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Enhancing the Health of NHS Staff: eTHOS—a randomised controlled pilot trial of an employee health screening clinic for NHS staff compared with usual care to reduce absenteeism and presenteeism

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Enhancing **t**he **H**ealth **o**f NHS **S**taff: **eTHOS** - a randomised controlled pilot trial of an employee health screening clinic for NHS staff compared with usual care to reduce absenteeism and presenteeism

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Abstract

Background

Staff sickness absence incurs high costs to the NHS and is associated with adverse patient outcomes. Mental and musculoskeletal ill-health are the main causes, with cardiovascular risk factors also common. We tested the feasibility of undertaking a definitive randomised controlled trial to assess the effectiveness and cost-effectiveness of a staff health screening clinic (SHSC) in reducing sickness absenteeism and presenteeism.

Methods

Individually randomised controlled pilot trial of a SHSC compared with usual care recruiting employees from four English NHS hospitals. Those in the intervention arm were assessed by a nurse using electronic database-driven screening for musculoskeletal, mental and cardiovascular health. Screen positives were given advice and/or referral to services according to UK guidelines. Three co-primary outcomes formed the stop-go criteria: recruitment, referrals, and attendance at referred services. Secondary outcomes included: generalisability, screening results, individual referrals required/attended, health behaviours, acceptability/feasibility of processes, indication of contamination, costs, health-related quality of life, self-reported and employee records of absenteeism. Process evaluation included interviews with participants, intervention delivery staff and service providers. Quantitative analyses used descriptive statistics with framework analysis for qualitative data. Due to the COVID-19 pandemic, follow-up was restricted to 6 months and acceptance of referral during the screening assessment used as proxy for attendance.

Results

Despite recruitment rates during the truncated timeframe indicating potential to reach target, the final proportion recruited of 314 consented/3788 invited (8.3%) was lower than anticipated, and those recruited were not fully representative of the hospital staff population. 236/314 were randomised. Of 118 allocated to the intervention arm, screening identified 57 (48.3%) eligible for referral, with 18 (31.6%) accepting the referral. Process evaluation demonstrated that the electronic database-driven screening intervention and data collection system was efficient, promoting good fidelity. The intervention could benefit from more personalisation, better understanding of local context, longer training and better integration with referral services.

Conclusions

We have identified clinical need and perceived benefit for a SHSC. Delivery was feasible and electronic data capture successful. The three stop/go criteria were red (recruitment), green (referral) and amber (attendance), therefore the Trial Oversight Committee recommended that a full-scale trial should proceed, but with modifications to adapt to local context and adopt processes to engage better with underserved communities.

Trial registration: ISRCTN, ISRCTN10237475, registered 09/12/2019, https://www.isrctn.com/ISRCTN10237475.

Keywords: Healthcare workers, absenteeism, presenteeism, occupational health, health screening, employee health, NHS, randomised controlled pilot trial

Key messages regarding feasibility

1) What uncertainties existed regarding the feasibility?

To evaluate the effectiveness and cost-effectiveness of an NHS staff health screening programme requires a large multi-centre randomised controlled trial of this complex intervention. There were uncertainties around response rates, reach, need for referral, attendance rates, acceptability and whether the full trial should be cluster or individually randomised.

2) What are the key feasibility findings?

Although the final proportion recruited was lower than anticipated (314 consented out of 3788 invited; 8.3%) and participants were not fully representative, health screening identified that 57/118 (48.3%) randomised to the intervention arm were eligible for a referral, with 31.6% of those eligible reporting that they intended to attend referrals. There was no evidence of contamination.

3) What are the implications of the feasibility findings for the design of the main study?

This pilot trial supported the clinical need and perceived benefit for a staff health screening clinic. A full-scale individually randomised trial is feasible, but modifications are needed to adapt the trial to local context and to adopt processes to engage better with underserved communities.

Background

The National Health Service (NHS) in the United Kingdom (UK), with 1.7 million employees [1], is in the top 5 largest employers in the world.[2] Sickness absenteeism is significant; over 20 days are now lost per person per year for key members of the healthcare team, such as nurses, midwives and healthcare assistants. This is about twice the public sector average of 10.6 days per employee [3] is costly and negatively affects staff retention.[4] Presenteeism (lost productivity resulting from attending work whilst unwell) is an additional problem.[5-7] In 2023, 54% of NHS staff reported feeling pressure to attend work when unwell,[8] rates of sickness absenteeism have risen since the COVID-19 pandemic, the most common reasons being stress and mental ill-health.[3, 9] NHS sickness absenteeism and presenteeism compromise the quality and safety of patient care.[1, 10-14]

Mental ill-health, the main cause of sickness absenteeism, has been responsible for around a quarter of all recorded days lost [15] and costing an estimated £3.79bn for sickness absenteeism, £6.07bn for presenteeism and £2.24bn for bank and agency staff to cover.[16] This is followed by infections and musculoskeletal (MSK) complaints.[17] Poor lifestyle (smoking, lack of physical activity) and overweight/obesity are also important independent determinants of sickness absenteeism and presenteeism.[18-22] Nearly half of hospital staff are overweight or obese, they report low levels of exercise, and 10-12% smoke.[23,24] Sickness absenteeism is highest in the lowest paid occupational groups (healthcare assistants), closely followed by midwives and nurses.[3] Higher numbers have also been seen in those working unsocial hours,[25] and among older workers.[26] Presenteeism

follows similar patterns.[27]

In response to the high levels of staff ill-health and sickness absenteeism, NHS England instigated a “Healthy Workforce Programme”, supported by the Royal College of Physicians,[28] to improve staff health and well-being, and thereby patient care.[29] Recommendations included improving access to the NHS cardiovascular disease (CVD) health check,[30] physiotherapy (including rapid access),[31] mental health, weight management and smoking cessation services.[32] Since the pandemic new policies and initiatives have been promoted and implemented, recognising the need in particular to focus on staff mental well-being.[9,33-5].

Despite several systematic reviews and individual studies which have evaluated the effectiveness of workplace health promotion and/or return-to-work programmes,[19,36-8] few studies have included a control group or evaluated impact on sickness absenteeism or presenteeism. Of the few which have focused on healthcare staff, most have aimed to promote mental health and well-being.[39] Hospital employees in one feasibility study in three NHS hospital sites, attended a workplace CVD health check, received tailored advice, signposting to health-related information, relevant free services, and advice to visit their general practitioner (GP) if appropriate. Participants reported the clinic to be convenient, informative and useful for raising awareness of health issues.[36]

No studies have rigorously evaluated the cost-effectiveness of interventions targeted at screening for and early management of the main causes of sickness absenteeism in

healthcare settings. The general workplace evidence suggests that focusing on high-risk groups, providing interventions of sufficient intensity and optimising attendance will maximise the chances of interventions being effective.[40,41] The most effective model is likely to be a combination of health screening and health/wellness programmes with targeted interventions.[42]

We developed a staff health screening clinic (SHSC) at the Queen Elizabeth Hospital Birmingham (QEHB), comprising a health screening service for hospital employees with pathways for direct invitation, assessment for MSK, mental health and CVD problems with onward referral. We present the results of a pilot randomised controlled trial (RCT) within four NHS hospitals to assess the feasibility of undertaking a larger full-scale RCT which would evaluate the effectiveness and cost-effectiveness of this service in reducing sickness absenteeism and presenteeism.

