*Health Promotion International*, 2022, 1–12
https://doi.org/10.1093/heapro/daac012
Article

OXFORD

# Change in health, wellbeing and physical activity levels during the COVID-19 pandemic: a longitudinal cohort of *parkrun* participants in the United Kingdom

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## Summary

Lockdown restrictions imposed across the UK in response to the coronavirus disease 2019 (COVID-19) pandemic had a profound impact on many people's health and wellbeing. People were encouraged to be active, but population surveys suggest some groups found this easier than others. We explored the changes in health, wellbeing and physical activity levels among a sample in the UK who experienced the sudden loss of a weekly community-based physical activity opportunity, *parkrun*. A sample of UK *parkrun* participants responded to two surveys: pre-COVID-19 in January/February 2019 and during the COVID-19 pandemic in September 2020. Outcomes were happiness, life satisfaction, connections with others, physical health, mental health and physical activity. The sample was stratified by gender, age, deprivation status, physical activity and number of *parkruns* completed. Demographics were reported using descriptive statistics; distributions between sub-groups were compared using Chi-square tests while differences in outcomes were determined using the Mann–Whitney U test. Open text responses were also analysed. Happiness, life satisfaction, connections with others, physical health and mental health of 450 *parkrun* participants were negatively impacted for all sub-groups, although the impact was not experienced equally. Physical activity fell by 6% while happiness and life satisfaction fell by 12%. People experienced the worst negative impact on their connections with others. The COVID-19 pandemic negatively impacted the wellbeing of a greater proportion of females, younger adults, inactive people, those from higher deprivation areas, and those who had completed fewer *parkruns*. There is evidence that the wellbeing of those who were more active, and those more involved in a community-based physical activity initiative pre-pandemic, was less negatively affected during the COVID-19 lockdown.

**Key words:** COVID-19, mental health, physical activity, longitudinal study, *parkrun*, community, inequalities

## INTRODUCTION

In March 2020, a nationwide 'lockdown' in the United Kingdom (UK) in response to coronavirus disease 2019 (COVID-19), placed stringent restrictions on travel, social interaction, and access to public spaces with the aim of slowing the spread of the virus and protecting healthcare services. People were advised to 'stay at home', only leaving for essential reasons. The closure of 'non-essential' businesses, organizations and spaces included leisure and fitness centres, gyms, swimming pools, physical activity events and sports clubs. This had a profound impact on the quality and quantity of social interactions and individual lifestyles with detrimental consequences to social isolation and loneliness (Bu *et al.*, 2020), mental distress (Banks and Xu, 2020), happiness and life satisfaction (Krekel *et al.*, 2020). This was especially true for women, younger adults, people from black and minority ethnic backgrounds and those with lower household income (Fancourt *et al.*, 2020a).

Despite the closure of sport, exercise and physical activity facilities, physical activity came into the spotlight as governments across the world encouraged people to become and stay active as an 'essential activity' for their health and wellbeing (Payne, 2020; World Health Organization, 2020). Much interest was given to population level changes in physical activity (Stockwell *et al.*, 2021). Research from the beginning of lockdown in March 2020 suggested that higher proportions of the UK population were self-reporting meeting physical activity guidelines compared to preceding years (Smith *et al.*, 2021a), which was supported by Google Trends data from the UK (Ding *et al.*, 2020). Conversely, Sport England data from across the COVID-19 pandemic suggested that lockdown restrictions had a negative impact on the type and volume of activity people were doing—especially during initial stages of the pandemic (between mid-March and mid-May; Sport England, 2021). The proportion of the population classed as 'active' dropped by 7.1% (over 3 million fewer active adults) compared to the 12 months before (Sport England, 2021).

Collectively, the available evidence into physical activity change is difficult to compare, generalize and interpret due to methodological differences, seasonal variation in activity levels and the changing COVID-19 lockdown restrictions over place and time. A consistent finding was that physical activity levels differed depending on socio-demographic characteristics such as age, sex, socioeconomic status, disability status, ethnicity and pre-lockdown physical activity level (Faulkner *et al.*, 2021; Smith *et al.*, 2021a; Sport England, 2021; Stockwell *et al.*, 2021). Given the importance of these socio-demographic factors, Marteau *et al.* (Marteau *et al.*, 2021) have highlighted the importance of addressing both social and behavioural factors to ensure that interventions are more likely to be successful for improving population health and reducing the gap between the richest and poorest in society.

The COVID-19 pandemic restrictions not only meant changes in the levels and type of physical activity, but also a loss of social interaction. Feeling a sense of belonging to a social group is a protective mechanism against social isolation, loneliness and poor mental health (Holmes *et al.*, 2020). It is therefore important to explore any changes in health, wellbeing and physical activity levels among those who had their community-based physical activity opportunities abruptly removed during lockdown restrictions.

