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Public Health and Primary Care
The Primary Care Unit

NHS Health Check Programme rapid evidence synthesis

The Primary Care Unit, University of Cambridge and RAND Europe

Dr Juliet Usher-Smith, Clinical Lecturer in General Practice, University of Cambridge
Professor Jonathan Mant, Professor of Primary Care Research, University of Cambridge

Dr Adam Martin, Health Economist, RAND Europe
Ms Emma Harte, Associate Analyst, RAND Europe
Mr Calum MacLure, Associate Analyst, RAND Europe
Dr Catherine Meads, Research Leader, RAND Europe
Dr Catherine Saunders, Senior Research Associate in Statistics, University of Cambridge
Professor Simon Griffin, Professor of General Practice, University of Cambridge
Dr Fiona Walter, Principal Researcher/Reader, University of Cambridge

Ms Kathryn Lawrence, Patient and Public Representative
Mrs Chris Robertson, Patient and Public Representative

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Preface

Following a competitive bidding process, on 31st October 2016 Public Health England commissioned the Primary Care Unit at the University of Cambridge, in collaboration with RAND Europe, to perform an independent rapid evidence synthesis of the NHS Health Check programme. The remit defined by Public Health England had a particular focus on attendance, delivery and health outcomes and included six specific questions.

This report presents the results of this rapid evidence synthesis. We hope it will be of value not only to Public Health England but also to academics, policy makers, commissioners, and those involved in delivering the NHS Health Check programme or considering similar prevention programmes.

The Primary Care Unit at the University of Cambridge, is based within the Department of Public Health and Primary Care, one of Europe's premier university departments of population health sciences. It is part of the National Institute for Health Research School for Primary Care Research, which is a partnership between eight leading academic centres for primary care research in England. The Primary Care Unit works to reduce the burden of ill health by identifying and targeting the behaviours that lead to chronic disease; by improving early detection of illness; by improving the delivery of health services in community settings; and by teaching medical students, clinicians, researchers and educators.

RAND Europe is a not-for-profit policy research organisation that aims to improve policy and decision making in the public interest, through rigorous and independent research and analysis.

For more information about this document please contact:

Dr Juliet Usher-Smith MA MB BChir MPhil PhD MRCGP

Clinical Lecturer
The Primary Care Unit,
Institute of Public Health,
University of Cambridge School of Clinical Medicine
Box 113 Cambridge Biomedical Campus
Cambridge
CB2 0SR
Email: jau20@medschl.cam.ac.uk
Telephone: +44 01223 748693

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The views and opinions expressed by authors in this publication are those of the authors and do not necessarily reflect those of the NIHR, the NHS, or the Department of Health.

Contribution of Authors

Juliet Usher-Smith developed the protocol, screened articles for inclusion, extracted and synthesised the quantitative and qualitative data, interpreted the findings and drafted the report.

Jonathan Mant developed the protocol, interpreted the findings and critically revised the report.

Adam Martin screened articles for inclusion, extracted and synthesised the quantitative data, interpreted the findings and critically revised the report.

Emma Harte screened articles for inclusion, extracted and synthesised the qualitative data, interpreted the findings and critically revised the report.

Calum MacLure extracted and synthesised the qualitative data.

Catherine Meads developed the protocol, interpreted the findings and critically revised the report.

Catherine Saunders developed the protocol, extracted and synthesised the quantitative data, interpreted the findings and critically revised the report.

Simon Griffin developed the protocol, interpreted the findings and critically revised the report.

Fiona Walter developed the protocol, interpreted the findings and critically revised the report.

Kathryn Lawrence commented on the findings and report from a Patient and Public Representative perspective.

Chris Robertson commented on the findings and report from a Patient and Public Representative perspective.

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SUMMARY

Background

The NHS Health Check programme is the largest current prevention initiative in England. Since its introduction in 2009 a growing literature has been published evaluating the first eight years of the programme. These have been summarised in reports published by Public Health England but, to date, no synthesis has been performed. There is, therefore, a need for an independent, comprehensive, rapid evidence synthesis to identify what has been learnt about the NHS Health Check programme so far.

Aims and Objectives

To provide a rapid synthesis of the published research evidence on NHS Health Checks, specifically addressing the six research questions posed by Public Health England:

1. Who is and who is not having an NHS Health Check?
2. What are the factors that increase take-up among the population and sub-groups?
3. Why do people not take up an offer of an NHS Health Check?
4. How is primary care managing people identified as being at risk of cardiovascular disease or with abnormal risk factor results?
5. What are patients' experiences of having an NHS Health Check?
6. What is the effect of the NHS Health Check on disease detection, changing behaviours, referrals to local risk management services, reductions in individual risk factor prevalence, reducing cardiovascular disease risk and on statin and antihypertensive prescribing?

Design

A systematic review with descriptive synthesis of quantitative data and thematic synthesis of qualitative data.

Data sources

Medline, PubMed, Embase, Health Management Information Consortium (HMIC), Cumulative Index of Nursing and Allied Health Literature (CINAHL), Global Health, PsycInfo, Web of Science, the Cochrane Library, NHS Evidence, Google Scholar, Google, OpenGrey, Clinical Trials.gov, the ISRCTN registry, and article reference lists.

Study selection

Studies identified by the searches were selected for inclusion in the review by two reviewers in a two-step process. First, studies relevant to the NHS Health Check were identified. These were then screened against predefined inclusion and exclusion criteria for each of the six research questions.

Data extraction

At least two researchers assessed eligibility, extracted data, and assessed the quality of the included studies.

Key findings

Coverage varies substantially across regions and in different settings. Multiple definitions used interchangeably make comparisons difficult. It is consistently higher in older people, females and more deprived populations but this may reflect targeting. Outreach services in the community can reach particular socio-demographic groups but better descriptions and robust evaluations are needed.

There is a lack of national level studies reporting the characteristics of those who take-up the invitation to an NHS Health Check.

Regional studies report uptake between 27% and 53%, similar to national reported uptake (48.3%). Older people, women in younger age groups and men in older age groups, and those from least deprived areas are more likely to take up invitations. Promising methods to increase uptake are modifications to the invitation (3-4% increase), and text message invites or reminders (up to 9% increase). There is a lack of quantitative evidence for the effect of community settings on uptake but qualitative evidence highlights their convenience and the value of community ambassadors.

People do not take up the offer of an NHS Health Check due to lack of awareness or knowledge, competing priorities, misunderstanding the purpose, an aversion to preventive medicine, difficulty getting an appointment with a GP, and concerns about privacy and confidentiality of pharmacies. Amongst attendees there are high levels of satisfaction (over 80%). Some reported attendance had acted as a wake-up call and precipitant for lifestyle changes. Others were left with feelings of unmet expectations, were confused about or unable to remember their risk scores, and found lifestyle advice too simplistic and un-personalised.

There are wide variations in the process, delivery and content of NHS Health Checks across the country, in part due to different local implementation. Regardless of region or setting those delivering NHS Health Checks reported challenges with workload, IT, funding, and training. Amongst general practice professionals there were concerns about inequality of uptake and doubts about the evidence underpinning the programme and the cost-effectiveness.

NHS Health Checks are associated with small increases in disease detection. There is very little data on behaviour change or referrals to lifestyle services. NHS Health Checks are associated with a 3-4% increase in prescribing of statins.

BACKGROUND

The NHS Health Check programme is the largest current prevention initiative in England. Introduced in 2009 to improve cardiovascular disease (CVD) risk factors through behavioural change and treatment informed by risk stratification, it became a mandated public health service in 2013, with local authorities responsible for offering an NHS Health Check to individuals aged 40-74 without existing cardiovascular disease every five years. The NHS Health Check itself consists of three components: risk assessment, communication of risk and risk management. Risk tools are used to establish the individual's risk of developing CVD and diabetes. That assessment is then used to raise awareness of relevant risk factors and inform discussion about the lifestyle and medical approaches best suited to managing the individual's health risk. Based on modelling studies of cross-sectional data it was estimated that the programme could prevent 1,600 heart attacks and strokes, at least 650 premature deaths, and over 4,000 new cases of diabetes each year with an estimated cost per quality adjusted life year (QALY) of approximately £3,000[1].

Since the introduction of the programme, however, it has remained controversial and the effectiveness challenged by some [2–4]. In the context of the current financial crisis within the NHS and reports of primary care services being stretched beyond safe limits[5], it is now more important than ever to have robust evidence for interventions. Whilst data from randomised controlled trials are considered the gold standard, this is difficult to obtain for interventions such as the NHS Health Check programme which are implemented simultaneously nationwide. There is, however, a growing literature of published studies describing the implementation of the programme and evaluating its impact over the first eight years. These have been summarised in reports published by Public Health England and, as expected for studies assessing population level interventions, include a range of methods including trials, cross-sectional studies, case-control studies, observational studies, case studies and qualitative research. To date no synthesis has been performed. There is, therefore, a need for an independent, comprehensive, rapid evidence synthesis to identify what has been learnt about the NHS Health Check programme so far.

AIMS AND OBJECTIVES

The aim of this report is to provide a rapid synthesis of the published research evidence on NHS Health Checks for Public Health England. Specific objectives, as defined by Public Health England, are to address the following six research questions:

1. *Who is and who is not having an NHS Health Check?*

2. *What are the factors that increase take-up among the population and sub-groups?*

3. *Why do people not take up an offer of an NHS Health Check?*

4. *How is primary care managing people identified as being at risk of cardiovascular disease or with abnormal risk factor results?*

5. *What are patients' experiences of having an NHS Health Check?*

6. *What is the effect of the NHS Health Check on disease detection, changing behaviours, referrals to local risk management services, reductions in individual risk factor prevalence, reducing cardiovascular disease risk and on statin and antihypertensive prescribing?*

METHODS

Literature search

To identify published studies relevant to each of the six research questions we used the results of an existing literature review conducted by Public Health England (PHE) covering the period from 1st January 1996 to 9th November 2016 supplemented by a search of the Web of Science, Science Citation Index covering the same period and hand searching of the reference lists of all publications included in this review. The PHE searches included the following sources: Medline, PubMed, Embase, Health Management Information Consortium (HMIC), Cumulative Index of Nursing and Allied Health Literature (CINAHL), Global Health, PsycInfo, the Cochrane Library, NHS Evidence, Google Scholar, Google, Clinical Trials.gov and the ISRCTN registry. Full details of all the search strategies are shown in Appendix 1. No language restrictions were applied.

To identify information on unpublished research or research reported in the grey literature, we also searched the OpenGrey database and reviewed the abstracts submitted for the PHE NHS Health Check conference due to take place March 2017. We had hoped to also search the OAIster database but this was unavailable due to maintenance during this work.

Inclusion and exclusion criteria and study selection process

Studies identified by the searches were selected for inclusion in the review in a two-stage process. The first stage identified studies relevant to the NHS Health Check by screening titles and abstracts for potential relevance and then further examining them against the inclusion and exclusion criteria in Box 1.

This stage had already been completed as part of the literature review conducted by PHE. One reviewer (EH) followed this process for the citations identified from the Web of Science database.

The second stage identified studies relevant to each of the six research questions. After piloting predefined inclusion and exclusion criteria for each of the six questions (Table 1 and Table 2), two researchers (JUS and AM) reviewed each study against those inclusion and exclusion criteria and identified all those potentially relevant to each question. Where it was unclear whether or not the inclusion criteria were met for any given study, those studies were discussed at consensus meetings with the wider research team.

Modelling studies that did not specifically address any of the six questions but provided data on potential impacts of NHS Health Checks were also identified and included in the overall evidence synthesis.

Box 1. Inclusion and exclusion criteria

Inclusion criteria

Studies reporting primary data and guidelines were included. Primary studies should have used one of the following study designs:

- Randomised controlled trials (RCTs), cluster RCTs
- Quasi-RCTs, cluster quasi-RCTs
- Controlled and uncontrolled before and after studies with appropriate comparator groups
- Interrupted time series
- Cohort studies (prospective or retrospective); and
- Case-control studies
- Qualitative studies from any discipline or theoretical tradition using recognised qualitative methods of data collection and analysis.
- Economic and health outcome modelling

Studies must also have included the NHS Health Check.

Exclusion criteria

Editorials, commentaries and opinion pieces

Table 1. Inclusion criteria

Question	1. Who is and who is not having an NHS Health Check?	2. What factors increase take-up among population and sub-groups?	3. Why do people not take up an offer of an NHS Health Check?	4. How is primary care managing people identified as being at risk of CVD or with abnormal risk factor results?	5. What are patients' experiences of having an NHS Health Check?	6. What is the effect of the NHS Health Check on disease detection etc.*
Research type	Quantitative	Qualitative/quantitative	Qualitative	Qualitative/quantitative	Qualitative	Quantitative
Participants	UK population eligible for NHS Health Checks	UK population invited for NHS Health Checks	UK population eligible but not attending NHS Health Checks	Primary care services across the UK providing NHS Health Checks	UK population attending NHS Health Checks	UK population eligible for NHS Health Checks
Measures (also see Table 3)	Patient demographic characteristics (age, gender, deprivation, socioeconomic status, region etc), patient condition characteristics (BMI, smoking status, CVD risk factors etc)	Patient characteristics (including subgroups, protected characteristics), Setting characteristics, (e.g. GP practice, size, pharmacy, etc), Mode of delivery, booking system, call/ recall methods, take up rates, use of point of care testing, etc.	Patient opinions, attitudes and experiences of NHS Health Checks, choices made and why, reasons and beliefs underlying decisions	Provider management protocols, recall methods, provider experiences of programme provision, referrals to lifestyle services, prescribing statins or anti-hypertensives, further investigations, adherence to guidelines, etc	Patient opinions and experiences of NHS Health Checks	Disease and condition detection rates, including hypertension, diabetes, chronic kidney disease, AF, familial hypercholesterolaemia, peripheral vascular disease etc, behaviour change, referrals to local risk management services, reductions in individual risk factor prevalence or CVD risk, statin and anti-hypertensive prescribing, any other physical or mental health outcomes, cost effectiveness

Table 2. Exclusion criteria

Question	1.Who is and who is not having an NHS Health Check?	2.What are the factors that increase take-up among the population and sub-groups?	3. Why do people not take up an offer of an NHS Health Check?	4. How is primary care managing people identified as being at risk of CVD or with abnormal risk factor results?	5. What are patients' experiences of having an NHS Health Check?	6. What is the effect of the NHS Health Check on disease detection etc.*
Participants	Patients not eligible for an NHS Health Check or receiving other forms of health check or screening services	Patients not eligible for an NHS Health Check or taking up other forms of health check or screening services	Patients not eligible for an NHS Health Check or choosing not to take up other forms of health check or screening services	Primary Care services not offering NHS Health Checks or people identified as at risk for CVD outside NHS Health Checks	Patients who have not had an NHS Health Check	Patients not eligible for an NHS Health Check

* full question – What is the effect of the NHS Health Check on disease detection, changing behaviours, referrals to local risk management services, reductions in individual risk factor prevalence, reducing CVD risk and on statin and antihypertensive prescribing?

Data extraction

Data from both quantitative and qualitative studies were extracted independently by at least two reviewers using data extraction forms developed to minimize bias. The quantitative data were extracted independently by two reviewers (JUS + AM/CS). As the perspective of the researcher is highlighted as an important factor in all types of qualitative research and is likely to, consciously or subconsciously, affect a researcher's interpretation of data, all qualitative data were extracted independently by three reviewers (JUS, CM and EH) with different research backgrounds. Qualitative information on experiences of minority issues from the point of view of participants and professionals was also particularly sought and extracted. Details of specific outcomes extracted for each of the research questions are shown in Table 3.

Quality assessment

The quality of all included studies was assessed at the same time as data extraction by one researcher (JUS, EH or CS), with a subset checked by a second researcher. For qualitative studies we used the Critical Appraisal Skills Programme (CASP) checklist for qualitative research[6]. As the review included quantitative studies with a range of methods and no CASP checklist exists for cross-sectional studies, we used a combined checklist combining the CASP checklists for cohort studies and randomised-controlled trials for all quantitative studies.

Table 3. Data extracted for each of the six research questions

1. Who is and who is not having an NHS Health Check?	2. What factors increase take-up among population and sub-groups?	3. Why do people not take up an offer of an NHS Health Check?	4. How is primary care managing people identified as being at risk of CVD or with abnormal risk factor results?	5. What are patients' experiences of having an NHS Health Check?	6. What is the effect of the NHS Health Check on disease detection, changing behaviours, referrals to local risk management services, reductions in individual risk factor prevalence, reducing CVD risk and on statin and antihypertensive prescribing?

Quantitative
• Coverage rates
• Demographic measures
  ○ Age
  ○ Gender
  ○ Deprivation
  ○ Region
  ○ Ethnicity
  ○ Employment status
• CVD risk profile
  ○ BMI
  ○ Calculated CVD risk
  ○ Smoking status
  ○ BP
  ○ LDL (or non-HDL cholesterol)
  ○ HbA1c
	Quantitative
	• Take up rates
	• Method/route of invitation
	• Appointment system
	• Use of reminders
	• Mode of delivery of NHS Health Check
	• Use of point of care testing
	• Setting of deliver
	  ○ Site e.g. GP practice/pharmacy
	  ○ Size
	• Intervention(s) used to improve uptake
	• Population characteristics
	  ○ Age
	  ○ Gender
	  ○ Deprivation
	  ○ Region
	  ○ Ethnicity
	  ○ Employment status
	  ○ CVD risk profile
	
	Qualitative
	• Population, subgroup and practitioner attitudes towards NHS Health checks
	• Population and practitioner experiences of invitation process
		Qualitative
		• Population perceptions of and attitudes towards NHS Health Checks and how those are formed, including both internal and external influences
		• Population experiences of invitation and appointment booking process
		• Practitioner views on uptake of NHS Health Checks
			Quantitative
			• Primary care management protocols
			• Recall methods
			• Adherence to guidelines
			• Referrals to lifestyle services, including type of service
			• Prescribing
			  ○Lipid lowering drugs
			  ○Anti-hypertensives
			• Further investigations
			
			Qualitative
			• Patient or provider experiences of programme provision
			• Staff responsible for delivery
				Qualitative
				• Patient opinions and experiences of NHS Health Checks
				• Patient satisfaction
					Quantitative
					• Disease and condition detection rates, including:
					  ○ Hypertension
					  ○ Diabetes
					  ○ Chronic kidney disease
					  ○ AF
					  ○ Familial hypercholesterolaemia
					  ○ Peripheral vascular disease
					  ○ CVD events
					• Behaviour change, including:
					  ○ Diet
					  ○ Physical activity
					  ○ Smoking cessation
					• Referrals to local risk management services
					• CVD risk factors
					  ○ BMI
					  ○ BP
					  ○ HDL cholesterol
					  ○ LDL (or non-HDL) cholesterol
					  ○ HbA1c
					• Calculated CVD risk
					• Prescribing
					  ○ Lipid lowering drugs
					  ○ Anti-hypertensive medication
					• Anxiety and general health
					• Cost effectiveness

Synthesis

The synthesis was performed separately for each of the six questions outlined above.

Quantitative data

We had hoped to perform meta-analysis for some of the measures but due to the heterogeneity in terms of study design, sampling, selection of measures, and matching, and the small numbers of high quality studies addressing each question, this was not possible. Instead, we grouped together all data addressing each question and presented that as tables and graphs with a narrative synthesis detailing and comparing the results of each study.

