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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

Rachel Adams¹, Rachel E. Jordan^{2*} , Alisha Maher³, Peymané Adab², Tim Barrett^{4,5}, Sheriden Bevan³, Lucy Cooper⁴, Ingrid DuRand⁶, Florence Edwards², Pollyanna Hardy⁷, Ciara Harris⁸, Nicola Heneghan⁹, Natalie Ives³, Kate Jolly², Sue Jowett², Tom Marshall², Margaret O'Hara¹⁰, Christopher Poyner¹¹, Kiran K. Rai², Hugh Rickards^{12,13}, Steven Sadhra¹², Sarah Tearne³, Gareth Walters^{2,14} and Elizabeth Sapey^{15,16}

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,

*Correspondence:

Rachel E. Jordan
r.e.jordan@bham.ac.uk

Full list of author information is available at the end of the article



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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 a 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

- What uncertainties existed regarding the feasibility?

To evaluate the effectiveness and cost-effectiveness of an NHS staff health screening programme requires a large multicentre 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.

- 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.

- 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] and 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 £3.79 bn for sickness absenteeism, £6.07 bn for presenteeism and £2.24 bn 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 rates 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, 33–35].

Despite several systematic reviews and individual studies which have evaluated the effectiveness of workplace

health promotion and/or return-to-work programmes [19, 36–38], few studies have included a control group or evaluated the 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 that 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 the 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 multicentre, 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 2 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 work-place 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 ($<40, \geq 40$ 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 5 pm. 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, 59] (Figs. 1, 2, 3). 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 (Fig. 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) (Fig. 1). 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 (i.e. advised to contact) to physiotherapy teams as per NICE guidance [47–50], either directly to in-house

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	<i>n</i> = 24	<i>n</i> = 18	<i>n</i> = 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

Table 1 (continued)

	SHSC (N = 118)	Control (N = 118)	Total (N = 236)
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 40 s NHS Health Check			
Ever received over 40 s 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

Table 1 (continued)

	SHSC (N = 118)	Control (N = 118)	Total (N = 236)
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 -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)

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 (i.e. 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" section).

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):

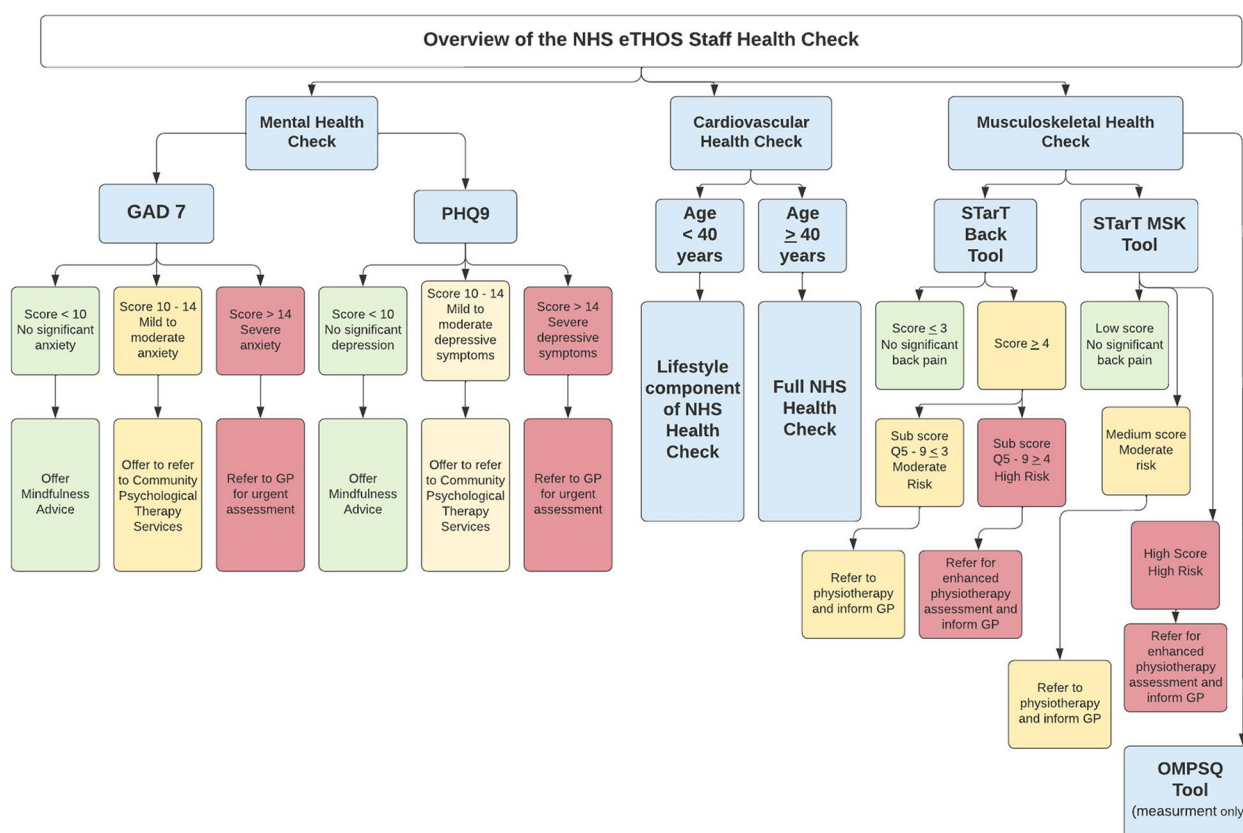


Fig. 1 Overview of staff health screening intervention

- (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 the 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).