We examine this issue in the context of *parkrun*, a community-based physical activity opportunity that suspended its 2200+ worldwide events in March 2020 (over 1,000 of which take place in the UK). *parkruns* are free, weekly, 5 km events where people can participate as a runner, walker or volunteer (www.parkrun.com). In the UK, before events were closed due to the COVID-19 pandemic, around 170 000 people were taking part each week. *parkrun* has removed many of the barriers to physical activity, encouraging participation by women (Stevinson and Hickson, 2014), older people (Grunseit *et al.*, 2018), people with long-term health conditions (Quirk *et al.*, 2021), people who were previously inactive (Quirk *et al.*, 2021) and those living in areas of high deprivation (Smith *et al.*, 2020b). Research suggests that the health and wellbeing gains of participation are derived from the friendly, welcoming and social nature of the events (Grunseit *et al.*, 2020). With the abrupt cancellation of *parkrun* events in March 2020, the *parkrun* population provides a unique opportunity to explore change over time in health and wellbeing among relatively active people.

In this study, we sought to understand how the health, wellbeing and physical activity level of UK *parkrun* participants changed during the COVID-19 pandemic and the extent to which people from different sub-groups differed.

## METHODS

Ethical approval for the original Health and Wellbeing Survey was granted by Sheffield Hallam University Research Ethics Committee on 24 July 2018 (reference number ER7034346). Ethical approval for this secondary data analysis study was granted by the same ethics

committee on 4 December 2020 (reference number ER29077901).

## Study samples

This study uses a single sample of *parkrun* participants responding to two surveys at two time points, described below.

### The health and wellbeing survey (labelled 'pre-COVID')

In 2018, *parkrun* commissioned the Advanced Wellbeing Research Centre (AWRC) at Sheffield Hallam University (UK) to conduct a study into the health and wellbeing of the UK *parkrun* community (Quirk *et al.*, 2021). This article reports data from new *parkrun* registrants who completed the survey during January/February 2019 (i.e. 'pre-COVID').

The Health and Wellbeing Survey measured happiness, life satisfaction, self-reported physical activity level, motives for participation, health status, healthcare usage, mental wellbeing, perceived impact of *parkrun* and the impact of *parkrun* on social opportunities. Participants in the Health and Wellbeing Survey gave permission for their anonymized responses to be used for further research.

### The parkrun COVID-19 survey (labelled 'COVID')

During the COVID-19 pandemic in September 2020, 20 months after the *parkrun* Health and Wellbeing survey was distributed, *parkrun* sent a COVID-19 survey to *parkrun* participants in the UK, including participants in England, Scotland, Wales and Northern Ireland. The online *parkrun* COVID-19 survey was sent via email to a stratified random sample balanced for gender, age and number of *parkrun* walk/runs completed in the 12 months prior to 18th March 2020. This represented 57 941 *parkrun* participants and included 2560 respondents from the pre-COVID Health and Wellbeing Survey. The *parkrun* COVID-19 survey aimed to understand the impact of the COVID-19 pandemic on the health and wellbeing of *parkrun* participants and their thoughts about returning to *parkrun* when events were relaunched in the UK. Participants in the *parkrun* COVID-19 survey gave permission for their responses to be shared with researchers for the purposes of further research.

### Combined dataset used in this secondary analysis

Responses to the Health and Wellbeing Survey and the *parkrun* COVID-19 survey were matched at the person-level using *parkrun* Athlete ID (provided to all *parkrun* registrants to identify them on the *parkrun* database and enable the collation of all their *parkrun* participation data) and date of birth across the two databases. This resulted in a combined (linked) dataset of 450 respondents who had completed both surveys and thus allowed a comparison of responses over time (before and during the pandemic).

### Demographic variables

Additional demographic variables not collected in the surveys were extracted from the *parkrun* database after the matching process. These were:

- Gender (female and male);
- Age derived from date of birth;
- Index of multiple deprivation (IMD) derived from postcode;
- Self-reported physical activity level at *parkrun* registration;
- Number of *parkrun* events completed before *parkrun* events closed in March 2020.

## Outcomes

### Health and wellbeing

Mental wellbeing was captured using questions on happiness, life satisfaction, mental health and connections with others. The pre-COVID and COVID surveys both used the Office of National Statistics (ONS) personal wellbeing scales questions for happiness and life satisfaction: (i) *Overall, how happy did you feel yesterday?* and (ii) *Overall, how satisfied are you with your life nowadays?* Respondents were asked to respond on a scale of 0 to 10, where 0 is 'not at all' and 10 is 'completely'.

In the COVID survey, participants were asked: *How has your (i) happiness, and (ii) satisfaction with life, (iii) connections with others in your community, (iv) physical health* and *(v) mental health been impacted by the COVID-19 pandemic?* On a five-point Likert scale, respondents were given the following options: major positive impact, moderate positive impact, no impact, moderate negative impact and major negative impact.

### Self-reported physical activity level

The pre-COVID and COVID surveys both used the Milton *et al.* (Milton *et al.*, 2011) single-item physical activity question which asked the following: *In the past week, on how many days have you done a total of 30 minutes or more of physical activity, which was enough to raise your breathing rate? This may include sport, exercise, and brisk walking or cycling for recreation or to get to and from places, but should not include housework or physical activity that may be part of your*

*job*. Respondents could answer: 0 days, 1 day, 2 days, etc., up to 7 days.

