NHS Health Check comorbidity and management: an observational matched study in primary care

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NHS Health Check comorbidity and management:

an observational matched study in primary care

Abstract

Background
The NHS Health Check programme completed its first 5 years in 2014, identifying those at highest risk of cardiovascular disease and new comorbidities, and offering behavioural change support and treatment.

Aim
To describe the coverage and impact of this programme on cardiovascular risk management and identification of new comorbidities.

Design and setting
Observational 5-year study from April 2009 to March 2014, in 139 of 143 general practices in three clinical commissioning groups (CCGs) in east London.

Method
A matched analysis compared comorbidity in NHS Health Check attendees and non-attendees.

Results
A total of 252 259 adults aged 40–74 years were eligible for an NHS Health Check and, of these, 85 122 attended in 5 years. Attendance increased from 7.3% (10 900/149 867) in 2009 to 17.0% (18 459/108 525) in 2013 to 2014, representing increasing coverage from 36.4% to 85.0%. Attendance was higher in the more deprived quintiles and among South Asians. Statins were prescribed to 11.5% of attendees and 8.2% of non-attendees. In a matched analysis, newly-diagnosed comorbidity was more likely in attendees than non-attendees, with odds ratios for new diabetes 1.30 (95% confidence interval [CI] = 1.21 to 1.39), hypertension 1.50 (95% CI = 1.43 to 1.57), and chronic kidney disease 1.83 (95% CI = 1.52 to 2.21).

Conclusion
The NHS Health Check programme provision in these CCGs was equitable, with recent coverage of 85%. Statins were 40% more likely to be prescribed to attendees than non-attendees, providing estimated absolute benefits of public health importance. More new cases of diabetes, hypertension, and chronic kidney disease were identified among attendees than a matched group of non-attendees.

Keywords
cardiovascular disease; Health Check; prevention; primary care; statins.

INTRODUCTION

England's NHS Health Check programme completed its first full 5-year cycle between 2009 and 2014. Uptake is now around 50%, with 1.5 million checks annually.[1–3] The introduction of this scheme was controversial. Statins received adverse publicity and the programme's effectiveness was contested.[4–8] This was largely based on a review of 16 trials of health checks, of which 12 were conducted before 1994 when neither statins nor modern antihypertensive drugs were in use.[9–20] During the study, statin treatment was recommended at a 10-year cardiovascular disease (CVD) risk of ≥20%.[21,22] Major structural changes in the NHS and austerity measures compounded the difficulties of implementation. Clinical commissioning groups (CCGs) replaced primary care trusts (PCTs) in April 2013, and responsibility for Health Checks passed to local authorities.[23–27] Implementation has been highly variable.[28,29] Public Health England is addressing improvements.[30–32]

This study took place in three neighbouring inner-London CCGs with some of the most ethnically diverse and socially deprived populations in the UK. Out of a population of 950 000, 50% are from ethnic minority groups, of which 30% are South Asian and 10% are black African–Caribbean. Levels of premature cardiovascular death are high, particularly among South Asians.[33] A high turnover of patients, extended overseas visits, and changes of address and language made programme delivery difficult. The NHS Health Check programme was well supported by these CCGs but their implementation differed.[34]

Because patients who attend for NHS Health Checks differ systematically from those who do not, comparison between groups requires matching of individuals to reduce the likelihood of bias. Therefore, this study aimed to add a comparative element to newly identified comorbidity in attendees in comparison with matched non-attendees, and to add a description of a full 5-year cycle to earlier reports.[35]

METHOD

Identification of study cohort

This was a retrospective observational 5-year study, from 2009 to 2014, on an open cohort of patients eligible for an NHS Health Check, based on data routinely collected and anonymised in GP electronic health records in City & Hackney, Newham, and Tower Hamlets CCGs. All but four of the 143 local general practices used the same web-enabled health record (EMIS Web), covering 98% of the 950 000 locally registered patients. The other four practices undertook NHS Health Checks, but they used a different computer system and were unable to provide study data.

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How this fits in

The NHS Health Check programme was successfully implemented in three east London clinical commissioning Groups (CCGs), with support including performance dashboards, managed practice networks, and financial incentives. Attendance was higher in the most deprived quintiles and among South Asian people. The finding that statins were 40% more likely to be prescribed to attendees than non-attendees is an intervention of public health importance with considerable room for further improvement. Replicated nationally, statin use resulting from NHS Health Checks would prevent an estimated 4600 to 8400 heart attacks, strokes, or death from these causes in 5 years. New comorbidities were 30 to 80% more likely to be identified in attendees than matched non-attendees and their treatment is likely to add to the impact of this programme.