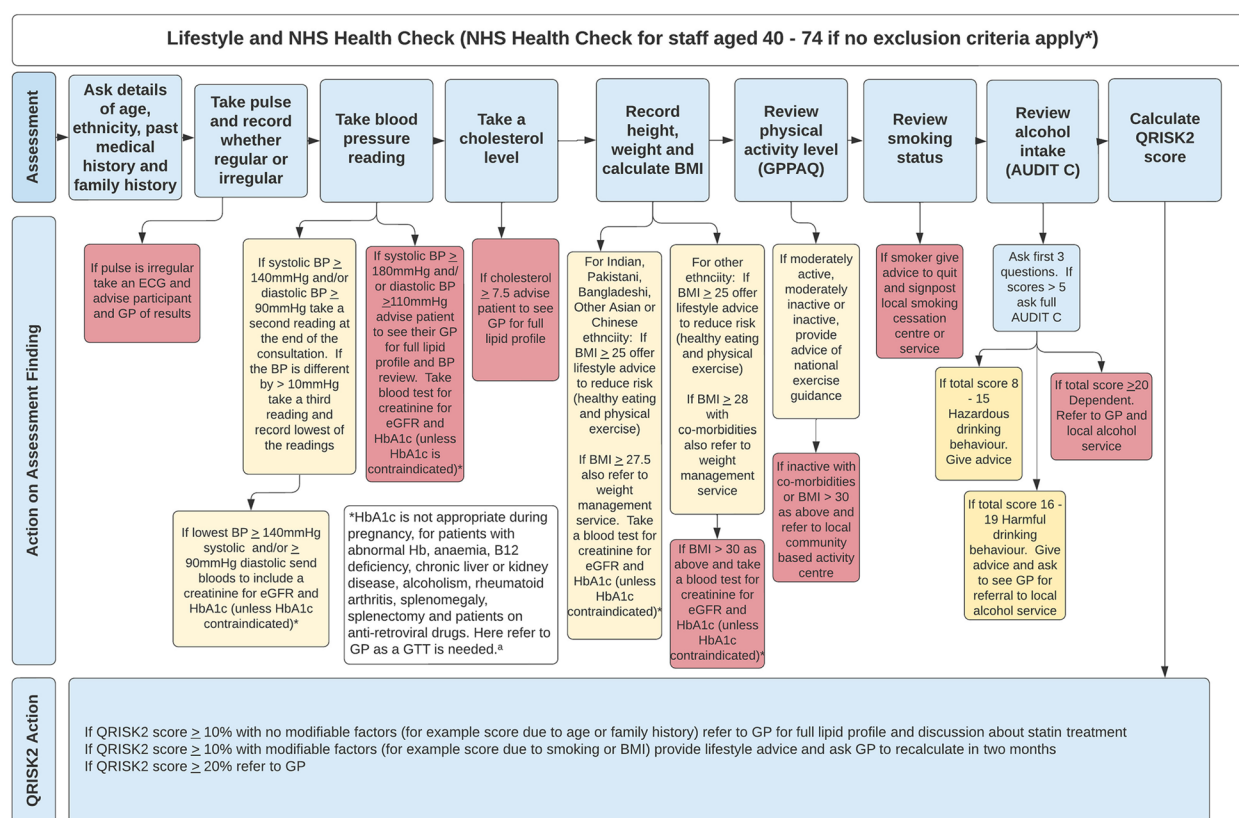


Fig. 2 Lifestyle and NHS Health Check (NHS Health Check for staff aged 40-74 if no exclusion criteria apply)

*National Institute for Health and Care Excellence. Cardiovascular Disease: Risk Assessment and Reduction, Including Lipid Modification. Clinical guideline [CG181]. July 2014, updated September 2016. URL: <https://www.nice.org.uk/guidance/cg181>. (accessed July 2018)

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 the 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 from 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)