Qualitative data

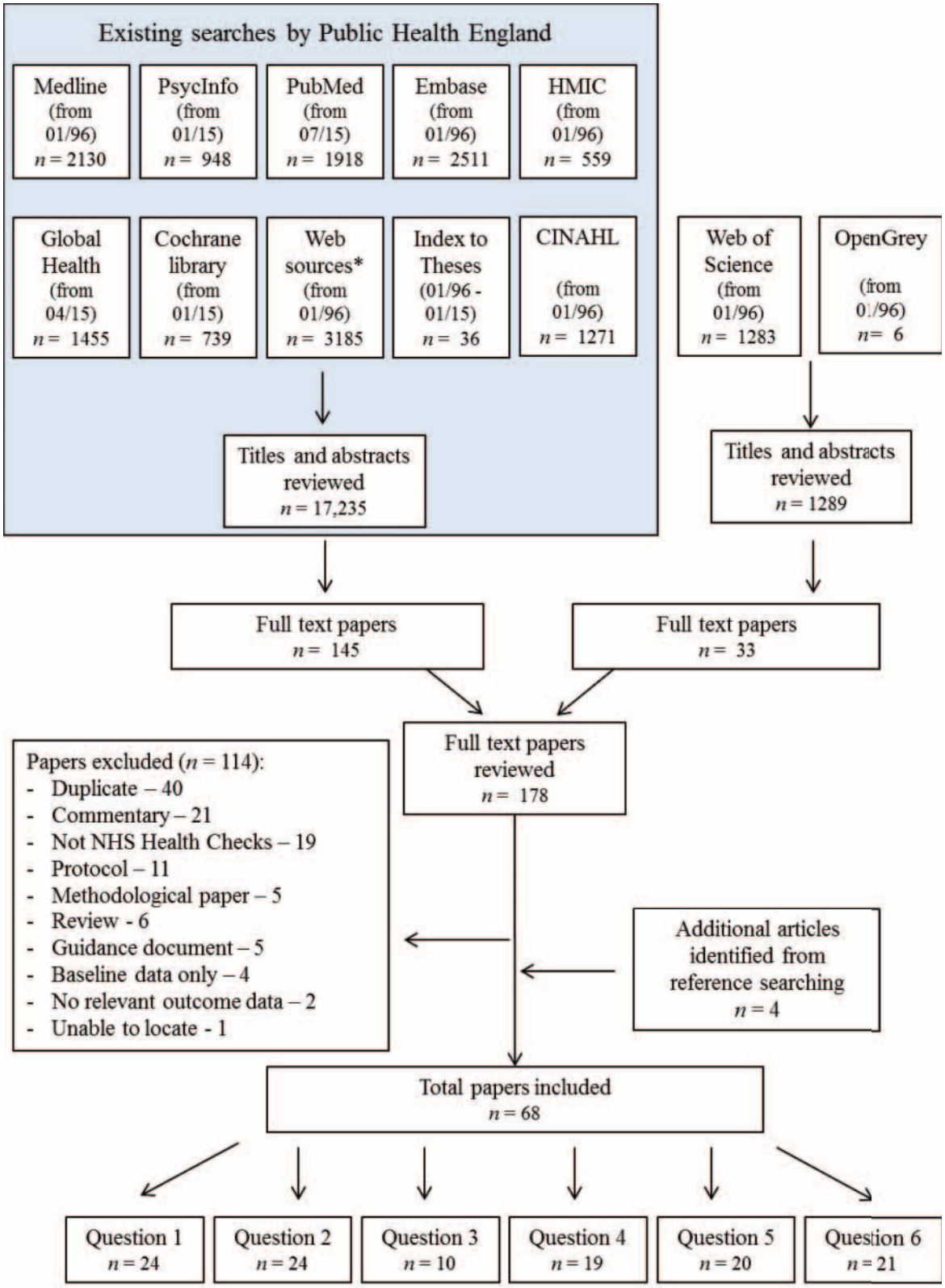
We synthesised the qualitative data using thematic synthesis. This approach focuses on the 'translation of qualitative studies into one another' with the objective of developing additional interpretations and conceptual insights beyond the findings of the primary studies. Following reading and re-reading of the included studies, this synthesis included three stages[7]: coding of the findings of the primary studies; organisation of these codes into related areas to develop descriptive themes; and then the development of analytical themes which addressed the specific research questions. The initial coding of the findings of the primary studies was performed by at least two researchers. Discrepancies were then discussed at consensus meetings and the subsequent stages were an iterative process with both the descriptive and analytical themes developed through a series of meetings involving researchers from a range of clinical and non-clinical backgrounds. To allow an appreciation of the primary data, we have included illustrative quotations from the original studies alongside the analytical themes in this report.

RESULTS

The existing literature review conducted by Public Health England covering the period from January 1996 to 9th November 2016 (see Appendix 1 for details of the search strategies) identified 145 papers potentially relevant to NHS Health Checks. An additional search of the Web of Science, Science Citation Index and OpenGrey covering the same period identified a further 33, giving a total of 178 papers that were reviewed at full text level. Of those, 115 were excluded. The most common reasons for exclusion were that they were duplicates, commentaries, or they did not describe NHS Health Checks. An additional five papers were identified from a manual search of the reference lists of the publications included in this review. 68 papers are, therefore, included in the six questions covered by this evidence synthesis (Figure 1).

Details of these studies, along with a summary of the quality assessment are given in the subsequent sections of this report whenever they provide relevant data. Full details of the quality assessment are given in Appendix 2 for the quantitative studies and Appendix 3 for the qualitative studies. Where studies included both quantitative and qualitative methods, quality assessment was completed separately for the two aspects of the study so they are included in both Appendix 2 and Appendix 3. Of the quantitative studies, 15 were assessed as high quality, 21 as medium and 11 as low quality, and from the qualitative studies, 18 were assessed as high quality, 10 as medium and 4 as low quality.

Figure 1. PRISMA diagram



1. Who is and who is not having an NHS Health Check?

When the economic modelling was done prior to initiation of the NHS Health Check programme[1], it was anticipated that all eligible individuals (those between 40-74 years old without a diagnosed vascular disease or already on statins and/or anti-hypertensives) would be invited over a five-year period and 75% of those would attend. National data published by Public Health England[8] show that the numbers of people receiving an NHS Health Check have been increasing since the programme was introduced in 2008. At the end of 2016, 31.8% of those eligible to receive an NHS Health Check in the five-year period from 2013-2018 have received one. In this section we first review the literature reporting the characteristics of those who have received an NHS Health Check across different settings and regions and then those studies that compare those who have attended with the eligible population.

In total, 24 studies that reported relevant data were identified. The characteristics of those studies along with a summary assessment of quality are shown in Table 1.1 and full details of the quality assessment are provided in Appendix Table 2. All were observational studies with four using national-level data, twelve using regional data from samples of general practices, and six using data from community settings.

Table 1.1 Features of studies reporting characteristics of people who have attended NHS Health Checks

Author / Year Publication type	Study design / Data source	Setting Study time period	Eligible population [if not reported then attended an NHS Health Check population shown in brackets][a]	Eligible population characteristics: Age, Gender, Ethnicity	Method for identifying NHS Health Check	Overall quality
NATIONAL STUDIES						
Artac 2013[9] ***Primary care…*** **Journal Article**	Observational cross sectional study Mandatory PCT data returns collated by the DH	151 NHS PCTs in England April 2011 - March 2012 (1 year)	Whole of England PCT-level data	Mean IMD score: 23.6 % ethnic minority: 12.1%	PCTs provided DH with data on NHS Health Check attendance	High
Chang 2015[10] ***Coverage of a…*** **Journal Article**	Observational study CPRD data	England April 2009 - March 2013 (4 years)	95571 (a random sample of eligible patients drawn from the national CPRD dataset)	% aged>60:60.2% % male:20.2% % British:35.8%	Read codes indicating measurement of four risk factors within six-month period	High
Forster 2015[11] ***Estimating the yield…*** **Journal Article**	Observational study CPRD data	England 2010-2013 (3 years)	[140,356]	Not reported	'Health check' or 'CVD risk assessment' Read codes	High
Robson 2016[12] ***…evaluation…***	Observational study QResearch data	England April 2009 to March 2013 (4 years)	1,679,024	% aged >60:22.2% % male:49.6% % white:63.4%	'NHS Health Check completed' or 'CVD risk assessment' Read codes	High
REGIONAL STUDIES						
Artac 2013[13] ***Uptake of the…*** **Journal Article**	Observational cross sectional study Electronic medical records	27 (of 31) PCTs in Hammersmith and Fulham, London 2009-2011 (2 years)	[Year 1: 4,748 high risk patients] [Year 2: 35,364]	Year 1: % aged>65: 34.2% % male: 78.4% % white: 71.4% Year 2: % aged>65: 5.89% % male: 45.2% % white: 56.8%	Business rules of the local financial incentive (QOF Plus) were used to determine completeness of NHS Health Check	High

Author / Year Publication type	Study design / Data source	Setting Study time period	Eligible population [if not reported then attended an NHS Health Check population shown in brackets][a]	Eligible population characteristics: Age, Gender, Ethnicity	Method for identifying NHS Health Check	Overall quality
Attwood 2015[14] **Journal article**	Trial[b] Data collected in a trial	4 GP practices in the East of England Not reported	[1,380]	Not reported	Reported by GP surgeries in the trial	Medium
Baker 2015[15] **Journal Article**	Observational cross sectional study Electronic medical records	83 (of 85) GP practices in Gloucestershire July 2011-July 2012 (1 year)	210,513	Not reported	Not reported	Medium
Carter 2015[16] **Journal Article**	Observational cross sectional study Electronic medical records	65 GP practices in Leicester City Clinical Commissioning Group April 2009-March 2014 (5 years)	[53,799]	Not reported	Not reported	Medium
Cochrane 2013[17] **Journal article**	Observational cross sectional study Electronic practice records	37 (of 57) GP practices in Stoke on Trent August 2009-January 2010 (6 months)	[10,483 high risk patients]	Not reported	Reported by GP surgeries in the study	High
Coffey 2014[18] **Research report**	Observation study Electronic records	40 (of 47) GP practices in Salford	57,486	Not reported	Read codes commonly used amongst those practices	Medium
Cook 2016[19] **Journal Article**	Observational study Electronic practice records	30 (all) GP practices in Luton April 2013-March 2014 (1 year)	50,485	% aged>55: 30.5% % aged>65: 7.6% % male: 53.3% % white British: 32.5%	Not reported	Low
Dalton 2011[20] **Journal Article**	Observational study Electronic practice records	29 (of 86) GP practices in Ealing, London 2008-2009 (1 year)	[5,294 high risk patients]	Not reported	Reported by GP surgeries in the study	High

Author / Year Publication type	Study design / Data source	Setting Study time period	Eligible population [if not reported then attended an NHS Health Check population shown in brackets][a]	Eligible population characteristics: Age, Gender, Ethnicity	Method for identifying NHS Health Check	Overall quality
Krska 2015[21] ***Implementation of NHS…*** **Journal Article**	Observational study Electronic practice records	13 (of 55) GP practices in Sefton, North West England Not reported (assumed first year of health checks since high risk patients)	2,892 high risk patients	% aged >65:69.4% % male:78.3% % white:99.1%	Reported by GP surgeries in the study	Medium
Kumar 2011[22] **Journal Article**	Observational study NHS Health Check data	2 (of approx. 57) GP practices in Stoke on Trent 2008 to 2010 (assumed two years)	[1,606 of whom 661 were high risk patients]	Not reported	Reported by GP surgeries in the study	Low
Roberts 2016[23] **Journal article**	Observational study Electronic practice records	General practices in Buckinghamshire	[12,190]	Not reported	GP records	Medium
Robson 2015[24] ***..implementation …*** **Journal Article**	Observational study Electronic practice records	139 (of 143) GP practices in North East London April 2009 to April 2012 (3 years)	144,451	% aged >60:10.8% % male: Not reported % white: 42.2%	Not reported	Medium
Usher-Smith 2015[25] **Journal Article**	Observational study Electronic practice records	1 GP practice in the East of England 1 April 2011 to 1 Dec 2014 (3 years and 8 months)	[1,646]	Not reported	GP records	Low
COMMUNITY SETTINGS						
Corlett 2015[26] **Journal Article**	Observational study Electronic practice records	Four community pharmacies within a London CCG February-August 2013 (6 months)	[190]	Not reported	Data were collected during and after the NHS Health Check	Medium

Author / Year Publication type	Study design / Data source	Setting Study time period	Eligible population [if not reported then attended an NHS Health Check population shown in brackets][a]	Eligible population characteristics: Age, Gender, Ethnicity	Method for identifying NHS Health Check	Overall quality
LGA Buckinghamshire[27] **Case study**	Evaluation	Community vernues	[>3,800]	Not reported	Data were collected during and after the NHS Health Check	Low
NHS Greenwich[28] **Evaluation report**	Observational study NHS Health check data	5 community based venues in Greenwich, South East London (e.g. Charlton Athletic Football Ground) May-June 2011 (2 months)	[1,400]	Not reported	Data were collected during and after the NHS Health Check	Medium
Roberts 2016[23] **Journal article**	Observational study NHS Health Check data	Community venues in Buckinghamshire	[3,849]	Not reported	Data were collected during and after the NHS Health Check	Medium
Trivedy 2016[29] **Journal Article**	Observational study NHS Health Check data	7 cricket venues in England 11 cricket events held during 2014 and 2015	[513]	Not reported	Data were collected during and after the NHS Health Check	Low
Visram 2014[30] **Journal article**	Formative evaluation	Community venues in Durham	[101]	Not reported	Routine monitoring data	Medium
Worringer 2015[31] **Conference abstract**	Observational study NHS Health Check data	Community venues 8 regions of England across 29 local authorities	[41,570]	Not reported	Routine monitoring data	Medium

[a]High risk patients are defined as those with an estimated cardiovascular risk >20% in the next 10 years

[b]The intervention arm of the trial (physical activity) was not relevant to this review. However, data reported on trial non-participants who attended the health check were extracted.

PCT – Primary Care Trust; CPRD – Clinical Practice Research Datalink; CCG – Clinical Commissioning Group; DH – Department of Health; QOF – Quality Outcomes Framework; CVD – cardiovascular disease; IMD – Index of Multiple Deprivation

1.1 Characteristics of people who have had an NHS Health Check

Eighteen studies reported the unadjusted characteristics of attendees (Table 1.1.1)[10–12,14–17,20–30]. Of these 18 studies, three used a national sample, four were in regional areas that had specifically targeted high-risk individuals, five were in regional areas without specifically targeting high-risk patients, five were in community settings, and one compared the characteristics of those attending general practice and community based NHS Health Checks. One additional study by Worringer *et al*. compared those attending community-based NHS Health Checks in eight regions of England across 29 local authorities with national census data[31].

Across all the studies there are large variations in the age, gender, ethnicity, deprivation level and cardiovascular risk profile of those who are having an NHS Health Check. Three studies used data from the Clinical Practice Research Datalink (CPRD)[10,11] or QResearch[12] databases. The CPRD is an ongoing primary care database of medical anonymised medical records from general practices in the UK. In the middle of 2015, approximately 6.9% (4.4 million) of the UK population were included from 674 practices[32]. It contains patient registration information and all care events that primary care health professionals have chosen to record as part of routine medical practice. This includes records of clinical events (medical diagnoses), referrals to specialists and secondary care settings, prescriptions issued in primary care, records of immunisations / vaccinations, diagnostic testing, and lifestyle information (e.g. smoking and alcohol status). It is also linked with mortality data, indices of multiple deprivation (IMD) 2010 scores for selected general practices in England, and key data from Hospital Episode Statistics. The included patients are broadly representative of the UK population in terms of age, sex and ethnicity but the general practices contributing data are less representative, both in terms of geography and size. For example, comparing CPRD data to general practice data in 2011, the median list size was higher in CPRD compared with English practices as a whole; 8,355 vs 5,918[33] and in 2013 the North West of England and London provided 80-89 practices each to CPRD, compared with 12-19 practices from the North East[32]. The QResearch database is also an ongoing primary care database of medical anonymised medical records from over 1000 general practices who use the EMIS clinical computer system across the UK, covering a population of over 20 million[34].

The data extracted for analysis in both databases has been entered during routine care using Read codes[35] which can then be used to identify patients who have attended NHS Health Checks. Although there is now a Read code specific for attendance at an NHS Health Check, when the programme first began there was no standard Read code used to record the completion of an NHS Health Check. The studies have, therefore, used various ways to identify those who have had an NHS Health Check. Chang *et al*[10]. defined NHS Health Check attendance by the measurement of four risk factors: blood pressure; body mass index; cholesterol ratio; and smoking status within a six month period; Forster *et al.*[11] used Read codes defined by the NHS Health Check programme in addition to codes that indicated that a

cardiovascular disease risk assessment had been completed; and Robson *et al.*[12] used Read codes for CVD risk assessment or NHS Health Check completed. All three cannot therefore be certain either that all patients they classify as having had an NHS Health Check have actually had an NHS Health Check and not a cardiovascular risk assessment as part of routine practice, or that some patients have received an NHS Health Check but have not had that recorded in their medical records.

Despite these potential limitations, these three studies provide the data most likely to be representative of the country as a whole. Looking at the absolute numbers of those attending they show that more females and more people in the most deprived quintile compared with the least deprived quintile have had NHS Health Checks (Figures 1.1.1 and 1.1.2 – note that the numbers for the Chang *et al* paper have been multiplied by 10 to allow comparison on the same scale). The absolute numbers of those in different age groups varied between the studies. The study by Robson *et al.* in the QResearch database reported approximately equal numbers across the age groups whilst the studies by Forster *et al.* and Chang *et al.* in the CPRD found more people in the youngest age group (40-49 years) had received an NHS Health Check.

Figure 1.1.1 Numbers of those attending NHS Health Checks from national datasets by gender and age

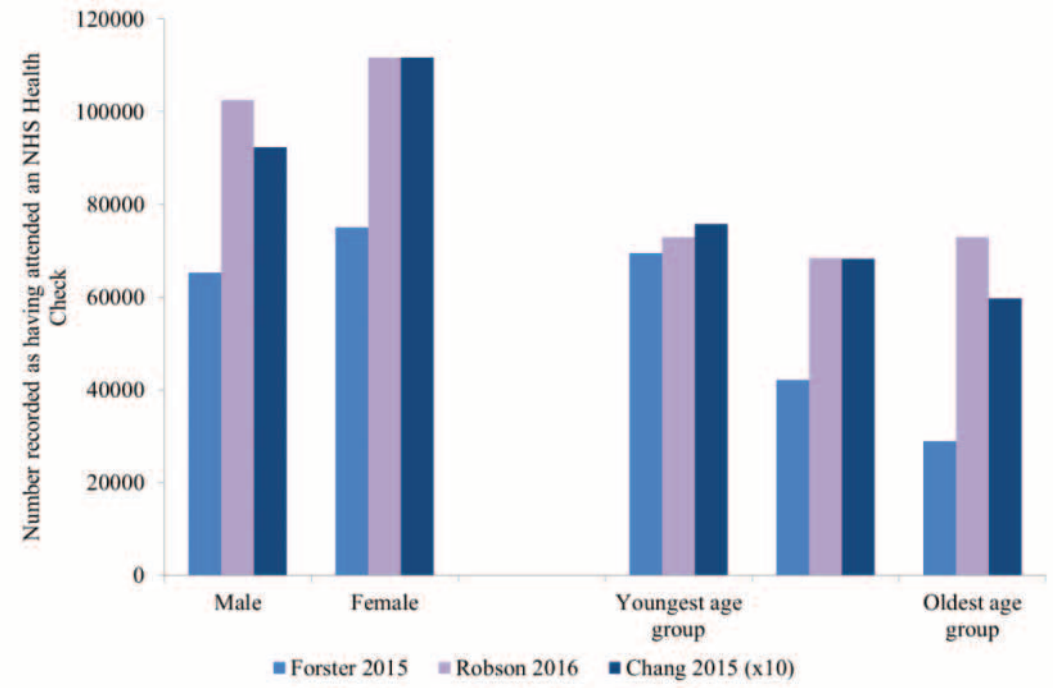
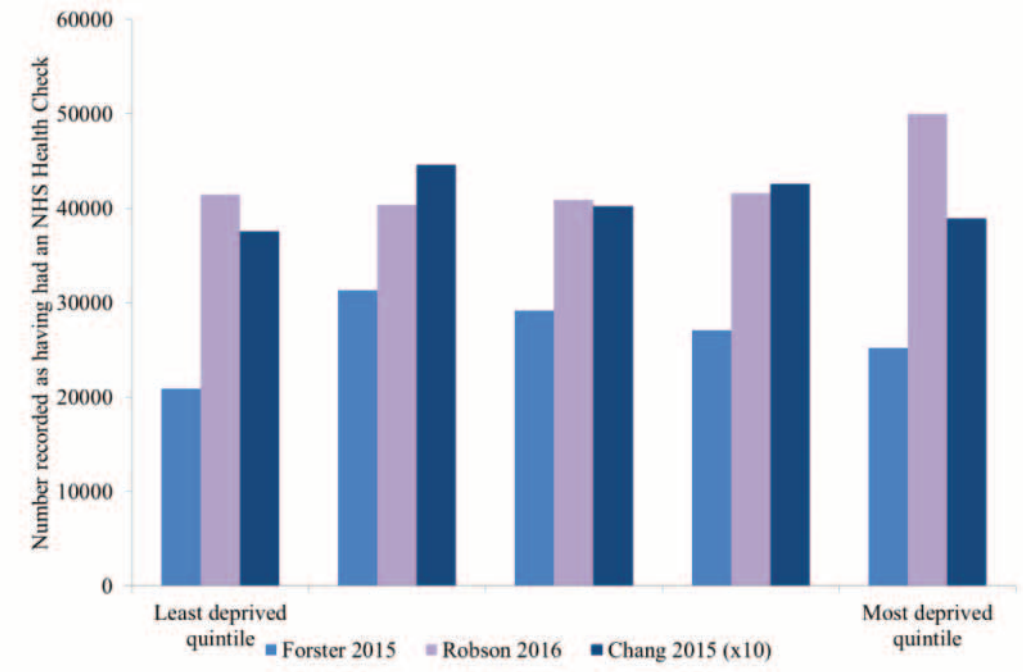


Figure 1.1.2 Numbers attending NHS Health Checks from national datasets by deprivation level



The heterogeneity of study setting, time period, and eligible population (Table 1.1) between the studies makes drawing meaningful comparisons across the different settings difficult. However, one study directly compared the characteristics of those attending general practice or community based NHS Health Checks[23]. The study found that more of those attending community-based NHS Health Checks were from ethnic minority groups and deprived areas than those attending general practices (11% vs 3% and 30% vs 13% respectively). The other four studies describing the characteristics of those attending community-based NHS Health Checks also show how the setting can influence the socio-demographic characteristics of those having an NHS Health Check. For example, when NHS Health Checks were offered in mosques, manufacturing companies, football clubs and cricket matches, a higher proportion of attendees were male[27,29]. In the study by Worringer *et al*. those who attended community based NHS Health Checks were also on average younger (the mean proportion of 40-49 and 50-59 year olds was 10.8% and 5.2% higher at $p<0.001$), from more deprived communities ($p<0.05$ in 22 of the 29 local authorities), and more likely to be female ($p<0.001$) than the general population in national census data[31].

