

Exploring the Benefits of Participation in Community-Based Running and Walking Events: A Cross-Sectional Survey of Parkrun Participants

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Abstract

Background: Whilst the benefits of physical activity for health and wellbeing are recognised, population levels of activity remain low. Significant inequalities exist, with socioeconomically disadvantaged populations being less physically active and less likely to participate in community events. We investigated the perceived benefits from participation in a weekly running/walking event by those living in the most socioeconomically deprived areas and doing the least physical activity.

Methods: A cross-sectional online survey was emailed to 2,318,135 *parkrun* participants in the UK. Demographic and self-reported data was collected on life satisfaction, happiness, health status, physical activity, motives, and the perceived benefits of *parkrun*. Motivation, health status and benefits were compared for groups defined by level of physical activity at *parkrun* registration and residential Index of Multiple Deprivation.

Results: 60,000 completed surveys were received (2.7% of those contacted). Respondents were more recently registered with *parkrun* (3.1 v. 3.5 years) and had a higher frequency of participation than non-respondents (14.5 v. 3.7 *parkruns* per year). Those who were inactive at registration and from socioeconomically deprived areas reported lower happiness, lower life satisfaction and poorer health than the full sample. They were more likely to want to improve their physical health, rather than get fit or lose weight. Of those reporting less than one bout of activity a week at registration, 88% (87% in the most socioeconomically deprived areas) increased their physical activity level and 52% (65% in the most socioeconomically deprived areas) reported improvements to overall health behaviours. Previously inactive respondents from the most socioeconomically deprived areas reported greater improvements to fitness (93% v. 89%), physical health (90% v. 85%), happiness (83% v. 79%) and mental health (76% v. 69%).

Conclusion: The least active respondents from the most socioeconomically deprived areas reported changes to their activity levels and benefits to their health and wellbeing since participating in *parkrun*. Whilst the challenge of identifying *how* community initiatives like *parkrun* can better engage with the least active and most socioeconomically deprived remains, if this can be achieved, then such interventions can have a critical public health role in addressing inequalities in benefits associated with recreational physical activity.

Background

In its Global Action Plan on Physical Activity 2018–2030, the World Health Organization (WHO) identified a need for physical activity opportunities that use public spaces and engage whole communities (1). Mass participation physical activity events have been recognised for their public health potential given their population reach, growing popularity and community context (2) and potential to engage patient populations (3). However a key criticism of mass events is that they tend to attract those who are already active and from more affluent areas (4, 5).

Starting in London, United Kingdom (UK) in 2004, *parkrun* is a charity that organises free, weekly, timed 5 kilometre events for people to participate as runners, walkers or volunteers. There is now a growing number of weekly events worldwide across 22 countries attracting over 3 million international participants and a global network of over 375,000 volunteers (6). *parkrun* (www.parkrun.com) has been recognised in WHO's Global Action Plan as a working example of "regular mass-participation initiatives in public spaces, engaging whole communities, to provide free access to enjoyable and affordable, socially and culturally appropriate experiences of physical activity (page 66)" (1).

parkrun events are organised by local volunteer teams and the opportunity to volunteer is open to all. *parkrun* events are promoted as being inclusive to people from all backgrounds and abilities and research evidence would support its perceived inclusivity (7–11). An increasing proportion of events have been established in more economically disadvantaged urban areas in the UK, with higher population density resulting in better geographical access to events for those living in areas of higher socioeconomic deprivation (12). Inequalities in registration and participation persist despite *parkruns* being located closer to more socioeconomically disadvantaged areas (12, 13). *parkrun* data shows that only 13.1% of those participating at least once live in the most socioeconomically deprived areas of the UK (see Table 1a).

Table 1. Population characteristics: (a) all *parkrun* participants (source *parkrun*); (b) survey respondents.

(a) <i>parkrun</i> participants (census date 3 rd December 2018)	(b) Survey respondents		
Population	1,549,806	Survey responses	60,000
Mean years registered with <i>parkrun</i>	3.5	Mean years registered with <i>parkrun</i>	3.1
Mean number of <i>parkruns</i> run/walked per year	3.7	Mean number of <i>parkruns</i> run/walked per year	14.6
Proportion female	51.3%	Proportion female	51.7%
Mean age (years)	40.5	Mean age (years)	48.0
Index of multiple deprivation (n)	1,385,961	Index of multiple deprivation (n)	46,153
Proportion in most deprived IMD Quartile 1	13.1%	Proportion in most deprived IMD Quartile 1	9.5%
Physical activity level at registration (n)	1,656,006	Physical activity level at registration (n)	42,747
Proportion reporting activity level of <i>Less than once per week</i>	6.6%	Proportion reporting activity level of <i>Less than once per week</i>	5.1%

Previous surveys have demonstrated that individuals who live in economically deprived areas and are physically active may experience much better health and quality of life than their neighbours who are less active (14). In a cohort study of 354 new *parkrun* participants in the UK, Stevinson and Hickson (15) also showed that *parkrun* participation is associated with significant positive changes in health and wellbeing over 6 and 12 months, including level of physical activity. However previous *parkrun* studies have not been designed to explore the relationship between socioeconomic deprivation and changes in physical activity for those inactive before participating and the perceived benefits of participation (15–17).