Methods

Aims and objectives

To assess the feasibility of undertaking a definitive RCT evaluating the effectiveness and cost-effectiveness of a health screening clinic compared to usual care, in reducing sickness absenteeism and presenteeism amongst NHS staff in the UK. Specific objectives were to:

1. Describe recruitment rates and participant characteristics and assess generalisability compared to the hospital workforce;

2. Describe screening results, recommended referrals and attendance at those referrals;
3. Assess the feasibility of measuring outcomes relating to the definitive trial;
4. Assess levels of contamination between intervention and usual care arms to inform trial design (to consider individual vs. cluster RCT);
5. Describe and explain the fidelity to the intervention and evaluate the barriers and enablers to participation;
6. Describe the views, experiences and satisfaction of participants and those delivering the health checks;
7. Explore feasibility of the trial/service in other NHS and non-NHS settings;
8. Quantify the costs of undertaking the screening service and its consequences;

Trial design

A multi-centre, 2-arm, parallel group, open, individually randomised pilot RCT of a complex intervention comparing a staff health screening clinic with usual care in staff employed within NHS hospitals in England. The full trial protocol has previously been published.[43]

Participants

Setting and eligibility criteria

The trial was undertaken in three large urban hospitals and one rural district general hospital within three NHS Hospital Trusts in the West Midlands. Employees in the participating hospitals were eligible if they were able to provide informed consent, had not previously attended the pilot health screening clinic at QEHB and were not participating in

another drug or health and well-being trial (with the exception of COVID-related drug/vaccine trials).

Recruitment, consent and data collection

Anonymous human resources (HR) data were used to select wards which reflected the sociodemographic and occupational characteristics (age, sex, ethnicity, part-time working and job role) of the hospitals' workforce to ensure the sample was representative. Posters advertising the trial were displayed in departments/wards for at least two weeks prior to sending out invitations, allowing staff time to opt out via the delegated point of contact specified on the posters. All staff in these selected areas were then invited to participate either via staff email (with up to three reminders), or by personal approach for those who did not have access to email. The trial was further promoted through staff meetings, noticeboards, and ward champions. Local staff were engaged to raise trial awareness and arrange cover to allow attendance at the screening clinic. Staff were able to respond to the trial invitation directly through an electronic trial data-collection platform system hosted by the Birmingham Clinical Trials Unit, or on paper to the clinic. All invitees had the option to provide reasons for taking/not taking part.

Participants completed eligibility checks, informed consent and the baseline and follow-up questionnaires using the electronic trial platform system, which could be accessed by participants using their own or workplace electronic devices, with assistance from trial staff if necessary. Up to four prompts were sent to remind participants to complete the baseline

questionnaire. At 26 weeks, a link to the follow-up questionnaire was sent for online completion, with up to one reminder.

Baseline and follow-up questionnaires

The baseline questionnaire included information on demographics, selected medical diagnoses and current medications. The baseline and follow-up questionnaires included information on: smoking status, current employment, weight, exercise levels (using the General Practice Physical Activity Questionnaire; GPPAQ),[44] Health-Related Quality of Life (HRQoL) (using the EQ-5D-5L),[45] health service utilisation, sickness absenteeism and presenteeism (using the World Health Organization Health and Work Performance Questionnaire; WHO-HPQ).[46] Participants were asked to provide their NHS number (this was optional) to assess the feasibility of future linkage to routine data such as hospital admissions, GP records, other healthcare utilisation and mortality data. See Supplementary File Table S1 for further details.

Human Resources data

Linked data from HR records were collected on participant age, sex, ethnicity, staff group and staff grade, number of hours contracted to work, hours worked - full time equivalent, sickness absenteeism and non-sickness absences relating to COVID-19 only for the 24 months pre-randomisation, and from randomisation to 26 week follow-up (start/end dates, duration in days, recorded reason), and leaving date (should participant leave employment of the Trust during trial participation).

Anonymised data were also collected at the time of site set-up from hospital HR records, at whole hospital level and for those invited, on age, sex, ethnicity, job role and number of days absent to assess the generalisability of the included participants.

Randomisation

On completion of the baseline questionnaire, eligible participants were randomised to either the intervention or usual care arm. Randomisation was at the level of the individual in a 1:1 ratio, using a minimisation algorithm (with random element) to ensure balance on the following variables: age (<40, ≥40 years); sex (male, female, prefer not to say); job category (categories as self-reported – see Table 1); nightshift work (yes/no); and hospital.

Intervention - Staff health screening clinic

The staff health screening clinic was delivered in-person by trained clinic nurses, and available on weekdays between 7am and 5pm. The intervention comprised self-reported screening assessments for mental health, MSK health, and CVD health; these were completed independently by the participant on the computer at the beginning of the appointment. These data were used to provide appropriate health advice and/or referral (if not already receiving treatment), according to level of risk, to appropriate local services as recommended in NHS and National Institute for Health and Care Excellence (NICE) guidance[47-51] (Figure 1). Referral in this case was defined as the participant being given links so they could contact relevant services in their own time, however, where participants returned high scores in their mental health checks, clinic staff offered to make an appointment with their GP, or in cases of more urgent concern, contacted the site PI who in

turn contacted the participant's GP. This standardised assessment was supported by prompts within the electronic trial platform system. Findings and recommendations were sent to participants and their GPs. Blinding of participants and nurses conducting the health screening clinic was not possible.

Mental health check

Participants self-completed the Generalised Anxiety Disorder (GAD-7; anxiety) questionnaire [52] and the Patient Health Questionnaire-9 (PHQ-9; depression) [53] to assess their mental health. Participants were categorised into three levels of risk (Figure 1): those without significant anxiety/depressive symptoms were offered online mindfulness advice [54]; those who were moderately affected were advised to seek support from local counselling services such as Birmingham Healthy Minds [55]; and those severely affected were referred to their GP for immediate treatment.

Musculoskeletal health check

The Keele STarT Back screening tool [56] was self-completed to categorise the participant's risk of developing disabling low back pain, and the STarT MSK tool was used for non-back complaints [57] (both categorise people into low, medium or high risk). The Örebro Musculoskeletal Pain Screening Questionnaire (OMPSQ) [58] was also used to enable comparison with international studies. Those with moderate or high risk scores on the STarT Back and/or STarT MSK tools were referred (ie advised to contact) to physiotherapy teams as per NICE guidance,[47-50] either directly to in-house physiotherapy or via their GP. Those with high scores were recommended to receive enhanced physiotherapy including cognitive

behavioural therapy to address associated psychological problems. In practice, in part due to pressures of the COVID-19 pandemic, direct referrals and cognitive behavioural therapy were largely unavailable.

Cardiovascular health check

Participants aged 40 years and over received the cardiovascular component of the NHS Health Check (excluding the dementia awareness component for those aged over 65).[59] This included lifestyle checks: body mass index (BMI), exercise level (using the GPPAQ),[44] smoking status and alcohol intake (using the Alcohol Use Disorders Identification Test Consumption; AUDIT-C).[60] Clinical measures (pulse, blood pressure, electrocardiogram, cholesterol, with HbA1c, estimated Glomerular Filtration Rate and creatinine tests if appropriate) were also taken, and the participant's Cardiovascular Risk Score (QRISK2) calculated.[61]. Actions taken included referral to GP (ie advised to contact), weight management, smoking cessation and/or alcohol reduction services, as well as brief advice on exercise and diet according to UK recommendations. Those under 40 years were assessed for lifestyle components only.

Occupational health

All participants with an identified health condition were asked whether they thought their health condition was affected by/or affected their ability to work, and what adjustments might improve their workability. If affected, they were offered an optional occupational health referral.

Usual care

Usual care consisted of standard access to medical/occupational health services, health promotion/counselling initiatives and the NHS health check if eligible.

Follow-up

Originally 52 weeks' follow-up was planned to fully test the trial processes. However, due to the COVID-19 pandemic, the 52-week follow-up was not completed and only a small number of participants were able to complete the 26-week follow-up assessment (see results).