#### Open text responses

The COVID survey gave respondents the option of providing an open-text response to the question: 'Is there anything you want to add about the impact of the pandemic, and the absence of *parkrun* events on your health and wellbeing?'

### Data analysis

Data were visually checked in Microsoft Excel by one researcher (SH) and analysed using frequency counts, means, standard deviations, medians, minimum and maximum and inter-quartile range. For categorical data, N and % were used.

#### Stratification

The sample was stratified by the following:

- *Gender*: female and male (Supplementary Data S1a);
- *Age*: derived from the date of birth and segregated into 'younger adults' (less than 55 years of age; mean age 41.2) and 'older adults' (55 years or over; mean age 62.4; Supplementary Data S1b);
- *Socioeconomic status (SES)*: using the indices of multiple deprivations (IMD), classified into four quartiles (Q1, Q2, Q3, Q4) and segregated into 'Low IMD' (those in the most deprived areas; IMD Q1 and Q2) and 'High IMD' (those in the least deprived areas; IMD Q3 and Q4; Supplementary Data S1c);
- *Activity level*: derived from a physical activity question asked at *parkrun* registration and segregated into 'lower activity' (those reporting 0, 1 or 2 days per week of at least 30 min moderate exercise) and 'higher activity' (those reporting 3 and 4 or more days per week of at least 30 min moderate exercise; Supplementary Data S1d);
- parkrun *engagement level*: derived from *parkrun* participation records and segregated either side of the median into 'low *parkruns*' ($\leq$9 *parkruns* completed in the previous 12 months; mean number of *parkruns* 3.7) and 'high *parkruns*' (>9 *parkruns* completed in the previous 12 months; mean number of *parkruns* 23.2; Supplementary Data S1e).

The change in physical activity between the pre-COVID and COVID surveys was determined using the single item activity question with a maximum change of $\pm$7 days of activity per week.

Distributions between sub-groups were compared using Chi-square tests with the significance of specific categories analysed using partitioned Chi-square tests. Happiness, life satisfaction and the single item physical activity level were classified as ordinal data with differences determined using the Mann–Whitney U test. Effect sizes were calculated using Cohen's *d* using pooled standard deviation. All statistical tests were analysed using SPSS (version 26).

The open-ended survey responses were analysed in Excel using content analysis and inductive coding (O'Cathain and Thomas, 2004). One researcher (HQ), an experienced qualitative researcher, devised a coding frame inductively from the data and manually assigned codes to the verbatim responses that captured what the respondent was saying (i.e. the thematic content of the response). Content analysis stopped when the researcher had reached a point of having summarized all the responses into themes. Themes were presented as numbers and proportions. Verbatim comments were extracted to illustrate the themes.

## FINDINGS

### Sample characteristics

Table 1 shows the demographics of the full sample; the demographics of all sub-groups are given in Supplementary Data S1. The mean age of the sample was 47.6 years with a slight skew towards younger respondents. The age range was 16–80 years and 55.3% were female. The proportion of the sample increased linearly with IMD quartile from 11.2% for quartile 1 (most deprived) to 35.1% for quartile 4 (least deprived). About 7.4% were inactive at *parkrun* registration (i.e. reported doing less than one day of least 30 min of moderate exercise per week) with the mode at 3 days of activity per week (31.7% of the cohort).

In the year prior to *parkrun* closing due to the COVID-19 pandemic (13–14 months after the pre-COVID survey), participants had done a mean of 13.3 *parkruns*, that is, just over one per month; the distribution was highly skewed, with a median of 9 *parkruns* and an inter-quartile range of 3–21 *parkruns*.

### Happiness, life satisfaction and physical activity

#### Full cohort

Table 2 shows happiness, life satisfaction and physical activity at the pre-COVID and at COVID surveys for the full cohort (all) and the sub-groups. Happiness fell from 7.48 before the COVID-19 pandemic to 6.60 during the COVID-19 pandemic by a mean of −0.88; similarly, life satisfaction fell from 7.48 to 6.56 by a mean of −0.92. Values of happiness and life satisfaction during

**Table 1:** Demographics (at registration) of newly registered parkrunners in pre-COVID and COVID surveys

| Age (years) | *N* | Min | Median | IQR | Max | Female |
|---|---|---|---|---|---|---|
| | 438 | 16.8 | 48.4 | 39.3–56.8 | 80.8 | 55.3% |
| Index of multiple deprivation | *N* | Q1 | Q2 | Q3 | Q4 | |
| Frequency | 436 | 49 | 100 | 134 | 153 | |
| Proportion | | 11.2% | 22.9% | 30.7% | 35.1% | |
| Activity level at registration (bouts of 30 min or more over last 4 weeks) | *N* | <1 | ≈1 | ≈2 | ≈3 | ≥4 |
| Frequency | 445 | 33 | 51 | 119 | 141 | 101 |
| Proportion | | 7.4% | 11.5% | 26.7% | 31.7% | 22.7% |
| Number of parkruns | N | Min | Median | IQR | Max | |
| | 356 | 1 | 9 | 3-21 | 49 | |

the COVID-19 pandemic were significantly lower for all sub-groups compared to before the COVID-19 pandemic (Table 2, $p < 0.01$ or $p < 0.001$ with moderate to large effect sizes). The physical activity level for the full cohort fell from 3.47 to 3.22 days per week by 0.21 days per week (Table 2, $p < 0.05$ with a small effect size).