In 2018, a Health and Wellbeing Survey of UK *parkrun* participants was undertaken (18). In this manuscript, we have used a large and diverse sample from that survey of *parkrun* runners/walkers and runners/walkers who volunteer to explore 1) the relationships between socioeconomic deprivation and physical activity status at *parkrun* registration and 2) the motivation for and self-reported health and wellbeing benefits from participation in *parkrun*.

Table 2. Data for participants who were runners/walkers and runners/walkers who volunteer (Percentages may not sum to 100% due to rounding).

Mann-Whitney test between full sample and sub-samples: ^x $p < 0.05$; ^y $p < 0.01$; ^z $p < 0.001$.

(a) Demographic	Sample/sub-sample			
	Full sample	Deprived	Inactive	Deprived / inactive
Survey responses (n)	60,000	4,384	2,184	237
Proportion female	51.7%	52.5%	54.8%	56.1%
Age (n)	59,619	4,377	2,233	237
Mean age (years)	48.0	44.3 ^z	45.6 ^z	43.6 ^z
Index of multiple deprivation (n)	46,153	4,384	2,134	237
Index of multiple deprivation: as proportion of n				
Q1	9.5%	100%	11.1%	100%
Q2	20.4%		22.2%	
Q3	30.0%		30.4%	
Q4	40.1%		36.3%	
Physical activity level at registration (n)	42,747	4,041	2,184	237
Physical activity level at registration (%)				
Inactive <1 per week	5.1%	5.9%	100%	100%
Active ≈ 1 per week	11.5%	11.3%		
Active ≈ 2 per week	22.8%	22.5%		
Active ≈ 3 per week	33.8%	34.0%		
Active ≥ 4 per week	26.9%	26.3%		
Ethnicity (n)	59,340	4,342	2,167	233
Ethnicity as proportion of n				
White	96.4%	94.0%	94.9%	93.1%
Black, Asian, Minority, Ethnic (BAME)	2.9%	5.3%	4.5%	6.0%
Rather not say	0.8%	0.8%	0.6%	0.9%
Employment status (n)	58,433	4,277	2,117	229
Employment status as proportion of n				
Employed	79.1%	84.2%	83.7%	86.0%
Fully retired	12.5%	8.0%	8.1%	4.4%
Student	3.1%	3.4%	3.3%	3.1%
Unemployed and not working	1.2%	1.7%	2.1%	3.1%
Other	4.1%	3.4%	2.8%	3.5%
(b) Health at survey	Sample/sub-sample			
	Full sample	Deprived	Inactive	Deprived / inactive
Happiness (n)	59,998	4,384	2,184	237
Life satisfaction (n)	59,993	4,384	2,183	237
Happiness score (mean)	7.52	7.35 ^z	7.26 ^z	7.11 ^y
Life satisfaction score (mean)	7.76	7.58 ^z	7.48 ^z	7.37 ^z
Health today (n)	57,283	4,205	2,093	225
Health today (/100) (mean)	81.0	79.3 ^z	77.3 ^z	74.7 ^z
(c) Motives	Sample/sub-sample			
	Full sample	Deprived	Inactive	Deprived / inactive