Primary outcomes and stop/go criteria

Three co-primary outcomes informed the traffic light criteria on progression to the definitive trial (see Table 2, and for further detail Supplementary File Table S2):

(1) **Recruitment of participants.** The proportion of invited employees who consented to take part. The proportion randomised is also presented;

(2) **Referral** (intervention arm only). Those eligible for referral to *any* recommended services (usually GP, local physiotherapy/community psychological services) as a result of the three screening components. We defined "eligible for referral" as anyone who recorded a suitable risk value who was not already being treated for that condition;

(3) **Attendance** at *any* recommended services (intervention arm only). Originally this was planned to be self-reported attendance at any services measured at 26 weeks. However, due to the follow-up period being shortened resulting in only a small number of participants completing the 26-week follow-up assessment, following discussion with the independent

Trial Oversight Committee, acceptance of the referral (signifying intention to attend) which was collected during the screening assessment, was used instead as a proxy for attendance.

Secondary outcomes

Secondary outcomes included:

- Comparison of participants' baseline characteristics with the hospital population to assess generalisability;
- Description of the intervention screening assessment results and referrals;
- Number and type of referrals to recommended services (intervention arm only);
- Attendance at any recommended services. As described above, this was revised to acceptance of referral during the screening assessment;
- Lifestyle relevant to screening intervention advice and referrals (self-report) at 26 weeks: exercise levels (using GPPAQ),[44] smoking status and weight (kg);
- Acceptability of the intervention (interviews with participants and trial/intervention delivery staff);
- Feasibility of trial processes (based on completeness of relevant data items and interviews);
- Indication of contamination (comparing pre/post data for health behaviours and healthcare/other service utilisation in the control arm).

To test data collection processes, at 26 weeks follow-up, we also collected data on planned outcome measures for the definitive trial, which included:

- Employee records of sickness absenteeism (planned primary outcome of definitive trial). This was obtained using routinely collected data from the NHS Electronic Staff Record Programme linked to employee ID;
- Self-reported absolute sickness absenteeism, relative sickness absenteeism and relative hours of work for last 7 days and last 28 days (using the WHO-HPQ);[46]
- Self-reported sickness absenteeism using a 6-month recall period;
- Self-reported absolute presenteeism and relative presenteeism for last 28 days (using the WHO-HPQ);[46]
- Self-reported attendance at occupational health services;
- Self-reported healthcare utilisation (e.g. GP consultations, hospital admissions);
- HRQoL (using the EQ-5D-5L index value).[45]
- Resource use and costs collected by self-report questionnaire to participants on health service utilisation and information from the screening assessment regarding duration and resources used.

Sample size

As this was a pilot trial, the study was not designed or powered to detect a statistically significant difference in efficacy between the two trial arms. We aimed to recruit 480 participants (20 per week) in 24 weeks. With this sample size, the 95% confidence interval (CI) for the proportion of staff recruited could be estimated to be 4% either side of the estimate (e.g. for a 25% recruitment rate, the 95% CI would be 21% to 29%).

Statistical methods

The primary comparison groups were composed of those randomised to the health screening (intervention) arm and those randomised to the usual care (control) arm. All analyses were based on the intention to treat principle. Analyses used available data only, with the extent of missing data reported in order to inform decisions regarding data collection for the definitive trial. Quantitative data (including relevant feasibility outcomes) were analysed using descriptive statistics, with binary outcomes summarised using number of responses with percentages, and continuous outcomes reported as means and standard deviations (SD), or medians and interquartile ranges (IQR) as appropriate. The three co-primary outcomes are presented as percentages with 95% CIs. No statistical modelling was undertaken and no p-values are reported. Data were analysed using SAS version 9.4 (SAS Institute Inc.).

Health economic analysis

Information was obtained from each participating site on the estimated time taken for each screening clinic task and grade of the member of staff responsible, as well as the cost of individual blood tests. A typical duration for each task was then agreed by the study team. The amount of staff time required for each screening task was then multiplied by the relevant unit costs obtained from standard sources.[62] See Supplementary File Table S3.

The total cost of screening included the cost of staff time to undertake all tasks and the cost of blood tests. Costs of screening per participant were presented for all possible combinations of healthcare staff, including the highest possible cost (where all tasks are carried out by the higher potential pay bands) and the lowest possible cost (for the lower

pay bands). The cost of blood tests per participant was weighted according to the proportion who received each type of blood test. Those tasks directly related to processing and reporting blood tests were only applied to the proportion who had at least one blood test. Costs were only applied to those who actually attended screening.

Responses to the EQ-5D-5L baseline questionnaire were valued using the crosswalk algorithm,[63] with the mean, SD and range, and also the frequency of responses within each dimension reported.

Process evaluation

A mixed-methods process evaluation explored programme reach, fidelity of screening delivery, attendance at referrals, participants' views of the intervention, views and experiences of those delivering the intervention, views of providers of follow-on services and additional organisations who might benefit in future from the intervention.

Quantitative elements were extracted from the research questionnaires, the screening clinic data and the routine HR records and analysed using descriptive statistics. Qualitative elements were obtained by interviewing a selection of participants from both trial arms (attenders and non-attenders, those requiring further referral or not), intervention delivery staff and service providers. To explore the screening tool's potential for broader rollout, we spoke with a range of stakeholders from organisations from both within and outside of the NHS who might be interested in the service in the future. Interviews were conducted remotely using semi-structured topic guides (see supplementary file 2), audio recorded and

transcribed prior to inductive analysis using the Framework method.[64] Data were coded using NVivo 12 (QSR International, Warrington, UK) and emergent themes discussed with the research team throughout (RA, RJ, PA, CH, KJ, CP, KR). Full details of the process evaluation methods are provided in the protocol paper.[43]

Trial management and monitoring

The trial was co-ordinated by the Birmingham Clinical Trials Unit at the University of Birmingham. A Trial Oversight Committee (combining the function of Trial Steering and Data Monitoring Committees) with an independent chair and lay representative oversaw, advised on, and monitored the trial.

Patient and public involvement (PPI)

Participant (4-6 clinical, administrative and retired NHS staff) and stakeholder advisory groups representing a wider body of professionals met on a regular basis throughout the project to provide advice on inclusive recruitment processes, study design, study documents, database design/testing, progression of the trial and data interpretation. There was also a hospital staff member (representing input from the participants) on the Trial Oversight Committee.

Results

Recruitment and participant flow

Recruitment was delayed by the COVID-19 pandemic with sites closed to non-COVID research at the time ethical approval was obtained (March 2020). Three sites opened to

recruitment between December 2020 and February 2021 before the study was paused due to COVID-19. Recruitment re-started in May 2021 when a 6-month only extension was granted. All four sites were open to recruitment from May to August 2021, allowing data to be analysed within the funding extension but providing a shorter recruitment period than originally planned.

During our truncated recruitment period of 16 weeks 3,788 of 24,344 NHS staff were invited to take part (Figure 2), with a recruitment rate (consented) which was projected to reach target numbers of 480 in just over 24 weeks had the trial continued (see Supplementary file Figure S1). Over 85% (422/490; 86.1%) of people who responded to the invite expressed interest in taking part in the study. Of these, 353 were eligible and 314 consented (8.3% of those invited, 65.4% of our planned target of 480 participants). Nearly three-quarters of people (309/420; 73.6%) stated that they were most prompted to take part because of receiving an email about the study. Of those who declined to take part, only 1.6% (61/3366) of invitees gave reasons for this; the most common being not interested in research (24.6%) and being too busy (21.3%), concerned about confidentiality (13.1%) and not able to take time out of work (9.8%) (see Supplementary File Table S4). Other reasons cited (44.3%) included that they were leaving/retiring/going on maternity leave; fear of doctors; and fear of being controlled.