The following sections describe the statistically significant findings for each sub-group.

**Females versus males**

Females had higher happiness and life satisfaction before the COVID-19 pandemic than during the COVID-19 pandemic. Although the differences between genders were not significantly different between time points, the *change* in life satisfaction from before to during the COVID-19 pandemic was, that is, for females it dropped by 1.17 while for men it dropped by 0.62 (Table 2, effect size = 0.26, $p < 0.01$). There was no statistically significant difference in physical activity levels between females and males.

**Younger versus older**

Happiness and life satisfaction were statistically higher for the older sub-group compared to the younger sub-group both before the COVID-19 pandemic and during the COVID-19 pandemic (Table 2, $p < 0.01$). There was no significant difference in physical activity levels between the two sub-groups at either time point.

**Low IMD (most deprived) versus high IMD (least deprived)**

Happiness and life satisfaction appeared to be lower at both time points for the low IMD group compared to the high IMD group, although this was only significant for happiness during the COVID-19 pandemic (Table 2: 6.30 vs 7.45, effect size = 0.23, $p < 0.05$). There was no significant difference for physical activity levels between the two sub-groups at either time point, although the *change* in physical activity level from before to during the COVID-19 pandemic was significantly larger for the low IMD group compared to the high IMD group; that is, the activity level of the low IMD group fell by 0.52 days per week while the high IMD group fell by 0.14 days per week (Table 2, effect size 0.19, $p < 0.05$).

**Low versus high activity at registration**

Happiness, life satisfaction and physical activity were lower for the low activity group compared to the high activity group before and during the COVID-19 pandemic. The *change* in activity from before to during the COVID-19 pandemic was greater for the high activity sub-group compared to the low activity group (Table 2, −0.57 vs 0.10, effect size 0.34, $p < 0.05$).

**Low versus high number of parkruns**

Happiness and life satisfaction tended to be higher before the COVID-19 pandemic for the low *parkruns* sub-group compared to the high *parkruns* sub-group; conversely, these variables were lower for the low *parkruns* sub-group during the COVID-19 pandemic. Although the differences between sub-groups were not significant, the *change* in happiness was significantly greater for the low *parkruns* sub-group with a drop of −1.10 compared to −0.70 (Table 2, effect size 0.19, $p < 0.05$).

## Perceived impact of the COVID-19 pandemic

Table 3 shows the perceived impact of the COVID-19 pandemic with supplementary data given in Supplementary Table S1. The most reported negative impact overall was on connections with others (66–77% depending upon sub-group), while physical health had the lowest negative impact (34–50%) and the largest