Minimum n	59,263	4,344	2,161	234
(Rank) Proportion of n for top 10 motives				
To contribute to my fitness	(1) 56.2%	(1) 52.2%	(1) 50.6%	(2) 45.1%
To improve my physical health	(2) 37.0%	(2) 39.5%	(2) 49.1%	(1) 48.1%
To gain a sense of personal achievement	(3) 26.9%	(3) 26.0%	(4) 25.4%	(5) 25.5%
To get a recorded time for a 5km	(4) 21.4%	(4) 22.0%	(7) 11.7%	(7) 12.8%
To manage my weight	(5) 19.8%	(5) 21.4%	(3) 29.2%	(3) 32.3%
My friends, family or colleagues encouraged me to	(6) 15.2%	(7) 15.2%	(5) 24.5%	(4) 26.0%
To train for another sport/event	(7) 14.2%	(8) 13.9%	(10) 6.7%	(9) 8.1%
To improve my mental health	(8) 13.0%	(6) 16.8%	(6) 17.1%	(6) 18.7%
To feel part of a community	(9) 11.0%	(9) 11.3%	(9) 6.8%	(10) 6.0%
To spend time outdoors	(10) 10.3%	(10) 10.2%	(8) 8.2%	(8) 10.2%
(d) parkrun participation	Sample/sub-sample			
	Full sample	Deprived	Inactive	Deprived / inactive
Years registered with parkrun				
n	47,701	4,300	2,184	237
Mean	3.13	2.71 ^z	2.40 ^z	2.28 ^z
Median	2.6	2.2	2.0	1.8
[Q1-Q3]	[0.9-4.8]	[0.7-4.2]	[0.7-3.8]	[0.7-3.5]
<i>parkruns</i> run/walked per year				
n	34,211	2,942	1,447	151
Mean	14.60	14.12 ^x	15.53 ^y	14.78
Median	11.3	10.7	12.2	12.7
[Q1-Q3]	[4.0-23.3]	[3.9-22.5]	[4.4-25.4]	[3.9-24.1]
Total <i>parkruns</i> run/walked				
n	45,708	4,193	2,116	232
Mean	46.0	39.2 ^z	37.4 ^z	35.0 ^x
Median	21	17	18	15
[Q1-Q3]	[6-62]	[5-51]	[6-50]	[6-44]
(e) physical activity at the survey	Sample/sub-sample			
	Full sample	Deprived	Inactive	Deprived / inactive
Single activity question n	59,967	4,382	2,183	236
Mean	3.59	3.45 ^z	2.41 ^z	2.47 ^z
Median	3	3	2	2
[Q1-Q3]	[2-5]	[2-5]	[1-3]	[1-3]
IPAQ n	45,496	3,303	1,568	171
Proportion low or moderate physical activity	35.8%	38.0%	62.2%	59.6%
Proportion high physical activity (health enhancing)	64.2%	62.0%	37.8%	40.4%

Ethical approval for the study was granted by Sheffield Hallam University Research Ethics Committee on 24/07/2018 (reference number: ER7034346) and approval was granted from the *parkrun* Research Board. The study used an online survey, incorporating wherever possible validated and robust measures used in health and wellbeing research. An advisory board, created using the *parkrun* Research Board, were consulted to longlist and then shortlist the questions used in the survey. For each measure, a search was undertaken by the research team to identify appropriate questionnaires or questions. Each questionnaire or question was selected using the following criteria: relevance; validity; reliability; length; previous use. If previous questionnaires or questions could not be identified, the research team developed study-specific questions to capture the outcome. The length and literacy were tested and re-tested via members of the research team and the advisory board. The reporting adheres to established standards for reporting internet-based surveys; The Checklist for Reporting Results of Internet E-Surveys (CHERRIES) (19).

Population and participants

The sample was drawn from all *parkrun* registrants in the UK aged 16 or over. Registrants received an email from *parkrun* containing a link to the survey. Survey participants had to be aged 16 or over and the survey was only available in online format and in the English language. There were no other explicit exclusion criteria. In this manuscript, we use the data from respondents who identified in the survey as runners/walkers and runners/walkers who also volunteer at *parkrun*. We present the data relating to running/walking at *parkrun* (not volunteering).

The survey

The measures in the survey are described fully in Additional file 1 with a full copy of the survey, including wording for consent. The list below describes the sub-set of measures used in this study.

Demographics

Demographic data included date of birth, gender, ethnicity, employment, home *parkrun* (the *parkrun* event they were most closely affiliated with) and long-term health conditions. One question asked participants to state whether they most closely identified as a *parkrun* runner/walker, a *parkrun* runner/walker and volunteer or a *parkrun* volunteer. Respondents were asked to provide their *parkrun* ID number to enable their survey responses to be matched to the *parkrun* database that holds their *parkrun* registration details (e.g. postcode, activity level at registration) and participation information (e.g. number of *parkruns* completed). See '*parkrun* data' section below for more details.

Life satisfaction and happiness

Two of the four personal wellbeing questions asked in the UK's Office of National Statistics Annual Population Survey (20) were used as measures of life satisfaction and happiness: 1) "*Overall, how satisfied are you with your life nowadays?*" and 2) "*Overall, how happy did you feel yesterday?*" Statements were rated on a 10-point visual analogue scale where 0 is "not at all", and 10 is "completely".

Subjective health status

Subjective health status was measured using the EuroQoL visual analogue scale (EQ-VAS) (21) which asks: "*We would like to know how good or bad your health is TODAY. This scale is numbered from 0 to 100. 100 means the best health you can imagine. 0 means the worst health you can imagine. Please enter a number in the box below to indicate how your health is TODAY.*" Permission was granted by EuroQoL Research Foundation for its use.

Motivation for participating in parkrun as a runner/walker

Motivation for participation in *parkrun* was measured with the question: "*What motivated you to first participate at parkrun as a runner or walker?*" Respondents were asked to select a maximum of three answers out of a possible 21 motives. The 21 choices were displayed in randomised order to help reduce response bias. The final choice was "other" and, if selected, respondents were asked to specify the motive.