Of the 314 who provided consent for the trial, 78 were not randomised as they did not complete the baseline questionnaires/randomisation form (n=68), were ineligible (n=9) or had left the Trust (n=1). In total, 236 participants were randomised into the trial (118 to the

intervention screening arm and 118 to the usual care arm), and 101 of 118 (85.6%) intervention participants attended and completed the health screening clinic. At trial closure, only 26/236 (11%) had reached the 26-week follow-up assessment point (Figure 2).

Characteristics of participants and generalisability

The mean age of participants was 42.5 (SD=10.4) years. The majority were female (188/236; 79.7%), 192 (82.1%) were of white British ethnic origin (192/234), and 107 (45.7%) lived within the poorest two quintiles of deprivation. Seventy-six (32.2%) were allied health professionals, scientists or technical staff and 63 (26.7%) were registered nurses or midwives. Half (50.4%) were recruited from the QEHB hospital (Table 1 and Supplementary File Table S5).

INSERT here: Table 1: Participant characteristics at baseline

Seventeen (7.6%) reported being current smokers, 38.7% were overweight and 30.2% obese. Seventy-two (30.9%) were either inactive or moderately inactive, but 155 (65.7%) reported being in good or very good health. Forty-three (18.5%) reported a previous clinical diagnosis of asthma, 71 (30.7%) anxiety, 67 (28.5%) depression, 25 (10.7%) hypertension, 24 (10.3%) hypercholesterolaemia and 12 (5.2%) diabetes. Fifty-six (24.1%; or 38.6% of the 145 eligible participants aged over 40 years) reported having received an NHS health check. Half (119/235; 50.6%) of participants had consulted a healthcare professional previously for a mental health problem and nearly two-thirds (150/236; 63.6%) for a MSK problem. Thirty-

two participants (13.6%) had previously attended a weight management programme and 13 (5.5%) a smoking cessation programme (Table 1 and Supplementary File Table S5).

The majority (69.9%) of participants worked during the day. Sixty percent (141/235) reported having been absent from work because of sickness in the last year; data from HR records indicated a mean of 13.2 (SD=27.3) days of sickness absence. There was no clear correlation (r=0.52) or systematic error between self-reported sickness absenteeism and HR sickness absenteeism data. Participants reported a mean absolute presenteeism over the previous 4 weeks of 77.2% (SD=18.5); a reduction in best performance of 22.8% (Table 1 and Supplementary File Table S5).

The characteristics of the invited population were similar to those of the hospital population. However, the final trial participants were slightly more likely to be female (79.7% vs. 77.2%), substantially more likely to be white British (78.0% vs. 59.7%), allied health professionals (14.0% vs. 6.9%) and healthcare scientists (11.9% vs. 5.0%) than the whole hospital population. They were less likely to be from estates and ancillary (2.5% vs. 4.7%), medical and dental (5.5% vs. 11.9%) and nursing and midwifery registered staff groups (26.7% vs. 33.4%) (Supplementary File Table S6).

Primary outcomes - stop/go criteria

The recruitment rate met the red stop/go criteria: 314 (8.3%, 95% CI: 7.4%-9.2%) of 3788 invited staff consented, and 236 (6.2%, 95% CI: 5.5%-7.0%) were randomised. Fifty-seven (48.3%, 95%CI: 39.0%-57.7%) of the 118 participants randomised to the intervention arm

were eligible for referral to at least one service (green). There was some ambiguity around who had been offered and accepted referrals to psychological services. Using a conservative (worst-case) approach, assuming none accepted referrals for mental ill-health, overall eighteen (31.6%, 95%CI: 19.9%-45.2%) of 57 participants eligible for a referral stated that they intended to accept the referral to at least one service (amber). If we assume that all referrals were accepted, this increased to 28 participants (49.1%, 95%CI: 35.6%-62.7%) (amber) (Table 2).

Table 2: Stop-go progression criteria and results

		Progression criteria		
Criteria	**Description**	**Green (go)**	**Amber (pause)**	**Red (stop)**
Recruitment (uptake)	% of invited employees consenting to take part.	>25%	15-25%	<15% 314 (8.3%) (95%CI: 7.4%-9.2%)
Referred directly to a service (intervention arm only)	% of participants referred to specified services.[a]*	>30% 57 (48.3%) (95%CI: 39.0%-57.7%)	10-30%	<10%
Attendance at referrals (intervention arm only)	% of participants accepting any referral at the staff health screening clinic.[b]	>50%	30-50% 18 (31.6%) (95%CI: 19.9%- 45.2%)	<30%

[a] Based on participants eligible for referral to any recommended services as a result of the three screening components. Eligible for referral was defined as anyone who recorded a suitable risk value who was not already being treated for that condition.

[b] Due to the follow-up period being shortened resulting in only a small number of participants completing the 26 week follow-up assessment, following discussion with the independent Trial Oversight Committee, acceptance of the referral (signifying intention to attend) which was collected during the health screening clinic, was used instead as a proxy for attendance

Secondary outcomes

Mental health

The median GAD-7 score was 5 (IQR: 2, 7). Eleven (10.9%) were classified as having moderate anxiety and five (5%) severe anxiety (Table 3). The median PHQ-9 score was 4 (IQR: 2, 8), with 13 (12.9%) reporting moderate/moderately severe depression and four (4%) severe depression.

Musculoskeletal health

The StarT Back tool identified eight (7.9%) participants at moderate risk of poor clinical outcome and two (2%) at high risk (Table 3). Twenty-seven (27%) demonstrated moderate risk on the StarT MSK tool for other types of pain, and five (5.0%) high risk. The mean OMPSQ score was 35.2 (SD=13.3; n=72). Nine (12.5%) participants scored over 50, indicating higher risk for future work disability. There were moderate-strong correlations between the OMPSQ and the StarT Back (r=0.65) and the StarT MSK (r=0.79) tools.

Cardiovascular disease

Thirty-eight (38%) participants were overweight and 32 (32%) were obese (Table 3). Forty-six (46%) reported themselves as active. Twelve (11.9%) reported increasing/higher risk on the AUDIT C alcohol dependence tool, and 10 (9.9%) were current smokers. Nearly half (46/101; 45.5%) received additional CVD health checks. Twenty-eight (27.7%) participants had additional blood tests; three (13%) had blood test results which indicated they had diabetes, and three (10.7%) had results which indicated presence of renal disease. Nine

(14.5%) participants eligible for the QRISK2 assessment had medium and two (3.2%) had a high risk of developing CVD in the next 10 years.

INSERT here: Table 3: Results of staff health screening clinic

Referral Details (Staff Health Screening Clinic arm only)

Forty-six (45.5%) participants were eligible for referral to their GP (14 accepted), 10 (9.9%) to local psychological services (1 accepted) and 17 (16.8%) to physiotherapy (4 accepted) (Table 4).

Table 4: Intervention referrals

	SHSC (randomised to intervention) (N=118)	**SHSC (completed intervention) (N=101)**
Required referral[a] to at least one service[b]	**62 (52.5%)**	**62 (61.4%)**
Total number of required referrals	98	98
Referred to GP	46	46
Referred to local psychological services	15	15
Referred to physiotherapy	37	37
Eligible for referral to at least one service[b,c]	**57 (48.3%)**	**57 (56.4%)**
Total number of eligible referrals	73	73
Referred to GP	46	46
Referred to local psychological services	10	10
Referred to physiotherapy	17	17
Accepted referral to at least one service[b]	**18/57 (31.6%)**	**18/57 (31.6%)**
Total number of accepted referrals	19	19
Referred to GP	14	14
Referred to local psychological services	1	1
Referred to physiotherapy	4	4

SHSC=Staff Health Screening Clinic.
[a] Met the score requirement for referral to a service.
[b] GP, local psychological services, physiotherapy.
[c] Participants were not eligible for a referral if they are already being treated for a component of the health check that required referral.