**Table 2:** Questions on happiness, life satisfaction and physical activity pre-COVID and during the COVID-19 pandemic

| | | Gender | | Age | | IMD | | Activity level | | Number of parkruns | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Female | Male | Younger | Older | Low | High IMD | Low | High activity | Low | High |
| Overall, how happy did you feel yesterday? (0–10) Mean (standard deviation) | | | | | | | | | | | |
| *n* | 398 | 216 | 182 | 276 | 122 | 132 | 253 | 178 | 215 | 157 | 155 |
| Pre-COVID | 7.48 (1.52) | 7.56 (1.46) | 7.38 (1.59) | 7.26 (1.52) | ***7.98 (1.41) | 7.45 (1.42) | 7.49 (1.58) | 7.25 (1.63) | *7.68 (1.40) | 7.61 (1.55) | 7.46 (1.57) |
| COVID | 6.60 (2.20) | 6.57 (2.26) | 6.62 (2.12) | 6.29 (2.18) | ***7.28 (1.82) | 6.30 (2.32) | *6.79 (2.08) | 6.37 (2.31) | 6.79 (2.09) | 6.52 (2.15) | 6.75 (2.09) |
| Change | −0.88 (2.1) | −0.99 (2.2) | −0.76 (2.0) | −0.96 (2.3) | −0.70 (1.8) | −1.14 (2.3) | −0.69 (2.0) | −0.91 (2.1) | −0.86 (2.2) | −1.10 (1.9) | *−0.70 (2.3) |
| *d* | ***0.47 | ***0.52 | **0.41 | ***0.50 | **0.43 | ***0.60 | ***0.38 | **0.44 | ***0.50 | ***0.58 | **0.38 |
| Overall, how satisfied are you with your life nowadays? (0–10) Mean (standard deviation) | | | | | | | | | | | |
| *n* | 397 | 216 | 181 | 276 | 121 | 131 | 252 | 178 | 214 | 157 | 155 |
| Pre-COVID | 7.48 (1.76) | 7.63 (1.74) | 7.31 (1.78) | 7.28 (1.79) | ***7.95 (1.62) | 7.35 (1.90) | 7.55 (1.71) | 7.32 (1.79) | *7.62 (1.74) | 7.57 (1.88) | 7.47 (1.65) |
| COVID | 6.56 (1.83) | 6.46 (1.90) | 6.69 (1.73) | 6.37 (1.89) | **7.01 (1.58) | 6.35 (1.97) | 6.70 (1.71) | 6.33 (1.90) | *6.76 (1.75) | 6.54 (1.82) | 6.73 (1.84) |
| Change | −0.92 (2.1) | −1.17 (2.2) | **−0.62 (2.0) | −0.91 (2.2) | −0.94 (1.8) | −1.00 (2.5) | −0.85 (1.9) | −0.96 (2.1) | −0.88 (2.2) | −1.04 (2.1) | −0.74 (2.2) |
| *d* | ***0.51 | ***0.64 | ***0.35 | ***0.49 | ***0.59 | ***0.52 | ***0.50 | ***0.54 | ***0.49 | ***0.56 | ***0.42 |
| In the past week, on how many days have you done a total of 30 minutes or more of physical activity, which was enough to raise your breathing rate? (0–7 days)? Mean (standard deviation) | | | | | | | | | | | |
| *n* | 425 | 232 | 193 | 297 | 128 | 141 | 270 | 191 | 229 | 171 | 158 |
| Pre-COVID | 3.47 (1.60) | 3.36 (1.58) | 3.61 (1.61) | 3.49 (1.56) | 3.42 (1.68) | 3.49 (1.62) | 3.43 (1.59) | 2.60 (1.38) | ***4.22 (1.35) | 3.43 (1.58) | 3.48 (1.52) |
| COVID | 3.22 (1.97) | 3.17 (1.93) | 3.28 (2.01) | 3.18 (1.94) | 3.33 (2.04) | 2.97 (1.87) | 3.29 (2.00) | 2.71 (1.87) | ***3.65 (1.91) | 3.08 (1.87) | 3.42 (2.02) |
| Change | −0.21 (1.9) | −0.19 (1.9) | −0.33 (2.1) | −0.32 (2.1) | −0.09 (1.9) | −0.52 (2.1) | *−0.14 (1.9) | 0.10 (2.0) | **−0.57 (2.0) | −0.36 (1.8) | −0.06 (2.1) |
| *d* | *0.14 | 0.11 | 0.18 | 0.18 | 0.05 | *0.30 | 0.08 | 0.07 | ***0.34 | 0.20 | 0.03 |

Young/old defined as <55 and ≥55 years; Low/high IMD <50% and ≥50%; Low/high activity ≤ 'About 2 days per week' and ≥ 'About three days per week'; fewer/more parkruns ≤9 runs and >9 runs Mann–Whitney U test.

*$p < 0.05$;

**$p < 0.01$;

***$p < 0.001$.

Effect size *d*: Small 0–0.2; 0.2–0.5 moderate; large 0.5–0.8; very large 0.8–1.2; huge > 2.0.

positive impact (23–31% depending upon sub-group). Around a third of respondents reported no impact of the COVID-19 pandemic on either their physical or mental health. The following sections describe the statistically significant findings for each sub-group: overall distributions are analysed using the Chi-square test with the significance of negative impact, no impact and positive impact for each measure determined using partitioned Chi-square tests.

**Females versus males**

There was little statistical difference between females and males although there were indications that a larger proportion of females improved their connections with others during the COVID-19 pandemic (Table 3, 17% vs 9%, $p < 0.05$) and a larger proportion of females reported worse physical health (Table 3, 47% vs 34%, $p < 0.05$).

**Younger versus older adults**

A larger proportion of younger adults reported a negative impact of the COVID-19 pandemic on their connections with others (Table 3, 77% vs 66%, $p < 0.05$) and on their mental health (Table 3, 65% vs 42%, $p < 0.001$). There are also indications that a larger proportion of younger adults reported a major negative impact on happiness, life satisfaction and mental health (Supplementary Data S1 and Tables S1a, S1b and S1e).

A larger proportion of older adults reported no impact to their physical health than younger adults (Table 3, 39% vs 30%, $p < 0.05$); this was also true for mental health (Table 3, 52% vs 28%, $p < 0.001$).

**Low IMD (most deprived) versus high IMD (least deprived)**

A larger proportion of those from the low IMD sub-group reported a negative impact of the COVID-19 pandemic on their physical health when compared to the high IMD sub-group (Table 3, 50% vs 37%, $p < 0.01$). This was also true for mental health (Table 3, 66% vs 55%, $p < 0.05$). Conversely, a larger proportion of those from the high IMD sub-group reported no impact to their life satisfaction than those from the low IMD sub-group (Table 3, 22% vs 14%, $p < 0.05$); this was also true for mental health (Table 3, 38% vs 28%, $p < 0.05$).

**Low versus high activity**

A larger proportion of those who had low activity levels at registration reported a negative impact of the COVID-19 pandemic on their physical health when compared to those with higher levels of physical activity (Table 3, 48% vs 35%, $p < 0.01$).

**Low versus high number of parkruns**

A larger proportion of those who did a low number of *parkruns* reported a negative impact of the COVID-19 pandemic on their happiness when compared to those who did a high number of *parkruns* (Table 3, 74% vs 63%, $p < 0.05$).

