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**TITLE: The effectiveness of using the workplace to identify and address modifiable health risk factors in deprived populations**

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## **ABSTRACT**

### **Objectives**

To establish whether a programme of targeted health screening, with referral to appropriate interventions, offered to an employed but socioeconomically deprived group was effective in overcoming barriers to uptake of such services, and improving a range of surrogate health markers for participants.

### **Methods**

Low paid local government employees from socially and economically deprived areas in North-East England were invited to attend a free health check. Health checks were conducted within working hours and close to their worksite, and included assessment of a range of lifestyle and health related risk factors, including those associated with cardiovascular disease (CVD). A range of additional interventions were offered where indicated. Subjects were invited to repeat screening approximately 9 months later.

### **Results**

635 (20% response rate) employees in the target age group ( $\geq 40$  years) attended the first check. Most health risk markers improved in those ( $N=427$ ) attending both health checks, as did mean CVD risk score ( $t=2.86$ ,  $p=0.004$ ). 269 referrals were made to the intervention programmes.

### **Conclusions**

This workplace programme had a positive impact on cardiovascular health, but attendance rates were low. These findings suggest that workplace health screening activities may have

the potential to improve health in a group often considered hard to reach by other routes, but do not offer a straightforward solution in overcoming barriers to access for such sub groups within the working population .

### **What This Paper Adds**

- National health policy in the United Kingdom has led to the offer of health checks for all citizens over 40 years of age
- Sub-groups of the population difficult to engage in this process have been identified, including male workers on low pay
- This intervention sought to remove obstacles to accessing such health checks in such an employment group, but did not achieve higher engagement than the national programme
- The intervention was as successful at engaging male employees as female
- Markers of disease risk improved in the group as a whole, and improved most in those referred to an exercise or weight management programme.
- This intervention suggests the targeting of the workplace as a method of removing obstacles to the engagement of low paid workers, using the approach described, has the potential to improve health in those who attend, but does not offer a simple solution to low engagement in this group.

### **INTRODUCTION**

There is extensive evidence that individuals from lower socioeconomic groups and deprived backgrounds experience higher levels of modifiable risk factors for, and actual, ill health<sup>1</sup>.

Such social groups are often difficult to engage by traditional methods of health screening and

promotion. Research based in the same geographical region as the study described here found participation in a physical activity promotion trial was lower amongst men, smokers and those with addresses in more deprived areas<sup>2</sup>. A study investigating low income and nutrition noted that poor diets of low income populations were accompanied by higher levels of other modifiable health risk factors including smoking, higher alcohol intake and lower physical activity compared with the general population<sup>3</sup>. Such populations also frequently have low levels of contact with primary care and other health support services, leading to men from deprived backgrounds being described as a 'hard to reach' group for health screening and promotion activities, <sup>4</sup>. These factors suggest alternative methods of engaging these groups in health screening and promotion activities need to be examined<sup>5</sup>.

These health differentials are not confined to unemployed populations. A review of the Whitehall studies in the UK describes a steep social gradient in morbidity and mortality in middle-aged men in stable employment. Coronary heart disease mortality was found to be 2.2 times higher amongst clerical compared to senior administrative civil servants, and employees in routine occupations have self-reported rates of ill health rates more than double those for people in higher managerial and professional roles<sup>67</sup>. It is possible that shift work and a number of work related psychological stressors, which are mooted CVD risk factors, may be more prevalent in such employment groups than a more 'white collar' workforce<sup>89</sup>. There is also evidence that employees of UK local authorities based in areas of higher deprivation experience higher levels of ill health, as measured by sickness absence rates<sup>10</sup>.

Potential benefits of workplace based screening for modifiable health risk factors may extend beyond reducing the costs of absence or poor performance and include improving an individual's health risk profile, quality of life, motivation and engagement in the workplace.