Table 1.1.1 Characteristics of those having an NHS Health Check

Author / Year Publication	Setting Time period	Sample size (attendees)	Age	Male (%)	White ethnicity (%)	Living in most deprived area (area-level) (%)	CVD risk >20% (%)	Smoke (%)	BMI>30 (%)	Family CHD history (%)
NATIONAL SAMPLE										
Chang 2015[10] Journal article	England 4 years	20,409		45.3	71.4	Quintile: 19.1	4.6	17.3	26.3	10.8
Forster 2015[11] Journal article	England 2010-2013 (3 years)	140,356	>65: 20.5%	46.5		Quintile: 18.0	17.0	18.1	22.3	
Robson 2016[12] Journal article	England	214,295	>60: 34.0%	47.9	86.4	Quintile: 23.3	11.6	17.7	21.2	6.9
REGIONAL SAMPLE OF PRACTICES (HIGH RISK ONLY)										
Cochrane 2013[17] Journal article	37 (of 57) GP practices in Stoke on Trent	4,580	>65:43.1%	83.6		Tertile: 71.7	CVD Risk>35: 15.6%			
Dalton 2011[20] Journal article	29 (of 86) GP practices in Ealing, London	2,370	>65:41.6%	80.5	19.9	Tertile: 36.6	Not reported	35.4	26.0	
Krska 2015[21] Journal article	13 (of 55) GP practices in Sefton, North West England	1,070	>65:74.1%	80.9	99.1	Quintile: 9.7	92.0	18.1	BMI>25kg/m2: 75.6%	56.7
Kumar 2011[22] Journal article	2 (of approx. 57) GP practices in Stoke on Trent	497	>60:40.6%	56.9						
REGIONAL SAMPLE OF PRACTICES										
Attwood 2015[14] Journal article	4 GP practices in the East of England	179	Mean: 56.6	42.5	80.4	Quintile: 14.8	Not reported			
Baker 2015[15] Journal article	83 (of 85) GP practices in Gloucestershire 1 year	20,973	45-49:17.3%	45.2	British or mixed British: 94.8		9.1	9.3	15.5	
Carter 2015[16] Journal article	65 GP practices in Leicester City Clinical Commissioning Group April 2009-March 2014 (5 years)	53,799	>60:30.5%	47.5	45.8		10.8	23.7	Mean BMI: 27.4kg/m^2	

Author / Year Publication	Setting Time period	Sample size	Age	Male (%)	White ethnicity (%)	Living in most deprived area (area-level) (%)	CVD risk >20% (%)	Smoke (%)	BMI>30 (%)	Family CHD history (%)
Roberts 2016[23] Journal article	General practices in Buckinghamshire	12,190		50	South Asian: 3	Quintile: 13				
Robson 2015[24] Journal article	139 (of 143) GP practices in North East London 3 years	50,651	>60 (Y3 only): 14.8%	Not reported	46.9		10.5			
Usher-Smith 2015[25] Journal article	1 GP practice in East of England	1,646	58.1 years	54.6		Tertile: 0.2	10.8			
COMMUNITY SETTINGS										
Corlett 2015[26] Journal article	Four community pharmacies within a London CCG February-August 2013 (6 months)	190	>65:7.4%	42.1	52.6		8	12.3	17.4	
LGA Buckingham-shire 2015[27] Case study	Mosques Costcutter stores Adult learning centre Bus stations Manufacturing firm Football club	155 20 >20 55 45 71		72 50 75 69 100	South Asian: 95 South Asian: 25 South Asian: 22	 Deprived: 50 Deprived: 57				
NHS Greenwich 2011[28] Evaluation report	5 community based venues in Greenwich, South East London (e.g. Charlton Athletic Football Ground)	620	>60:40.6%	39.4	59	Quintile: 22	25	16	47	25
Trivedy 2016[29] Journal article	7 cricket venues	513	Male: 49 years Female: 47 years	63.2	84			11	20	
Visram 2014[30] Journal article	Various community settings including workplaces, colleges, libraries and children's centres	101	>60: 18%	46.5		Quintile: 18	12.8			
Roberts 2016[23] Journal article	Various community settings including places of worship, supermarkets, shopping centres, workplaces, libraries, community events, and bus stations	3,849	Mean 54	38	78 South Asian: 11	Quintile: 30				

1.2 Characteristics of those who have received an NHS Health Check compared with the eligible population

Nine studies reported estimates of coverage (the percentage of the eligible population who received an NHS Health Check) (Table 1.2.1)[9,10,12,13,15,18,19,21]. Comparing the coverage between these studies is challenging for a number of reasons. Firstly, definitions of coverage vary and the term is sometimes erroneously used interchangeably with uptake (the percentage of those invited who receive an NHS Health Check). As the NHS Health Check is a five-year programme, some authors adjust the denominator to account for the fact that in any given year only one fifth of the population are eligible, whilst others are not clear about how they have defined the eligible population. Coverage of the programme as a whole has also increased since it was first introduced, making comparison of studies conducted over different time periods inappropriate. A further limitation of these studies is the difficulty and range of methods used for identifying those who have received an NHS Health Check as described above.

Table 1.2.1 Estimates of coverage reported across studies

Author / Year Publication type	Mean coverage, setting and time period	Denominator used in the study	Estimate of coverage per year per one fifth of the total eligible population
NATIONAL LEVEL			
Artac 2013[9] *Primary care…* Journal article	8.1% 2011-12	Unclear	8.1%
Chang 2015[10] Journal article	21.4% (9.4% to 30.7% between regions) 2009-13	Total eligible population	26.7%
Robson 2016[12]	12.8% 2009-12	One fifth of the total eligible population	12.8%
REGIONAL LEVEL			
Artac 2013[13] *Uptake of the…* Journal article	2008-09: 32.7% (high risk) 2010-11:20.0% 27 (of 31) PCTs in Hammersmith and Fulham	Unclear	Y1:32.7% Y2:20.0%
Baker 2015[15] Journal article	49.8% 83 (of 85) practices in Gloucestershire 2011-12	One fifth of the total eligible population	49.8%
Coffey 2014[18] Research report	6.8% 40 (of 47) practices in Salford 2013-14	Total eligible population	34%
Cook 2016[19] Journal article	Not reported 2013-14	Total eligible population	56.5%
Krska 2015[21] Journal article	47.2% 13 (of 55) GP practices in Sefton, North West England 2011-12	Unclear	47.2%
Robson 2015[24] Journal article	2009-10: 33.9% 2010-11: 60.6% 2011-12: 73.4%	One fifth of the total eligible population	Y1: 33.9%, Y2: 60.6%, Y3: 73.4%

Of these nine studies, five reported coverage for different population sub-groups[10,12,13,19,21] and three reported associations between coverage and regional or individual-level characteristics in multivariate analysis[9,10,13]. All used electronic medical records to report on the characteristics of those attending and those eligible. A major limitation of all these studies is that data are less complete in people without an NHS Health Check, consequently all comparisons between attenders and those eligible are prone to bias.

The results of the five studies reporting coverage across different population sub-groups are summarised in Table 1.2.2. Two used national datasets: Chang *et al.*[10] the CPRD; and Robson *et al*.[12] the QResearch database. Both studies examined the first four years of the NHS Health Check programme and were consistent in showing that coverage was higher in females, older people, those in the most deprived areas, and those with a family history of coronary heart disease. Coverage was also higher in Bangladeshi, Caribbean and Indian ethnic groups than amongst White individuals in both studies and lower within Chinese groups. Neither study reported coverage amongst smokers or non-smokers.

The three regional studies also showed that coverage was higher among older individuals, those in the most deprived areas, those with a family history of coronary heart disease and non-smokers. Coverage was also higher amongst females, except in both studies which reported coverage only among those at high risk (year one for the study by Artac *et al.*[13] and the study by Krska *et al.*[21]).

The results of the three studies that report associations between coverage and regional or individual-level characteristics using multivariate regression / or multilevel modelling are shown in Table 1.2.3. In multivariate analysis, older age, higher deprivation and a family history of coronary heart disease remained associated with higher coverage and smoking with a lower coverage. However, in contrast to the univariate data, an association between being female and coverage was only observed in the second year of the two-year study by Artac *et al*.[13].

The study by Artac *et al*. also reported no significant associations between PCT-level coverage and either the proportion of people in the PCT area aged 40–74 years, the proportion from ethnic minorities, or practice population size or staffing levels[9].

Two studies additionally compared the unadjusted characteristics of attendees with non-attendees in the eligible population[12,24]. They showed that the percentage of those aged over 60 years, with a family history of coronary heart disease, and non-drinkers were higher in attendees than non-attendees (14.8% vs 10.8%, 21.7% vs 10.7% and 26.0% vs 24.9% respectively). The percentage of non-smokers were similar between both groups (55.1% vs 55.5%).

Table 1.2.2 Variation in coverage across different population subgroups

Author / Year Publication type	Age group	Gender	Ethnicity	Deprivation (area-level)	Family history of coronary heart disease	Smokers
NATIONAL LEVEL						
Chang 2015[10]	Aged 40-49:17.0% Aged 50-59:22.4% Aged 60-69:29.0% Aged 70-74:31.2%	Male:20.2% Female:22.4%	British: 35.8% Pakistani/Bangladeshi: 44.5% Other Asian: 42% Irish: 43.4% Indian: 42.8% Caribbean: 37.1%	Most deprived quintile:24.0% Least deprived quintile:21.8%	No: 20.2% Yes: 41.6%	
Robson 2016[12]	Aged 40-49: 9.0% Aged 50-59:13.7% Aged>60:19.6%	Male:12.3% Female:13.2%	White: 17.4% Selected others Indian 17.7% Bangladeshi 29.6% Caribbean 19.6%	Most deprived quintile:14.9% Least deprived quintile: 12.3%		
REGIONAL LEVEL						
Artac 2013[13] *Uptake of the…* Journal Article	Y1: Aged 40-54: 26.9% Aged 55-64: 30.5% Aged 65-74: 39.2% Y2: Aged 40-54: 17.7% Aged 55-64: 25.6% Aged 65-74: 33.1%	Y1: Male: 32.6% Female: 22.0% Y2: Male: 17.0% Female: 22.5%	Y1: White:35.7% Black: 31.8% South Asian: 47.4% Y2: White: 22.5% Black: 28.9% South Asian: 29.0%	Y1: Most deprived tertile::32.5% Least deprived tertile: 32.7% Y2: Most deprived tertile: 22.9% Least deprived tertile: 17.5%	Y1:No: 28.5% Yes: 45.9% Y2:No: 17.6% Yes: 30.8%	Y1:No: 36.9% Yes: 28.5% Y2:No: 20.3% Yes: 18.6%
Cook 2016[19] Journal article		Male:10.1% Female:12.6%				
Krska 2015[21] Journal article	Aged <65: 31.3% Aged>65: 39.5%	Male: 38.3% Female: 32.5%	White:43.6% Other: 20.7%	Most deprived quintile:36.4% Least deprived quintile:35.4%	No: 34.4% Yes: 40.3%	No: 39.6% Yes: 31.2%

Table 1.2.3 Associations between coverage and regional or individual-level characteristics in multivariate analysis

Author / Year Publication type	Age	Gender	Ethnicity	Deprivation (area-level)	Smoker	Family history of CHD:	Other
NATIONAL LEVEL							
Artac 2013[9] *Primary care…* Journal article	Proportion of PCT population in 40-74 age range: Not significant	Not reported	Not significant	Least deprived tertile: -0.51 (-1.88 to 0.00)*			Population size, service factors (e.g. FTE GPs) and CVD prevention need: Not significant
Chang 2015[10] Journal article	Aged 50-59: 1.60 (1.54 to 1.67)* Aged 60-69: 2.47 (2.36 to 2.58)* Aged 70-74: 2.88 (2.49 to 3.31)* (compared to <50)	Female: 1.01 (0.98 to 1.05)	Significantly lower amongst African, Chinese, other White and other Black (compared to White British)	No significant differences		2.37 (2.22 to 2.53)*	Significantly lower coverage in Yorkshire/Humber, East and West Midlands and East of England
REGIONAL LEVEL							
Artac 2013[13] *Uptake of the…* Journal article	Aged >65 compared to 40-54: Y1: 2.05 (1.67-2.52)* Y2: 2.79 (2.49 to 3.12)*	Female: Y1: 0.80 (0.67 to 0.94)* Y2: 1.27 (1.20 to 1.35)*	Black (compared to White): Y1: 1.05 (0.78 to 1.41) Y2: 1.58 (1.43 to 1.75)* South Asian (compared to White): Y1: 1.27 (0.88 to 1.87) * Y2: 1.50 (1.25 to 1.78)*	Least deprived tertile: Y1: 0.84 (0.69 to 1.01) Y2: 0.80 (0.73 to 0.87)*	Y1: 0.71 (0.61 to 0.83)* Y2: 0.83 (0.77 to 0.90)*	Y1: 2.49 (2.15 to 2.90)* Y2: 2.01 (1.87 to 2.16)*	

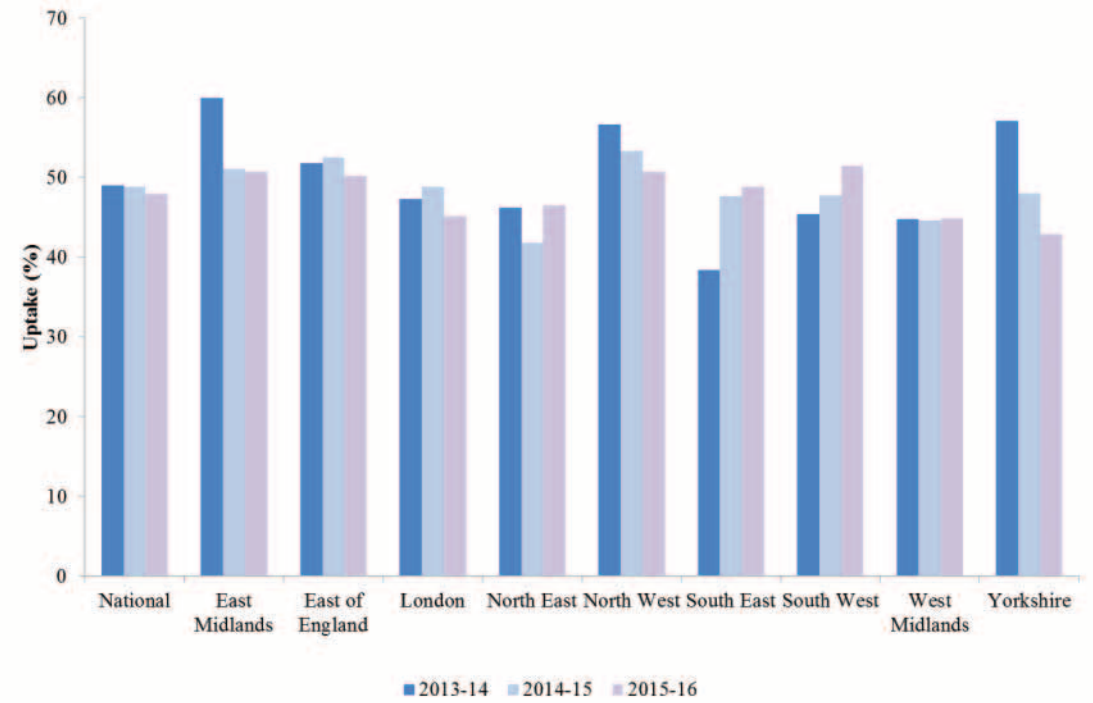
1.3 Key findings and interpretation

- In national samples, more females and those in the most deprived areas have received NHS Health Checks than men or those in the least deprived areas.
- There are large variations in the age, gender, ethnicity, deprivation level and cardiovascular risk profile of those having an NHS Health Check in different regions of the country and in different settings. This is likely due, at least in part, to local policy decisions about targeting of invitations and support for provision of NHS Health Checks rather than a function of who is taking up invitations. These variations in implementation have, however, not been well characterised which limits geographical comparison.
- There are also variations in coverage but comparison is difficult as different definitions are used and coverage is often confused with uptake. Encouraging universal definitions would improve future evaluations.
- Both national and regional studies consistently report higher coverage (the percentage of the eligible population who received an NHS Health Check) amongst older individuals, those in the most deprived areas, and those with a family history of coronary heart disease. They also show coverage to be higher in females except where high-risk individuals are specifically targeted and regional studies show coverage is lower in smokers than non-smokers.
- Increasing age, higher deprivation, being a non-smoker and the presence of a family history of coronary heart disease are also independent predictors of having had an NHS Health Check in multivariate analyses. Both in these studies and in the univariate descriptions the apparent association with family history of coronary heart disease may be due to recording bias.
- Coverage amongst different ethnic groups varied but was comparable with or higher than in white British groups in many of the studies.
- These findings go against suggestions that those receiving NHS Health Checks are predominantly white British with low cardiovascular risk and from areas of low deprivation.
- Data from those attending NHS Health Checks in the community show how different settings can potentially be used to target particular socio-demographic groups but only one study directly compared those attending community-based NHS Health Checks with those attending general practices. Robust evaluations of the numerous outreach programmes across the country are needed.

2. What factors increase take-up among population and sub-groups?

The most recent national data published by Public Health England reports that 48.3% (*n* = 4,903,516) of those offered an NHS Health Check since 2013 have received one[8]. This is lower than the 75% overall uptake rate used in the economic modelling undertaken to establish the clinical and cost effectiveness of the overall programme prior to its introduction[1]. Whilst it has remained relatively stable over the past four years, there are both regional (Figure 2.1) and local variations. For example, within Yorkshire in 2015-16, uptake varied from 8% to 89% between areas. This section aims to understand some of the reasons behind this variation by reviewing the data around which factors increase uptake among populations and sub-groups. It is divided into three sections. The first describes the associations between socio-demographic factors and uptake, the second the effect of the method of invitation, and the third factors relating to the setting in which the NHS Health Check is delivered.

Figure 2.1 Uptake of NHS Health Checks across England from 2013-2016 (data from[8])



2.1 Socio-demographic factors

Eleven quantitative studies (Table 2.1.1) provide data on socio-demographic factors affecting uptake of NHS Health Checks, defined as those who attend an NHS Health Check as a proportion of those who have been invited[14,17,19–22,28,36–39]. Of those eleven studies, nine examined uptake in general practices with sample sizes ranging from two[22] to 40[37] general practices and between 1,380[14] and 50,485[19] patients. The other two studies examined uptake in community settings: one in two community mental health centres in Birmingham which included 188 patients who were already accessing mental health services[36]; and the second across five community-based venues in Greenwich, London[28].