Self-reported physical activity

Self-reported physical activity was measured using three different measures: 1) the a single item four week recall physical activity question that is asked at *parkrun* registration; 2) a single item one week recall physical activity question (22); and 3) the International Physical Activity Questionnaire Short Form (IPAQ-SF) (23).

Four week recall

This question asked: "*Over the last 4 weeks, how often have you done at least 30 minutes of moderate exercise (enough to raise your breathing rate)?*" Respondents could answer: less than once per week, about once per week, about twice per week, about three times per week, four or more times per week, rather not say, don't know. This was chosen because the same question is asked at *parkrun* registration, allowing direct comparison.

One week recall

This single-item physical activity measure was developed by Milton, Bull (22) and asks: "*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 days, 2 days, 3 days, 4 days, 5 days, 6 days, 7 days. This has been validated against the Global Physical Activity Questionnaire in a UK sample of 240 adults (22).

IPAQ-SF

Physical activity was also measured using the International Physical Activity Questionnaire short form (IPAQ-SF) (23). The IPAQ-SF is a validated, subjective measure of physical activity (24). Respondents answered 7 questions on the frequency, intensity (moderate, vigorous, walking, sitting) and duration of physical activity participation over the past 7 days.

Perceived impact of running/walking at parkrun

The perceived impact of *parkrun* was measured using the following question: “Thinking about the impact of *parkrun* on your health and wellbeing, to what extent has running or walking at *parkrun* changed.” Respondents were presented with a list of 15 potential impacts and asked to rate each one on the following 5-point scale: much worse, worse, no impact, better, much better. The answer choices were displayed in randomised order to help reduce response bias. The final choice was “other” and, if selected, respondents were asked to specify the impact.

parkrun data

Additional data was exported from the *parkrun* database wherever enough personal details were provided to enable data matching. Additional data matched to responses included the following: postcode provided at *parkrun* registration; date of *parkrun* registration; self-reported physical activity level at registration using the four-week recall question; and total number of *parkruns* completed since registration.

Data collection

Pilot testing was carried out on a randomly selected sample of 200 UK participants (aged 16 or over). Subsequent power calculations suggested that the survey would have to be sent to the full *parkrun* population to allow segmentation to a sub-sample from socioeconomically deprived areas (derived by postcode) and who were previously inactive at registration. The survey was distributed between 29th October and 3rd December 2018.

The survey used Qualtrics online survey software (25). The web link contained an introductory page with a participation information sheet and a confirmation box to indicate it had been read, understood and consent given to be part of the take part. Only people emailed the web link could access the survey. View rate of the survey was not captured. The survey was open for five weeks from 29th October 2018 with staggered sending of emails due to email server limitations. Reminders were emailed after one week. There were no incentives offered for taking part in the survey.

Questions were asked in the order presented in Additional file 1, with the exception of the International Physical Activity Questionnaire Short Form (IPAQ-SF), which was asked as a final, optional question due to its length and to keep it apart from the other physical activity measures used earlier in the survey. Questions were not randomised, but response choices within some questions were (see Additional file 1).

Adaptive questioning was utilised, such that certain questions were displayed based on answers to previous questions. For example, people who reported being walkers/runners did not see questions about volunteering at *parkrun*. There was a maximum of 47 questions, with an average of 4.3 questions per page and a maximum number of 11 screens (pages) of questions (total question number and page number were shorter depending on how respondents answered questions).

Questions were optional (i.e. non-compulsory) with the exception of the question about *parkrun* participation type (to enable the appropriate questions to be presented to the respondent), one question about long-term health conditions and two questions about life satisfaction and happiness. Respondents could go back and forth within the survey to review or change answers. Upon clicking 'submit', answers could not be changed. With consent, partially completed survey responses were saved and data kept for analysis unless the respondent requested removal by contacting the research team.

Data handling

Survey returns that included identifiers (*parkrun* ID number, name, date of birth, home *parkrun*) were matched, with consent, to *parkrun* registration data for 74% of survey respondents (the remaining 26% did not contain enough information to allow the match). All data was anonymised after matching with *parkrun* registration data. Data was handled in accordance with the Data Protection Act 2018 and the General Data Protection Regulation 2018. Raw survey data was stored on centrally encrypted hard drives in password protected files. Raw data was exported from Qualtrics to Microsoft Excel (Microsoft Office 2011, Microsoft Corporation, USA) for data validation, cleaning and the removal of personal identifiers to create a pseudo-anonymised data set. Analysis was carried out in Microsoft Excel, SPSS (IBM SPSS Statistics 24.0) and MATLAB (version 13.0b, MathWorks, USA).