There is some evidence of cost effectiveness of workplace based physical activity promotion interventions leading to significantly increased levels of exercise, particularly of 'blue collar' female employees, and they may reduce sickness absence<sup>11</sup>. In addition a systematic review of randomised control trials of lifestyle interventions in the workplace to reduce CVD risk factors found evidence of effectiveness in reducing overall body fat, although no other common risk factors<sup>12</sup>. However, a recent review of the evidence underpinning English public health policy concluded that there was a lack of robust evidence to support such workplace interventions, and concluded that private companies and workplaces introducing such programmes for unselected adults are acting outside the evidence<sup>13</sup>.

A national health screening and education programme for the wider UK community was introduced in 2009. This made available to all adults with no known pre-existing diagnosed vascular disease and aged 40-74, on a five yearly recall basis, a general health screening and education intervention intended to identify CVD risk factors and reduce cardio-vascular mortality<sup>14</sup>. More generally, recent research described an absence of evidence for effectiveness for this programme<sup>15</sup>.

Although evidence for effectiveness is lacking, recent UK public health policy has emphasized the role of public sector bodies in promoting healthy lifestyle choices in the communities in which they are based, and specifically within their own work forces<sup>16,17</sup>. Basing such activities in the workplace may offer advantages such as access to large structured groups, where peer and social support may enhance engagement and compliance with health related interventions. However, research relating to the effectiveness of screening programmes to identify modifiable health risk factors based in the work place has generally reported on subjects unselected by socioeconomic factors. A recent meta-analysis examining the effects of

such screening activities on a range of health outcomes, found that they are more effective amongst white-collar workers<sup>18</sup>, although recent research into bus and truck drivers also describes such benefits<sup>19</sup>. So, in order to reduce such differences in health, it may be that health-related screening interventions targeted at workplaces with high proportions of workers in lower socioeconomic groups may enhance the engagement of such 'hard to reach' groups, including low paid male workers with likely high levels of modifiable risk factors. If so, such targeted screening may represent a more effective method of identifying modifiable health risk factors and, ultimately, improving health outcomes. Although such approaches have face validity testing to date has been limited.

The analysis of the study described sought to establish whether a programme of targeted health screening and onward referral to appropriate interventions offered to low paid employees of two large UK local authorities was effective at (i) increasing uptake of such services by employed socioeconomically deprived groups, in comparison to national programmes(ii) achieving higher uptake by male employees, in comparison to national programmes, and (iii) effective in improving a range of health risk factors for participants.

## **METHODS**

### *Study Population*

The study took place within two metropolitan local government employers in the North East of England. These authorities represent some of the most socially and economically deprived areas of the UK. The 2007 Index of Multiple Deprivation (IMD) provides an overall measure of deprivation at Local Authority and small area level<sup>20</sup>. Both employers are based in areas with highest quintile IMD index, a disadvantage associated with subjective and objective poor

health indicators. Health profiles for these authorities found: deaths from smoking related disorders, cancer, heart disease and stroke are worse than the averages for England; male and female residents of the least deprived areas can expect to live, respectively, approximately six and four years longer than men and women from the most deprived areas within these authorities; adverse lifestyle behaviours associated with smoking, diet, physical activity and alcohol consumption are more prevalent across the two authority areas as a whole than the average for England.<sup>21</sup>

Subjects were drawn from the social care and contract services divisions of each authority, being principally unskilled and semi-skilled workers undertaking personal care, maintenance, environmental and cleaning occupations. Staff employed on salaries of between £12,300 and £16,300 (employer 1) and £14,200 and £18,500 per annum (employer 2) were enrolled. The nature and content of the proposed health promotion programme was discussed with and endorsed by the local staff representative bodies and unions, and a series of workplace events to publicise the programme subsequently took place prior to launch. This enabled staff with concerns regarding issues such as confidentiality and job security to seek reassurance. Subsequently, a single individualised invitation was sent to all staff within the target group, alongside simultaneous promotion of the programme within standard employer staff communication routes. The promotional material emphasised the confidentiality of screening findings, assurance that screening findings would be held independent of the occupational health record, would not be used for occupationally related fitness decisions and that the employer had undertaken to provide the time to travel to and from health promotion venues and the time for the clinical encounter itself, within normal working hours.

Subjects of any age were assessed, but only those aged 40 years or more were included in the final analysis, to achieve consistency with the target group for the UK National Health Service Health Check programme.

