the dataset(s) clearly described?
Yes

Are the protocols appropriate and is the work technically sound?
Yes

Are sufficient details of methods and materials provided to allow replication by others?
Yes

Are the datasets clearly presented in a useable and accessible format?
Yes

Competing Interests: No competing interests were disclosed.
Reviewer Expertise: adolescent mental health, assessment and psychometrics

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.