Eight of the studies were full articles published in peer-reviewed journals. Despite all being based in general practices there were substantial variations in the age, gender and ethnicity of the patient populations. For example, 79.6% of patients in the study by Cochrane *et al*[17] (37 general practices in Stoke on Trent) but just 30.5% in the study by Cook *et al*[19] (30 GP practices in Luton) were aged over 55 years. Similarly, the proportion of participants reporting white ethnicity in the study by Attwood *et al.*[14] (four GP practices in East of England) was 72.9% whereas in the study by Krska *et al.*[21] (13 GP practices in North West England) it was 99.1%. These differences were likely due in part to different recruitment strategies (four studies targeted patients at high risk of cardiovascular disease), the geographic area (each study focused on a single town, city or region – no study used national-level data) and the representativeness of the sampled practices to the geographic area (whereas the study by Cook *et al.*[19] included all general practices in the geographic area, all other studies included only a sample of general practices).

One of the remaining studies was a conference abstract including data from 17 general practices in Bristol[38] and the remaining two were reports describing community pilot projects[28,36].

This heterogeneity makes comparing the findings across the studies more difficult and limits the external validity of the findings, except in the study by Cook *et al*[19], as the sites included may not be representative of the sites that were not included. Nevertheless, it is possible to draw some conclusions from the data.

Table 2.1.1 Features of studies providing data on socio-demographic factors affecting uptake of NHS Health Checks.

Author / Year Publication	Study design / Data source	Setting	Recruitment	Sample size / Study population[a]	Sample characteristics: Age, Gender, Ethnicity	Study period	Method for identifying Health Check	Overall quality
Attwood 2015[14] Journal article	Trial /Trial data[b]	4 GP practices in the East of England	Invitation to attend NHS Health Check and a physical activity trial	1,380 patients	Mean age: 52.4 % male: 49.7% % white: 72.9%	Not reported	Reported by GP surgeries in the trial	Medium
Cochrane 2013[17] Journal article	Observational study/ Electronic practice records	37 (of 57) GP practices in Stoke on Trent	Invitation to attend NHS Health Check	10.483 high risk patients	% aged >55: 79.6% % aged >65: 36.4% % male: 81.3% Ethnicity: Not reported	August 2009-January 2010 (6 months)	Reported by GP surgeries in the study	High
Coffee 2015[36] Report	Observational study / Case study data	2 community medical centres in Birmingham (where patients are already accessing mental health care)	Invitation to attend NHS Health Check	188 patients already using secondary mental health services	Not reported	October 2014 – June 2015 (8 months)	Reported by the NHS Trust	Low
Coghill 2016[38] Conference slides	Quasi-experimental study / Electronic practice records	17 GP practices in Bristol	Invitation to attend NHS Health Check (two methods: by letter or by telephone)	5,678 patients	Not reported	Not reported	Not reported	Low
Cook 2016[19] Journal Article	Observational study/ Electronic practice records	30 (all) GP practices in Luton	Face-to-face, letter or telephone invitation	50,485 patients	% aged>55: 30.5% % aged>65: 7.6% % male: 53.3% % white British: 32.5%	April 2013-March 2014 (1 year)	Electronic health records	Low

Author / Year Publication	Study design / Data source	Setting	Recruitment	Sample size / Study population[a]	Sample characteristics: Age, Gender, Ethnicity	Study period	Method for identifying Health Check	Overall quality
Dalton 2011[20] Journal Article	Observational study/ Electronic practice records	29 (of 86) GP practices in Ealing, London	Invitation to attend NHS Health Check	5,294 high risk patients	% aged>55: 80.8% % aged >65: 40.8% % male: 80.9% % white British: 21.7%	2008-2009 (1 year)	Reported by GP surgeries in the study	High
Hooper 2014[37] Short article	Observational study / Health checks data	40 GP practices offering health checks in Warwickshire	Invitation to attend NHS Health Check	37,236 patients	Not reported	April 2010 – March 2013	Reported by providers of NHS health checks	Medium
Krska 2015[21] Journal Article	Observational study/ Electronic practice records	13 (of 55) GP practices in Sefton, North West England	Invitation to attend NHS Health Check	2,892 high risk patients	% aged >65: 69.4% % male: 78.3% % white: 99.1%	Not reported (assumed first year of health checks since high risk patients)	Reported by GP surgeries in the study	Medium
Kumar 2011[22] Journal Article	Observational study/ Health checks data	2 (of approx. 57) GP practices in Stoke on Trent	Invitation to attend NHS Health Check	1,606 patients (of whom 661 were high risk patients)	% aged >60: 31.5% % male: 56.7% Ethnicity not reported	2008-2010 (assumed two years)	Reported by GP surgeries in the study	Low
NHS Greenwich[28] Evaluation report	Observational study Health checks data	5 community based venues in Greenwich, South East London (e.g. Charlton Athletic Football Ground)	Invitation to attend NHS Health Check PLUS (the national scheme plus people at risk of falls and alcohol dependency)	1,400 patients	% aged >65: 27.5% % male: 45.1% Ethnicity not reported	May-June 2011 (2 months)	Reported by GPs	Medium
Sallis 2016[39] Journal article	Pragmatic quasi-randomised controlled trial	4 GP practices in Medway	Invitation to attend NHS Health Check either standard or enhanced letter	3,511 patients	Mean Age 53.1/52.8, % Female 53.3/50.9%	2013	Electronic health records	Medium

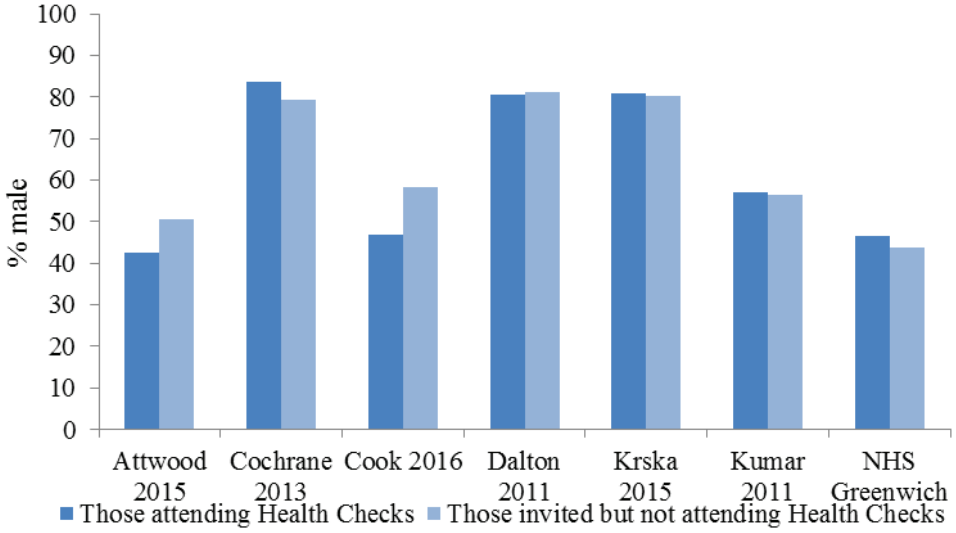
[a]High-risk patients are defined as those with an estimated cardiovascular risk >20% in the next 10 years

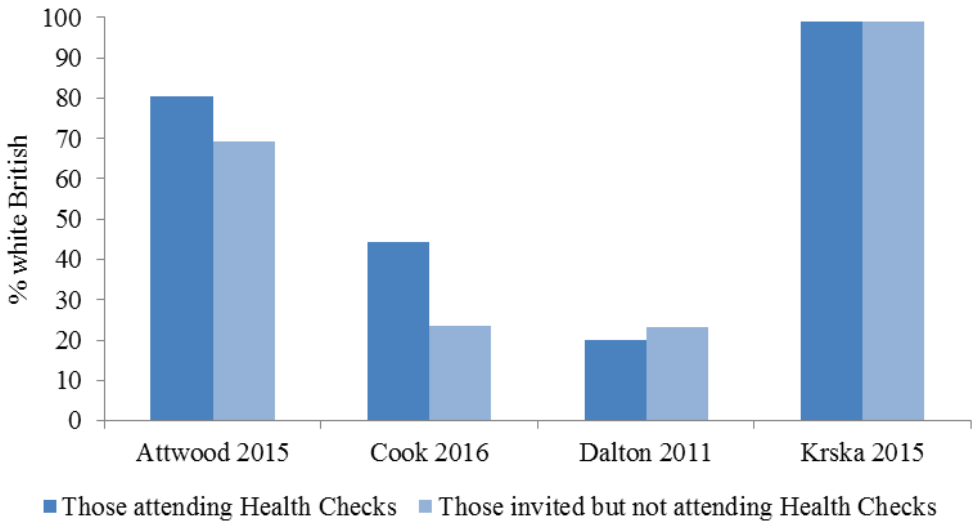
[b]The intervention arm of the trial (physical activity) was not relevant to this review. However, data reported on trial non-participants who attended the health check were extracted.

Eight of the ten studies reported socio-demographic characteristics of participants who attended an NHS Health Check compared with those who were invited but did not attend. The results are summarised in Table 2.1.2. The reported uptake across these studies ranged from 27% in four general practices in the East of England[14] to 71.8% in two community mental health centres in Birmingham[36]. Across the seven studies based in general practices, the mean uptake was 44.1% and attendees were older than those who were invited but did not attend. This was in contrast to the one study reporting uptake in five community based venues where the percentage of those aged over 65 years was higher among those who did not attend that those who did[28].

The findings for gender, ethnicity and deprivation were more mixed (Figure 2.1.1). Some studies reported that proportionally more men, people of white British ethnicity and people in the most deprived regions were more likely to take up invitations while other studies reported no differences or the opposite findings.

Figure 2.1.1 Gender, ethnicity and deprivation of those attending Health Checks compared with those invited but not attending.





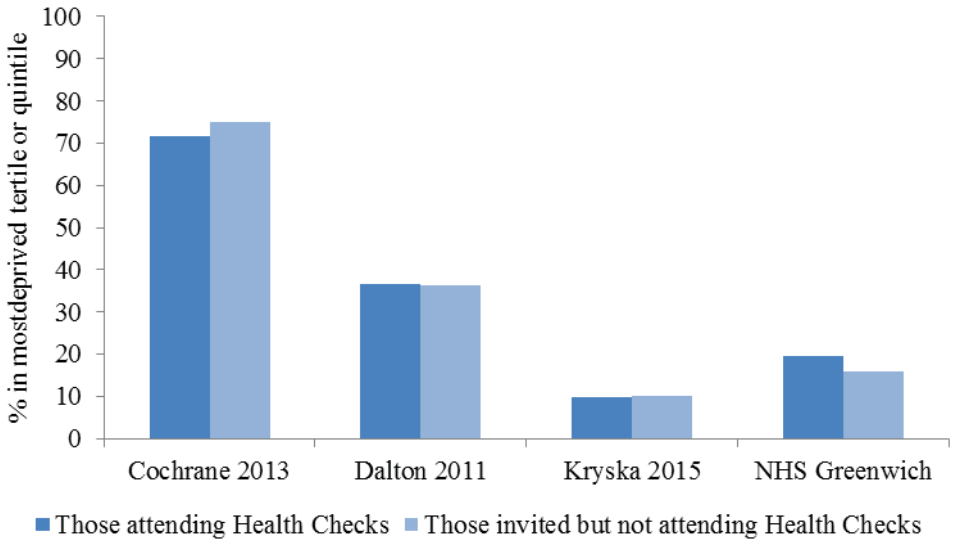


Table 2.1.2. Characteristics of people who attended NHS Health Checks compared with those who were invited but did not attend

Author / Year	Setting	Uptake	Age (mean)		Gender / Ethnicity		Deprivation (area-level)	
			Attended	*DNA*	*Attended*	*DNA*	*Attended*	*DNA*
Attwood 2015[14]	4 GP practices in the East of England	27.0%	56.6	52.0	42.5% male[a] 80.4% white	50.6% male[a] 69.3% white	Median IMD score: 18.3[b]	13.3[b]
Cochrane 2013[17]	37 (of 57) GP practices in Stoke on Trent	43.7%	>55:86.7% >65:43.1%	>55:74.1% >65:31.2%	83.6% male	79.4% male	% living in most deprived tertile: 71.7%	74.9%
Coghill 2016[38]	17 GP practices in Bristol	34.1%	Not reported	Not reported	7.2% minority	11.7% minority[c]	Mean IMD score: 43.0	42.3[c]
Cook 2016[19]	30 (all) GP practices in Luton	43.7%	>55:35.3% >65:11.8%[d]	>55:25.8% >65:4.4%[d]	46.8% male 44.3% white British[e]	58.3% male 23.4% white British[e]	Not reported[f]	
Dalton 2011[20]	29 (of 86) GP practices in Ealing, London	44.8%	>55:82.4% >65:41.6%	>55:80.0% >65:40.2%	80.5% male 19.9% white British	81.2% male 23.1% white British	% living in most deprived tertile: 36.7%	36.4%
Kryska 2015[21]	13 (of 55) GP practices in Sefton, North West England	52.9%	>65:74.1%	>65:56.6%	80.9% male 99.1% white	80.1% male 99.0% white	% living in most deprived quintile: 9.7%	10.0%
Kumar 2011[22]	2 (of approx. 57) GP practices in Stoke on Trent	30.9%	>60:40.6%	>60:27.4%	56.9% male	56.5% male	Not reported	
NHS Greenwich[28]	5 community based venues in Greenwich	45.9%	>65:25.1%	>65:29.6%	46.6% male	43.9% male	% most deprived quintile: 19.5%	16.0%

[a] In univariate logistic regression analyses, female gender was statistically significant: 1.50 (1.16 to 1.95)
[b] In univariate logistic regression analyses, the most deprived quintile was associated with increased likelihood of attendance: 2.90 (1.84 to 4.58)
[c] All patients invited, including those who attended
[d] In univariate analysis ages 60-64, 65-69 and 70-74 had significantly higher uptake
[e] In univariate analysis White British, White Irish, Indian, Bangladeshi, Caribbean, and Chinese all had significantly higher uptake and African had significantly lower uptake
[f] In univariate analysis the least deprived quintile had significantly higher uptake and the most deprived quintile significantly lower uptake

Six of the studies reported results of multivariate regression analyses (Table 2.1.3). All were based on data from those invited to an NHS Health Check within general practices and all reported statistically significant increased odds of attending with increasing age. As with the unadjusted data, however, evidence for gender, ethnicity and deprivation were mixed.

For gender, one large study across 37 general practices by Cochrane *et al.*[17] found that being female was associated with significantly lower odds of taking up the invitation compared to being male. This was in contrast to another smaller study across four general practices by Sallis *et al.*[39] which found being female was associated with significantly higher odds of taking up the invitation (adjusted OR 1.50 (1.29-1.74)). A similarly large study across 29 general practices by Dalton *et al.*[20] reported adjusted odds ratios for gender with age interaction and found that in the 35-54 year age group females were statistically significantly more likely to take up the invitation than males (adjusted OR 1.71 (95%CI 1.03-2.85)). In this study[20], however, this effect was not statistically significant in the age group 55-64 years and among those aged 65-74 years, although not statistically significant, females were less likely to take up the invitation (adjusted OR 0.96 (95%CI 0.76-1.22)). Both the studies by Cochrane *et al.*[17] and Dalton *et al.*[20] invited people with a cardiovascular risk of >20% by letter and had similar age and gender distributions (Table 2.1.1) with between 36% and 40% aged over 65 years. The study by Sallis *et al*.[39], however, invited all patients regardless of risk level and the mean age was 53 years. One potential explanation for the different findings in relation to the effect of gender could be due to an interaction between age and gender, with being female associated with an increased odds of taking up an invitation at younger ages and a decreased odds at older ages. A third study was a service evaluation conducted in five general practices in Bristol which were acting as control practices in a study to determine the efficacy of a telephone outreach service for inviting patients for an NHS Health Check. In this study men were significantly less likely to attend (adjusted OR 0.82); however, the data come from an unpublished conference presentation and no data are available on the age of those either invited or who took up the NHS Health Check invitation. The final small study by Attwood *et al.*[14] in four general practices in the East of England, in which participants had a mean age of 52.4 years, found no statistically significant association with gender.

Only two studies reported the effects of ethnicity on uptake in multivariable regression. One, based on four studies in the East of England in which only 3.3% of those invited were not of white ethnicity, found no difference in uptake between participants of white and non-white ethnicity (adjusted OR 0.85 (95%CI 0.29-2.52))[14]. The other large study across 29 practices in London[20] found varying associations with different ethnic groups. Those of South Asian or mixed ethnicity were more likely to attend than those who were white British (adjusted OR 1.71 (95%CI 1.29-2.27) and 2.42 (95%CI 1.50-3.89) respectively) whilst there was no difference for Black or Other groups. However, data on ethnicity was missing for 31.8% of those invited and 37.9% of those who attended and those with missing data were statistically significantly less likely to attend when compared to those who were white British (adjusted OR 0.51 (95%CI 0.30-0.88)). As the authors of that study highlight, the area in which it was

based also has many general practitioners of South Asian origin and that cultural concordance may have improved attendance in that group.

Five studies reported the association between deprivation and uptake. Two reported no statistically significant association[17,21] whilst the other three all showed that those in the least deprived areas were more likely to take up the invitation for an NHS Health Check[14,38,39].

Table 2.1.3 Results of multi-variate logistic regression analysis of individual-level factors affecting uptake of NHS Health Checks

Author/ Year	Setting	Uptake	Age	Gender	Ethnicity	Deprivation (area-level)	Other
Attwood 2015[14]	4 GP practices in the East of England	27.0%	Years: 1.05 (1.04 to 1.07)*	Female: 1.29 (0.95 to 1.76)	Non-white: 0.85 (0.29 to 2.52)	Most deprived quintile: 0.42 (0.20 to 0.88)*	None
Cochrane 2013[17]	37 (of 57) GP practices in Stoke on Trent	43.7%	Higher age group: 1.64 (1.51 to 1.77)*	Female: 0.70 (0.58 to 0.84)*	Not reported	Least deprived tertile: 1.12 (0.96 to 1.30)	Higher risk category: 0.90 (0.80 to 1.02) Larger practice size category: 1.03 (0.88 to 1.20)
Coghill 2016[38]	5 GP practices in Bristol	34.1%	Aged 70-74: 2.09*	Male: 0.82*	Not reported	Least deprived quintile most likely to attend	None
Dalton 2011[20]	29 (of 86) GP practices in Ealing, London	44.8%	Age 55-64: 1.74 (1.34 to 2.25)* Age 65-74: 2.27 (1.47 to 3.50)*	Female 35-54[a]: 1.71 (1.03 to 2.85)* Female 55-64: 1.22 (0.89 to 1.67) Female 65-74: 0.96 (0.76 to 1.22)	South Asian: 1.71 (1.29 to 2.27)* Mixed race: 2.42 (1.50 to 3.89)* Differences between other ethnic groups and White British were not statistically significant.	Not analysed	Smaller practice size category: 2.53 (1.09 to 5.84)* Hypertension: 1.31 (1.15 to 1.51)* Smoker: Not statistically significant
Krska 2015[21]	13 (of 55) GP practices in Sefton, North West England	52.9%	Age >65: 1.93 (1.48 to 2.50)*	Not reported	Not reported	No significant association	Hypertension: 1.52 (1.18 to 1.97)* Cholesterol above 5mmol/L: 1.39 (1.09-1.78)* Smoker: 0.55 (0.42-0.73)*
Sallis 2016[39]	4 GP practices in Medway		10 years: 1.62 (1.50-1.75) *	Female: 1.50 (1.29-1.74) *	Not reported	Least deprived quintile most likely to attend 1.61 (1.14-2.26) *	None

* $p<0.05$

[a] Results were reported as age-gender interaction terms

2.2 Invitation method

2.2.1 Quantitative studies

Seven quantitative studies reported the impact of different methods of inviting individuals[19,22,38–4142]. The design and methods for each of these studies are summarised in Table 2.2.1 and full details of the quality assessment for each in Appendix 2. They include one high quality RCT[41], two medium quality trials[39,40], three low quality observational studies[19,22,38] and one case report[42].

Between them, a range of interventions were considered (Box 2.2.1). Additionally three studies considered whether the impact of the intervention varied by age, gender or ethnicity[19,4138] and two by setting[39,41].