Patients eligible for an NHS Health Check were aged 40–74 years, without pre-existing vascular disease, hypertension, familial hyperlipidaemia, chronic kidney disease (CKD), diabetes, or current statin prescription. In 2015, the Clinical Effectiveness Group at Queen Mary University of London extracted patient-level data for eligible patients during the period 1 April 2009 to 31 March 2014. Attendance was recorded once, as this is a 5-year rolling programme.

For those registered with the practice on 1 April 2009, eligibility and entry into the cohort were assessed on that date. For patients who registered after 1 April 2009, eligibility and entry were set as the date of registration. Eligibility was reassessed each year on 1 April. The index date for attendees was the date of the NHS Health Check, and for non-attendees it was 1 April each year (or later date of registration).

Attendees to NHS Health Checks were eligible patients with a Read code 38B1 or 8BAg denoting attendance, recorded 1 April 2009 to 31 March 2014. Non-attendees were those eligible on 1 April of each year and did not have these codes recorded in that year. Townsend deprivation scores were grouped into quintiles based on national distributions. Self-reported ethnicity was grouped into census categories. Coverage was reported as number of attendees divided by one-fifth of the eligible population in that year, expressed as a percentage.

In City & Hackney and Tower Hamlets CCGs, the practice payment for each NHS Check attendance was partly incentivised, based on achieving targets for uptake and for statin prescription in patients at high CVD risk. In Newham, a flat fee was paid. In Tower Hamlets, and to a lesser extent City & Hackney, patients at highest CVD risk were invited first, but invitations in Newham were not targeted in this way. Finally, Tower Hamlets used managed practice networks to support implementation and target achievement.[34] Because of these differences in implementation, the authors report the three CCGs separately, and in combination.

Matching of cases and controls

From previous analyses,[35] attendees and non-attendees differed in demographic and clinical characteristics. Therefore, for the purpose of comparison of comorbidity in these two groups, the authors matched attendees and non-attendees (1:2 ratio) by CCG, NHS Health Check year, age, sex, and ethnic group in order to reduce bias. Other CVD risk factors were not used for matching because recording of smoking, blood pressure, and QRISK®2 was less complete in non-attenders. Deprivation was not used, as the vast majority of patients were highly deprived by national standards.

Outcome assessment

The first diagnosis of CKD was identified by a record of estimated glomerular filtration rate (eGFR) <60 ml/min/1.73 m^2, and diabetes and hypertension were based on coded diagnoses conforming to the national Quality and Outcomes Framework (QOF) code set.[36] QRISK2 was used to estimate the 10-year risk of a CVD event.[37] Comorbidity for attendees was identified within 12 months after the NHS Health Check, and for non-attendees new comorbidity was identified within 12 months of the 1 April index date. Outcome data were collected until the end of follow-up on 31 March 2014, with the first comorbid diagnosis considered in the analysis.

Statistical analysis

To account for the clustered nature of the data, the authors used individual patient data (IPD) meta-analysis techniques,[38] using mixed-effects models with binomial family and logit link to account for paired cluster data. The authors considered including random-effects terms for CCG and match-id to account for clustering in the models. However, as the CCG term was not statistically significant in any of the models, the parsimonious model was opted for, with only match-id as the random effect. Further, a second set of models with appropriate interaction terms were

Table 1. Numbers and percentages of eligible attendees and non-attendees by population characteristics, 5 years 2009–2010 to 2013–2014

	Non-attendee		Attendee	
Patient characteristics	***n***	**%**	***n***	**%**
Total	**167 137**	**100**	**85 122**	**100**
CCG				
City & Hackney	64 053	38.3	24 631	28.9
Newham	56 620	33.9	35 765	42.0
Tower Hamlets	46 464	27.8	24 726	29.0
Sex				
Female	67 620	40.5	40 591	47.7
Male	99 516	59.5	44 530	52.3
Not specified	1	0.0	1	0.0
Age band, years				
40–59	152 935	91.5	75 347	88.5
60–74	14 202	8.5	9775	11.5
Ethnicity				
White	69 108	41.3	37 977	44.6
Black	29 732	17.8	18 229	21.4
South Asian	26 168	15.7	21 392	25.1
Other/not recorded	42 129	25.2	7524	8.8
Townsend quintile of deprivation (national rankings)				
1 (most affluent)	81	0.0	33	0.0
2	381	0.2	156	0.2
3	1596	1.0	794	0.9
4	30 814	18.4	14 943	17.6
5 (most deprived)	133 408	79.8	69 073	81.1
Not recorded	857	0.5	123	0.1

CCG = clinical commissioning group.

fitted to explore whether the impact of Health Checks was moderated by CCG. All analyses were conducted using Stata (version 12.1). The *P*-values were two-sided, with statistical significance set at 0.05.