### *Data Collection*

The modifiable health risk factors targeted were based on outcomes of regional health needs assessment and analysis of routinely collated data recording reasons for sickness absence.

The presence of a risk factor triggered a pathway of care including assessment, health screening, intervention and referral / signposting to support services relevant to need with the goal of enabling individuals to make changes in their health related behaviours or treatment.

The programme was provided at a number of work sites for ease of access and was delivered by occupational health nursing staff. The clinical protocol was consistent with the regional NHS public health protocol, using the same cardio-vascular risk assessment tool and smoking cessation and alcohol referral questionnaires and pathways. The nurses undertaking the screening were trained in smoking cessation and alcohol awareness to the same standard as the local NHS health promotion workers.

The health screening exercise consisted of the following:

- Recording of gender; age; systolic blood pressure; diastolic blood pressure; smoking status; body mass index (BMI) and non-fasting total serum cholesterol
- Cardiovascular risk assessment (participants aged 40 or over only) using the UK National Health Service Health Check programme method (Cardiovascular Risk Assessor software), usually delivered within UK Primary Care. This estimates the

probability of a cardiovascular event in the next 10 years, based on the above risk factors, to give a low(1-9%), medium (10-19%)or high ( $\geq 20\%$ )risk category<sup>14</sup>

- GHQ12 for psychological wellbeing<sup>22</sup>
- AUDIT for alcohol consumption<sup>23</sup>
- standardised smoking questionnaire
- question regarding physical activity outside of work

The equipment used for near patient testing was Accutrend GC total cholesterol (finger prick blood lipids) and Omron M6 Comfort automated blood pressure meter (consistent with the broader NHS community health promotion programme and calibrated in line with manufacturer guidance).

Those who were at high risk were advised to see their GP for further advice regarding pharmacotherapy. Triggers for intervention were consistent with those for the national public health community health promotion programmes, leading to referral to either relevant NHS community based health intervention programmes or the subjects general practitioner, the latter where a clinical risk factor potentially requiring pharmacological treatment was identified. Triggers for NHS specialist weight management advice required an individual's 10 year CVD risk to be 'high' or 'moderate' and BMI to be  $\geq 28$ . Referral for exercise training required an individual's 10 year CVD risk to be 'high' or 'moderate', low reported physical activity (less than five 30 minute periods of aerobic exercise per week) and BMI  $\geq 28$  without relevant co-morbidities, or  $< 28$  with one or more co-morbidities . Contact details for local smoking cessation services were provided to subjects who smoked and who indicated they wished to quit. AUDIT scores in the harmful range ( $> 7$ ) led to the provision of contact details for local community alcohol services. Subjects with a GHQ 12 score  $> 25$ , thus reaching the definition of

'caseness', were provided with the contact details for counselling services available to them by self-referral being, at the employees discretion, either 'face-to-face 'or 24hr telephone counselling services provided by the employer. It was not possible to discriminate between those who did or did not complete the interventions.

If no specific health issues leading to a formally defined care pathway were identified the subjects were advised on generic healthy living advice, and provided with supporting literature. This group included those indicating that they did not eat their '5 a day' of fruit and vegetables. Subjects were categorised as in principally sedentary or manual duties on the basis of job title.

A copy of the outcome data from all assessments, where consent was provided, was forwarded to the subject's general practitioner. All subjects were found to be registered with a general practitioner.

Approximately nine months after the initial assessment, all participants were invited to attend for a follow up 'face to face' assessment at which the complete screening process was applied again.

Data on ethnicity were only available in one authority, where all participants were of White European origin, other than one of Asian origin. A few participants did not provide complete data and sample sizes for each analysis are provided.

### *Data Analysis*

To test whether the experience of participating in a health check brought about positive changes in health indicators for the group as a whole, paired t-tests were used for continuous

variables (having confirmed that the distribution of the differences between first and second assessment levels were normal in each case) and McNemar's test for categorical variables. To test whether those who were referred to either the exercise or weight management intervention at the initial health check showed greater improvements than those who were not referred, a repeated measure analysis of variance was conducted, with assessment occasion (within-subjects) and referral (between-subjects), and the interaction between the two included in the model. The significance of the interaction between assessment and intervention referral was reported. Data were analysed using SPSS version 20.