Box 2.2.1 Interventions covered

- Modifications to the standard national invitation letter based on behavioural insights, including a shorter letter, deadline commitment, or a Question-Behaviour-Effect questionnaire[39–41]
- Inclusion of pre-booked appointments with invitation[42]
- Text messages[40]
- Telephone invitations[19,38]
- Face-to-face invitations[19]
- Invitations to drop-in clinics in addition to offering booked appointments[22]

Table 2.2.1 Features of studies providing data on the impact of different methods of inviting individuals on take-up

Author / Year Publication	Study design / Data source	Setting	Sample size / Study population	Sample characteristics: Age, Gender, Ethnicity	Study time period	Unit of analysis / Comparison	Method for identifying health check	Outcome measure(s)	Overall quality
McDermott 2016[41] Journal	Three-arm randomised trial and cohort study	18 GP practices in Lambeth and Lewisham	12,459	Median age 45 (IQR 40-54) 39% White ethnicity	2013-15	Individual randomisation	Electronic health records	Health Check uptake	High
Alpsten 2015[40] Journal	Trial	28 GP practices in Southwark	13,800	Not stated	2013-14	Person-level analysis	Not stated	Health Check uptake	Medium
Sallis 2016[39] Journal article	Pragmatic quasi-randomised controlled trial	4 GP practices in Medway	3,511 patients Intervention – 1,756 Control – 1,755	Control/ Intervention Mean Age 53.1/52.8, % Female 53.3/50.9%	2013	Person-level analysis	Not reported	Health Check uptake	Medium
Kumar 2011[22] Journal article	Observational study / Quality improvement report	2 GP practices in Stoke-on-Trent	1,606 patients	57% male 40% 40-49 years 28% 50-59 years 32% 60-75 years	2008-10	Person-level analysis	Electronic health records	Cost-effectiveness	Low
Coghill 2016[38] Conference presentation	Quasi-experimental study / Electronic practice records	17 GP practices in Bristol in the lowest LSOAs	5,678 patients Intervention – 2,399 Control – 3,279	Not reported	Not reported	Person-level analysis	Not reported	Health Check uptake	Low
Cook 2016[19] Journal Article	Observational study/ Electronic practice records	30 (all) GP practices in Luton	12,048 (sample size by invitation method not stated)	% aged>55: 30.5% % aged>65: 7.6% % male: 53.3% % white British: 32.5%	2013-14	Not clear if invitation method varied by practice or patient; likely practice	Electronic health records	Health Check uptake	Low
Local Government Assocation 2015 (Stoke-on-Trent)[42]	Before and after study	Stoke-on-Trent (one GP surgery)	Not stated	Not stated	Not stated	Person-level	Not stated	Health Check uptake	Low

The results of each of the seven studies are summarised in Table 2.2.2.

Three studies reported the effect of behavioural modifications to the invitation letter[39–41]. The first was a high quality RCT of completion of a Question-Behaviour-Effect (QBE) questionnaire focused on thoughts and feelings about attending an NHS Health Check before receiving the standard invitation letter. The authors found no evidence of impact in an intention to treat analysis (risk difference associated with the QBE questionnaire was 1.43% (95%CI: –0.12-2.97%, p=0.070)[41]. However, the QBE questionnaire was only returned by 23% in the intervention group and among those who returned the questionnaire, uptake of the NHS Health Check was 17.9% higher (95%CI: 14.7-21.3%, p<0.001) compared to the control group, with the 'intentions' construct most strongly associated with NHS Health Check uptake. Analysis by sub-groups of gender, age group, ethnicity and deprivation showed that estimates for intervention effects were generally similar across subgroups but there was weak evidence for a greater effect of the intervention in men than in women. The other two trials modified the invitation letter either by adding a deadline commitment (e.g. 'Your NHS Health Check is due in [date]')[40], or by making the letter simpler with prominence of action statement to book an appointment (e.g. a statement 'You are due to attend your Health Check' as opposed to 'invited' and inclusion of a tear-off slip with space to record details of appointment with instructions to stick it to their fridge)[39]. Both found a 3-4% higher uptake in the intervention groups.

Two studies reported the effect of telephone invitations. Both used different methods and so are not directly comparable. In the study by Cook *et al*. patients were contacted by telephone by their general practice and uptake was significantly higher among those telephoned than those who received a letter of invitation (43% compared with 29.5%)[19]. However, this was an observational study across 30 general practices in Luton and practice-level confounding factors were not considered. In the study by Coghill *et al*. patients were contacted by community link workers and, where consent was provided, the initial part of the NHS Health Check was completed over the phone. Uptake was lower amongst those contacted by telephone than those receiving an invitation letter from their general practice (24% compared with 36%)[38]. In that study the intervention general practices were more likely to complete an NHS Health Check on more deprived patients compared to the control practices, however, it is not possible to tell whether this is due to confounding factors.

The study by Cook *et al*. also compared the effect of face-to-face interventions on uptake. Compared with an invitation letter, the percentage taking up the invitation following a face-to-face invitation was over double (29.5% compared with 71.9%)[19]. Together with the finding, from an observational study of electronic patient records embedded in the high quality trial, that 49% of NHS Health Checks recorded in primary care records were opportunistic rather than the result of invitations being sent[41], this suggests face-to-face invitations are an effective and commonly used method. They will, however, only target people already attending general practices.

The effect of both primer and reminder text messages was reported in one RCT[40]. In that study, primer text messages (e.g. '*Your NHS Health Check is due at your GP practice. We will post you a letter soon with info about how to book your appt'*) alongside reminder text messages (e.g. '*Your GP recently sent you a letter inviting you to attend your NHS Health Check. Call [telephone number] to book an appt'*) were associated with an increase in uptake from 21% to 30% and reminder text messages alone with an increase from 21% to 27%. The only report of this trial, however, is a short, non-peer reviewed report published by the commercial company who provided the text messaging system. It is, therefore, at high risk of reporting bias and the results should be interpreted with that in mind.

The final two studies reported the effect of inclusion of pre-booked appointments with invitations[42] and invitations to drop-in clinics in addition to offering booked appointments[22]. The first is a case-study with very limited details of the method or results, stating just that after pre-booked appointments were introduced the uptake increased 'substantially'. The study by Kumar *et al*. was also an evaluation of an improvement project. No data are given on uptake rates in the two groups but the overall uptake of the NHS Health Check was 32% and the offer of drop-in was more cost-effective to implement (£44,080 per 1000 patients compared with £93,962 per 1000 patients).

Table 2.2.2. Results of studies assessing different methods of invitation

Author/year	Setting	Intervention group(s)	Comparison group	Measurement of outcomes and exposures	Outcome / Unadjusted analysis	Subgroup or supplementary analysis	Adjusted analysis
McDermott 2016[41]	18 general practices in Lambeth and Lewisham	1) Question-Behaviour-Effect (QBE) questionnaire plus standard invitation letter 2) QBE questionnaire plus £5 voucher as incentive to return questionnaire plus standard invitation letter	Standard national invitation letter	Electronic health records	Control uptake 14.4% 1) 15.8% uptake 2) 15.9% uptake	Consistent across subgroups of gender, ethnicity and deprivation quintile, but weak evidence of a greater effect in men than women	
Alpsten 2015[40]	28 general practices in Southwark	1) Invitation letter including a deadline commitment 2) Invitation letter including a deadline commitment PLUS primer and reminder text messages 3) Invitation letter including a deadline commitment PLUS reminder text message only	Standard national invitation letter	Not stated	Control uptake 18% 1) 21% uptake 2) 30% uptake 3) 27% uptake	None presented Follow up visits to GP post outreach health check	None presented
Sallis 2016[39]	4 general practices in Medway	Letter modified in four ways using behavioural insights: 1) Simplification 2) Prominence of action statement to book an appointment 3) Statement 'you are *due* to attend your Health Check' as opposed to '*invited*' 4) Inclusion of a tear-off slip with space to record details of appointment with instructions to stick it to their fridge	Standard national invitation letter	Not stated / Electronic records	Control uptake 29.3% Intervention uptake 33.5%	The intervention was more effective in some practices (interaction OR for practice 1.76 (1.18-2.64)	Adjusted OR 1.26 (95%CI 1.09-1.47)
Kumar 2011[22]	2 general practices in Stoke-on-Trent	Drop-in clinics or booked appointment	Booked appointments alone	Electronic health records	Offering drop-in clinics or booked appointments more cost-effective	None	None
Coghill 2016[38]	17 general practices in Bristol	Telephone invitation from community link worker	Invitation letter	Not stated	Control uptake 34% Intervention uptake 24%	Letters sent within 2 weeks of telephone invite reinforced the intervention (OR 3.26) Letters sent 9 months before phone call decreased uptake (OR 0.57)	Intervention practices had more attenders from ethnic minorities and from more deprived areas compared with control practices

Author/year	Setting	Intervention group(s)	Comparison group	Measurement of outcomes and exposures	Outcome / Unadjusted analysis	Subgroup or supplementary analysis	Adjusted analysis
Cook 2016[19]	30 (all) general practices in Luton	1) Face-to-face invitation 2) Telephone invitation from GP practice	Invitation letter	Not stated / Electronic records	Control uptake 29.5% 1) Uptake 71.9% 2) Uptake 43%	Variation by age and ethnicity	None presented
Local Government Association 2015 (Stoke-on-Trent)[42]	Stoke-on-Trent	Standard invitation letter with pre-booked appointment time	Standard invitation letter	Not stated	Control (Before) 52% Intervention (After) – increased "substantially"	None stated	None stated *note DNA rate was high

2.2.2 Qualitative studies

Five qualitative studies described the views of those who had attended NHS Health Checks on different methods of invitation (Table 2.2.2.1). Three were articles in peer reviewed journals[43–45], one an evaluation report[28] and one a Masters thesis[46]. Participants had attended NHS Health Checks in community settings in three of the studies[28,43,45] and in general practices in two[44,46].

Three main themes were described in those studies: 1) Differing views on opportunistic recruitment depending on setting; 2) Benefit of community ambassadors, particularly for ethnic minority groups; and 3) Preference for telephone contact.

1) Differing views on opportunistic recruitment depending on setting

The response of participants to opportunistic recruitment appeared to depend on setting. In general practice settings, whilst effective, being invited opportunistically left some patients feeling that they did not have enough time or information to make an 'informed' decision and found the process 'emotionally and psychologically wearing'[46 44].

> *"No not really. Not straight away. Do they know something I don't? Sort of got a bit frightened at first cause no one explained anything about it! a bit out of the blue to tell you the truth"* [44]

When discussing NHS Health Checks in a community setting, however, some described how they had only participated because they had been approached and offered the opportunity. In this way, 'being approached' was perceived by these participants to be more effective than advertising.

> *"I'm one who doesn't do anything like that, and I got collared in ASDA and it suited me, but I wouldn't have noticed any adverts or anything; they approached me, and I probably would never have got it done unless I was approached."*[45]

2) Benefit of community ambassadors, particularly for ethnic minority groups

For ethnic minority groups the presence of community ambassadors or engagement workers was a key factor in their decision to take-up the offer of community-based NHS Health Checks. Trusted community ambassadors were able to publicise the programme through peer groups and encourage people to attend using language they understood and connected with[28,43]. Having the programme endorsed by someone within their community also appeared to encourage uptake and, for some, it was their respect for, and loyalty to, the engagement worker which prompted them to attend[43].

"Because my very good friend, [male engagement worker], called upon me. And I think if he called upon a thousand people, 999 would turn up. He's just well-loved within the community and nobody wants to let him down."[43]

3) Preference for telephone contact

Whilst some participants felt that receiving a letter of invitation to the NHS Health Check programme from their general practice gave them impetus to get round to organising the check[46], when asked directly, many participants attending community based NHS Health Checks expressed a preference for telephone or in person invitations rather being contacted by post or e-mail[28]. These methods were perceived to be the most 'immediate and direct' means of contact and allowed them to ask questions about the programme.

Table 2.2.2.1 Features of qualitative studies including participants' views on the method of invitation to NHS Health Checks

Author/ year	Type of report	Study period	Location of study	Setting of NHS Health Check	Data collection method	*n*	Method of recruitment to study	Participant characteristics	Overall quality
Greenwich 2011[28]	Evaluation report	2011	Greenwich	Community	Open ended questionnaire, focus groups and in-depth phone interviews	612 survey responses 4 focus groups and 31 interviews	Recruited from community outreach services providing NHS Health Checks	Ethnic minority participants: 42% female	Medium
Ismail and Atkin 2015[44]	Journal article	Not given	Not specified	General practices	Semi-structured interviews	45 baseline 38 follow-up	Purposive sampling from a list provided by 5 participating general practices	21 female, 24 male. Average age: 58. Ethnicity: 37 White, 5 South Asian and 3 African Caribbean	High
Perry 2014[45]	Journal article	2010	Knowsley	Community	Interviews and focus groups	36	Letter or telephone invitation to all 38 people who were at high risk of CVD and had attended an NHS Health Check in the past 12-18 months were invited. The remaining attendees at low risk of CVD were purposively sampled for gender, age , risk score.	3 focus groups: 1 for high risk scores [6 males], 2 for low risk scores (17 females and 7 males) 6 semi-structured interviews (2 females and 4 males with high risk score)	High
Riley 2015[43]	Journal article	2013	Bristol inner-city	Community	Semi-structured interviews	16	Participants were recruited via their attendance of community outreach events.	7 females, 9 males All from black and minority ethnic populations	High
Strutt 2011[46]	Masters thesis	2010	Darlington, Co. Durham, UK	Two general practices	Semi-structured face-to-face interviews	16	Invitation letters or telephone	7 females, 9 males White, South-Asian, and Middle Eastern	High

2.3 Setting

No quantitative studies compared uptake (as opposed to attendance or coverage) across different settings. Six qualitative studies include participants' views on the impact offering NHS Health Checks in different settings had on their decision to take up the offer of an NHS Health Check (Table 2.3.2.1). Four are articles published in peer reviewed journals[43,47–49] and two evaluation reports[28,50]. These studies included views on attending NHS Health Checks in general practices, pharmacies and community settings, and two included predominantly ethnic minority populations.

Two main themes emerged across the studies: 1) Convenience of settings outside general practice; and 2) Sense of duty to attend general practice-based NHS Health Checks.

1) Convenience of settings outside general practice

In a number of studies, participants identified the additional convenience of pharmacies[48,49], community[28,43] and workplace[50] settings over general practices as key factors influencing their decision to have an NHS Health Check. This included both the convenience of being able to get an appointment at a time that fitted with their daily lives, and also the convenience and familiarity of the location itself.

> *"I rang up the pharmacy, I thought it sounded a bit strange that you could, but I knew I'd never get an appointment at the right time at my GP. So I just rang the pharmacy and they were great... Made the appointment exactly when I needed it."*[48]

> *"So it being here [name of community centre], and because I'm always passing here, in and out of here, it was easy to just come in and do that."*[43]

Some also perceived community and pharmacy settings as more relaxed and informal than general practices[49] [43] and felt more time was provided in these settings[45].

> *"I do not visit the doctor and also I thought a chemist would be better for me in a relaxed atmosphere."* [49]

However, as discussed in Question 3, a minority of participants raised concerns about pharmacists' competence, privacy and confidentiality[48,49] and similar concerns regarding confidentiality were cited by those attending workplace-based NHS Health Checks[50].

2) Sense of duty to attend general practice-based NHS Health Checks

Having been invited to attend an NHS Health Check at their general practice was in itself a key factor promoting uptake among a small number of participants. For these participants not attending the NHS Health Check was not an option. Some described how they had felt that as the general practice had called for them directly it must be of great importance and so they

had accepted the invitation immediately[50], whilst others had felt they should accept everything that was offered by general practices[4748].

> *"Yes, it's like you get your letter to go and have your mammogram, it's part of it, take all the help you can get!"* [47]

Table 2.3.2.1 Features of qualitative studies including participants' views on the setting of NHS Health Checks

Author/ year	Type of report	Study period	Location of study	Setting of NHS Health Check	Data collection method	*n*	Method of recruitment to study	Participant characteristics	Overall quality
Burgess 2015[48]	Journal article	2012-13	South London	Four general practices	Semi-structured interviews	10	Purposive sampling by age, sex and attendance of patients registered at the 4 general practices who had been invited to attend an NHS Health Check	7 females, 3 males Predominantly white ethnicity	Medium
Greenwich 2011[28]	Evaluation report	2011	Greenwich	Community	Open ended questionnaire, focus groups and in-depth phone interviews	612 survey responses 4 focus groups and 31 interviews	Recruited from community outreach services providing NHS Health Checks	Ethnic minority participants: 42% female	Medium
Oswald 2010[50]	Evaluation report	2009 - 2010	Teesside	General practices or pharmacies	Semi-structured interviews	8	Invited by general practices or pharmacies or from a list of patients who had attended an NHS Health Check and agreed to take part in the service evaluation	6 had attended general practices and 2 pharmacies	Medium
Perry 2014[45]	Journal article	2010	Knowsley	Community	Interviews and focus groups	36	Letter or telephone invitation to all 38 people who were at high risk of CVD and had attended an NHS Health Check in the past 12-18 months were invited. The remaining attendees at low risk of CVD were purposively sampled for gender, age , risk score.	3 focus groups: 1 for high risk scores [6 males], 2 for low risk scores (17 females and 7 males) 6 semi-structured interviews (2 females and 4 males with high risk score)	High
Riley 2015[43]	Journal article	2013	Bristol inner-city	Community	Semi-structured interviews	16	Participants were recruited via their attendance of community outreach events.	7 females, 9 males All from black and minority ethnic populations	High
Taylor 2012[49]	Journal article	Not given	Sefton PCT	Pharmacy	Face-to face survey	261	High-street locations, community centres and other social settings in the vicinity	172 females, 89 males 20.7% 35-45 years 30.6% 46-55 years 23.4% 55-65 years 25.3% 66-75 years	High

2.4 Key findings and interpretation

- There is a notable lack of national level studies reporting the characteristics of those who take-up the invitation to an NHS Health Check and those who do not. This is most likely due to lack of data on those being invited. Encouraging recording of invitations within electronic health records would allow analysis in the future.
- The regional studies report uptake of between 27% and 53% (mean across studies 44.1%) in different general practice settings. These are all lower than the 75% used in the original modelling by Public Health England[1] but similar to the national reported uptake of 48.3%[8].
- There is consistent evidence across all the studies that older people are more likely than younger people to take-up an invitation for an NHS Health Check and some evidence that those from the least deprived areas are more likely to take-up an invitation than those in the most deprived areas.
- The data suggests there is an interaction between age and gender, with being female associated with increased odds of taking up an invitation at younger ages and being male associated with increased odds at older ages. Further research is needed to confirm this finding.
- There is evidence from one study of a variation in take-up across different ethnic groups but that study had large amounts of missing data and was based in an area which has a large number of general practitioners of south Asian origin so may not be representative.
- Simple modifications to the invitation letter based on behavioural insights were associated with a 3% to 4% increase in uptake. Although this is a small increase, the changes (for example, adding a deadline commitment) would be easy to introduce and on a national level a 4% increase in uptake would result in an additional over 100,000 people receiving an NHS Health Check.
- Text message invites or reminders may improve uptake by up to 9%, however this finding is based on only one trial, which is not reported in full and at risk of bias. As text-messaging services become more widespread within healthcare, this could be a relatively cheap and therefore cost-effective way of increasing take-up. Further research is needed to confirm these findings.
- Telephone invitations may also improve uptake but again the finding is based only on one observational study across multiple general practices where practice level confounding factors were not considered.
- In the one study comparing the invitation letter with a face-to-face invitation in general practice the percentage taking up the invitation following a face-to-face invitation was over double that of the invitation letter (71.9% compared with 29.5%). Although not clear from that study, it is likely that the face-to-face invitations were also opportunistic. Together with the finding from one large RCT that half of NHS Health Checks in general practice are performed opportunistically, this suggests that opportunistic invitations are a commonly used and effective means of recruiting patients to NHS Health Checks and should be encouraged. However, opportunistic

NHS Health Checks need to be done in a way that ensures patients are offered adequate time and information to make an informed decision about participation.

- Having the NHS Health Check programme endorsed by community ambassadors or engagement workers appears to be particularly important for ethnic minority groups and may help promote uptake amongst hard to reach groups.
- Data on the impact of community settings on NHS Health Check uptake is notably absent. This may be because most community based NHS Health Check services do not systematically invite people to take part in the same way that general practices do and so the denominator of those invited is unknown.
- Qualitative studies with attendees suggest the main benefit of community settings over general practices is that of convenience. Offering NHS Health Checks in non-medical settings may, therefore, help increase uptake among some groups but further research is needed, particularly to assess the cost-effectiveness of such initiatives.
- Moving NHS Health Checks out of general practice settings may, however, lose the 'sense of duty' to attend that some of those attending general practice-based NHS Health Checks described.