26-week outcomes

The trial closed too early to allow meaningful analyses of the 26 week follow up data and the data are not presented as only seven participants provided data at 26 weeks. HR sickness absence records were available for all 26 eligible participants. Full details are available on request to the authors.

Intervention costs

The base case times for each screening task, grades of staff responsible for each task and disaggregated costs per task are presented in the Supplementary file Table S7. Of the 101 intervention participants who attended screening, 56 (55.4%) received at least one blood test. The average cost of blood tests per participant was £3.29 (see Supplementary file Table S8). The overall maximum screening cost per participant (including blood tests) was £107.48 if the highest band staff were used and £99.98 if the lowest band staff ran the clinic (Table 5 and Supplementary file Table S9).

Table 5: Total cost of screening intervention

Salary band of health care professionals performing tasks	Total cost of salaries for tasks (£)	Total cost including: salaries and cost of blood tests (£)
Highest possible cost, with all highest possible band staff	104.19	107.48
Intermediate cost, with band 6 and 2	103.86	99.65
Intermediate cost, with band 5 and 3	96.69	107.15
Lowest possible cost, with all lowest possible band staff	96.36	99.98

Quality of life

Complete EQ-5D-5L data were available for 233 (98.7%) participants, with a mean score of 0.793 (SD=0.168, range: 0.0140 to 1.000) (Table 1). Participants reported few problems with mobility, self-care or usual activities. However, 22.8% reported at least moderate pain or discomfort, and 18.9% were at least moderately anxious or depressed.

Process evaluation

Intervention fidelity, feasibility of measuring outcomes, assessment of contamination

Using a computer-prompted electronic data capture system resulted in little missing information on the key variables required from either the screening assessment or the baseline questionnaire. A sample of clinic logs indicated low non-attendance rates. Insufficient quantitative data were available to assess completeness of follow-up information or likely levels of contamination, however interviews with trial participants in the usual care arm suggested that contamination between trial arms was unlikely.

Views, experiences and satisfaction

Fifty-one interviews were conducted with 31 trial participants (see Supplementary file Table S10), eight eTHOS nurses delivering the intervention, three physiotherapists, one GP providing the referral services, and 13 representatives from eight additional organisations (other NHS Trusts, a private occupational health provider, a University, an industrial company and a utility provider).

The main findings from the process evaluation are summarised in the Supplementary file

Table S11. We also identified four cross-cutting themes (Figure 3). Firstly "Positive Feedback" regarding the principles behind the intervention. Reported benefits included identification of information sources and services that participants had not been previously aware of, for some faster referral and implementation of the recommendations (for example, increasing exercise, reducing alcohol consumption and losing weight). However, there were some "Modifications Suggested" to improve participants' recruitment, retention and experiences of the trial including: Improved referral pathways, clearer messaging for participants and eTHOS staff regarding content and confidentiality, longer development and training period for eTHOS staff, improved access to underserved groups, revised health screening tools and a flexible delivery model. Despite much positive feedback, concern was expressed that the service was merely a "Sticking Plaster," which did not address the cultural discord between the pressure to act proactively in relation to staff health *versus* the priority to meet patient demands, where the latter takes precedence and contributes to staff "stress". Finally, the impact of the "COVID-19 Pandemic" highlighted both need and demand for, but reduced availability of onward services, it also had an unknown effect on participant recruitment.

Discussion

Key findings

Primary outcomes

Despite disruption, delays and early trial closure due to the COVID-19 pandemic, we have shown that it is feasible to recruit participants and deliver a RCT of a staff health screening clinic within NHS hospitals. Whilst the proportion recruited of 8.3% did not meet our

planned target, the rate of recruitment in time and the large pool of potential participants to invite meant that had the trial been permitted to continue, the target numbers would have been reached just beyond the allotted recruitment time. Furthermore, we found that 48.3% of those randomised to the health screening intervention were eligible for referral, demonstrating a strong clinical need for health assessment, intervention and improvement. Due to early trial closure, it was not possible to determine whether those referred onward attended their appointments, but we ascertained from the screening appointment that under a third (31.6%) intended to do so, suggesting there is a need for some modifications e.g. a more personalised approach including lifestyle advice that could be incorporated into busy family lives, improved referral pathways such as direct referrals, direct access to a wider range of services, requests for expedition of existing referrals to optimise attendance. Importantly, we found that there was clear enthusiasm for the health screening clinic amongst those that engaged, and have shown that there is a clinical need for such a service, which has heightened since the start of the COVID-19 pandemic.

Recruitment

Although we did not recruit to target, encouragingly, the trial did recruit quickly, achieving two-thirds of the original target recruitment of 480 participants within less than four months, when we were required to close. Our original recruitment period was 24 weeks. With a target of 480 participants, this would equate to 320 in 16 weeks. We were only six short of this, achieved by increasing the planned number of invitations sent out. The majority of participants were successfully recruited by email, with online consent and data collection using their own devices. Although multiple approaches were used to engage with

all groups of staff, further work is clearly needed in advance of any future trial to address representation of ethnic minority, lower paid staff and night-shift workers.

The hope that the research would lead to positive changes in the workplace was a motivator to participate as well as having an alternative to visiting a GP. Receipt of the invitation by email was also reported as an enabler. Barriers to participation included being too busy and disinterested in research; we know that the COVID-19 pandemic exacerbated workload pressures during the period of recruitment, therefore, we cannot rule out the pandemic as a factor. The largest of the four sites was a hub for COVID-19 research; this may have contributed to research fatigue.

Intervention delivery, acceptability and satisfaction

Staff delivering the nurse-led electronic health screening intervention found it efficient and feasible, although impersonal at times. Extra training and practice (e.g. role play) could be provided to address this. Participants appreciated the convenience of the onsite service and valued the time to focus on their own needs. However, some felt that it did not reflect or address their stress levels appropriately, or meet their expectations in providing faster access to additional services e.g. physiotherapy or as an alternative to a standard GP appointment. There were also concerns that it would not address the wider determinants of ill health and problems in the workplace. The costs were estimated at around £100 per participant, but because of the range of clinic organisation scenarios, a full economic analysis requires more detailed, site by site data collection of costs.

Comparisons with existing literature

There are no studies which exactly compare to this but the positive reception and demand by our staff reflect other studies of occupational health checks [36]. Whilst current smoking rates in our participants were slightly lower than healthcare workers in other studies (7.6% vs. 10-12%), many more were overweight or obese (69% vs. just over half as reported in other surveys of NHS staff).[23,24] Nearly 70% reported they were active or moderately active which compares reasonably with data from Public Health England.[65] Symptoms of anxiety and depression were reported in 16% and 17% respectively, reflecting the impact of the COVID-19 pandemic as observed in other studies.[66] Just under 40% of those eligible reported having received an NHS health check, compared with the national average of 43.8% in 2019-20.[67]

The mean number of participant-reported days absent from work over the 12 months prior to randomisation was 10.5 days, although HR records indicated this was higher at 13.2 days. This is more than previously reported in the literature, likely reflecting increased rates of sickness absence from work due to the COVID-19 pandemic.[68] Participation in workplace health promotion programmes (WHPPs) typically range from 20 to 30% [69], but can be as low as 9.7% [70], however, health promotion programmes are different from health screening programmes. A study [71] targeting low-paid government employees, including care workers, in the North East of England (an economically deprived area with poor health outcomes) achieved a 20% response rate. The study was conducted over 18 months, prior to the introduction of a national primary care-led health promotion programme (NHS Health Check) in 2009 (where the average uptake for the NHS health check is 39. 2% [72]).