## **RESULTS**

Within the two organisations 3264 qualifying employees were identified [male 1201 (37%); female 2063 (63%)]. In total 665 employees in the target group (20% response rate) attended the first round of health screening (Figure 1). The proportion of participants and participation rate of the two employers was similar (301(52% of participants, 22% participation rate) v 278 (48% of participants, 19% participation rate). Table 1 summarises demographic and clinical data for those attending the initial and follow up health screening programmes.

Of those who attended the first health check, 30 were aged under 40, and 56 were not eligible to be assigned a cardiovascular risk category because of a previous diagnosis of cardiovascular disease or diabetes, and their data are not considered further here. Of the 579 eligible employees who attended the health check, 427 (74%) returned for the follow-up assessment (Table 1). Of these, 8 had received a cardiovascular diagnosis following the initial

health check and were not assigned a cardiovascular risk score at follow-up. However, other data were collected from these employees and are included here.

Information on referral was missing for 6 participants. A total of 269 (47%) subjects reached a clinically significant intervention threshold and agreed to referral for one or more of a range of interventions to support exercise, weight management, smoking cessation, mental health and alcohol reduction (Figure 1, Table 1). Most of these, a total of 212 (37% of those who attended first assessment), were referred to either an exercise or weight management intervention, or both (N=101). All participants agreed that their results should be sent to their GP.

The number of people categorised as being at low risk of cardiovascular disease was 267 (46%), while 256 (44%) were categorised at medium risk, and 56 (10%) at high risk.

#### *Changes in risk markers and self-reported health behaviour*

The mean interval between repeat assessments was 267+/- 48 days (SD). In those who attended the follow-up (including those who were referred to an intervention and those who were not) there was a significant improvement in BMI, waist circumference, systolic blood pressure and diastolic blood pressure, but no change in total cholesterol level (Table 2). A clinically significant weight loss of 5% or more was achieved by 43 (10%) participants. There was a significant reduction in cardiovascular risk score.

In those who attended follow-up, self-reported consumption of 5 portions of fruit and vegetables per day increased, consumption of cake and biscuits decreased, physical activity increased and alcohol consumption decreased (Table 3). However, there was no significant change in the proportion of smokers.

### *The impact of referral to intervention*

There was a significant difference in change in BMI, waist circumference and total cholesterol level between those who were referred to either the exercise or weight management intervention (or both) and those who were not, such that those in the intervention group showed a more positive change (Table 4). However, there was no significant difference in change in blood pressure or in overall CVD risk score between those referred to an intervention and those not referred.

## **DISCUSSION**

The design of this study sought to identify and engage a likely high risk sub-group of employees, as defined by income, with anticipated high levels of modifiable risk factors for ill health. The study took place over an 18 month period *prior* to the introduction of a national primary care led health promotion programme (NHS Health Check) in 2009, and was preceded by an extensive promotion programme. Consequently these results should provide a reliable indication of what uptake of such services can be achieved when non-psychological barriers to engagement are minimised, with no dilution of results by non-participants accessing the same programme through their primary care providers.

The participation rate of 20% in this study was significantly lower than the annual national participation target set for NHS Health Checks for the general population, being 50% attendance of those offered the intervention in the 40-75 age group. Figures for 2011-12 for the national NHS Health Checks offered to the general population in the same geographic areas as the local government employers in this study report an uptake in 40-75 year old offered Health Checks of between 46.8% to 63.5%<sup>24</sup>. A study of attendance at NHS Health