Table 2. Proportion of attendees by CVD risk and CCG, 2009–2010 and 2013–2014

		City & Hackney		Newham		Tower Hamlets		East London	
QRISK band		**2009**	**2013**	**2009**	**2013**	**2009**	**2013**	**2009**	**2013**
0 to <5%	*n*	237	2799	3794	4497	313	2614	4344	9910
	%	33.0	50.9	44.1	57.6	19.9	50.8	39.9	53.7
5 to <10%	*n*	156	1376	2295	1536	347	1327	2798	4239
	%	21.7	25.0	26.6	19.7	22.1	25.8	25.7	23.0
10 to <15%	*n*	100	596	1025	665	238	565	1363	1826
	%	13.9	10.8	11.9	8.5	15.2	11.0	12.5	9.9
15 to <20%	*n*	83	268	509	303	181	279	773	850
	%	11.6	4.9	5.9	3.9	11.5	5.4	7.1	4.6
≥20%	*n*	139	190	745	250	490	172	1374	612
	%	19.4	3.5	8.7	3.2	31.2	3.3	12.6	3.3
Not recorded	*n*	3	275	244	559	1	188	248	1022
	%	0.4	5.0	2.8	7.2	0.1	3.7	2.3	5.5

CCG = clinical commissioning group. CVD = cardiovascular disease.

RESULTS

A total of 85 122 patients attended over the 5 years from 2009 to 2014 (Table 1). Attendance progressively increased from 7.3% (10 900/149 867) in 2009, to 12.7% in 2010, 16.1% in 2011, 14.0% in 2012, and to 17.0% (18 459/108 525) in 2013. Coverage increased from 36.4% in 2009 to 85.0% in 2013–2014.

Age, deprivation, and ethnic group

Attendees were older than non-attendees, and more likely to be from more deprived quintiles or from South Asian ethnic groups. Attendees aged ≥60 years comprised 40.8% (9775/23 977) of the eligible population, and attendees <60 years comprised 33.0% (75 347/228 282). The two most deprived quintiles, 4 and 5, comprised 33.8% [84 016/248 238] of the eligible patients that attended, compared with 29.0% (189/651) in the least deprived quintiles, 1 and 2. By ethnic group, attendees as a proportion of those eligible comprised 35.5% (37 977/107 085) for white patients, 38.0% (18 229/47 961) for black African–Caribbean, 45.0% (21 392/47 560) for South Asian, and 15.1% (7524/42 129) for other ethnic groups or those with no record.

Assessment of CVD risk

CVD risk using QRISK2 was recorded in 96.2% of attendees, compared with 72.0% of non-attendees. Table 2 shows that attendance among patients at higher CVD risk (QRISK2 ≥20%) was highest in earlier years, and the proportion of attendees at high CVD risk declined over time. This occurred because patients at highest risk were called first, leaving a pool of eligible patients at lower risk in later years. This was most pronounced in Tower Hamlets CCG, which pursued this invitation strategy most rigorously. Here, 31.2% of attendees were at high CVD risk in 2009 and 3.3% in 2013. In City & Hackney it was 19.4% and 3.5%, respectively, and in Newham 8.7% and 3.2%.

Over the 5 years, 8.8% of all attendees in Tower Hamlets, 6.4% in City & Hackney, and 6.4% in Newham were identified at ≥20% CVD risk. This was a 38% increase in those identified at high CVD risk in Tower Hamlets. Overall, 7.1% were at ≥20% CVD risk, 19.1% were 10–19% CVD risk, and 44.6% were <5% CVD risk (Table 3).

Prescribing statins

New statin prescriptions were higher in attendees (11.5%, 9802/85 122) than in non-attendees (8.2%, 13 741/167 137). Table 4 describes statin prescription in those

Table 3. Number and percentage of attendees by CVD risk and CCG, 5 years 2009–2010 to 2013–2014

QRISK band	City & Hackney	Newham	Tower Hamlets	Total east London	% of all attendees
0 to <5%	10 556	17 730	9678	37 964	44.6
5 to <10%	6290	8284	6942	21 516	25.3
10 to <15%	3225	3786	3533	10 544	12.4
15 to <20%	1804	1900	2021	5725	6.7
≥20%	1585	2276	2170	6031	7.1
Not recorded	1171	1789	382	3342	3.9
Total attendees	24 631	35 765	24 726	85 122	100

CCG = clinical commissioning group. CVD = cardiovascular disease.