Although invitations were only sent once, the study concerned was publicised through local staff representative bodies and unions, workplace events and routine communications. Promotional material emphasised the confidential nature of the programme and that both attendance and travel time to the workplace venues was permitted during normal working hours. The programme was delivered by occupational nurses. In another feasibility study, 253 hospital employees attended a workplace CVD health check in three NHS hospital sites, received tailored advice, signposting to health-related information, relevant free services, and advice to visit their GP where appropriate. Uptake rates were not available, but 236 were referred to their GP. 54% attended within five weeks of referral; most of the remainder intended to do so. [36] Our proportion recruited were lower than comparable studies pre-pandemic,[71] and are likely to reflect pandemic-related pressures on healthcare services, and the limited reactive promotional opportunities due to both the focus on COVID at that time, and the shortened recruitment period. The recruitment rates in ethnic minorities and lower paid staff were lower than anticipated but are consistent with other studies - active, personal recruitment [73] should be considered. Further stakeholder work would be needed in advance of a full trial in order to more thoroughly explore barriers to participation, particularly in underserved groups. With hindsight, we may also have set too ambitious a target proportion for recruiting “healthy populations” to a screening trial.

Strengths and limitations

A major strength of our trial was the use of an electronic data capture system throughout (recruitment/consent, intervention delivery and data collection) which minimised the need for face-to-face contact during the pandemic, allowed flexibility for staff to participate

during or outside work hours using their own devices if preferred and promoted good fidelity.

Delays meant the trial was conducted over a six-month period meaning we were unable to meet our original recruitment target or complete the planned 52-week follow-up. Therefore, we had limited follow-up data and the timeframes and sampling for the qualitative interviews were sub-optimal, including mainly nurses and daytime workers. However, despite this, we were able to recruit two thirds of our target in less than four months, due to the large pool of available staff and our flexible recruitment and intervention delivery strategies.

The COVID-19 pandemic altered the profile and culture of research amongst the healthcare staff population, which may have contributed to research fatigue. The results of this feasibility study may therefore not be fully generalisable to non-pandemic times, but it does provide good evidence of what can be achieved even under enormous pressure.

Recommendations for design of full trial

Information from the results and the process evaluation suggest the following key recommendations for a future full trial:

- Additional strategies would be needed to recruit underserved groups e.g. discussion with specific minority staff network groups and leaders.
- Clearer messaging regarding confidentiality which incorporates the perspectives shared by participants may improve recruitment.

- Clearer messaging regarding the intervention itself will help to manage expectations.
- Wait-list controls may also improve recruitment and aid trial retention.
- Extra training and practice (e.g. role play) for staff delivering the intervention could be provided to ensure sufficient familiarity with the questions and improve personalisation.
- Clearer referral pathways are needed to optimise attendance at referrals and realise health outcomes, the possibility of direct referrals to in-house services such has physiotherapy or mental health support, or smoking cessation services should be explored.
- The amount of data collected, and length of questionnaires, should be reviewed to reduce the dropout between consent and randomisation.
- The mental health screening tools need reviewing as participants reported that occupational stress and burnout were not adequately identified and treated.
- More detailed site by site data collection would be required in a full trial, to allow presentation of the full range of clinic organisation scenarios.

Conclusions

Despite significant delays and challenges due to the COVID-19 pandemic, we were able to deliver this randomised pilot trial in four different hospitals. We were able to assess important aspects of the feasibility of an RCT, with both recruitment and intervention delivery considered feasible, and the intervention efficient and acceptable to both participants and those delivering the intervention. Although a lower proportion of staff took part in the trial than anticipated, the health screening assessments revealed significant

health needs of NHS staff. While the enthusiasm reported reflects a self-selecting group, and no doubt tempered by being offered amidst the healthcare crisis during the COVID-19 pandemic, this study nonetheless highlights a clear clinical need and strong interest in such a service among those who engaged.

The stop/go criteria for the trial were in the red (recruitment), green (referral) and amber (attendance) zones. When these were considered together, alongside the valuable information from the process evaluation, the Trial Oversight Committee recommended that a full-scale trial should proceed, but with modifications to adapt the trial to local context and to adopt processes to engage better with underserved communities.

List of Abbreviations

AUDIT C	Alcohol Use Disorders Identification Test Consumption
BMI	Body Mass Index
CI	Confidence Interval
CVD	Cardiovascular Disease
EQ-5D-5L	EuroQol 5 Dimension 5 Level
eGFR	Estimated Glomerular Filtration Rate
GAD-7	Generalised Anxiety Disorder questionnaire
GP	General Practitioner
GPPAQ	General Practice Physical Activity Questionnaire
HbA1c	Haemoglobin A1c
HR	Human Resources
HRQoL	Health-Related Quality of Life
IQR	Interquartile Range
MSK	Musculoskeletal
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
NIHR	National Institute for Health and Care Research
OMPSQ	Örebro Musculoskeletal Pain Screening Questionnaire
PHQ-9	Patient Health Questionnaire-9
PPI	Patient and Public Involvement
QEHB	Queen Elizabeth Hospital Birmingham

QRISK2	Cardiovascular Risk Score
RCT	Randomised Controlled Trial
SD	Standard Deviation
SHSC	Staff Health Screening Clinic
STarT	Subgroups for Targeted Treatment
U&E	Urea and Electrolytes
UK	United Kingdom
WHPP	Workplace health promotion programmes
WHO	World Health Organization
WHO-HPQ	World Health Organization - Health and Work Performance Questionnaire
WTE	Whole Time Equivalent

Declarations

Ethics approval and consent to participate

The study received ethical and research governance approval from the West Midlands – Edgbaston Research Ethics Committee on 13th January 2020 (Reference number: IRAS261855). The trial was sponsored by the University of Birmingham, UK. All participants provided informed consent prior to taking part in the trial.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

KJ is part funded by the National Institute for Health and Care Research (NIHR) Applied Health Research Collaboration West Midlands. TB is part funded by the NIHR as a Senior Investigator. TB is a member of the Novo Nordisk Global Expert Panel on type 2 diabetes in children. All other authors declare that they have no competing interests.

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Authors' contributions

RJ and ES had the initial concept, and co-led the study design with PH, PA, KJ, TM and contributions from other authors (TB, LC, ID, NH, HR and GW). NH advised on the musculoskeletal screening, SS on workplace impact and occupational health, and HR on the mental health aspects of the health screening intervention design. MO led on the public and patient involvement and engagement. PH and SJ led on the methodological/ statistical aspects and economic evaluations respectively. KJ led the process evaluation, with advice on the design of the qualitative methodology from a senior colleague in the area of workplace mental health, and RA leading on the qualitative data collection and analysis with CH and CP. RJ, PA and KR also contributed to the design and oversight of the qualitative processes. RJ and ES oversaw the running of the trial with contributions from all other authors. ST and

SB, with PH, NI and AM, were responsible for the trial management and delivery of the study within the Birmingham Clinical Trials Unit. AM and NI were responsible and undertook the final analyses, and FE undertook the economic analyses under the supervision of SJ. ES (Queen Elizabeth Hospital, Birmingham), GW (Heartlands Hospital, Birmingham), TB and LC (Birmingham Children's Hospital) and ID (Hereford Hospital) all played key roles in supporting the delivery of the trial at their sites.

All authors contributed to the development and/or oversight of this study. All authors contributed to the manuscript and approved the final version before submission.