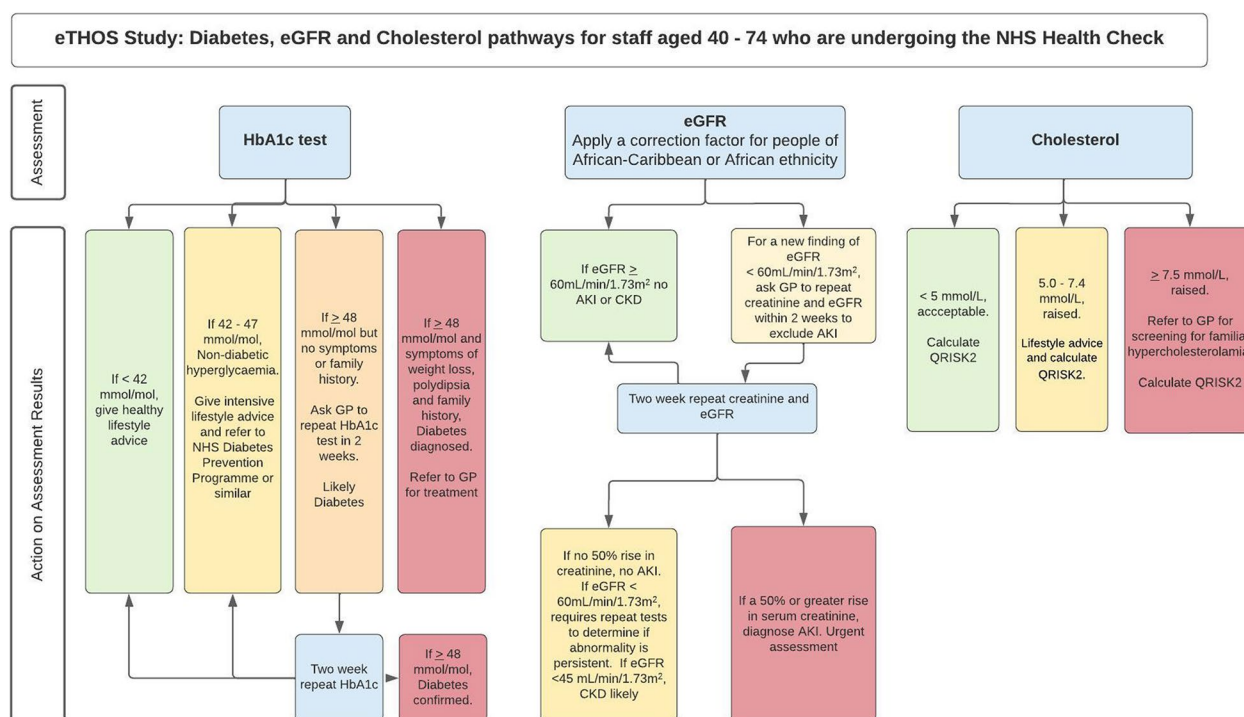


Fig. 3 eTHOS Study: Diabetes, eGFR and Cholesterol pathways for staff aged 40-74 who are undergoing the NHS Health Check

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 coordinated 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 restarted 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 3788 of 24,344 NHS staff were invited to take part (Fig. 4), 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 Fig. 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 (Fig. 4).

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).

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.