Table 4. Number and percentage of new statin prescriptions in high CVD risk attendees, 5 years 2009–2010 to 2013–2014

	Prescribed statins				
	No		Yes		
Health Check year	*n*	%	*n*	%	Total
2009	799	58.2	575	41.8	1374
2010	1137	63.5	653	36.5	1790
2011	929	62.9	549	37.1	1478
2012	486	62.5	291	37.5	777
2013	437	71.4	175	28.6	612
	Locality CCG				
City & Hackney	1136	71.7	449	28.3	1585
Newham	1630	71.6	646	28.4	2276
Tower Hamlets	1022	47.1	1148	52.9	2170
East London	3788	62.8	2243	37.2	6031

CCG = clinical commissioning group. CVD = cardiovascular disease.

Table 5. Odds ratios of attendees compared with matched non-attendees, for new comorbidity diagnosed within 12 months of NHS Health Check

	Odds ratio (95% CI)	*P*-value
Diabetes	1.300 (1.215 to 1.390)	<0.001
Hypertension	1.499 (1.428 to 1.574)	<0.001
CKD stages 3–5	1.833 (1.521 to 2.210)	<0.001

CKD = chronic kidney disease.

patients at high CVD risk (≥20% CVD risk). Because of the declining risk profile over time, the proportion prescribed statins fell steadily from 41.8% in 2009 to 28.6% in 2013, and averaged 37.2% over the 5 years of the study because of the declining risk profile of attendees over time. Over the full 5 years, the proportion of high CVD risk attendees prescribed statins differed between CCGs — 52.9% in Tower Hamlets, 28.3% in City & Hackney, and 28.4% in Newham.

Diagnosis of new comorbidities

Table 5 shows the adjusted odds ratio (OR) of comorbidities diagnosed in NHS Health Check attendees in comparison with a matched group of non-attendees up to 12 months after the index date. Among attendees across all CCGs there were more new diagnoses of comorbidities than in non-attendees: diabetes OR 1.30 (95% CI = 1.22 to 1.39), hypertension OR 1.50 (95% CI = 1.43 to 1.57), and CKD OR 1.83 (95% CI = 1.52 to 2.21) (*P*<0.001).

Table 6 shows differences between CCGs in the extent to which comorbidities were identified. Tower Hamlets demonstrated the highest yield of new hypertension (OR 2.53; 95% CI = 2.31 to 2.78), followed by City & Hackney (OR 1.61; 95% CI = 1.42 to 1.78) (interaction terms were *P*<0.001). The odds ratio in Newham was not significantly increased (OR 1.058; 95% CI = 0.984 to 1.138).

For new diabetes the OR in City & Hackney was 1.66 (95% CI = 1.43 to 1.93), 1.35 in Tower Hamlets (95% CI = 1.20 to 1.52), and 1.14 in Newham (95% CI = 1.04 to 1.26) (interaction terms were *P*<0.01). For CKD, the interaction terms suggested no difference across CCGs, and the CKD results in Table 5 apply to all three CCGs.

DISCUSSION

Summary

The data from the first 5 years of implementation of the NHS Health Check showed year-on-year increase in coverage to 85% in 2013–2014, with no evidence of inequity of provision. Older patients, those in the most deprived quintiles, and South Asians were more likely to attend than younger, least deprived, or other ethnic groups. New diagnoses of diabetes were 30% more likely in attendees than non-attendees, hypertension 50%, and CKD 80%. Attendees were more likely to be prescribed statins. Of the attendees at high CVD risk (≥20%), 37% were prescribed statins.

The results also suggest that a targeted approach to invitation may be more efficient than non-targeted invitation. There was more new diabetes, hypertension, and CKD diagnosed in the CCGs using a targeted approach. In Tower Hamlets, which used targeted invitation most extensively, 8.8% were identified at high CVD risk over 5 years, compared with 6.4% in Newham using unselective invites: a 38% increase in those identified at high CVD risk. Statin

Table 6. Odds ratios of attendees compared with matched non-attendees for new diabetes or hypertension diagnosed within 12 months of NHS Health Check, by CCG

	Odds ratio (95% CI)	
CCG	**Diabetes**	***P*-value**
City & Hackney	1.660 (1.425 to 1.933)	<0.001
Newham	1.145 (1.037 to 1.263)	0.007
Tower Hamlets	1.353 (1.204 to 1.521)	<0.001
	Hypertension	
City & Hackney	1.612 (1.463 to 1.776)	<0.001
Newham	1.058 (0.984 to 1.138)	0.130
Tower Hamlets	2.531 (2.306 to 2.779)	<0.001

CCG = clinical commissioning group.

prescription in those at high CVD risk was also highest in Tower Hamlets, at 52.9%, although local managed practice networks also contributed to performance.