3. Why do people not take up an offer of an NHS Health Check?

In the context of the lower rates of uptake than expected, it is important to understand why people to do not take up an offer of an NHS Health Check. Ten studies included participants who had not attended NHS Health Checks and so provide data to address this question. Four performed content analysis on free text responses provided in surveys[41,49,51,52], five conducted qualitative interviews[28,47,48,50,53], and one reported quantitative data on reasons for non-attendance where documented in primary care records[17]. Six were journal articles published in peer reviewed journals[17,47–49,52,53], three were research reports of service evaluation[28,50] or a trial[41], and one is published as a case study[51]. All recruited people who had not attended an NHS Health Check either through invitations sent out from general practices or from community settings. Further details of the design and methods used in those studies relevant to the data in this section are given in Table 3.1 and full details of the quality assessment are given in Appendix 3.

3.1 Reasons for not taking up the offer of an NHS Health Check

As acknowledged in a number of the studies, non-attenders to NHS Health Checks are a particularly difficult group to recruit to research studies as they have already not engaged with the NHS Health Check programme. Whether their views are representative of the large group who decline the invitation is, therefore, not known. Nevertheless, four general themes emerged from the data relating to reasons why these participants had not attended an NHS Health Check: 1) Lack of awareness or knowledge; 2) Time constraints or competing priorities; 3) Misunderstanding the purpose; 4) Aversion to preventive medicine. Two further themes were specific to settings: 5) Difficulty with access in general practices; and 6) Concerns around the pharmacy as a setting.

1) Lack of awareness or knowledge

A lack of awareness of the NHS Health Check programme was apparent in a number of studies[49,50,53]. For example, 91% of those taking part in a face-to-face survey on the street about pharmacy NHS Health Checks report being unaware of the service in one study [49] and 34% having either no knowledge of the NHS Health Check or no recollection of receiving an invitation in another[53]. Others appeared to be aware of the programme but a lack of knowledge had contributed to their decision not to attend [28,41].

> *"Are they free? How do you go about getting a Health Check?"* [41]

2) Time constraints or competing priorities

Time constraints or conflicting priorities were other frequently cited reasons for not attending the NHS Health Check [28,47,51,53]. Some stated being "*too busy*" as a reason for non-attendance whilst others had forgotten to go or found it difficult to arrange an appointment that suited

their daily schedules, including work, caring for others and travelling abroad. The presence of a significant co-morbidity was also the most common reason given for not attending in the study by Cochrane *et al*.[17].

3) Misunderstanding the purpose

There was evidence across several of the studies that many participants who had chosen not to take up invitations for an NHS Health Check had not recognised the preventive role of the NHS Health Check. This led to beliefs that if they were unaware of any problems or perceived themselves as healthy they did not need to attend, and that their attendance would divert time and resources away from others or place an unnecessary burden on the NHS or their doctor [48,51,53].

> "*I mean there's no point in doing that if it's, you know, using up people's precious time and resources if it's not necessary*."[48]

> "*I don't have any complaints; I don't have anything that I want to have checked out. I didn't want to waste their time."* [48]

> *"It's beneficial for those already having problems.. but for me I'm fit and active, you should go when you're poorly, not just for the sake of it"* [53]

Some also felt it was unnecessary as they were already receiving regular monitoring for other health conditions or had had their blood pressure or cholesterol recently checked [47,48,53].

> *"If I hadn't of been coming to the Doctors on a regular basis anyway, probably I would have thought more about taking it up, but because I was already in contact on a regular basis, then I didn't."* [53]

4) Aversion to preventive medicine

Others appeared to have understood the purpose of the NHS Health Check but did not wish to engage in preventive medicine [47,48,50,52,53]. For some this was because they were just not interested [28] whilst others "*did not want to know*" [48,50] or were afraid of receiving negative news about their health [47,48,53].

> *"I am just the type of person who wouldn't want to know. I would rather things just happen and then deal with it. I worry about the now and not the future."* [50]

> "*you go for a check and something is discovered… I hear lots of people end up going for so many tests, and worry about their health*" [53]

Others appeared to avoid the NHS Health Check as they did not wish to be "*told off*" or given lifestyle advice[47,48,50].

Table 3.1. Features of studies including the views of people who had not taken up an offer of an NHS Health Check

Author/ year	Type of report	Study period	Region	Setting of NHS Health Check	Data collection method	Number of non-attenders included	Recruitment of non-attenders	Participant characteristics	Overall quality
Burgess 2015[48]	Journal article	2012-13	South London	Four general practices	Semi-structured interviews	10	Purposive sampling by age, sex and attendance of patients registered at the 4 general practices who had been invited to attend an NHS Health Check	7 females, 3 males Predominantly white ethnicity	Medium
Cochrane 2013[17]	Journal article	2009-10	Stoke-on-Trent	37 general practices	Routine data collected within each practice at time of invitation to NHS Health Check	1,453 (13.9% of those not attending)	All patients with estimated 10 year CVD risk > 20% from the 37 practices were invited to attend an NHS Health Check and those not attending identified from practice records	Not given	High
Ellis 2015[53]	Journal article	Not given	Stoke-on-Trent	Four general practices	Telephone and face-to-face semi-structured interviews	41	500 letters of invitation sent by GPs to those who had not taken up the invitation for an NHS Health Check. Incentivised with the offer of £15 to participate	22 females, 19 males Mean age 52.9 ± 8.5 Socio-demographically representative of non-attendees	High
Greenwich 2011[28]	Evaluation report	2011	Greenwich	Clinic and community setting	In-depth telephone interviews	10 plus unspecified number of ethnic minority participants	Recruited through a 'social marketing approach' by social marketing professionals.	Not given	Medium
'A picture of health' case study 2014[51]	Case studies	Not given	North East of England	General practice, pharmacy	Face-to-face survey	325	Recruited on the street	N/A	Low

Author/ year	Type of report	Study period	Region	Setting of NHS Health Check	Data collection method	Number of non-attenders included	Recruitment of non-attenders	Participant characteristics	Overall quality
Jenkinson 2015[47]	Journal article	2013	Torbay	Four general practices	Face-to-face and telephone interviews	10	Letters of invitation sent to a random sample identified by general practices from lists stratified by age and gender of those who had not responded to an invitation to an NHS Health Check within 4 weeks.	6 females, 4 males 4 employed, 1 unemployed, 5 retired	High
Krska 2015[52]	Journal article	2011	Sefton, an area of North West England	16 general practices	Postal survey with free text responses	210	All patients with estimated 10 year CVD risk > 20% from the 16 practices were sent a postal survey regardless of whether they had attended an NHS Health Check or not	46 females, 164 males 67.% over 65 99.5% white 14.6% highest quintile of deprivation 9.2% lowest quintile of deprivation	Medium
McDermott 2016[41]	HTA report	2013 - 14	Lambeth and Lewisham	18 general practices	Content analysis of questionnaire	Not given	Questionnaires sent to all participants in the two intervention arms of a trial of enhanced invitation methods.	Not given	Medium
Oswald 2010[50]	Evaluation report	2009 - 10	Teesside	Any	Semi-structured interviews	51	Participants approached 'on the street' at job centres, working mens' clubs and libraries	Not given	Medium
Taylor 2012[49]	Journal article	Not given	Sefton PCT	Pharmacy	Face-to face survey	261	High-street locations, community centres and other social settings in the vicinity	172 females, 89 males 20.7% 35-45 years 30.6% 46-55 years 23.4% 55-65 years 25.3% 66-75 years	High

"I just don't like the idea of people telling me how to live my life and, if the tests turned up something, I might have to make changes I don't want to make." [50]

5) Difficulty with access in general practices

A common theme amongst those who had not taken up invitations to attend NHS Health Checks at their general practice was not being able to get an appointment at a convenient time or anticipating not being able to do so [41,47,48,50,53], particularly for those who worked normal office hours or had care responsibilities.

"*it is just the time to arrange to go in,…I…come to work early and they are shut. They are shut when I go home. Weekends they are not open, so it's difficult to get there*"[53]

"I'm 100% supportive of health checks but have two small children and not much support so depends on childcare arrangements." [41]

"It's very difficult for me to (go to the appointment) and hold on to a nine-to-five job. It means I have to take personal time off from my employer to do this. They don't give you an option where you can go in the evening." [48]

"*Time is a big issue for me. I leave the house at 5 am and don't get home until after 6 pm so it's hard to get to the doctor's*."[50]

A related theme amongst those who had not taken up invitations to attend NHS Health Checks at general practices was of not wanting to visit the GP, with a number of participants describing actively trying to avoid visiting the doctor [47,53]. In contrast, over a quarter (27%, *n*=208) of those declining an invitation to attend an NHS Health Check in a community setting gave their reason for not attending as that they would prefer an appointment at their general practice [28].

6) Concern around the pharmacy as a setting

Specific barriers to attending NHS Health Checks within pharmacies highlighted by participants included concerns about pharmacists' competence, privacy and confidentiality, with males demonstrating less willingness to be screened at a pharmacy compared to women [48,49].

"Not enough privacy in small pharmacy – unless special rooms are kept just for that. Don't feel they are qualified" [49]

"People working in the chemist don't have the same knowledge as a nurse and they live in the same area. I wouldn't want them to know my business." [49]

"The relationship with pharmacies is a consumer one, about products, and not about care and health…potentially it's pretty intimate information. It should not be the place for delivering bad news about cholesterol." [48]

3.2 Key findings and interpretation

- The main reasons participants who had not taken up the offer of an NHS Health Check gave for not attending were lack of awareness or knowledge, competing priorities, misunderstanding the purpose, and an aversion to preventive medicine. Although they are presented separately it is likely that these reasons may act together to influence an individual's decision. For example, those who were afraid of receiving negative news about their health may have perceived more difficulties with arranging an appointment.
- There was consistent evidence that, for some, lack of awareness or knowledge had been the reason they had not attended an NHS Health Check. Together with the finding that a number had not recognised the preventive role of the NHS Health Check, this suggests that the publicity around the programme has not reached all those eligible and that greater clarity about the purpose of the NHS Health Check is needed. Emphasising the benefits of prevention and early detection might also encourage those who are fearful of receiving bad news.
- A common theme among those who had not taken up invitations to attend NHS Health Checks at their general practices was not being able to get an appointment at a convenient time or anticipating not being able to do so. Increasing out of hours provision or making explicit the arrangements for booking NHS Health Checks as opposed to other appointments may, therefore, increase attendance.
- Providing reassurance about the privacy and confidentiality of NHS Health Checks conducted in pharmacies and about the training and professionalism of pharmacists may also increase attendance in pharmacies whilst raising awareness of the convenience of attending at a pharmacy, which may also allay the fears of some that NHS resources are being wasted within general practices.

4. How is primary care managing people identified as being at risk of cardiovascular disease or with abnormal risk factor results?

Achieving the maximum benefits from the NHS Health Check programme relies on buy-in from the healthcare professionals delivering the NHS Health Checks, effective delivery of the NHS Health Checks, and appropriate management of those identified as being at risk of cardiovascular disease or with abnormal risk factor results. In this section, we focus on the delivery of the NHS Health Checks within primary care, including protocols, recall methods, provision of services and lifestyle advice provided within the NHS Health Check itself for those at high risk. We also include a synthesis of the views of healthcare professionals as, although not directly relevant to this question, understanding the views of those delivering the programme is essential. Outcomes from the NHS Health Checks, including referrals made to external lifestyle services and prescribing are covered in section 6.

4.1 Studies reporting on delivery of NHS Health Checks within primary care

Eleven studies reported data on the delivery of NHS Health Checks within primary care (Table 4.1.1). Nine were based on NHS Health Checks provided in general practices[44,54–60], one community services[28] and one all services provided across eight primary care trusts[61]. Five collected data from semi-structured interviews, five from surveys and one from both. All had small sample sizes of healthcare professionals and were based on regional practice and so the findings are not necessarily generalisable outside the individual settings.

Variation in delivery, recall systems and follow-up

Across the studies there was evidence of variation in how NHS Health Checks were delivered within primary care but in most practices GPs or nurses provided clinical leadership whilst NHS Health Checks were delivered by practice nurses and healthcare assistants[50,54,55].

There was also variation in how high-risk patients received their results and were followed-up. In a cross-sectional survey of healthcare professionals, from 65 of 99 general practices in two inner London boroughs, 51% (*n*=33) of practices had a regular recall system. 14% (*n*=9) had a high- risk register but no recall system, 11% (*n*=7) regularly reviewed results and in 9% (*n*=6) the only follow-up provided was by asking patients to make an additional appointment[54]. Three qualitative studies with healthcare professionals and patients also described how some practices only called in patients found to be at high risk and patients were told that if they did not hear back everything was fine, suggesting that some patients are not receiving their risk score as intended by the programme. Others invited all patients back for a follow-up appointment regardless of their risk score or offered discretionary follow-up appointments for lower risk patients[44,56,57]. There was also evidence that some GPs had

additionally chosen to schedule follow-up appointments after one year for those identified as being at high risk[59].

Variation in lifestyle advice provided and service availability

Four of the studies reported on healthcare professionals' reports of the lifestyle advice provided within the NHS Health Checks to those at high risk of cardiovascular disease or with abnormal risk factor results and the provision of lifestyle support services. One is a cross-sectional survey completed by the NHS Health Check lead for each of the eight Primary Care Trusts (PCTs) in North West London at a time when the PCTs were responsible for delivery of the NHS Health Check programme[61]. The responses indicated that all eight PCTs had explicit referral criteria and pathways in place, with most expecting GPs to actively manage high risk patients and all including referring identified smokers to a smoking cessation service and referring or signposting appropriate patients to weight management and exercise programmes. However, there was variation in the way NHS Health Checks were linked to non-medical support or services. One PCT commissioned a nurse to coordinate a multidisciplinary family-based programme to provide integrated care for those at high risk of vascular disease within a community facility. Another used community-based health trainers to support high-risk patients to make lifestyle changes whilst two other PCTs had commissioned programmes specifically for patients diagnosed with pre-diabetes.

This variation in provision of lifestyle services was also seen in the cross-sectional survey of healthcare professionals from 65 general practices in London[54]. Whilst most (82%, *n*=53) reported usually offering advice within the initial consultation to all patients attending for NHS Health Checks, for patients with high risk (≥20% modelled 10-year cardiovascular risk) in 36 practices (55%) this was usually in-depth advice that took 10 minutes or more to discuss, whereas in 17 (26%) it was usually brief advice only. In the same survey, referral to other staff within the practice, or to external services, was 'usually' offered to high risk patients at 35 (54%) practices and 'sometimes' offered at 15 (23%) practices. It was more common for practices to refer patients to other services within the practice than to external services. The number of practices offering structured in-house interventions in addition to advice given in consultations was 88% (*n*=57) for smoking cessation, 74% (*n*=48) for weight management, 68% (*n*=44) for alcohol use, and 37% (*n*=24) to promote physical activity. External services were available at a further 48% (*n*=31) practices for physical activity, 12% (*n*=8) for weight management and 20% (*n*=13) for alcohol use[54].

Data collected from clinicians delivering the NHS Health Checks at community sites in a pilot programme in Greenwich[28] showed similar findings with smoking cessation advice offered to 76% of smokers, dietary advice to 84% of those at high cardiovascular risk, physical activity advice provided to 76% of those at high cardiovascular risk, alcohol advice given to 16% of participants, and 82% offered referral for management of high risk among those with high cardiovascular risk.

The final two studies reporting healthcare professionals' views on provision of lifestyle advice were qualitative studies in which interviews were conducted with healthcare professionals from practices in an ethnically diverse area of Birmingham[55,56]**.** The local guidance was to address lifestyle factors using a goal-setting sheet to be worked through with patients to develop a set of lifestyle change goals unique to them. The idea was that it was a collaborative exercise allowing patients to make active informed choices. However, there was inconsistency in the use of this approach[55,56] with not all practitioners doing it "*as formally as that*" and the suggestion that it was not always prioritised, with a focus instead on the biomedical tests.

Three further studies reported lifestyle advice that participants recalled having received during their NHS Health Check[44,52,58]. In a survey of 434 high-risk participants who had attended an NHS Health Check in general practices in the North West of England[52], 376 (86.6%) claimed to have received at least one piece of lifestyle advice during their Health Check (smoking 180 (41.5%); alcohol 227 (52.3%); diet 295 (67.9%); and exercise 266 (61.3%). In an interview study with 45 participants[44] the majority of participants recalled having been advised to increase their exercise levels and being given practical tips such as getting off the bus one stop early, or taking part in sports. Smokers recalled receiving verbal advice about their smoking behaviour but the majority could not recall being offered any assistance on how to give up. The final study was a survey with 1,011 patients who had attended an NHS Health Check[58] and when asked to recall the lifestyle advice they had been provided with, smoking accounted for the majority of advice given (60.4%, n = 612), followed by weight (46.8%, n = 468) and exercise advice (40.7%, n = 407), with alcohol advice the least frequently provided (29%, n = 290).

Table 4.1.1 Features of studies reporting on delivery of NHS Health Checks within primary care

Author, year	Type of report	Study period	Location of study	Setting of NHS Health Check	Data collection method	*n*	Method of recruitment to study	Participant characteristics	Overall quality
Baker 2015[57]	Journal article	Not given	South West England	30.1% of total practices delivering NHS Health Checks	Surveys including quantitative and qualitative questions	25	Identified randomly via the County Medical List to ensure geographic spread	2 GPs, 14 practice managers, 6 practice nurses, 2 healthcare assistants and 1 administrator	Medium
Baker 2014[58]	Journal article	2012	Gloucester	83 general practices	Content analysis of cross-sectional survey	1,011 (43%)	Survey sent to all patients who had completed an NHS Health Check within a 2-month period	55.2% female 19% 56-60 years 10.8% 40-45 years 96% white British	High
Greenwich 2011[28]	Report	2011	Greenwich	Community	Open ended questionnaire	11	All (12) clinicians delivering community outreach services providing NHS Health Checks were invited	Healthcare assistants, nurses, pharmacists and health trainers	Medium
Graley 2011[61]	Journal article	2010	North West London	8 (all) primary care trusts	Survey	8	No details given	NHS Health Check leads of each primary care trust	
Ismail and Atkin 2015[44]	Journal article	Not given	Not specified	General practices	Semi-structured interviews	45 baseline 38 follow-up	Purposive sampling from a list provided by 5 participating general practices	21 female, 24 male. Average age: 58. Ethnicity: 37 White, 5 South Asian and 3 African Caribbean	High
Krska 2015[60]	Journal article	2011	Sefton, an area of North West England	33 (of 55) general practices	Postal survey with free text responses	83 (76% of practice managers, 24% of GPs)	Personally addressed letters of invitation with a covering letter to all practice managers and GPs at 55 practices	40 practice managers and 43 GPs	Medium
Nicholas 2012[54]	Journal article	2011	Two London boroughs	70 (of 96) general practices	Survey including free text responses	65	Invitations to all 96 general practices	25 practice managers, 8 GPs, 16 practice nurses, 2 healthcare assistants, 3 administrators and 14 not specified	High
Oswald 2010[50]	Evaluation report	2009 - 2010	Teesside	13 general practices	Semi-structured interviews	25	Letter of invitation to practice managers	8 practice managers, 14 practice nurses, 1 GP, 1 healthcare assistant, 1 pharmacist	Medium

Author, year	Type of report	Study period	Location of study	Setting of NHS Health Check	Data collection method	*n*	Method of recruitment to study	Participant characteristics	Overall quality
Research works 2013[59]	Research report	2013	Not given	Not given	Semi-structured interviews	12	Contacts provided by Commissioners with snowballing recruitment	GPs, practice managers, health care assistant, nurse practitioner, physical activity development officer, health bus workers and a community pharmacist	Medium
Shaw 2015[56]	Journal article	2010-11	Birmingham and Black Country	General practices and community	Semi-structured interviews	31	Recruited through lead clinicians	9 GPs, 6 practice managers, 4 practice nurses, 6 healthcare assistants, 1 alternative provider director, 1 call centre manager, 2 call centre operatives and 2 alternative provider registered practice nurses	High
Shaw 2016[55]	Journal article	Not given	Birmingham	General practices	Semi-structured interviews	9	Recruitment undertaken by local NHS trust. No further details provided	All GPs	High

4.2 Healthcare professional perspectives

Fifteen studies reported the views of health-care professionals towards the NHS Health Check programme and some of the challenges faced when implementing it within practice[28,41,43,50,54–57,59,60,62–66]. The characteristics of these are shown in Table 4.2.1 and the detailed quality assessment in Appendix 3. All included only small sample sizes and recruiting GPs was consistently reported to have been difficult, particularly from low performing practices. Those healthcare professionals who took part and whose views are reflected in the findings may, therefore, have been particularly enthusiastic or have stronger views about the NHS Health Check. Nevertheless, between them, the studies include the views of a range of professionals from different settings and a number of common themes emerge.