Duplicate responses were identified by their unique Qualtrics code assigned during the survey and only the latest time-stamped response retained. Responses were excluded if they consented and filled out some or all demographic data but did not fill out any other survey questions to enable analysis. Six respondents were removed either due to abusive comments in free text, because of nonsensical responses, or both. Some respondents were found to give responses between 0 and 10 for the EQ-VAS which had a scale of 0 to 100; any data from 1 and 10 inclusive were removed with zeros retained as a valid minimum. This removed 1,270 responses for this question. Respondents were not obliged to answer all questions and partially completed surveys were included in the analysis.

Respondents were allocated an Index of Multiple Deprivation (IMD) for Lower Level Super Output Areas (LSOA) derived from the postcode they provided at *parkrun* registration. LSOAs are the smallest units from which Population Census data is compiled and onto which official data on socio-economic context is mapped by the Office of National Statistics (26). The participants IMD scores were grouped into quartiles where quartile 1 was the most deprived.

A detailed protocol and full description of the dataset is available in the survey report published on the *parkrun* Research Board website (18).

Data analysis

Descriptive statistics were used to characterise the respondents and compare them to the total population of *parkrun* registrants from which they were drawn. Stratified analyses were then undertaken to compare health and wellbeing, motivation for participation and self-reported benefits of participation between

groups defined by socioeconomic deprivation status as well as their self-reported activity level at registration.

For descriptive statistics, we report percent, mean, median and interquartile range (IQR). Data such as age, happiness, life satisfaction, health today, *parkruns* per year, years registered and the single activity question were non-parametric. Group comparisons were carried out using the Mann-Whitney U test.

Results

Survey responses

The survey resulted in 100,864 respondents (4.5% participation rate). The following were removed from the analysis: 1) respondents who did not consent (1,349); 2) respondents who consented to view the survey but did not answer any questions (37,040); 3) respondents who had registered with *parkrun* but not participated (1,787); 4) respondents who identified as *parkrun* volunteers (681), i.e. were not runners or walkers; and 5) respondents who provided invalid responses (7). The dataset used in this paper had 38,071 who identified as runners/walkers and 21,929 who identified as runners/walkers who volunteer, giving a combined data set of 60,000 (2.7% completion rate).

Demographic characteristics of respondents

The characteristics of survey participants were compared to the surveyed population (Table 1). In comparison to the registered *parkrun* population, survey respondents had been registered for a shorter mean period of time and participated in *parkrun* events almost four times as frequently, having undertaken 14.6 *parkruns* per year for 3.1 years (compared to 3.7 *parkruns* per year for 3.5 years).

Descriptive characteristics of respondents (including sub-groups of most socioeconomically deprived areas and least active at registration)

Descriptive statistics for the sample as a whole and its sub-groups defined by their socioeconomic deprivation status (i.e. IMD derived from postcode) and activity level at registration are shown in Table 2. Respondents from the most socioeconomically deprived areas (IMD quartile 1) are labelled 'deprived sub-sample' and those who self-reported as being the least active at *parkrun* registration (i.e. less than one bout a week) are labelled 'inactive sub-sample'. Respondents from the most socioeconomically deprived areas *and* the least active at registration are labelled 'deprived/inactive sub-sample'.

Table 2b shows that those in the deprived sub-sample reported 2.3% lower happiness than the full sample (7.35 compared to 7.52 out of 10; $p < 0.001$) and 2.3% less life satisfaction (7.58 compared to 7.76 out of 10; $p < 0.001$). This difference increased to 3.3% for happiness ($p < 0.001$) and 3.5% for life satisfaction for the inactive sub-sample ($p < 0.001$). The deprived/inactive sub-sample reported 5.3% less happiness ($p < 0.01$) and 4.5% less life satisfaction than the full sample ($p < 0.001$). It should be noted that the sample size was small in the latter group ($n = 237$). In England and Wales, national happiness has been reported as 7.53 out of 10 and life satisfaction 7.69 out of 10 (ONS, 2018a).

In terms of overall health as measured by the EQ-VAS, those in the deprived sub-sample reported 2.1% lower health scores than the full sample (79.3 out of 100 compared to 81.0; $p < 0.001$); those in the inactive sub-sample reported 4.6% lower health scores (77.3 compared to 81.0 out of 100; $p < 0.001$) and the deprived/inactive sub-sample reported the greatest reduction at 7.8% (74.7 compared to 81.0 out of 100; $p < 0.001$). It should be noted that there were only 225 respondents in the latter group.

Motives for participating in parkrun

Respondents to the survey were asked to select three motives for initially taking part in *parkrun*: the results are shown in Table 2c. The most commonly reported motives for the full sample were 'to contribute to my fitness' (56.2% of respondents) and 'to improve my physical health' (37.0% of respondents). The proportions choosing fitness tended to decrease for the deprived and inactive sub-samples, while the proportions choosing physical health tended to increase. The rankings reversed for the deprived/inactive sub-sample, so that 'to improve my physical health' was the first-ranked motive (48.1% of respondents) while 'to contribute to my fitness' dropped to second place (45.1% of respondents).