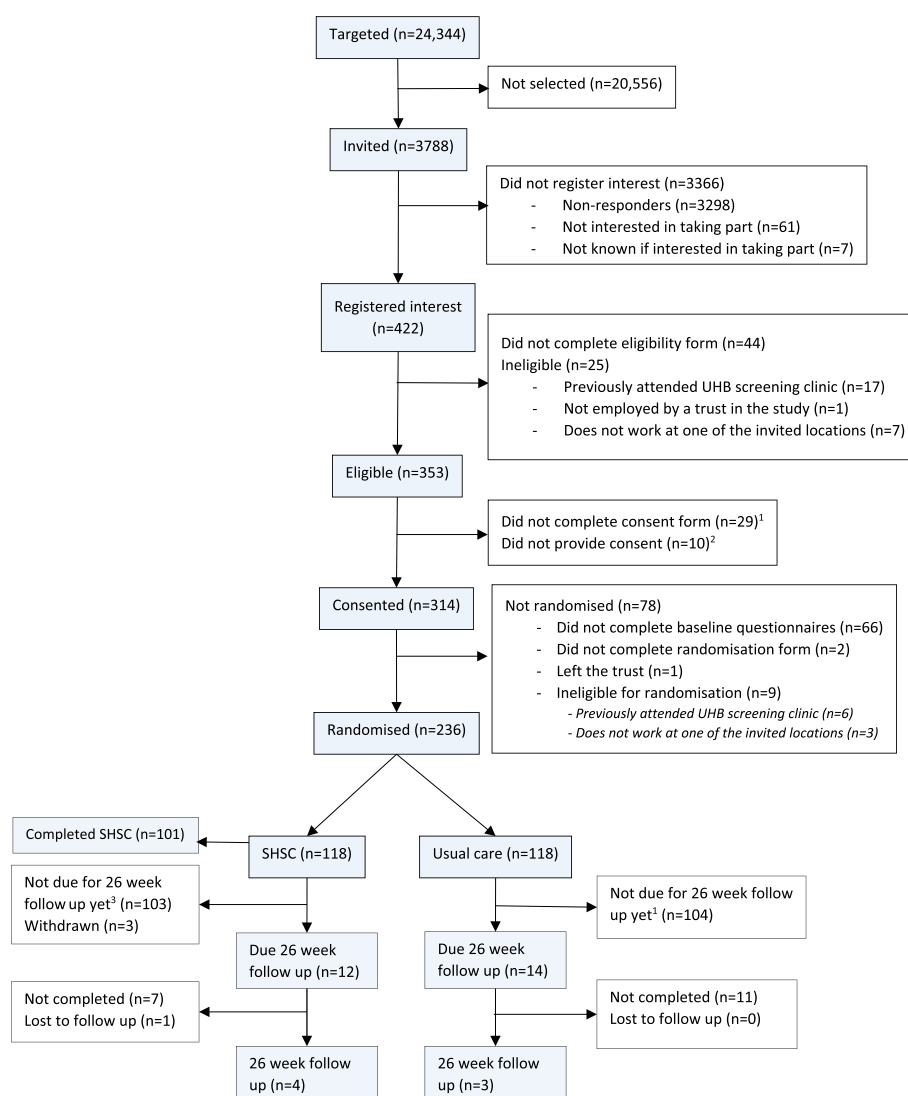


Fig. 4 Participant flow through the eTHOS trial

SHSC=Staff Health Screening Clinic. ¹completed expression of interest and eligibility screening but either did not complete consent or only did so partially.

²completed expression of interest and eligibility screening, but put 'no' to one of the consent questions so were ineligible. ³26 week follow-up was only collected in those participants recruited prior to the study pausing to recruitment (i.e. those recruited between December 2020 and February 2021)

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

Table 2 Stop-go progression criteria and results

Criteria	Description	Progression criteria		
		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

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).

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%) at 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.

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).

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

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

Table 3 (continued)

	SHSC (N = 101)
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/1.73 m ²) ^o	
Indication of kidney disease (< 60)	3 (10.7%)
Normal (≥ 60)	25 (89.3%)

Table 3 (continued)

	SHSC (N = 101)
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 $\geq 10\%$

^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 lowering 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 eGFR < 60 ; or normal if eGFR ≥ 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%

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).

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

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 were already being treated for a component of the health check that required referral**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

indicated low non-attendance rates. Insufficient quantitative data were available to assess the 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 (Fig. 5). Firstly,

“Positive Feedback” regarding the principles behind the intervention. Reported benefits included the 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