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Table 1: Participant characteristics at baseline

	SHSC (N=118)	Control (N=118)	Total (N=236)
MINIMISATION VARIABLES			
Age (years)			
<40	45 (38.1%)	44 (37.3%)	89 (37.7%)
≥40	73 (61.9%)	74 (62.7%)	147 (62.3%)
Mean (SD)	42.4 (10.1)	42.6 (10.7)	42.5 (10.4)
Range	23.0, 65.0	22.0, 68.0	22.0, 68.0
Sex			
Male	24 (20.3%)	24 (20.3%)	48 (20.3%)
Female	94 (79.7%)	94 (79.7%)	188 (79.7%)
Job category			
Allied Health Professionals / Healthcare Scientists / Scientific and Technical	39 (33.1%)	37 (31.4%)	76 (32.2%)
Medical and Dental	5 (4.2%)	8 (6.8%)	13 (5.5%)
Registered Nurses and Midwives	31 (26.3%)	32 (27.1%)	63 (26.7%)
Nursing or Healthcare Assistants	9 (7.6%)	11 (9.3%)	20 (8.5%)
Wider Healthcare Team	15 (12.7%)	12 (10.2%)	27 (11.4%)
General Management	3 (2.5%)	4 (3.4%)	7 (3.0%)
Other Occupational Group	16 (13.6%)	14 (11.9%)	30 (12.7%)
Nightshift worker			
Yes	5 (4.2%)	2 (1.7%)	7 (3.0%)
No	113 (95.8%)	116 (98.3%)	229 (97.0%)
Hospital			
Queen Elizabeth Hospital Birmingham	61 (51.7%)	58 (49.2%)	119 (50.4%)
Heartlands Hospital	14 (11.9%)	17 (14.4%)	31 (13.1%)
Birmingham Children's Hospital	18 (15.3%)	19 (16.1%)	37 (15.7%)
Hereford Hospital	25 (21.2%)	24 (20.3%)	49 (20.8%)
DEMOGRAPHIC AND BASELINE VARIABLES			
Ethnic group			
White / White British	101 (86.3%)	91 (77.8%)	192 (82.1%)
Mixed / multiple ethnic groups	4 (3.4%)	5 (4.3%)	9 (3.9%)

Asian / Asian British	9 (7.7%)	11 (9.4%)	20 (8.6%)
Black / African / Caribbean / Black British	2 (1.7%)	3 (2.6%)	5 (2.1%)
Other ethnic group	1 (0.9%)	5 (4.3%)	6 (2.6%)
Prefer not to say	0 (-)	2 (1.7%)	2 (0.9%)
Missing	1	1	2
Smoking status			
Never smoked	73 (66.4%)	85 (75.2%)	158 (70.9%)
Ex-smoker	26 (23.6%)	22 (19.5%)	48 (21.5%)
Current smoker	11 (10.0%)	6 (5.3%)	17 (7.6%)
Missing	8	5	13
If current or ex-smoker, pack years[a]	**n=24**	**n=18**	**n=41**
Mean (SD)	10.0 (8.1)	13.7 (10.6)	11.5 (9.3)
Range	0.3, 27.8	3.0, 39.0	0.3, 39.0
Missing	0	1	1
BMI (kg/m^2)[b]			
Underweight	1 (0.9%)	0 (-)	1 (0.5%)
Healthy weight	38 (33.9%)	30 (27.3%)	68 (30.6%)
Overweight	43 (38.4%)	43 (39.1%)	86 (38.7%)
Obese	30 (26.8%)	37 (33.6%)	67 (30.2%)
Missing	6	8	14
EXERCISE LEVELS AND QUALITY OF LIFE			
GPPAQ			
Inactive	16 (13.8%)	14 (12.0%)	30 (12.9%)
Moderately inactive	22 (19.0%)	20 (17.1%)	42 (18.0%)
Moderately active	31 (26.7)	38 (32.5)	69 (29.6)
Active	47 (40.5%)	45 (38.5%)	92 (39.5%)
Missing	2	1	3
General health			
Very good	27 (22.9%)	23 (19.5%)	50 (21.2%)
Good	53 (44.9%)	52 (44.1%)	105 (44.5%)
Fair	36 (30.5%)	40 (33.9%)	76 (32.2%)
Bad	2 (1.7%)	3 (2.5%)	5 (2.1%)
Very bad	0 (-)	0 (-)	0 (-)
EQ-5D-5L[c]			
Mean (SD)	0.799 (0.171)	0.789 (0.165)	0.793 (0.168)
Range	0.0140, 1.000	0.255, 1.000	0.0140, 1.000
Missing	2	1	3
NHS RESOURCE USAGE			
Over 40s NHS Health Check			
Ever received over 40s NHS Health Check?			
Yes	23 (19.7%)	33 (28.7%)	56 (24.1%)
No	94 (80.3%)	82 (71.3%)	176 (75.9%)

Missing	1	3	4
Ever consulted a healthcare professional (or equivalent) for mental health problems			
Yes – in the last year	33 (28.0%)	16 (13.7%)	49 (20.9%)
Yes – more than 1 year ago	30 (25.4%)	40 (34.2%)	70 (29.8%)
No	55 (46.6%)	61 (52.1%)	116 (49.4%)
Missing	0	1	1
Ever consulted a healthcare professional (or equivalent) for musculoskeletal problems			
Yes – in the last year	35 (29.7%)	39 (33.0%)	74 (31.4%)
Yes – more than 1 year ago	43 (36.4%)	33 (28.0%)	76 (32.2%)
No	40 (33.9%)	46 (39.0%)	86 (36.4%)
Ever attended a smoking cessation programme			
Yes – in the last year	0 (-)	0 (-)	0 (-)
Yes – more than 1 year ago	7 (6.0%)	6 (5.1%)	13 (5.5%)
No	110 (94.0%)	112 (94.9%)	222 (94.5%)
Missing	1	0	1
Ever attended a weight management programme			
Yes – in the last year	5 (4.3%)	7 (5.9%)	12 (5.1%)
Yes – more than 1 year ago	8 (6.8%)	12 (10.2%)	20 (8.5%)
No	104 (88.9%)	99 (83.9%)	203 (86.4%)
Missing	1	0	1
ABSENTEEISM/PRESENTEEISM			
Absenteeism up to 12 months before randomisation (from HR records)			
Absenteeism (WTE days)			
Mean (SD)	13.6 (27.4)	12.8 (27.3)	13.2 (27.3)
Missing	1	3	4
Absenteeism (self-reported)			
Taken time off work during the last 12 months due to ill health or otherwise?			
Yes	69 (58.5%)	72 (61.5%)	141 (60.0%)
No	49 (41.5%)	45 (38.5%)	94 (40.0%)
Missing	0	1	1
Number of days off work in the last 12 months			
Mean (SD)	7.1 (19.0)	13.7 (37.2)	10.5 (29.9)
Missing	16	10	26
Presenteeism (using WHO-HPQ)			
Absolute presenteeism[d]			
Mean (SD)	78.1 (17.3)	76.3 (19.6)	77.2 (18.5)
Range	0.0, 100.0	0.0, 100.0	0.0, 100.0
Missing	4	1	5

BMI=Body Mass Index; EQ-5D-5L=EuroQol 5 Dimension 5 Level; HR=Human Resources; GPPAQ=General Practice Physical Activity Questionnaire; NHS=National Health Service; SHSC=Staff Health Screening Clinic; WHO= World Health Organization; WHO-HPQ= World Health Organization-Health and Work Performance Questionnaire; WTE = Whole time equivalent.

[a] Only those who smoke/used to smoke cigarettes exclusively are included.

[b] BMI categories are based on WHO guidelines for different ethnic populations.
[c] EQ-5D-5L score ranges from of -0.594 to 1, where 1 represents the best health state, 0 corresponds to death and negative values indicate a state worse than death.
[d] Absolute presenteeism is a measurement of actual performance in relation to possible performance at work. It has a lower bound of 0 (total lack of performance during time on the job) and an upper bound of 100 (no lack of performance during time on the job).