The motives 'to gain a sense of personal achievement' was ranked third in the full sample and had a similar proportion of respondents across the sub-samples (25.4 to 26.9%). The fourth ranked motive in the full sample was 'to get a recorded time for a 5k' at 21.4%; this reduced to 11.7% for the inactive sub-sample and to 12.8% for the inactive/deprived sub-sample so that it was ranked seventh place. In contrast, the fifth ranked motive for the full sample was 'to manage my weight' (19.8%); this moved up to third place for the inactive and inactive/deprived sub-samples (29.2% and 32.3% respectively).

Participation and physical activity levels

Table 2d shows the frequency of participation in *parkrun*. The sub-samples were registered more recently than the full sample ($p < 0.001$) with the inactive/deprived sub-sample registered for 0.85 years less at 2.28 compared to 3.15 years. Those in the deprived sub-sample did 3.3% fewer *parkruns* per year than the full sample (14.12 compared to 14.60; $p < 0.05$), while those in the inactive sub-sample did 6.4% more *parkruns* per year (15.53 compared to 14.60; $p < 0.001$). Those in the inactive/deprived sub-sample did 1.2% more *parkruns* per year (14.78 compared to 14.60), although this was not statistically significant. It should be noted that there were only 151 respondents in the latter category.

Comparison of the *parkrun* physical activity question at the survey compared to registration showed that 88.2% of the inactive sub-sample had increased their activity level following *parkrun* participation (see Additional file 2). A similar increase of 86.5% was found for the deprived/inactive sub-sample. The median number of days of activity was 2.

Table 2e shows similar findings using the single physical activity question: those in the inactive sub-sample reported undertaking activity on 2.41 days per week following participation in *parkrun*. Those in the deprived/inactive sub-sample did 2.47 days of activity. The IPAQ-SF results (Table 2e) indicated that

37.8% of the inactive sub-sample and 40.4% of the inactive/deprived sub-sample did physical activity that was vigorous enough to be health enhancing, according to the scoring system provided by IPAQ-SF (23).

Perceived impact of running or walking at parkrun

The reported benefits for the sub-samples are compared with the full sample in Table 3. All respondents tended to select no impact, better or much better for the 15 impacts. The proportion selecting worse or much worse was on average 0.5% for the 15 impacts, with the exception of 'the amount of time spent with family' at 6.2%.

Table 3
Perceived impact of running or walking at *parkrun* using the question "Thinking about the impact of *parkrun* on your health and wellbeing, to what extent has running or walking at *parkrun* changed:". Response options were: 'much worse, worse, no impact, better, much better'. Data in the table are a combined value for 'better' and 'much better'.

(d) parkrun participation	Sample/sub-sample			
	Full sample	Deprived	Inactive	Deprived / inactive
Years registered with parkrun				
n	47,701	4,300	2,184	237
Mean	3.13	2.71 ^z	2.40 ^z	2.28 ^z
Median	2.6	2.2	2.0	1.8
[Q1-Q3]	[0.9-4.8]	[0.7-4.2]	[0.7-3.8]	[0.7-3.5]
<i>parkruns</i> run/walked per year				
n	34,211	2,942	1,447	151
Mean	14.60	14.12 ^x	15.53 ^y	14.78
Median	11.3	10.7	12.2	12.7
[Q1-Q3]	[4.0-23.3]	[3.9-22.5]	[4.4-25.4]	[3.9-24.1]
Total <i>parkruns</i> run/walked				
n	45,708	4,193	2,116	232
Mean	46.0	39.2 ^z	37.4 ^z	35.0 ^x
Median	21	17	18	15
[Q1-Q3]	[6-62]	[5-51]	[6-50]	[6-44]
(e) physical activity at the survey	Sample/sub-sample			
	Full sample	Deprived	Inactive	Deprived / inactive
Single activity question n	59,967	4,382	2,183	236
Mean	3.59	3.45 ^z	2.41 ^z	2.47 ^z
Median	3	3	2	2
[Q1-Q3]	[2-5]	[2-5]	[1-3]	[1-3]
IPAQ n	45,496	3,303	1,568	171
Proportion low or moderate physical activity	35.8%	38.0%	62.2%	59.6%
Proportion high physical activity (health enhancing)	64.2%	62.0%	37.8%	40.4%

Table 3 shows the proportions reporting improvements to the measures, i.e. a combined value of those reporting 'better' and 'much better'. The data for the full sample shows that, 'a sense of personal achievement' had the largest proportion showing improvement at 90.7%. The second highest rated measure was fitness (89.3%) followed by physical health (84.7%), happiness (78.8%) and the amount of time spent outdoors (74.1%). Mental health was improved for 69.3% of respondents and 'overall lifestyle choices' improved for 51.8%.