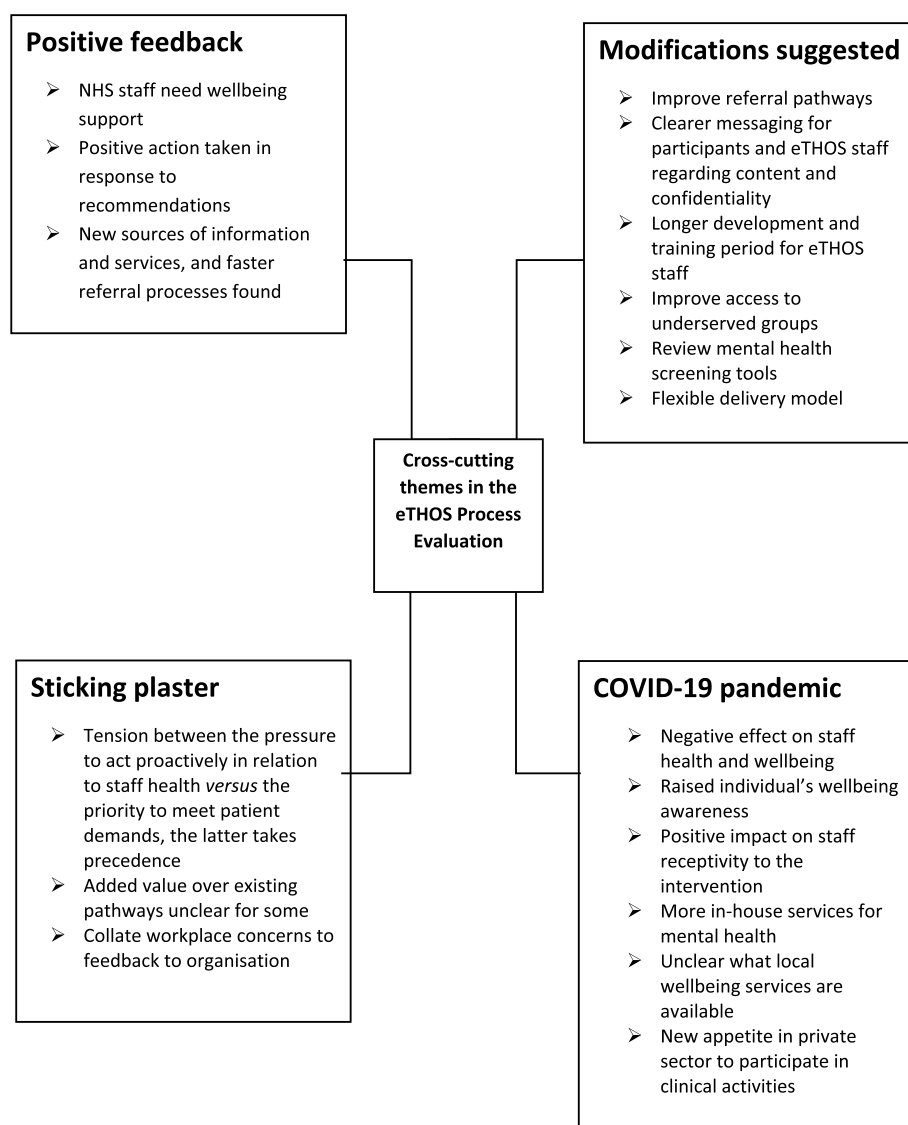


Fig. 5 Cross cutting themes in the process evaluation

meet patient demands, where the latter takes precedence and contributes to staff “stress”. Finally, the impact of the “COVID-19 Pandemic” highlighted both the 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 4 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 5 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 6-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 suboptimal, including mainly nurses and daytime workers. However, despite this, we were able to recruit two thirds of our target in less than 4 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 suggests 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 as 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.

Data availability

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

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
GPAAQ	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
STaT	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

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s40814-026-01794-x>.

Supplementary Material 1: Supplementary Table S1: Schedule of Assessments. Supplementary Table S2: Progression criteria informing the decision to progress to a full trial. Supplementary Table S3: Unit costs for staff roles and blood tests. Supplementary Table S4: Reasons for interest/non-interest in the eTHOS trial. Supplementary Table S5: Additional baseline participant characteristics. Supplementary Table S6: Comparison of baseline demographics between randomised participants and hospital population. Supplementary Table S7: Costs for each screening task by pay band. Supplementary Table S8: Average cost of blood test by proportion of participants undergoing each test. Supplementary Table S9: Costs of tasks taking into account the proportion of participants requiring each task. Supplementary Table S10: Characteristics of participants included in the qualitative study. Supplementary Table S11: Qualitative data informing the process evaluation.

Supplementary Material 2.

Supplementary Material 3.

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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 for, 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. Birmingham Clinical Trials Unit staff contributing to the trial: Sheriden Bevan, Pollyanna Hardy, Nicholas Hilken, Natalie Ives, Alisha Maher, Catherine Moakes, William McKinnon, Gurmail Rai, Caroline Rick, Sarah Tearne, and Kamila Ziomek.

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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.

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.

Author details

¹Health Services Management Centre, University of Birmingham, Birmingham B15 2TT, UK. ²Department of Applied Health Sciences, College of Medicine and Health, University of Birmingham, Birmingham B15 2TT, UK. ³Birmingham Clinical Trials Unit, College of Medicine and Health, University of Birmingham, Birmingham B15 2TT, UK. ⁴Birmingham Women's and Children's Hospital, Steelhouse Lane, Birmingham B4 6NH, UK. ⁵Department of Cancer and Genomic Sciences, College of Medicine and Health, University of Birmingham, Birmingham B15 2TT, UK. ⁶Hereford County Hospital, Stonebow Road, Hereford HR1 2ER, UK. ⁷National Perinatal Epidemiology Unit Clinical Trials Unit, Nuffield Department of Women's and Reproductive Health, University of Oxford, Oxford OX3 7LF, UK. ⁸Warwick Medical School, University of Warwick, Coventry CV4 7AL, UK. ⁹School of Sport, Exercise and Rehabilitation, University of Birmingham, Birmingham B15 2TT, UK. ¹⁰Public and Patient Involvement and Engagement, University Hospitals Birmingham NHS Foundation Trust, Birmingham B15 2TH, UK. ¹¹THRIVE Mental Health Research Unit, Department of Psychology and Mental Health, University of Worcester, Worcester WR2 6AJ, UK. ¹²Birmingham Medical School, College of Medicine and Health, University of Birmingham, Birmingham B15 2TT, UK. ¹³National Centre for Mental Health, Barberry Building, 25 Vincent Drive, Birmingham B15 2FG, UK. ¹⁴Birmingham Heartlands Hospital, Bordesley Green East, Birmingham B9 5SS, UK. ¹⁵School of Medical Sciences, College of Medicine and Health, University of Birmingham, Birmingham B15 2TT, UK. ¹⁶Respiratory Medicine and General Internal Medicine, University Hospitals Birmingham NHS Foundation Trust, Queen Elizabeth Hospital Birmingham, Birmingham B15 2TH, UK.