### Open-text responses

A total of 125 respondents (28% of the COVID survey sample) provided an open-text response. 80% of those providing an open text response (100 respondents) described aspects of *parkrun* that they missed. Data coding led to the generation of 11 themes that captured how people had responded to the absence of *parkrun*, to the COVID-19 pandemic and other comments about *parkrun* in relation to its anticipated return (Table 4). The top two themes related to missing the *parkrun* community and the lack of incentive for physical activity that *parkrun* engenders.

## Discussion

We have been able to analyse changes in health, wellbeing and physical activity among a sample of *parkrun* participants who had completed surveys before and during the COVID-19 pandemic. Happiness and life satisfaction dropped by about 12% in the 20-month period between *parkrun* registration (pre-COVID) and during the COVID-19 pandemic. The happiness and life satisfaction scores fell by almost one point below the pre-COVID-19 national averages for England and Wales 2019–2020 [Office of National Statistics (ONS), 2018], though they were higher than those reported in other studies from England during the COVID-19 pandemic (Carson *et al.*, 2020).

While the happiness and life satisfaction among all sub-groups were impacted negatively, this was not experienced equally across groups. Happiness levels fell more among participants who were younger, female and from more deprived areas. Life satisfaction levels fell more among participants who were female, from more deprived areas and who were less activity at registration. These findings are consistent with reports of younger adults and females in the UK demonstrating worse mental health symptoms and larger deteriorations in mental health compared to older adults and males during the COVID-19 pandemic (Fancourt *et al.*, 2020b; Krekel *et al.*, 2020; Pierce *et al.*, 2020). The gender differences

**Table 3:** Perceived change in happiness, life satisfaction, connections with others, mental health and physical activity due to the COVID-19 pandemic

| | Gender | | | Age | | | IMD | | | Activity level | | | Number of parkruns | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Female | Male | Total | Younger | Older | Total | Low | High | Total | Low | High | Total | Low | High | Total |
| How has your happiness been impacted by the COVID-19 pandemic? | | | | | | | | | | | | | | | |
| Negative impact | 70% | 67% | 69% | 70% | 65% | 68% | 70% | 67% | 68% | 69% | 67% | 68% | 74% | †63% | 68% |
| No impact | 19% | 24% | 21% | 20% | 25% | 22% | 17% | 24% | 22% | 22% | 21% | 22% | 17% | 24% | 20% |
| Positive impact | 11% | 9% | 10% | 10% | 10% | 10% | 12% | 9% | 10% | 8% | 12% | 10% | 9% | 14% | 11% |
| | $X^2 = 1.55$, $p = 0.460$ | | | $X^2 = 1.17$, $p = 0.222$ | | | $X^2 = 2.87$, $p = 0.238$ | | | $X^2 = 1.25$, $p = 0.537$ | | | $X^2 = 4.78$, $p = 0.091$ | | |
| How has your overall satisfaction with your life been impacted by the COVID-19 pandemic? | | | | | | | | | | | | | | | |
| Negative impact | 67% | 68% | 67% | 68% | 65% | 67% | 72% | 65% | 67% | 72% | 63% | 67% | 68% | 65% | 66% |
| No impact | 19% | 21% | 20% | 18% | 23% | 20% | 14% | † 22% | 19% | 16% | 23% | 20% | 21% | 20% | 20% |
| Positive impact | 15% | 11% | 13% | 13% | 12% | 13% | 13% | 13% | 13% | 12% | 14% | 13% | 12% | 15% | 14% |
| | $X^2$=1.43, $p = 0.489$ | | | $X^2$=1.18, $p = 0.554$ | | | $X^2$=4.17, $p = 0.125$ | | | $X^2$=3.87, $p = 0.145$ | | | $X^2$= 0.99, $p = 0.805$ | | |
| How have your connections with others in your community been impacted by the COVID-19 pandemic? | | | | | | | | | | | | | | | |
| Negative impact | 71% | 76% | 73% | 77% | †66% | 74% | 76% | 72% | 74% | 77% | 71% | 74% | 75% | 76% | 76% |
| No impact | 12% | 15% | 13% | 12% | 17% | 14% | 14% | 13% | 13% | 10% | 16% | 13% | 10% | 14% | 12% |
| Positive impact | 17% | † 9% | 13% | 11% | 17% | 13% | 10% | 15% | 13% | 13% | 13% | 13% | 15% | 9% | 12% |
| | $X^2 = 6.37$, $p = 0.041$ | | | $X^2 = 5.29$, $p = 0.071$ | | | $X^2 = 1.74$, $p = 0.419$ | | | $X^2 = 3.67$, $p = 0.160$ | | | $X^2 = 3.55$, $p = 0.170$ | | |
| How has your physical health been impacted by the COVID-19 pandemic? | | | | | | | | | | | | | | | |
| Negative impact | 47% | †34% | 41% | 43% | 36% | 41% | 50% | ††37% | 41% | 48% | ††35% | 41% | 44% | 35% | 40% |
| No impact | 31% | 35% | 33% | 30% | †39% | 33% | 26% | 35% | 32% | 29% | 36% | 33% | 31% | 36% | 34% |
| Positive impact | 23% | 31% | 26% | 27% | 24% | 26% | 23% | 28% | 26% | 23% | 29% | 26% | 26% | 28% | 27% |
| | $X^2 = 7.41$, $p = 0.025$ | | | $X^2 = 4.05$, $p = 0.132$ | | | $X^2 = 7.45$, $p = 0.024$ | | | $X^2$=7.41 $p = 0.025$ | | | $X^2$=2.58 $p = 0.275$ | | |
| How has your mental health been impacted by the COVID-19 pandemic? | | | | | | | | | | | | | | | |
| Negative impact | 62% | 55% | 59% | 65% | †††42% | 58% | 66% | † 55% | 59% | 62% | 56% | 58% | 60% | 56% | 58% |
| No impact | 32% | 37% | 35% | 28% | †††52% | 35% | 28% | † 38% | 34% | 33% | 37% | 35% | 34% | 35% | 34% |
| Positive impact | 6% | 7% | 7% | 7% | 7% | 7% | 6% | 7% | 7% | 5% | 8% | 7% | 6% | 9% | 7% |
| | $X^2$=1.85, $p = 0.397$ | | | $X^2$=23.5, $p < 0.001$ | | | $X^2$=5.27, $p = 0.072$ | | | $X^2$=2.17, $p = 0.338$ | | | $X^2$=2.02, $p = 0.364$ | | |