Checks in a suspected high risk population of a deprived area of London found: overall attendance rates in invitees of 45%; a significant difference in uptake by gender for the 35-54, but not 55-64, age group; uptake of 41% in the White British population; and uptake of 41% and 46% in the 35-54 and 55-64 age groups respectively. These figures are also significantly higher than that achieved in our study, although the employment status of participants in the London study was not recorded<sup>25</sup>. A further study, set in Stoke-on-Trent, found uptake of Health Checks in primary care, of patients between 32-74 years and in the most deprived tertile areas of 42.6%, and the least deprived tertile areas of 48.4%. Possible higher levels of Health Check uptake amongst the retired may have increased the differences seen in uptake between these two programmes and the study reported here, but the size of the difference in uptake is unlikely to be fully explained by this factor. This latter study also analysed reasons for non-attendance and non-uptake of interventions offered in the 3507 individuals. Only one individual (who attended for assessment but declined a subsequent offer of treatment) cited work as a barrier to engagement<sup>26</sup>. On balance, the workplace programmes described in our study did not seem as effective in engaging a low paid workforce, compared to the limited published studies undertaken in other deprived populations in the UK. A qualitative study, exploring the reasons for participation in this intervention, or otherwise, is in preparation for future publication.

Only 10% of those screened were classified into the high cardiovascular risk category. A report of NHS Health Checks targeted at a suspected high risk group in a UK inner city setting (59.2% under 65 years) detected risk CVD risk status of  $\geq 20\%$  in 74.5% of attendees, considerably greater than the 10% in our work based intervention<sup>25</sup>

Improvement in a wide range of self-reported and objective health parameters was observed. Specifically, there were statistically significant improvements in self-reported diet, physical activity, and alcohol consumption. Small but statistically significant improvements were also seen in BMI, waist circumference, blood pressure and CVD risk score. Health behaviours were self-reported, and therefore may well have been subject to bias. However, positive changes in objective markers of health suggest that there were real changes in health behaviours. The large group of participants referred to exercise or weight management interventions showed a more positive change in BMI, waist circumference and cholesterol level than those who were not referred, suggesting that these referrals were effective. These findings are consistent with other reports of such interventions in the primary care setting<sup>27</sup>.

We acknowledge a number of limitations in the design of this study. These include the possibility that those who made positive changes in response to the first health check and/or interventions were more likely to return for the second assessment than those who failed to make positive changes. In addition, we have not information on the contact of participants with their general practitioners that resulted from the initial health check.

The workplace as a setting for improving health has a number of potential advantages such as ease of access to much of the male adult population, the presence of peer pressure and support, and the potential to exploit established channels of communication. Such approaches are in keeping with current UK national policy<sup>2829</sup>, but evidence for the effectiveness of the workplace as a site for such interventions is lacking. The intervention described in this study removed barriers to participant engagement as far as practicable and included high profile promotion of a free new service, not available through other routes at the time, which should have acted to maximise uptake. Despite these positive features this study found relatively low

uptake of such interventions by a relatively deprived working population when compared to data subsequently collated from the same programme 'rolled out' to the general population through primary care. No proportionate greater uptake by male employees was achieved, but this may be interpreted as a positive feature of this study as proportionately fewer males have been found to engage with the equivalent national programme. Limited comparative data on the prevalence of the health risk factors assessed are available in other 'hard to reach' populations, although that which is available did not suggest particularly high levels of such risks in the participants in the workplace study. These results suggest that if such health screening and education programmes targeted at subgroups of the working population are to be implemented, alternative strategies should be evaluated. This could include additional approaches such as employers granting paid leave to such employees to attend such programmes based in their own general practices, and basing relevant interventions (such as exercise and weight management) within the workplace itself. Recent research has also reported some evidence of effectiveness for an internet based worksite health promotion programme, although this was not targeted at a 'hard to reach' subgroup of employees<sup>30</sup>.

This study did not establish a clear case for the implementation of health promotion delivered in the workplace using the approach described. Further research into potential obstacles to engagement of such groups in the workplace, and the prevalence of modifiable health risk factors in non-participants before the wider use of the workplace in an evidence-based national Health Check programme is merited.