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References

- Maben J, Ball J, Edmondson AC. Workplace conditions. In: Workplace Conditions. Cambridge: Cambridge University Press (Elements of Improving Quality and Safety in Healthcare). Jan 2023. <https://www.cambridge.org/core/product/identifier/9781009363839/type/element>.
- Rolewicz L, Palmer B & Lobont C. The NHS workforce in numbers: Facts on staffing and staff shortages in England. 07 Feb 2024. <https://www.nuffieldtrust.org.uk/resource/the-nhs-workforce-in-numbers>.
- Darzi A. Independent investigation of the National Health Service in England. 2024. efaidnbmnnnibpcjpcgclefindmkaj/<https://assets.publishing.service.gov.uk/media/66f42ae630536cb92748271f/Lord-Darzi-Independent-Investigation-of-the-National-Health-Service-in-England-Updated-25-September.pdf>.
- West M, Dawson J, Admasachew L & Topakas A. NHS staff management and health service quality: results from the NHS staff survey and related data. Report to the Department of Health. 2011. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/215455/dh_129656.pdf.
- Dew K. Pressure to work through periods of short term sickness. *BMJ*. 2011;342:d3446.
- Goetzel RZ, Long SR, Ozminkowski RJ, Hawkins K, Wang S, Lynch W. Health, absence, disability, and presenteeism cost estimates of certain physical and mental health conditions affecting U.S. employers. *J Occup Environ Med*. 2004;46:398–412.
- Rantanen I, Tuominen R. Relative magnitude of presenteeism and absenteeism and work-related factors affecting them among health care professionals. *Int Arch Occup Environ Health*. 2011;84:225–30.
- NHS Employers. NHS Staff Survey 2023: health and wellbeing overview. 2024. <https://www.nhsemployers.org/articles/nhs-staff-survey-2023-health-and-wellbeing-overview>.
- NHS England. NHS Long Term Workforce Plan, NHS England. June 2023. <https://www.longtermplan.nhs.uk/publication/nhs-long-term-plan/>.
- Kirk K. Time for a rebalance: psychological and emotional well-being in the healthcare workforce as the foundation for patient safety. *BMJ Qual Saf*. 2024;33(8):483–6.
- Hall LH, Johnson J, Watt I, et al. Healthcare staff wellbeing, burnout, and patient safety: a systematic review. *PLoS One*. 2016;11:e0159015.
- The Kings Fund. The Courage of Compassion: Supporting Nurses & Midwives to Deliver High-Quality Care. London, 2020.
- Aiken LH, Sloane D, Griffiths P, et al. Nursing skill mix in European hospitals: cross-sectional study of the association with mortality, patient ratings, and quality of care. *BMJ Qual Saf*. 2017;26:559–68.
- Powell M, Dawson J, Topakas A, Durose J, Fewtrell C. Staff satisfaction and organisational performance: evidence from a longitudinal secondary analysis of the NHS staff survey and outcome data. *Health Serv Deliv Res*. 2014;2:50.
- NHS Digital. Sickness absence due to mental health reasons, 2010 and 2019 PQ43100. https://digital.nhs.uk/supplementary-information/2020/sickness-absence-due-to-mental-health-reasons-2010-and-2019_pq43100.
- O'Meara S. NHS staff wellbeing: the financial impact and actions for improvement. What Works Wellbeing. 07 Jul 2022. <https://whatworkswellbeing.org/blog/nhs-staff-wellbeing-the-financial-impact-and-actions-for-improvement/>.
- NHS Digital. NHS Sickness Absence rates in England by reason and organisation. 2019. <https://digital.nhs.uk/data-and-information/find-data-and-publications/supplementary-information/2019-supplementary-information-files/nhs-sickness-absence-rates-in-england-by-reason-and-organisation>.
- Bielecky A, Chen C, Ibrahim S, Beaton DE, Mustard CA, Smith PM. The impact of co-morbid mental and physical disorders on presenteeism. *Scand J Work Environ Health*. 2015;41:554–64.
- Cancelliere C, Cassidy JD, Ammendolia C, Côté P. Are workplace health promotion programs effective at improving presenteeism in workers? A systematic review and best evidence synthesis of the literature. *BMC Public Health*. 2011;11:395.
- Christensen JR, Kongstad MB, Sjøgaard G, Sjøgaard K. Sickness presenteeism among health care workers and the effect of BMI, cardiorespiratory fitness, and muscle strength. *J Occup Environ Med*. 2015;57:e146–52.
- Schultz AB, Edington DW. Employee health and presenteeism: a systematic review. *J Occup Rehabil*. 2007;17:547–79.
- Pit WS, Hansen V. The relationship between lifestyle, occupational health, and work-related factors with presenteeism amongst general practitioners. *Arch Environ Occup Health*. 2016;71:49–56.
- Blake H, Mo PK, Lee S, Batt ME. Health in the NHS: lifestyle behaviours of hospital employees. *Perspect Public Health*. 2012;132:213–5.
- Mittal TK, Cleghorn CL, Cade JE, Barr S, Grove T, Bassett P, et al. A cross-sectional survey of cardiovascular health and lifestyle habits of hospital staff in the UK: Do we look after ourselves? *Eur J Prev Cardiol*. 2018;25:543–50.
- Boorman S. NHS Health and Well-being. Final Report, November 2009. Leeds, UK; 2009.
- Office for National Statistics. Sickness absence in the labour market: 2016. <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/articles/sicknessabsenceinthelabourmarket/2016>.
- Admasachew L, Dawson J. The association between presenteeism and engagement of National Health Service staff. *J Health Serv Res Policy*. 2011;16(Suppl 1):29–33.
- Royal College of Physicians. Work and wellbeing in the NHS : why staff health matters to patient care. London, UK: Royal College of Physicians; 2015.
- NHS England. Commissioning for Quality and Innovation (CQUIN). Guidance for 2016/17. 2016. <https://www.england.nhs.uk/wp-content/uploads/2016/03/cquin-guidance-16-17-v3.pdf>.
- NHS. How to access published NHS Health Check Official Statistics. 2022. https://www.healthcheck.nhs.uk/commissioners_and_providers/data/.
- NHS Employers. Rapid Access to treatment and rehabilitation for NHS staff. 2022. <https://www.nhsemployers.org/articles/rapid-access-treatment-and-rehabilitation-nhs-staff>.
- NHS England. £5million plan to improve the health of NHS staff. 2015. <https://www.england.nhs.uk/2015/09/improving-staff-health/>.
- Blake H, Gupta A, Javed M, Wood B, Knowles S, Coyne E, et al. COVID-Well study: qualitative evaluation of supported wellbeing centres and psychological first aid for healthcare workers during the COVID-19 pandemic. *Int J Environ Res Public Health*. 2021;18:3626.
- Clarissa C, Quinn S, Stenhouse R. Fix the issues at the coalface and mental wellbeing will be improved: a framework analysis of frontline NHS staff experiences and use of health and wellbeing resources in a Scottish