Younger/older <55 and ≥55 years; Low/high IMD <50% and ≥50%; Low/high activity ≤ 'About 2 days per week' and ≥ 'About three days per week'; low/high parkruns ≤9 runs and >9 runs. Partitioned Chi-square test of differences between categories of sub-groups.

†$p < 0.05$;

††$p < 0.01$;

†††$p < 0.001$.

**Table 4:** Themes generated from the responses to the question asked in the COVID survey: 'Is there anything you want to add about the impact of the pandemic, and the absence of parkrun events on your health and wellbeing?'

| | Open text response theme and example quote | Proportion reporting theme |
|---|---|---|
| 1 | Missing the parkrun community and socialization<br>'I liked the community & fun nature of parkrun. Without it and similar, life feels more isolated'. | 22% |
| 2 | Feeling little incentive/motive to continue being active in the absence of parkrun<br>'Without parkrun I've lost purpose to my running. I stopped running early in the lockdown because of outside time limits and I just haven't got going again. parkrun would help provide a purpose'. | 20% |
| 3 | Negative impact of the COVID-19 pandemic on mental wellbeing, activity levels, lifestyle and fitness<br>'Definitely a negative on my health, not just mental, but also increased lower back issues contributed to by working from home set up/less physical exercise and anxiety. | 19% |
| 4 | General comments and providing recommendations for *parkrun's* anticipated return<br>'parkrun is so needed now more than before Covid'. | 18% |
| 5 | Missing the sense of achievement and challenge parkrun provides<br>'Although I am not a great runner, I miss the challenge and the excitement of finding out how well I did/didn't do'. | 10% |
| 6 | Just miss parkrun (no specific reason given) 10% 'I've missed parkrun hugely. Can't wait for it to be back!' | 9% |
| 7 | Fine without parkrun/neutral<br>'I am quite happy to continue to run alone for the moment. I would consider a return to parkrun at some point, but I do not need it to remain motivated to exercise'. | 9% |
| 8 | Miss the routine/sense of normality provided by parkrun 8% 'I miss the routine of getting up and going out to parkrun on Saturdays'. | 6% |
| 9 | The return of parkrun as a motivator to keep active<br>'During lockdown I gained weight and drank too much alcohol. When the Indoor gyms re-opened I became a member and did a 10 week fitness challenge to get myself back in shape ready for when parkrun starts again. This was the only way I could deal with my mental health at the time'. | 6% |
| 10 | Positive impact of the pandemic running on ability/fitness and mental wellbeing 'Pandemic has allowed me to run more frequently due to time saved commuting'. | 6% |
| 11 | Lack of confidence to run alone/due to social distancing 4% | 4% |

are consistent with pre-existing health inequalities (Pierce *et al.*, 2020) and have been attributed in part to informal caring responsibilities and childcare responsibilities held alongside working commitments by females during the COVID-19 pandemic (Mak *et al.*, 2021).

Just over half of our sample reported a negative impact of the pandemic on mental health with 6% reporting a positive impact of the pandemic on mental health. Again, younger adults were more likely to report a negative impact of the pandemic on their mental health than older adults, which supports other findings [O'Connor *et al.*, 2020; Office of National Statistics (ONS) 2020; Pierce *et al.*, 2020]. We did not find any differences in the mental wellbeing impact of the pandemic on people from more deprived neighbourhoods compared to those in less deprived neighbourhoods which could be attributed to higher physical activity levels (Johansson *et al.*, 2019), though this needs investigating further.