The proportion reporting improvements was highest for the inactive/deprived sub-sample compared to the other sub-samples and full sample for all but four measures: 1) fitness (where the proportion was highest in the deprived sub-sample at 92.7%); 2) your enjoyment of competing (where the proportion was highest in the inactive sub-sample at 74.2%); 3) ability to control your weight (where the proportion was highest in the inactive sub-sample at 56.4%); and 4) amount of time you spend with family (where the proportion was highest in the deprived sub-sample at 31.9%).

Discussion

In this self-selected sample of *parkrun* participants, all respondents, irrespective of demographic characteristics and socioeconomic deprivations status, reported diverse benefits from participation in *parkrun* as runners/walkers. Whilst there was response bias in favour of those participating in *parkrun* more frequently, and fewer responses from those from more socioeconomically deprived areas and less active at registration, the scale of the survey ensured that comparison of these sub-groups with the sample as a whole was possible. We were able, for the first time, to compare benefits in those groups who have the greatest theoretical capacity to benefit from participation in *parkrun* with other sub-groups from within the *parkrun* population. This addresses a key priority linked to the achievement of population goals identified in the WHO's Global Action Plan on Physical Activity (1).

The *parkrun* participants (runners/walkers) in our survey who were previously inactive had increased their activity levels from doing less than one day of activity per week at registration, to doing 2.4 days per week. Thus, in addition to the fifteen *parkruns* completed per year on average, this would equate to another 111 days per year of activity outside *parkrun*; this increases to 115 days per year if they are also from socioeconomically deprived areas. Given that individuals living in more socioeconomically disadvantaged areas who are physically active may experience better health and quality of life than their neighbours who are less active (14), further research is needed to explore how community physical activity initiatives like *parkrun* can use strategies which promote inclusivity.

Whilst the range and magnitude of benefits reported in this study indicate that respondents from across all sub-groups believe running or walking at *parkrun* impacted positively on their health and wellbeing, more of those who were from the most socioeconomically deprived areas, and those least active at registration, reported greater improvements than the full sample. Despite this, their self-reported health and wellbeing was consistently lower than the full sample, reflecting persistent and widely recognised health inequalities.

Further research to explore factors related to benefits from participation

There is a growing body of qualitative research exploring the motivations for participation in *parkrun* and the positive benefits experienced by those who attend (7–9, 27, 28). Research has also explored the barriers to participation for specific communities and population groups and the potential for action research in developing inclusive strategies to increase participation by underrepresented groups (11). Valuable insights could be gleaned from understanding the barriers to participation in community initiatives like *parkrun* among people from more inactive groups, including those from socioeconomically deprived areas. Such research would help build a more nuanced understanding of the factors that underpin inequalities in participation. Working with communities to understand these challenges is an important step in designing inclusive strategies to promote participation that could potentially translate into important health benefits and contribute to reducing inequalities.

Further analysis of matched *parkrun* data, using recorded *parkrun* participation as well as survey responses, could be used to explore the complex and bi-directional relationship between frequency of participation and objectively measured changes in health and fitness (for which recorded running and walking times may be a proxy) and reported benefits. These relationships may vary for different types of benefit, with some benefits being experienced at lower levels of engagement and frequency of participation than others. It is also likely that overall perceived benefits may be related to the original motivation for participation.

The benefits related to volunteering at *parkrun*, as well as those related to running and walking should also be explored, as there is substantial evidence from previous research that there can be direct and substantial health and wellbeing benefits from volunteering (29). There is also potential for *parkrun* and similar community-based events to address current inequalities in both volunteering opportunities and the related benefits (30).

The overall benefits to a community are likely to be much greater than the sum of the benefits reported by individual participants. Wider benefits may include improved perceptions of the local area, increased economic activity if participants use local cafes and shops when attending an event (28), community spirit (27, 31) and linking stakeholders within a community, as seen in the UK's *parkrun practice* initiative (32). Previous researchers have used a Social Return of Investment methodology to quantify the wider benefits due to sport (33). A similar analysis of *parkrun* would allow potential funders, local authorities and those wishing to set up similar interventions to understand their social impact and return on investment.

Implications for policy and practice

The example of *parkrun* shows that large scale physical activity interventions can impact positively on the health and wellbeing of participants and have the potential to address health inequalities. It has been assumed that the population groups with lowest levels of physical activity and highest risk of the associated chronic health conditions, who are also more likely to live in more socioeconomically deprived areas, potentially have the most to gain from being more active. However inequalities in personal and environmental resources, including access to transport and free time for recreation at weekends, and other social and cultural barriers to attendance, are reflected in disparities in health behaviours (e.g. recreational physical activity) (34). This study shows that if these population groups do participate in recreational physical activity, they do (as might be hoped if not expected) report the highest levels of benefits. Further research is needed into the barriers experienced by people who theoretically have the most to gain from participation.