- health board area during the COVID-19 pandemic. *BMC Health Serv Res.* 2021;21:1089.
35. NHS England. WE ARE THE NHS: People Plan for 2020/2021 - action for us all. NHS England July 2020.
36. Blake H, Bennett E, Batt ME. Evaluation of occupational health checks for hospital employees. *Int J Workplace Health Manag.* 2014;7:247–66.
37. Bolier L, Ketelaar SM, Nieuwenhuijsen K, Smeets O, Gärtner FR, Sluiter JK. Workplace mental health promotion online to enhance well-being of nurses and allied health professionals: a cluster-randomized controlled trial. *Internet Interv.* 2014;1:196–204.
38. Dugdill L, Brettell A, Hulme C, McCluskey S, Long A. Workplace physical activity interventions: a systematic review. *Int J Workplace Health Manag.* 2008;1:20–40.
39. Raine GA, Thomas S, Rodgers M, Wright K, Eastwood AJ. Workplace-based interventions to promote healthy lifestyles in the NHS workforce: a rapid scoping and evidence map. *Health Serv Deliv Res.* 2020. <https://doi.org/10.3310/hsdr08180>.
40. Groeneveld IF, Proper KI, van der Beek AJ, Hildebrandt VH, van Mechelen W. Lifestyle-focused interventions at the workplace to reduce the risk of cardiovascular disease—a systematic review. *Scand J Work Environ Health.* 2010;36:202–15.
41. Pereira MJ, Coombes BK, Comans TA, Johnston V. The impact of onsite workplace health-enhancing physical activity interventions on worker productivity: a systematic review. *Occup Environ Med.* 2015;72:401–12.
42. Arena R, Arnett DK, Terry PE, Li S, Isaac F, Mosca L, et al. The role of worksite health screening: a policy statement from the American Heart Association. *Circulation.* 2014;130:719–34.
43. Adams R, Jordan R, Adab P, Barrett T, Bevan S, Cooper L, et al. Enhancing the health of NHS staff: eTHOS - protocol for a randomised controlled pilot trial of an employee health screening clinic for NHS staff to reduce absenteeism and presenteeism, compared with usual care. *Pilot Feasibility Stud.* 2022;8:155.
44. Ahmad S, Harris T, Limb E, Kerry S, Victor C, Ekelund U, et al. Evaluation of reliability and validity of the General Practice Physical Activity Questionnaire (GPPAQ) in 60–74 year old primary care patients. *BMC Fam Pract.* 2015;16:113.
45. Herdman M, Gudex C, Lloyd A, Janssen M, Kind P, Parkin D, et al. Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Qual Life Res.* 2011;20:1727–36.
46. Kessler RC, McInnes K. World Health Organization Health and Work Performance Questionnaire (HPQ). HPQ Short Form (Absenteeism and Presenteeism Questions and Scoring Rules). Harvard Medical School. 2005. <http://www.hcp.med.harvard.edu/hpq/index.php>.
47. National Institute for Health and Care Excellence. Low back pain and sciatica in over 16s: assessment and management. In: NICE guideline [NG59]. London: NICE; 2016.
48. National Institute for Health and Care Excellence. Neck pain - cervical radiculopathy. London: NICE. 2023. <https://cks.nice.org.uk/neck-pain-cervical-radiculopathy>.
49. National Institute for Health and Care Excellence. Neck pain - non-specific. London: NICE. 2023. <https://cks.nice.org.uk/neck-pain-non-specific>.
50. National Institute for Health and Care Excellence. Shoulder pain. London: NICE. 2022. <https://cks.nice.org.uk/topics/shoulder-pain/#management>.
51. National Institute for Health and Care Excellence. Common mental health problems: identification and pathways to care. In: Clinical guideline [CG123]. London: NICE; 2011.
52. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med.* 2006;166:1092–7.
53. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med.* 2001;16:606–13.
54. NHS. Mindfulness. 2022. <https://www.nhs.uk/mental-health/self-help/tips-and-support/mindfulness/>.
55. NHS Birmingham and Solihull Mental Health. Birmingham Healthy Minds <https://www.bsmhft.nhs.uk/our-services/birmingham-healthy-minds/>.