Our data show that the greatest negative impact of the COVID-19 pandemic among our sample was on people's connections with others. Younger adults were more detrimentally impacted. Our open-text responses captured how people missed the socialization and community *parkrun* provides, perhaps more so than the physical activity itself. This is supported by previous *parkrun* research that has highlighted that the community and social connections are both major appeal and positive outcome of *parkrun* participation (Grunseit *et al.*, 2020).

Our findings suggest that, given many respondents were able to maintain their level of physical activity during the COVID-19 lockdown, physical activity on its own was not enough to support mental wellbeing, showing that the lack of social connections had the most detrimental impact. The importance of maintaining social connections during the COVID-19 pandemic has been strongly advocated as a potential buffer against negative

physical and mental health outcomes (Nitschke *et al.*, 2020). This suggests that a return to *parkrun* may mitigate some of the negative mental health effects of lockdown. Further research is needed to find out if this is the case.

Less than half of respondents reported a negative impact of the pandemic on their physical health and around a quarter reported a positive impact of the pandemic on their physical health. This may be attributed to physical activity levels and our sample's ability to roughly maintain their activity level during the pandemic (still around 3 days a week of activity). Physical activity levels fell across the whole sample by about 6%, though there was evidence that some people increased their activity level whilst others decreased, which is consistent with the existing, but somewhat mixed evidence base (Bann *et al.*, 2020).

The open-text comments suggest that people's physical activity response to the pandemic may have been influenced by motivation (i.e. having an incentive to be active alone) and opportunity (i.e. time in relation to other commitments), which varied according to living, working and caring arrangements. *parkrun* provided some people with motivation and incentive to be active and lacked sufficient incentive to remain active in the absence of *parkrun* events.

Participating in events like *parkrun*, when they return, could contribute to the enhancement of mental wellbeing, especially among younger female participants during future lockdowns, in the 'back to normal' transition and 'post-lockdown' periods (Sallis *et al.*, 2020). Further research is needed to find out if this is the case.

### Methodological considerations

Findings should be interpreted in the context of the following methodological considerations. First, the self-reported measures may have been biased by measurement errors and reporting biases. Second, the surveys were conducted at different times of the year (January/February and September) so the findings should be interpreted with consideration of potential seasonality effects. Third, it is possible that those who provided a response could be different from other *parkrun* participants, and therefore caution must be taken when extrapolating these findings to a wider population.

In our exploration of potential inequalities, it is important to note the following limitations. The socioeconomic status of respondents was not inferred from employment, income etc. but was inferred from IMD which was sourced by the postcode provided at *parkrun* registration. This gives an average for the area lived in when the respondent first registered with *parkrun*, it does not guarantee that it is specific to the person. A further limitation of our analysis is that we did not consider the impact of the COVID-19 pandemic on ethnic minority groups which have shown inequalities in physical activity levels during the COVID-19 pandemic (Bann *et al.*, 2020).

We did not control for the potential confounding factors in the analysis and cannot draw any conclusions as to whether the observed associations between participation and outcomes are causally related. Additional analysis in Supplementary Data S2 identified the key confounding variables. Further adjusted analysis using logistic regression could explore the extent to which the observed associations may be explained by the demographic characteristics associated with participation, rather than participation per se. Finally, our analysis was unable to distinguish the impact of the pandemic from the impact of the lockdown policy on health and wellbeing (Foa *et al.*, 2020).

## CONCLUSIONS

The overall wellbeing of a cohort of 450 *parkrun* participants declined during the COVID-19 pandemic. Physical activity fell by 6% while happiness and life satisfaction fell by 12%. The *parkrun* participants perceived that the most notable detrimental impact of the pandemic was on their connections with others. The pandemic was found to affect more women, younger adults, those from more deprived neighbourhoods, those who were least active at registration and those who had completed a lower number of *parkrun* events in the 12 months prior to the close of *parkrun* events. The role that community-based physical activity initiatives will have in bringing people's mental health, connections with others, happiness and life satisfaction back to pre-COVID-19 levels in post-lockdown periods needs further investigation and ongoing monitoring.

## SUPPLEMENTARY MATERIAL

Supplementary material is available at *Health Promotion International* online.

## ACKNOWLEDGEMENTS

The authors would like to thank Allison Dunne for her helpful critique of the final manuscript.

## FUNDING

The pre-COVID parkrun Health and Wellbeing Survey 2018 was delivered by Sheffield Hallam University and funded by parkrun. The COVID survey was delivered by parkrun. For the preparation of the manuscript, H.Q. was funded by a National Institute for Health Research (NIHR) School for Public Health Research (SPHR) post-doctoral launching fellowship. Other authors have no other personal funding to declare.

## ETHICS STATEMENT

Ethical approval for the original Health and Wellbeing Survey was granted by Sheffield Hallam University Research Ethics Committee on 24 July 2018 (reference number: ER7034346). Ethical approval for this secondary data analysis study was granted by the same ethics committee on 4 December 2020 (reference number ER29077901).

## CONFLICT OF INTEREST

C.W. and M.G. are parkrun staff members. S.H., A.B., E.G. and H.Q. are members of the parkrun research board. All authors except E.G. are parkrun registrants/participants.

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