Table 4.2.1 Features of studies reporting the views of healthcare professionals on NHS Health Checks

Author/ year	Type of report	Study period	Location of study	Setting of NHS Health Check	Data collection method	*n*	Method of recruitment to study	Participant characteristics	Overall quality
Baker 2015[57]	Journal article	Not given	South West England	30.1% of total practices delivering NHS Health Checks	Surveys including quantitative and qualitative questions	25	Identified randomly via the County Medical List to ensure geographic spread	2 GPs, 14 practice managers, 6 practice nurses, 2 healthcare assistants and 1 administrator	Medium
Crabtree 2010[63]	Conference abstract	2009	Not given	32 (of 35) pharmacies in the area delivering NHS Health Checks	Semi-structured telephone interviews	32	All 35 pharmacies delivering the service were contacted	15 pharmacists, 13 support staff and 4 pre-registration pharmacists	Medium
Greenwich 2011[28]	Report	2011	Greenwich	Community	Open-ended questionnaire	11	All (12) clinicians delivering community outreach services providing NHS Health Checks were invited	Healthcare assistants, nurses, pharmacists and health trainers	Medium
Ismail and Kelly 2015[62]	Journal article	2010	Yorkshire	25 general practices	Semi-structured interviews	58	Letters of invitation or flyers to 41 general practices targeted to reflect diversity in terms of performance	Healthcare assistants, GPs, practice managers, practice nurses and other support staff	High
Krska 2015[60]	Journal article	2011	Sefton, an area of North West England	33 (of 55) general practices	Postal survey with free text responses	83 (76% of practice managers, 24% of GPs)	Personally addressed letters of invitation with a covering letter to all practice managers and GPs at 55 practices	40 practice managers and 43 GPs	Medium
Loo 2011[64]	Conference abstract	2009	Not given	Pharmacies	Postal questionnaire	442 (34%)	Questionnaire posted to all pharmacies in the area	All pharmacists 59% male; 89.1% full time; 53.4% worked for large multiple pharmacies	Medium
McDermott 2016[41]	Journal article	2013-15	2 London boroughs	17 general practices	Semi-structured interviews	24	Recruited from within a trial of an enhanced invitation method	52% practice managers, 9% healthcare assistants, 30% administrators, 9% public health leads	Medium
McNaughton 2011[65]	Journal article	Not given	Tees Valley	8 pharmacies	Semi-structured interviews	20	Postal invitation	10 primary care trust members, 8 pharmacists, 2 representatives from Local Pharmaceutical Committee	High

Author/ year	Type of report	Study period	Location of study	Setting of NHS Health Check	Data collection method	*n*	Method of recruitment to study	Participant characteristics	Overall quality
Nicholas 2012[54]	Journal article	2011	2 London boroughs	70 (of 96) general practices	Survey including free text responses	65	Invitations to all 96 general practices	25 practice managers, 8 GPs, 16 practice nurses, 2 healthcare assistants, 3 administrators and 14 not specified	High
Oswald 2010[50]	Evaluation report	2009 - 2010	Teesside	13 general practices	Semi-structured interviews	25	Letter of invitation to practice managers	8 practice managers, 14 practice nurses, 1 GP, 1 healthcare assistant, 1 pharmacist	Medium
Research works 2013[59]	Research report	2013	Not given	Not given	Semi-structured interviews	12	Contacts provided by Commissioners with snowballing recruitment	GPs, practice managers, health care assistant, nurse practitioner, physical activity development officer, health bus workers and a community pharmacist	Medium
Riley 2015[43]	Journal article	2013	Bristol inner-city	Community settings	Semi-structured interviews	4	Participants were recruited via their involvement with community outreach events.	1 practice nurse, 1 healthcare assistant, 1 engagement worker and 1 health trainer	High
Riley 2015[66]	Journal article	2013-14	Bristol	11 general practices	Semi-structured interviews	15	18 were invited with purposive sampling	5 GPs, 5 practice nurses, 3 healthcare assistants, 2 pharmacists	High
Shaw 2015[56]	Journal article	2010-11	Birmingham and Black Country	General practices and community	Semi-structured interviews	31	Recruited through lead clinicians	9 GPs, 6 practice managers, 4 practice nurses, 6 healthcare assistants, 1 alternative provider director, 1 call centre manager, 2 call centre operatives and 2 alternative provider registered practice nurses	High
Shaw 2016[55]	Journal article	Not given	Birmingham	General practices	Semi-structured interviews	9	Recruitment undertaken by local NHS trust. No further details provided	All GPs	High

4.2.1 Views of general practice healthcare professionals on the NHS Health Check programme

In general, healthcare professionals from primary care taking part in interview studies expressed the view that NHS Health Checks were beneficial [62 41 55 59]. However, in a survey of 43 GPs from 31 practices[60] only 51% (*n*=22) viewed the programme as important and 54% (*n*=24) as beneficial to their patients and in a second survey of 25 healthcare professionals 72% (*n*=18) perceived that NHS Health Checks were useful in early detection and gave time to discuss patient health and lifestyles[57].

> *"It's a good way to try and prevent illness and long term or serious conditions developing in the future"* Practice manager[41]

> *"I think it's a very good idea. We have a very high proportion of our patients who suffer with diabetes, almost 10% of our patients are diabetic so I thought this was an excellent opportunity to screen those earlier and pick them up."* GP[55]

There were a number of concerns raised about the programme, particularly concerning inequality of uptake and doubts about longer-term benefits and cost-effectiveness.

1) Concerns about inequality of uptake

Many GPs described how they felt the programme attracted the "*worried well*" and that the patients who would benefit the most were the ones who were least likely to attend.[54,57,59,62,66]

> *"if you send out an invite to a large number of people then the people who present themselves (laughs) er might well fit into that worried well category, um won't necessarily be um the HGV driver who works long hours and smokes a lot"* GP[66]

This was perhaps the reason behind why 74% (n=32) of GPs agreed with a decision to target high-risk patients in an area in the North West of England[60].

2) Doubts about long-term benefits and cost-effectiveness

Many also described doubts about the long-term benefits and the costs of implementation, including staff resources and lack of evidence for the effectiveness[41,57,60,62,66].

> *"I think the theory behind the programme is very laudable, but in terms of the amount of resource it takes up within a general practice, and what it picks up, it doesn't seem to be what I would consider sort of value for money."* Practice Manager [41]

> *"I don't think there is an awful lot of value. I think you'll pick up a few people a little bit earlier. Now whether that's worth the cost, obviously it's great for those individual*

patients, whether that's worth the cost of running a programme like this. I'd be amazed if it was." Nurse [66]

"I think really this is mass screening and there's not a great deal of proof behind it…..Not entirely convinced with being told we have to offer a check to everyone." GP [62]

4.2.2 Views of pharmacists of the NHS Health Check programme

In contrast to the studies with healthcare professionals from general practice, very few participants from pharmacies discussed the benefits or otherwise of the NHS Health Checks overall. Instead the focus was on delivering NHS Health Checks in pharmacies with all feeling it offered immense job satisfaction, promoted the image of the pharmacy and provided a good opportunity for staff development[63–65].

"*I wanted to do this regardless, because I thought this is for me, for patients who come in I can actually have time for them... if I'm in a position where I can give somebody information that will then enable them to change their behaviour and live a healthier life that's a satisfying thing to do*." [63]

"For being the place to come in your local area for your health concerns, I think all round, for both the staff personally and for the company's goal, I think it's a positive thing." [63]

"One of our counter staff...said 'I never thought I would be doing this!' She's quite excited and it's a huge jump from their present role." [65]

4.2.3 Challenges to implementation of NHS Health Checks within general practice

Healthcare professionals involved in delivery of NHS Health Checks in general practice settings identified six main challenges to implementation (Box 4.2.3.1).

Box 4.2.3.1. Main challenges to implementation of Health Checks within general practice identified by healthcare professionals

1) Difficulties with IT and computer software [54,59,60,62]
2) Impact on practice workload[54,57,60,62]
3) Funding [62 60]
4) Difficulty getting people to make changes to their lifestyle[54,56,62]
5) Limited access to follow-up lifestyle services [54,55,57,59,62]
6) Inadequate training [54,55,57,62]

1)Difficulties with IT and computer software

Difficulties with IT and computer software were mentioned in a number of studies, particularly related to the call and recall system when the programme was introduced[54,59,60,62].

2)Impact on workload

In a survey of 25 healthcare professionals, approximately 40% indicated there had been issues with staffing levels since starting to deliver NHS Health Checks, with some attributing these issues to the extra workload created by NHS Health Checks[57].

> *"NHS Health Check generates a huge workload for our staff in addition to what we do, a roughly 20 per cent additional workload*" Nurse [57]

In a second study, practice managers also generally agreed that the programme's impact on workload had knock-on effects on other services and both managers and GPs felt that payments were insufficient to cover costs [60].

3)Funding

GPs are financially incentivised to recruit patients to the NHS Health Check programme. This meant that for some, financial issues featured strongly in their decision to offer the NHS Health Check, whilst others did not feel the reimbursement was enough to justify the work[55,59].

> *"In order to get good payments we had to reach 50% target within three months …it was important for us to get the targets very very quickly.'* GP [55]

> *"Some doctors won't do it because they think it's a lot of work to be done for the amount of finance that they will be reimbursed".* GP [55]

4) Difficulty getting people to make changes to their lifestyle

Participants in many of the studies recognised the challenges to achieving behaviour change and described difficulties they had getting people to make longstanding changes to their lifestyle [55] [56,62] [57]

> *"Even if you access them, even if you find out that they're a really high risk score then getting these people to take on board you know the lifestyle changes, changes to their diet, exercising more. It's very difficult to get them to take those changes on."* Nurse [62]

Managing high-risk levels of alcohol consumption was felt to be especially challenging for some GPs and staff delivering the NHS Health Check, particularly amongst certain religious groups in which alcohol consumption can be stigmatised[55].

5) Limited access to follow-up lifestyle services

Related to the difficulties described getting people to make changes to their lifestyle, participants in a number of studies also described a lack of resources and a lack or inconsistency of well-funded support services in the wider community [55,57,62], with weight management and alcohol services rated the least in a survey of 25 healthcare professionals[57].

> *"We used to have things called exercise referral and we refer people to free gym sessions and send them to Slimming World and they'd get Slimming World sessions. We had really good responses and really good uptake for that, but that's all gone now."* Nurse [62]

> *"What the government needs to do is to supplement some money…and say to the gyms we'll give you this much money but what we want as part of that is we want you to accept patients from inner city practices like this."* GP [55]

6) Inadequate training

Training was another common theme across many of the studies[54,55,57,62]. These include a survey of 25 health care professionals in which 44% (*n*=11) indicated that they required further training[57]. A second survey of staff at 65 general practices in two inner London boroughs showed that staff at 62% (*n*=40) and 65% (*n*=42) of practices had attended training on lifestyle advice or delivering risk information, but only 43% (*n*=28) of practices reported that staff had attended training in measurement methods; at 23% (*n*=15) of practices no specific training was reported and 28% (*n*=18) considered that additional training would have been beneficial[54].

> *"[Training] would be good. As I say, we just learnt from our healthcare assistant what to do; basically it was like kind of on the job training… It would be nice to understand it in depth more, wouldn't it?"* HCA [62]

4.2.4 Challenges to implementation of NHS Health Checks within pharmacies

In a survey of 442 community pharmacists[64], the three most important perceived barriers to implementation were lack of time, lack of staff and lack of reimbursement (all reported by over 55% of respondents).

Lack of time and staff were also reported in studies that had conducted qualitative interviews with pharmacy staff. In particular, they described how, due to other commitments, most pharmacists did not have the capacity to perform the initial assessments as part of the NHS

Health Checks. These were instead carried out by pharmacy assistants, who in turn needed more substantial training than was initially offered[63–65]

> *"Most pharmacists that I've ever worked with will never have the opportunity to leave the counter or leave the dispensary close to 20 minutes to spend time with a patient... it's absolutely imperative for pharmacy to move forward to actually have support staff that are trained to understand exactly what goes on..."* [63]

Other challenges (Box 4.2.4.1) included lack of private space for consultations, difficulties with IT, particularly the need for a sufficiently secure internet connection to allow them to transfer patient identifiable data, and difficulty recruiting participants as the eligible population was largely dictated by footfall within the pharmacy[59,65]. Some pharmacies that were very close to GP practices delivering the NHS Health Check, also experienced competition between the settings.

> *"Actually there's another problem, capturing the people. Everyone is out to capture them...it's very hard if you see someone coming in and say, 'Oh! You could be a candidate', and they say, 'The surgery has approached me and I'm going there'."* [65]

Box 4.2.4.1. Main challenges identified to implementation within pharmacies by healthcare professionals

1) Lack of time / need for support staff[63–65]
2) Funding[64]
3) Training
4) Limited private space for consultations[59,64,65]
5) Difficulties with IT[59,65]
6) Difficulty recruiting participants[59,65]

4.2.5 Challenges to implementation of NHS Health Checks within community settings

Only two studies reported the views of those involved in delivering NHS Health Checks in community settings[28,43]. In contrast to some of the views expressed by healthcare assistants working in general practice, in a small study of 10 HCAs delivering community-based NHS Health Checks, most felt there were enough staff and felt they had adequate support[28]. The main challenges identified (Box 4.2.5.1) were poor access to some venues, inadequate privacy, and problems with some of the equipment and connection to the internet.

> *"I don't think you come across very professional when you're sitting in a kitchen and all huddled round and all on top of each other. And it's not very nice for the patients, because…quite personal information"* Nurse [43]

"Because we were all in the same room it was easy to listen to what was happening next door." [28]

Box 4.2.5.1. Main challenges identified to implementation within community settings by healthcare professionals

1) Poor access to some venues[28]
2) Inadequate privacy[28 43]
3) Problems with some of the equipment and connection to the internet[28 43]

4.3 Key findings and interpretation

- Reflecting the freedom that local authorities and general practices have in the funding, design and implementation of the NHS Health Check programme, there is evidence of variation in the way the NHS Health Check programme has been introduced, the interventions delivered to those identified as being at high risk, and the organisation of follow-up. Individuals attending different general practices may therefore experience important differences in process with respect to the implementation of NHS Health Checks. No studies, however, have directly compared different systems on patient experience or outcomes.
- Variations were also reported in the lifestyle advice provided. Whilst most patients are offered advice at the NHS Health Checks there is evidence that this aspect is not always prioritised and the provision of lifestyle services is variable.
- Whilst there was evidence that some healthcare professionals could see the benefit of the programme for their patients, nearly half in one survey did not view it as important or beneficial to their patients. The main concerns raised about the programme were around inequality of uptake and doubts about the evidence behind the programme and the cost-effectiveness.
- The main challenges to implementation in primary care were difficulties with IT and computer software, the impact on practice workload, funding, difficulty getting people to make changes to their lifestyle, limited access to follow-up lifestyle services, and inadequate training.
- Difficulties with IT, funding and training were also challenges raised by those delivering NHS Health Checks in pharmacy settings. Additionally, concerns were raised about the lack of pharmacist time, limited private space for consultations and difficulty recruiting patients. In contrast to the studies with healthcare professionals from general practice, however, all felt delivering NHS Health Checks offered immense job satisfaction, promoted the image of the pharmacy and provided a good opportunity for staff development. Although these were healthcare professionals already involved in delivering NHS Health Checks and so may be more supportive than other pharmacy workers, this suggests there may be greater enthusiasm generally amongst pharmacies than general practices.
- Similar challenges, particularly around privacy and IT, were also reported in community settings.

5. What are patients' experiences of having an NHS Health Check?

As with all health service interventions, it is important to understand patients' experiences of having an NHS Health Check. In this section we first review the studies reporting quantitative results from participant satisfaction questionnaires and then explore their experiences in more depth from qualitative studies with people who had attended an NHS Health Check.

5.1. Quantitative results from patient satisfaction questionnaires

Nine studies included quantitative results from surveys of participants who had attended NHS Health Checks [26,28,29,49,51,52,58,67,68] (Table 5.1.1). As with all surveys, they are all at risk of responder bias and may therefore represent the views of those with particularly strong opinions. Four are high quality journal articles published in peer reviewed journals in which questionnaires were sent to all those who had attended an NHS Health Check in either general practices[52,58] or pharmacies[26,49] and response rates were between 23.4% and 43%. A fifth study of the views of those attending outreach clinic at cricket groups was also published in a peer reviewed journal but did not report the methods in detail of the response rate[29]. Another was a report of a service evaluation in which the views of ethnic minority participants were particularly sought[28] and the final three were case study reports which report no methods or response rate and are at high risk of both reporting and responder bias[51,67,68].

Despite these variations in method and quality, all reported high levels of satisfaction, with almost all respondents across the range of settings reporting a positive experience and over 80% feeling that they had benefited from the process. Where reported, nine out of ten respondents also felt that they had been given enough time, had been able to ask all their questions, and would recommend it to others.

Table 5.1.1 Features of and findings from studies reporting results of participant satisfaction questionnaires

Study/ year	Type of report	Setting	*n*	Recruitment	Response rate (%)	Participant satisfaction	Overall quality
Baker 2014[58]	Journal article	83 general practices	1,011	Survey sent to all patients who had completed an NHS Health Check within a 2-month period	43	91.7% rated the overall experience highly 90.2% felt it was worth attending	Medium
Corlett 2015[26]	Journal article	Pharmacy-based NHS Health Checks	190	Survey sent to all those who had attended an NHS Health Check within a 4 week period	35	Almost all viewed their experience positively 92% felt they were given enough time 94% were able to ask all their questions 3% had unanswered questions 99% understood everything	Medium
Cowper 2013[67]	Case study	NHS Health Checks in County Durham	483	No details provided	Not given	82.2% were very satisfied 99.6% would recommend to others	Low
Krska 2015[52]	Journal article	16 general practices in North West England	434	All patients with estimated 10-year CVD risk > 20% from the 16 practices were sent a postal survey regardless of whether they had attended an NHS Health Check or not	23.4	85.6% felt they had benefited 89.6% felt they were given enough time 90.2% were able to ask all their questions 93.6% felt comfortable discussing their lifestyle 91.9% understood everything discussed 13.5% would have liked more support changing lifestyle 7.4% had concerns that had not been dealt with	Medium
LGA – East Riding[68]	Case study	Outreach NHS Health Check clinics at leisure centres, community centres and workplace settings	Not given	No details provided	Not given	92% rated experience as good or very good	Low
NHS Greenwich[28]	Evaluation report	Outreach clinics	540	Questionnaire distributed at community NHS Health Check venues	Not given	97% satisfied or very satisfied overall 90% likely or very likely to return if invited back	Medium
NHS Greenwich[28]	Evaluation report	Outreach clinics	72	Questionnaire distributed at community NHS Health Check venues	Not given	95% satisfied or very satisfied	Medium
'A picture of Health'[51]	Case study	General practice-based pilot of point-of-care NHS Health Checks in Tyne and Wear	281	No details provided	Not given	'High levels' of satisfaction 78% likely to recommend to others	Low
Taylor 2012[49]	Journal article	Pharmacy-based NHS Health Checks	97	Pharmacists gave invitation packs to all those who attended an NHS Health Check during the first six months	37.4	Almost all reported a positive experience 99% felt they had benefited 99.7% felt they were given enough time 99% felt comfortable discussing their lifestyle 10.8% had unanswered questions	Medium
Trivedy 2016[29]	Journal article	Outreach NHS Health Check clinics at cricket grounds	513	Participants were asked to complete an anonymous questionnaire immediately after their NHS Health Check	Not given	83% rated their experience as excellent 100% would recommend to others	Low

5.2. Qualitative data on patient experience

Patient experience was also reported in 15 qualitative studies. Three performed content analysis on free-text responses provided in surveys[28,52,58] whilst the others conducted focus groups or interviews with between 8 and 45 participants. Ten are journal articles published in peer reviewed journals[26,44,47,5845,52,6543,56,66], four are research reports of service evaluations[28,50,69,70], and one is a Masters thesis[46]. All recruited people who had attended NHS Health Checks either through invitations sent out from general practices or from community settings. Most included approximately equal numbers of men and women. Where reported, most participants were White British but three studies had particularly sought to describe the experiences of those from ethnic minority groups[28,43,56]. Further details of the design and methods used in those studies are given in Table 5.2.1 and full details of the quality assessment are given in Appendix 3.