**Competing Interests:** None declared

Table 1

**Sociodemographic characteristics and referrals to intervention for subjects attending the initial health check**

	<b>Attended First Assessment</b>	<b>Attended Both First and Follow-up Assessment</b>
	n = 579	n=427
<b>Age (SD)</b>	50.5 (6.4)	50.4 (6.3)
<b>Sex</b>		
• <b>Males</b>	217 (37%)	188 (44%)
• <b>Females</b>	363 (63%)	239 (56%)
<b>Occupation</b>		
• <b>Non-manual</b>	148 (26%)	116 (27%)
• <b>Manual</b>	427 (74%)	307 (75%)
<b>Referred to weight management programme††</b>	116 (20%)	80 (19%)
<b>Referred to exercise intervention††</b>	218 (38%)	152 (36%)
<b>Referred to smoking cessation programme††</b>	50 (9%)	40 (9%)
<b>Referred to alcohol</b>	5 (1%)	4 (1%)

<b>services††</b>		
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†N= 575 and 423 respectively; †† N=573 and 422 respectively

**Table 2.**

**Modifiable health risk factors and Cardiovascular Risk Score at the initial health check and at follow up in those who attended both assessments, with results of paired t-tests, testing for significance of change over time**

<b>Risk Factor (N=427)</b>	<b>Health Check (mean ± SD)</b>	<b>Follow Up (mean ± SD)</b>	<b>Mean Change (95% confidence intervals)</b>	<b>t</b>	<b>p</b>
<b>BMI (kg/m<sup>2</sup>)</b>	28.3 ± 5.3	28.1 ± 4.9	-0.21 (-0.06, -0.36)	2.80	0.005
<b>Waist circumference (cm)†</b>	96.1 ± 13.1	94.9 ± 12.8	-1.15 (-0.67, -1.63)	4.70	0.001
<b>Systolic blood pressure (mmHg)</b>	137 ± 15	132 ± 14	-5.0 (-4.0, -6.0)	9.82	0.001
<b>Diastolic blood pressure (mmHg)</b>	83 ± 9	81 ± 9	-2.7 (-2.0, -3.4)	7.28	0.001
<b>Total cholesterol (mmol/l)††</b>	5.0 ± 0.9	5.0 ± 0.9	0.02 (-0.06, 0.10)	0.53	0.60
<b>Cardiovascular Risk Score†††</b>	11±6	10±6	-0.52 (-0.16, -0.88)	2.86	0.004

†N=425; ††N=422; †††N=419

**Table 3.**

**Health behaviours at the initial health check and at follow up in those who attended both (N=427 unless otherwise specified), with results of model testing for significance of change over time**

	<b>Health Check</b>	<b>Follow Up</b>	<b>p†</b>
<b>Five portions of fruit or vegetables per day</b>	153 (36%)	176 (41%)	<0.001
<b>Cake or biscuits less than once per day</b>	206 (48%)	232 (54%)	0.009
<b>Physical activity outside work (N=410)</b>	202 (49%)	318 (78%)	<0.001
<b>0-7 units of alcohol per week</b>	239 (56%)	286 (67%)	<0.001
<b>Non-smoker (N=414)</b>	354 (83%)	355 (83%)	>0.99

†calculated using McNemar exact test

**Table 4 The impact of referral to a weight management and/or exercise intervention on modifiable health risk factors**

	No Intervention Referral (N=268)		Intervention Referral (N=154)		Test of Group Difference in Change over Time	
	Health Check	Follow Up	Health Check	Follow Up	F	p
<b>BMI</b>	26.3 ± 3.9	26.3 ± 3.9	32.0 ± 5.6	31.4 ± 4.9	21.0	<0.001
<b>Waist circumference (cm)</b>	91.4 ± 10.6	90.7 ± 10.8	104.7 ± 12.4	103.0 ± 11.7	23.5	<0.001
<b>Systolic blood pressure (mmHg)</b>	136 ± 16	131 ± 15	140 ± 13	134 ± 12	0.1	0.77
<b>Diastolic blood pressure (mmHg)</b>	82 ± 10	79 ± 9	85 ± 8	83 ± 8	0.1	0.94
<b>Total cholesterol (mmol/l)</b>	4.8 ± 0.8	4.9 ± 0.8††	5.2 ± 1.0	5.1 ± 0.9†††	9.9	0.002
<b>Cardiovascular Risk Score</b>	10 ± 6	10 ± 6††	13 ± 6	12 ± 6††††	2.7	0.10

†N=267; ††N=264; †††N=153; ††††N=150

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