Strengths and limitations

The major strength of this study is the size and diversity of the data set that ensured that, despite the low response rate and response bias expected for an email based online survey (19), the sample had the statistical power to explore variation between sub-groups of participants including those underrepresented in previous research i.e. those least active at registration and those living in the most deprived areas.

Response bias could also be assessed from the matching of survey responses to *parkrun* registration data available for the full sample. This indicates that the main difference between respondents and *parkrun* participants invited to complete the survey is in the number of *parkrun* events attended (14.5 v. 3.7 per year). The results therefore relate to a sample that attend more often and that in addition may well have experienced higher levels of perceived benefit, leading in turn to both more frequent attendance and greater motivation to complete a questionnaire on their health and wellbeing in relation to *parkrun* participation.

The findings should be interpreted in light of further methodological considerations. The cross-sectional nature of the data (a sub-sample at one snapshot in time) means the associations observed cannot be inferred as causal; many influential factors outside of *parkrun* may have contributed to the positive changes observed. Longitudinal studies are needed to explore how *parkrun* and health and wellbeing interact over time.

The findings should be interpreted with small sub-sample sizes in mind, especially the deprived/inactive sub-sample. The socioeconomic deprivation status of respondents was not studied directly through questions about employment, income etc., but was inferred from IMD sourced by the postcode provided at *parkrun* registration. This gave a proxy socioeconomic status measure for the area lived in when the respondent first registered with *parkrun*, rather than specific to the respondent at the time of survey completion. The survey was only available in online format in the English language which may potentially exclude people who had limited internet access or low literacy and digital literacy levels.

Given the evidence that the respondents represent more frequent *parkrun* participants, we also undertook analysis of a truncated sub-sample (n = 18,206) that excluded the most frequent participants and therefore was more representative of *parkrun* participant population: this generated very similar results (see Additional files 3 and 4).

Conclusions

Survey respondents, representing *parkrun* participants with a diverse range of demographic and socioeconomic characteristics and of physical activity levels at *parkrun* registration, reported significant increases in physical activity levels and a wide range of benefits that they ascribed to *parkrun* participation. Survey respondents who were the least active at registration and from socioeconomically deprived areas reported the most change to their activity levels and the greatest benefit to their health and wellbeing of all respondent groups. Whilst the challenge of identifying how community initiatives like *parkrun* can better engage with those who are less active and/or from socioeconomically deprived areas remains, if this can be achieved, *parkrun* and similar initiatives could have an important public health role in addressing inequalities in access to opportunities for recreational physical activity. It is important that future research helps identify *how* community initiatives like *parkrun* can better engage with those who potentially have most to gain from being more active in order to maximise impact.

Abbreviations

EQ-5D
EuroQol
EQ-VAS
EuroQol Visual Analogue Scale
IMD
Index of Multiple Deprivation
IPAQ-SF
International Physical Activity Questionnaire Short Form
LSOA
Lower Level Super Output Area
UK
United Kingdom
WHO
World Health Organization

Declarations

Ethical approval and consent to participation

The research design and consent procedures were reviewed and approved by Sheffield Hallam University Research Ethics Committee (Reference number: ER7034346). Written informed consent was received from all participants via the first page of the online survey.

Consent for publication

Not applicable

Availability of data and material

The datasets supporting the conclusions of this article are stored in the Sheffield Hallam University Research Database (SHURDA) for access and in accordance with the Data Protection Act 2018 and the General Data Protection Regulation 2018. In the hope of ensuring the full research potential of the dataset, a copy of the anonymised data will be accessible to researchers for research purposes through the *parkrun* Research Board, as originally outlined in the participant information sheet.

Competing interests

AB, CW, CS, EG, HQ, LR, MG, RC, SH (author initials) are all *parkrun* registrants, but did not complete the survey. All authors are members of the *parkrun* Research Board (<https://awrcparkrunresearch.wordpress.com/>) based at the Advanced Wellbeing Research Centre at Sheffield Hallam University (UK). SH is the Chair of the *parkrun* Research Board. CW and MG are employees at *parkrun*. *parkrun* commissioned Sheffield Hallam University (AB, HQ and SH) to conduct this survey. There are no financial competing interests related to this survey. All other authors declare that they have no competing interests.

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Author contributions

CW and SH conceived the idea of a *parkrun* health and wellbeing survey. AB, HQ and SH designed the survey, sampling method and analysis plan. HQ, LG and SH drafted the manuscript. MG assisted with *parkrun* data acquisition and all authors contributed to the design of the survey and interpretation of the findings. All authors revised and approved the final manuscript.

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