56. Hill JC, Whitehurst DGT, Lewis M, Bryan S, Dunn KM, Foster NE, et al. Comparison of stratified primary care management for low back pain with current best practice (STarT Back): a randomised controlled trial. *Lancet.* 2011;378:1560–71.
57. Dunn KM, Campbell P, Lewis M, Hill JC, van der Windt DA, Afolabi E, et al. Refinement and validation of a tool for stratifying patients with musculoskeletal pain. *Eur J Pain.* 2021;25:2081–93.
58. Linton SJ, Boersma K. Early identification of patients at risk of developing a persistent back problem: the predictive validity of the Örebro musculoskeletal pain questionnaire. *Clin J Pain.* 2003;19:80–6.
59. Public Health England. NHS Health Check Best practice guidance For commissioners and providers October 2019 URL: 20200417 NHS Health Check Best Practice Guidance 2019_update.pdf. Accessed May 2026.
60. Alcohol use disorders identification test consumption (AUDIT C). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/684826/Alcohol_use_disorders_identification_test_for_consumption__AUDIT_C_.pdf.
61. Hippisley-Cox J, Coupland C, Vinogradova Y, Robson J, Minhas R, Sheikh A, et al. Predicting cardiovascular risk in England and Wales: prospective derivation and validation of QRISK2. *BMJ.* 2008;336:1475–82.
62. Curtis L, Burns A. Unit Costs of Health and Social Care 2020. Canerbury: Personal Social Services Research Unit, University of Kent; 2020.
63. van Hout B, Janssen MF, Feng YS, Kohlmann T, Busschbach J, Golicki D, et al. Interim scoring for the EQ-5D-5L: mapping the EQ-5D-5L to EQ-5D-3L value sets. *Value Health.* 2012;15:708–15.
64. Gale NK, Heath G, Cameron E, Rashid S, Redwood S. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Med Res Methodol.* 2013;13:117.
65. Public Health England. Physical Activity: England. 2020. <https://fingertips.phe.org.uk/profile/physical-activity/data>.
66. De Kock JH, Latham HA, Leslie SJ, Grindle M, Munoz SA, Ellis L, et al. A rapid review of the impact of COVID-19 on the mental health of health-care workers: implications for supporting psychological well-being. *BMC Public Health.* 2021;21:104.
67. Public Health England. NHS Health Check: England. 2020. <https://fingertips.phe.org.uk/profile/nhs-health-check-detailed/data#page/4/gid/1938132726/pat/159/par/K02000001/ati/15/are/E92000001/iid/91735/age/219/sex/4/cat/-1/ctpt/-1/yrri/1/cid/4/tbm/1>.
68. NHS England. NHS Sickness Absence Rates January to March 2021, and Annual Summary 2009 to 2021, Provisional Statistics. <https://digital.nhs.uk/data-and-information/publications/statistical/nhs-sickness-absence-rates/march-2021-annual-summary-2009-to-2020>.
69. Lier LM, Breuer C, Dallmeyer S. Organizational-level determinants of participation in workplace health promotion programs: a cross-company study. *BMC Public Health.* 2019;19(1):268.
70. Bensa K, Širok K. Is it time to re-shift the research agenda? A scoping review of participation rates in workplace health promotion programs. *Int J Environ Res Public Health.* 2023;20(3):2757. <https://doi.org/10.3390/ijerph20032757>.
71. Abbas SZ, Pollard TM, Wynn P, Learmonth A, Joyce K, Bamba C. The effectiveness of using the workplace to identify and address modifiable health risk factors in deprived populations. *Occup Environ Med.* 2015;72:664–9.
72. Dept. of Health. NHS Health Check – Data <https://fingertips.phe.org.uk/profile/nhs-health-check-detailed/data#page/4/gid/1938132726/pat/159/par/K02000001/ati/15/are/E92000001/iid/91116/age/219/sex/4/cat/-1/ctpt/-1/yrri/5/cid/4/tbm/1>. Accessed 09/10/25.
73. Chaudhuri RK, Podlowska A, Lau YH, Gonde C, McIntosh A, Qamar MA, et al. Addressing the gap for racially diverse research involvement: The King's model for minority ethnic research participant recruitment. *Public Health Pract.* 2023;6:100426.

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