The NHS Health Check programme is likely to have an impact of public health importance with need for further improvement in management of identified risks.

Strengths and weaknesses

This large unselected study included almost all local practices. Standard data entry templates and a single computer system ensured fidelity of coding, high levels of data entry, and use of QRISK2 as the validated risk score. Although the authors matched individuals on major CVD risk factors — age, sex, ethnic group, and locality — the possibility of residual confounding contributing to the observed differences cannot be excluded.[39]

The three CCGs are atypical and serve very disadvantaged populations with high CVD risk. All three CCGs benefited from a strong local improvement infrastructure, including web-enabled IT support with near real-time performance dashboards, which may not be available in other CCGs. In Tower Hamlets, managed practice networks, including financial incentives, may also have contributed to high performance.[34,40,41]

Comparison with existing literature

The coverage of 85% found in this study compares with around 50% nationally. Highest coverage and treatment were associated with invites initially targeting those at highest risk and managed practice networks.

The results are similar to most comparable analyses, which show attendees have higher levels of statin prescribing.[42,43] A matched comparison of NHS Health Checks nationally by *Chang et al*[30] also reported a greater increase in new diagnoses of diabetes and hypertension among attendees than non-attendees. It also showed higher levels of statin prescribing in attendees: 9.1% versus 3.1% in non-attendees, in comparison with the results in this study of 11.5% and 8.2%, respectively. The increase in new comorbidities has not been demonstrated in all studies.[44]

Internationally, the Danish Inter99 study is relevant. In attendees, in comparison with non-attendees, mortality fell by 37% and risk factors were significantly reduced. Analysis by randomised group — invited versus not invited — showed no mortality difference, a not unsurprising result because only 35% of those randomised to invitation actually attended.[45] A study of the Scottish Keep Well health check showed increased statin prescribing in practices using checks compared with those that did not.[46]

More new diagnoses were identified in the two CCGs targeting higher-risk individuals for first invitation. In Newham, with a non-selective approach to invitation, new hypertension in attendees did not increase and, despite non-fasting glucose testing of every attendee, new diagnoses of diabetes were lower than in the other two CCGs. The lower rates of diagnoses in Newham are likely to have been due to the selection of a population in this CCG at lower overall risk, with 8.7% at high CVD risk in 2009, compared with 31.2% in Tower Hamlets. The proportion of patients at high CVD risk who were prescribed statins fell over time, from 41.8% in 2009 to 28.6% in 2013, reflecting a reduction in average risk over time as patients at highest risk were selected first.

Implications for research

Over the 5 years of this study, 40% more attendees were prescribed statins than non-attendees: 11.5% of attendees were prescribed statins in comparison with 8.2% of non-attendees. This 3.3% absolute difference represents 2800 more patients prescribed statins among attendees over a period of 5 years. Assuming a 15% 10-year CVD risk among those treated, this would prevent a heart attack or stroke in an estimated 50 patients. In England, with 1.5 million attendees annually, this additional statin use would prevent an estimated 4600 to 8400 heart attacks, strokes, or death from these causes in 5 years as a result of attending an NHS Health Check. Treatment of hypertension, diabetes, and kidney disease would further reduce CVD events. These results are of public health importance, and a full economic analysis based on contemporary data would provide useful information.

This study indicates that higher levels of coverage are achievable in the NHS Health Checks programme than is currently the case in England.[47] Treatment with statins in patients at high CVD risk was <30% in two of the three CCGs, and could be improved. Statins are highly effective, safe, and well tolerated.[48] Targeted invitation requires further confirmation as a more efficient method of implementation.[49,50] The subsequent management of those identified with comorbidities or high CVD risk, and reasons for non-uptake of treatment or behavioural support, also merit further investigation.

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Ethical approval

All data were anonymised and managed according to the UK NHS information governance requirements. Ethics committee approval was not required and reporting conformed to the STROBE and RECORD recommendations.

Provenance

Freely submitted; externally peer reviewed.

Competing interests

John Robson, Sandra Eldridge, and Isabel Dostal received personal fees from the funding grant. John Robson is an author of QRISK2, used in the assessment of CVD risk, and chaired the National Institute for Health Care and Excellence Lipid Modification guideline CG67 (2008), which recommended use of CVD risk assessment in routine care. John Robson, Sally Hull, and Kambiz Boomla supported the implementation of the NHS Health Check programme for the three east London CCGs in this study, and received personal fees from these organisations. The remaining authors have no competing interests to declare.

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