Table 3: Results of staff health screening clinic

	SHSC (N=101)
MENTAL HEALTH CHECK	
Receiving mental health check	101
GAD-7[a]	
Mean (SD)	5.3 (4.5)
Median [IQR]	5.0 [2.0, 7.0]
Range	0.0, 20.0
Minimal anxiety (score <5)	49 (48.5%)
Mild anxiety (score 5-9)	36 (35.6%)
Moderate anxiety (score 10-14)[b]	11 (10.9%)
Severe anxiety (score 15+)[c]	5 (5.0%)
PHQ-9[d]	
Mean (SD)	5.7 (5.1)
Median [IQR]	4.0 [2.0, 8.0]
Range	0.0, [21.0]
Minimal depression (score <5)	53 (52.5%)
Mild depression (score 5-9)	31 (30.7%)
Moderate depression (score 10-14)[2]	9 (8.9%)
Moderately severe depression (score 15-19)[3]	4 (4.0%)
Severe depression (score 20+)[3]	4 (4.0%)
MUSCULOSKELETAL HEALTH CHECK	
Receiving musculoskeletal health check	101
STarT Back Tool[e]	
Mean (SD)	1.2 (1.7)
Median [IQR]	0.0 [0.0, 2.0]
Range	0.0, 8.0
Low risk (overall score <4)	91 (90.1%)
Moderate risk (overall score 4+ and subscore <4)[f]	8 (7.9%)
High risk (overall score 4+ and subscore 4+)[f]	2 (2.0%)
STarT MSK Tool[g]	
Mean (SD)	2.8 (3.1)
Median [IQR]	2.0 [0.0, 5.0]
Range	0.0, 10.0
Low risk (score <5)	68 (68.0%)
Moderate risk (score 5-8)[f]	27 (27.0%)
High risk (score 9+)[f]	5 (5.0%)
Missing	1
Orebro Musculoskeletal Pain Screening Questionnaire (Short)[h]	**n=72**
Mean (SD)	35.2 (13.3)
Median [IQR]	36.0 [24.5, 42.5]

Range	11.0, 85.0
Score ≤50 (not indicating higher estimated risk for future work disability)	63 (87.5%)
Score >50 (indicating higher estimated risk for future work disability)	9 (12.5%)
Missing	7
CARDIOVASCULAR HEALTH CHECK	
Receiving cardiovascular health check	101
BMI (kg/m^2)[i]	
Mean (SD)	28.3 (6.4)
Median [IQR]	27.2 [23.8, 31.8]
Range	16.8, 50.3
Underweight	1 (1.0%)
Healthy weight	29 (29.0%)
Overweight	38 (38.0%)
Obese	32 (32.0%)
Missing	1
GPPAQ	
Inactive	9 (9.0%)
Moderately inactive	18 (18.0%)
Moderately active	27 (27.0%)
Active	46 (46.0%)
Missing	1
AUDIT C[j]	
Mean (SD)	3.9 (3.8)
Median [IQR]	3.0 [1.0, 5.0]
Range	0.0, 23.0
Lower risk (score <8)	89 (88.1%)
Increasing risk (score 8-15)	10 (9.9%)
Higher risk (score 16-19)	1 (1.0%)
Possible dependence (score 20+)	1 (1.0%)
Current smoker	
Current smoker who wants to quit	8 (7.9%)
Current smoker who does not want to quit	2 (2.0%)
Non-smoker / Ex-smoker	91 (90.1%)
ADDITIONAL CARDIOVASCULAR HEALTH CHECKS	
Excluded from additional cardiovascular health checks	**55**
Excluded due to being aged under 40	39 (70.9%)
Excluded due to being on cholesterol lowering medication or previously diagnosed conditions[k]	16 (29.1%)
Receiving additional cardiovascular health checks	**46**
Pulse	
Regular	46 (100.0%)
Irregular	0 (-)
Blood pressure (mmHg)[l]	

Eligible for blood pressure treatment	1 (2.2%)
No blood pressure treatment required	45 (97.8%)
Cholesterol (mmol/l)	
No referral *(<7.5)*	46 (100%)
Required referral *(7.5+)*	0 (-)
ADDITIONAL BLOOD TESTS	
Excluded from additional blood tests	**73**
Receiving additional blood tests[m]	**28**
HbA1c (mmol/mol)[n]	
Indication of diabetes (≥ 48)	3 (13.0%)
Pre-diabetic (42-47.99)	3 (13.0%)
Normal (<42)	17 (73.9%)
Missing	5
U&E / eGFR (mL/min/1.73m^2)[o]	
Indication of kidney disease (<60)	3 (10.7%)
Normal (≥ 60)	25 (89.3%)
QRISK2 SCORE	
Excluded from QRISK2[p]	**39**
Receiving QRISK2	**62**
QRISK2[q]	
Low risk (<10%)	51 (82.3%)
Medium risk (10-19.9%)	9 (14.5%)
High risk (20%+)	2 (3.2%)

AUDIT C=Alcohol Use Disorders Identification Test Consumption; BMI=Body Mass Index; CVD=Cardiovascular Disease; eGFR=Estimated Glomerular Filtration Rate; GAD-7=General Anxiety Disorder-7; GP=General Practitioner; GPPAQ=General Practice Physical Activity Questionnaire; HbA1c=Haemoglobin A1c; MSK=Musculoskeletal; OMPSQ= Orebro Musculoskeletal Pain Screening Questionnaire; PHQ-9=Patient Health Questionnaire -9; QRISK2=Cardiovascular Risk Score; SD=Standard Deviation; SHSC=Staff Health Screening Clinic; STarT=Subgroups for Targeted Treatment; U&E=Urea and Electrolytes; WHO=World Health Organization.

[a] GAD-7 score ranges from 0 to 21, with a higher score indicating a higher level of anxiety.

[b] Required referral to a local psychological service. Due to a database error, those who scored 14 were referred to the GP for an urgent assessment.

[c] Required referral to GP for urgent assessment.

[d] PHQ-9 score ranges from 0 to 27, with a higher score indicating a higher level of depression.

[e] STarT Back score ranges from 0 to 9, with a subscore ranging from 0 to 5. A low overall score indicates low risk. A high overall score with a low subscore indicates medium risk. A high subscore indicates high risk.

[f] Required referral to a physiotherapist.

[g] STarT MSK score ranges from 0 to 12, with a higher score indicating higher risk.

[h] OMPSQ score ranges between 1 and 100, with a score >50 indicating higher estimated risk for future work disability. Only completed if participant is suffering from back pain or suffering from any other type of pain.

[i] BMI categories are based on WHO guidelines for different ethnic populations.

[j] AUDIT C score ranges from 0 to 40, where a higher score indicates higher dependency on alcohol.

[k] Coronary heart disease, chronic kidney disease, diabetes, hypertension, atrial fibrillation, transient ischaemic attack, hypercholesterolemia, heart failure, peripheral arterial disease, stroke or prescribed statins.

[l] Where a participant is eligible for blood pressure treatment if they have a systolic blood pressure ≥160 or a diastolic blood pressure ≥100. They are also eligible if they have a systolic blood pressure ≥140 or a diastolic blood pressure ≥90 and at least one of the following: diabetes, MI/angina, stroke, chronic kidney disease, or QRISK ≥10%.

[m] Participants had additional blood tests if they were: 40 or older and were currently being treated for any excluded conditions and/or not regularly taking cholesterol lowing medication and had a BMI in the obese category; or 40 or older and are not being treated for any of the excluded conditions and are not regularly taking cholesterol lowering medication and had a BMI in the obese category and/or have a raised blood pressure.

[n] Where a participant is indicative of diabetes if they have an HbA1c value ≥48; pre-diabetic if they have an HbA1c value ≥42 and <48; or normal if they have an HbA1c value <42 mmol/mol.

[o] Where a participant is indicative of kidney disease if they have an eGRF <60; or normal if eGRF ≥60.

[p] Participants were excluded if they were younger than 40 years old.

[q] QRISK score is an estimate of the risk of a person developing CVD over the next 10 years ranging from 0% to 100