As with all qualitative research, they include small, selected groups of participants whose expressed views are likely to be affected by both recall bias (systematic errors due to inaccuracy of recollections about NHS Health Checks) and social desirability bias (the tendency of interviewees to give responses they think might be viewed favourably by the interviewer). By virtue of the fact they have chosen to take part in medical research they may also be more interested in their health than the general population so their views may not reflect the full range of views and experiences of those attending NHS Health Checks. Nevertheless, thematic synthesis identified five main themes common across the studies: 1) Unmet expectations; 2) Limited understanding of the risk score; 3) Quality of information; 4) A potential trigger for behaviour change; and 5) Confusion around follow-up.

Unmet expectations

Despite the overall high levels of satisfaction, a strong theme throughout many of the studies was a feeling of unmet expectations that a significant minority of participants were left with at the end of the NHS Health Check.

For many, this arose from confusion about the purpose of the NHS Health Check. The comparison made between the NHS Health Check and an 'MOT' in the promotional material and the use of the term 'Health Check' left many expecting the NHS Health Check to include a more general wide ranging assessment of health and not just cardiovascular disease[44,58,70].

> "*I just assumed that they would test you for everything when you were there. My perception of reading through things was that it was going to be a good overhaul, you know overall body check for everything.*" [70]

> "*As a general health check it was not a series of tests as I expected. Only centred around the result of a blood test. Not comprehensive as I would have expected*" [52]

Table 5.2.1 Features of qualitative studies describing patient experiences of NHS Health Checks

Author, year	Type of report	Study period	Location of study	Setting of NHS Health Check	Data collection method	*n*	Method of recruitment to study	Participant characteristics	Overall quality
Alford 2010[69]	Evaluation report	Not given	Knowsley	Community	Interviews and focus groups	36	No details given	19 female, 17 male 13 high risk score, 23 low risk score	Medium
Baker 2014[58]	Journal article	2012	Gloucester	83 general practices	Content analysis of cross-sectional survey	1,011 (43%)	Survey sent to all patients who had completed an NHS Health Check within a 2 month period	55.2% female 19% 56-60 years 10.8% 40-45 years 96% white British	High
Chipchase 2011[70]	Report	2011	East and North Birmingham	2 general practices	Face-to-face semi-structured interviews	10	Attendees to NHS Health Checks in the first two weeks of February 2011 received a recruitment letter	8 female, 2 male	High
Corlett 2015[26]	Journal article	2013	London	4 pharmacies	Telephone interviews with sample of survey respondents	19	Invitation for a semi-structured telephone interview included with survey sent to all those who had attended an NHS Health Check within a 4 week period	Not given	Medium
Greenwich 2011[28]	Report	2011	Greenwich	Community	Open ended questionnaire, focus groups and in-depth phone interviews	612 survey responses 4 focus groups and 31 interviews	Recruited from community outreach services providing NHS Health Checks	Ethnic minority participants: 42% female	Medium
Ismail and Atkin 2015[44]	Journal article	Not given	Not specified	General practices	Semi-structured interviews	45 baseline 38 follow-up	Purposive sampling from a list provided by 5 participating general practices	21 female, 24 male. Average age: 58. Ethnicity: 37 White, 5 South Asian and 3 African Caribbean	High
Jenkinson 2015[47]	Journal article	2013	Torbay	4 general practices	Telephone or face-to-face interviews	17	Letters of invitation sent to a random sample identified by general practices from lists stratified by age and gender of those who had not responded to an invitation to an NHS Health Check within 4 weeks.	12 females, 5 males 6 employed, 1 unemployed, 10 retired	High

Author, year	Type of report	Study period	Location of study	Setting of NHS Health Check	Data collection method	*n*	Method of recruitment to study	Participant characteristics	Overall quality
Krska 2015[52]	Journal article	2011	Sefton, an area of North West England	16 general practices	Postal survey with free text responses	434 (23.4%)	All patients with estimated 10 year CVD risk > 20% from the 16 practices were sent a postal survey regardless of whether they had attended an NHS Health Check or not	19% female 68.2% over 65 99.5% white 7.7% highest quintile of deprivation 13.7% lowest quintile	Medium
McNaughton 2015[71]	Journal article	2009-12	North East of England (non-specific location)	5 general practices	Semi-structured interviews	29	Invitations to patients from five general practices who had received an NHS Health Check and had an estimated 10 year CVD risk >20%	10 females, 19 males 24 over 65 years 13 in least deprived quintile	High
Oswald 2010[50]	Evaluation report	2009 - 2010	Teesside	General practices or pharmacies	Semi-structured interviews	8	Invited by general practices or pharmacies or from a list of patients who had attended an NHS Health Check and agreed to take part in the service evaluation	6 had attended general practices and 2 pharmacies	Medium
Perry 2014[45]	Journal article	2010	Knowsley	Community	Interviews and focus groups	36	Letter or telephone invitation to all 38 people who were at high risk of CVD and had attended an NHS Health Check in the past 12-18 months were invited. The remaining attendees at low risk of CVD were purposively sampled for gender, age , risk score.	3 focus groups: 1 for high risk scores [6 males], 2 for low risk scores (17 females and 7 males) 6 semi-structured interviews (2 females and 4 males with high risk score)	High
Riley 2015[43]	Journal article	2013	Bristol inner-city	Community	Semi-structured interviews	16	Participants were recruited via their attendance of community outreach events.	7 females, 9 males All from black and minority ethnic populations	High
Riley 2015[66]	Journal article	2013-14	Bristol	General practices	Face-to-face and telephone semi-structured interviews	28	Purposive sampling from those identified through a search of patient records for patients who had undertaken an NHS Health Check within the previous 6 months	16 females, 12 males 23 White British 11 most deprived quintile 11 high (>20%) CVD risk	High
Shaw 2015[56]	Journal article	2010-11	Birmingham and Black Country	General practices and community	Semi-structured interviews	23	Patients who had attended an NHS Health Check were invited by practice managers or lead clinicians	High black and minority ethnic population and high levels of deprivation	High
Strutt 2011[46]	Masters thesis	2010	Darlington, Co. Durham, UK	2 general practices	Semi-structured face-to-face interviews	16	Invitation letters or telephone	7 females, 9 males White, South-Asian, and Middle Eastern	High

Additional specific areas that participants had been expecting or thought should be covered are listed in (Box 5.2.1).

Box 5.2.1. Additional areas that participants had been expecting or thought should be covered:

- A Well woman check [70]
- Diabetes checks for all [43,50,70]
- Cancer screening, including breast, testicular and prostate cancer [44,46,70]
- An assessment of mental well-being [44]
- An ECG [44]
- Testing for anaemia [44]
- Discussion around health conditions that impacted on their daily lives, such as joint and back pain [46]
- Chronic long-term conditions [50]

Limited understanding of the risk score

Whilst some participants reported improved understanding of cardiovascular disease risk following an NHS Health Check[26,52,56], a common theme throughout the studies was participants' limited understanding of the risk score.

Across many of the studies there was evidence that a large number of participants were either not able to recall being provided with a risk at all[44,47,52], found the risk score confusing [58,66,70], or had interpreted it incorrectly[44–46,66].

> "*my cholesterol is high…and, I had a score saying sixteen per cent diabetes in ten years. What does that mean? I've got no idea what that means. It sounds bad because it's higher than it's meant to be but is it?*"[66]

> "'*My QRisk score is 11 per cent. But after getting someone to Google it for me, we still have no idea what it means. It should be explained better in a letter from the Doctor*" [58]

> "*The conclusion was I have a 6% chance of getting heart disease, which on one hand sounds good because 6 people out of one hundred, but then if I'm one of those 6...so I feel very unclear about it.*"[70]

The score itself also appeared to have held little meaning or significance for most participants. Low scores (<20%) were sometimes perceived as meaning there was nothing to worry about[45], but participants with low-risk scores were as likely to report being worried or

anxious after receiving the scores as those with high-risk scores [66]. When describing their motivation to change behaviour, in general participants also described how it was not necessarily related to their risk score, and how even a high risk score was not necessarily enough to motivate them to try and change[45,46].

> "*Sometimes you need a reason and I think it was like me, I needed a reason [to change] and isn't it sad that showing me the percentage wasn't reason enough for me to give up [smoking].*" [45]

Quality of information

Most participants reported receiving lifestyle advice within the NHS Health Check. Many, however, felt it was too simple, brief, superficial or generic and felt they would have benefitted from more detail and more personalised information [26,28,45,46,56,66,71].

> *"And it was that kind of information which was the kind of the bit beyond, you know, eat less, exercise more, don't smoke, don't drink .. .that would have been useful ..the kind of advice that was on offer was actually very, um, simple"* [66]

For some this lack of personalised information led to confusion and uncertainty [46], with some feeling they had received mixed messages about their health[44] and been left unsure about what actions they should take [69]. This was not a universal view, however, with some seeing the value in being provided with 'common knowledge' again as it provided a fresh way of looking at their lifestyle and, in one study the simplicity of the information appeared to encourage participants to make changes to their behaviour [45].

> *"We should have been like that in the first place, the way I look at it, eating healthy and doing exercise, so it was quite easy."* [45]

> *"So I thought it was very helpful it was very informative and it was thought-provoking, it just gave us some fresh view on things, because you can get very easily into doing what you think is okay"* [46]

In most cases the lifestyle advice had been provided face-to-face but participants also valued, or felt it would have been helpful to have received, written information both for their own reference and also as a means to encourage behaviour change among friends and family[45,58,70].

> *"Well I suppose it's good to have a question and answer thing cos you can have somebody explain it to you. But I suppose you could, something written'd be quite useful."* [44]

A potential trigger for behaviour change

Participants variously described the NHS Health Check as a "*wake-up call*"[28,45], a "*reality check*" [45], a "*kind of turning point*" [46], a *"nudge"* [26], an "*eye-opener"* [56], or a "*prompt*"[70] which helped bring patients' health into focus by highlighting underlying health issues of which they were not necessarily aware of [58] and making them aware that there were lifestyle-related diseases to which they may be susceptible and may be able to prevent[56].

> "*It's like a reality check when…two and half stone over weight, your cholesterol is high and you know your life expectancy, them three things, it's a bit of a shock even though you know ….., when it actually gets written down and presented to you, it becomes reality*" [45]

> "*It's really good. It makes you aware of what problems are around. What you can get and that. It is really good. It teaches you..it's an eye-opener for people who would want to do things properly*" [56]

For some, this led on to behaviour change, with many of the studies citing examples of participants who had reported making changes that they attributed to having attended the NHS Health Check[43–45,56,66,69,71]. These included changes to diet, cutting down on smoking, decreasing alcohol intake and increasing physical activity.

> *"I've changed my diet um and, and lost a stone in weight I think as a result actually. So I'm quite happy with that, that makes me feel even healthier"* [66]

> *"Well the walking I do generally but I started going to Zumba now so I've been doing that Mondays and Fridays. That's an hour each day. And I started doing some sit-ups of a morning."* [56]

> "*Having the results of the check, I've actually started to go to [swimming baths] a couple of times, so I've made some progress….and I've actually felt better in meself.*" [45]

In general, dietary changes were perceived to be the easiest changes to make, particularly small changes that did not cause too much disruption to their daily routines [71] and there was recognition that changing behaviour was hard, with a number of barriers identified (Box 5.2.2).

Box 5.2.2. Reasons provided by participants for not making lifestyle changes

- Older participants feeling that making changes to their lifestyle was unnecessary [71]
- Healthy eating information was too generic [71]
- Guidance they had been given was likely to be subject to change [71]
- Co-morbidities which made physical activity difficult [71]
- Psychosocial circumstances, e.g. bereavement, stress or socio-economic barriers, such as shift work or unemployment [45,66]
- Having previously been offered a behaviour intervention strategy [44]
- Cost of eating fresh fruit and vegetables [44]
- Difficulty incorporating changes into their daily lives [45]
- Underlying medical conditions [45]

Confusion around follow-up

The final theme is related to confusion over follow-up [28,56,69]. This was particularly seen amongst participants who had attended NHS Health Checks in community settings. Individuals felt unsure about what steps should be taken next, specifically in relation to whether they needed to contact their GP or if their GP would contact them if any causes for concern had been identified [69]. Participants also reported a lack of sufficient information on follow-up and sign-posting to other NHS services[28].

Some participants also reported that they would have liked their healthcare professionals to be more pro-active in supporting them to make lifestyle changes and felt there should have been on-going follow-up and monitoring [44,50,56].

5.3 Key findings and interpretation

- Amongst those who respond to patient satisfaction surveys, there are consistently very high levels of satisfaction with NHS Health Checks reported, with over 80% feeling that they had benefited from the process.
- Despite these overall high levels of satisfaction, there was evidence from interviews that a significant minority of participants were left with a feeling of unmet expectations at the end of the NHS Health Check. For some this appeared to arise from confusion about the purpose of the NHS Health Check whilst others had been expecting a more general assessment of health. This suggests that the current promotional material and invitation letters are not providing sufficient clarity about the programme and raises more general questions about whether the NHS Health Check should be expanded to cover other areas of health.
- The cardiovascular risk score also appeared to generate confusion. It was poorly understood, interpreted differently among individuals with the same level of risk, and overall, seemed to have little meaning or significance for people in terms of how to use it to think about their health and future planning. These difficulties and limitations with communicating risk have been widely reported but particularly highlight here the potential limitations of relying on the risk score alone as a trigger for facilitating behaviour change within NHS Health Checks.
- Most participants reported receiving lifestyle information within the NHS Health Check but for many it was regarded as too simple and not sufficiently personalised. Lack of clarity around follow-up and reports that participants would have liked their healthcare professionals to be more pro-active in supporting them to make lifestyle changes additionally suggests there are potential missed opportunities to support behaviour change.
- Nevertheless, there was evidence that the NHS Health Check acted as a wake-up call for many participants and a number of those had gone on to make substantial lifestyle changes which they attributed to the NHS Health Check.

6. What is the effect of the NHS Health Check on disease detection, changing behaviours, referrals to local risk management services, reductions in individual risk factor prevalence, reducing cardiovascular disease risk and on statin and antihypertensive prescribing?

Eighteen studies examined the impact of the NHS Health Check on health-related outcomes or referrals to risk management services (Table 6.1). No relevant randomised controlled trials were identified and, of those eighteen studies, only five included an appropriate comparison group. Of those, two are high quality studies reporting on individual-level data from the Clinical Practice Research Datalink (CPRD). As described in section 1, the CPRD is an ongoing primary care database of the medical anonymised medical records of approximately 6.9% (4.4 million) of the UK population from 674 practices[32]. The included patients are broadly representative of the UK population in terms of age, sex and ethnicity whilst the general practices contributing data are less representative, both in terms of geography and size. The main strengths of using this data to assess the effect of the NHS Health Check on health outcomes are the breadth of the data, which includes information on health conditions, referrals, prescribing and lifestyle risk factors, the large sample size, and the ability to follow-up patients longitudinally. The quality of the data is also generally high although can be variable as it is entered by healthcare professionals during routine consultations and not specifically for research purposes. Other weaknesses include a lack of standardised Read codes for attendance at the NHS Health Check and for clinical diagnoses or lifestyle factors, and missing data. Missing data, both at baseline and follow-up, is a particular problem when assessing the impact of a prevention initiative such as the NHS Health Check programme as it is not missing at random. Those people who have not attended an NHS Health Check but have a disease or risk factor recorded may be those in whom healthcare professionals have suspected disease or those who consult more often; and those who had attended an NHS Health Check and have follow-up data present may be those in whom follow-up was advised or those who were more health conscious. Statistical methods are therefore required to attempt to account for this missing data.

Chang *et al.*[72] conducted a difference-in-differences model with propensity score matching on age, gender, ethnicity, deprivation and region and multiple imputation with all the variables of the QRISK2 algorithm, region and NHS Health Check attendance to estimate missing data for blood pressure, BMI and cholesterol. The difference-in-differences approach allows for background changes in time in the non-attendees, with the treatment effect estimating the difference between the observed change amongst the attendees and the calculated difference that would have existed if they had not attended. With appropriately matched groups (as was the case in the study by Chang *et al*.) this study design removes unobserved heterogeneity

that was fixed over time or that followed parallel time trends between the groups. Using multiple imputation to estimate missing data for blood pressure, BMI and cholesterol is an established method for dealing with missing data when data are missing at random. It cannot, however, account for data missing not at random and so, although the authors included all the variables of the QRISK2 algorithm, region and NHS Health Check attendance to estimate these missing values, there remains potential for bias in either direction. This is particularly the case for follow-up values which for many outcomes were only available for less than half the sample and for only 27.2% and 2.3% of the attendees and matched non-attendees respectively for QRISK2 10-year cardiovascular disease modelled risk.

Forster *et al.*[73] instead analysed the CPRD data as a cohort study with matching on age, gender and general practice. They did not impute missing data but instead focused on the effect of the programme on recording of risk factor values and prescribing, for which missing data is not a concern as prescriptions are automatically coded within the electronic record at the time of issue.

The other three are ecological studies that examine the association between outcomes and NHS Health Check coverage at general practice or Primary Care Trust level. Caley *et al.*[74] compared changes in prevalence of cardiovascular disease in general practices that had implemented NHS Health Checks compared with control practices that had not. The effect that the NHS Health Checks had had on these changes was estimated using multiple linear regression analysis with practice list size, mean age of practice population, proportion of the practice population that were male, practice deprivation score, baseline prevalence of disease, and proportion of eligible patients with a completed NHS Health Check. The study by Jamet *et al.*[75] used data on prescribing of statins in each Primary Care Trust and data on number of NHS Health Checks received from NHS England statistics to study the association between NHS Health Checks received and statin prescribing using a log linear regression model controlling for deprivation, distribution of lifestyles and the prevalence of cardiovascular disease in the area, and the prevalence of hypertension and diabetes. The third study by Lambert *et al*.[76] also used regression analysis to describe associations between the number of NHS Health Checks provided by each of 101 general practices and incident cases of high-risk cardiovascular disease and hypertension, and register size for diabetes and hypertension whilst adjusting for deprivation and completeness of the hypertension register. As ecological studies, these three studies are not able to prove any causal relationships between NHS Health Checks and the various outcomes but they nevertheless provide possible evidence on the impact of the programme.

The remaining studies were either before-and-after studies, which examined changes in outcomes that occurred over time at the individual-level or studies that reported health-related outcomes for individual patients at the NHS Health Check, but did not include any comparison group. Several of these include data at an individual level on both attendees and non-attendees but for the reasons described above direct comparisons between the attendees

and non-attendees is not appropriate. We have therefore treated these studies as before-and-after studies in this analysis.

In this section we discuss the effect of the NHS Health Check on the following outcomes in turn: 1) Disease detection; 2) Behaviour change; 3) Referrals to local risk management services; 4) Reductions in individual risk factors and cardiovascular disease risk; and 5) Prescribing.

Table 6.1. Features of studies reporting the impact of the NHS Health Check on health-related outcomes

Author / Year Publication type	Study design / Data source	Setting Study time period	Sample	Population characteristics	Comparison	Method	Unit of analysis	Overall quality
STUDIES WITH APPROPRIATE COMPARISON GROUPS								
Caley 2014[74] Journal Article	Non-randomised controlled study Electronic medical records	GP practices in Warwickshire June 2010 – March 2013 (39 months)	79 GP practices	Mean age: 41 years % male: 50.0%	Differences in population-level coverage	Multivariate regression models	Practice level	Medium
Chang 2016[72] *Impact* Journal Article	Matched cohort study CPRD data	England Baseline: April 2009 - March 2013 (4 years) Follow-up: Median of 2 years	138,788 patients (a random sample drawn from the national CPRD dataset)	Mean age: 53.5 (attendees) 50.1 (comparison) % male: 47.4 (attendees) 50.0 (comparison) % white: 71.9 (attendees) 54.8 (comparison)	Attendees compared with non-attendees	Difference in differences with propensity score matching on age, gender, ethnicity, deprivation and region	Individual-level	High
Forster 2015[73] *Do health* Journal article	Matched cohort study CPRD data	England April 2009 - March 2013 (4 years)	75,123 patients (intervention) 182,245 patients (matched controls)	Mean age: 54 years %male: 48% % living in most deprived quintile: 15.2%	Attendees compared with non-attendees	Cohort study with matching on age, gender and general practice	Individual-level	High
Jamet 2014[75] Working Paper	Observational study BNF (Large national prescriptions dataset)	England 2012 (1 year)	145 PCTs	N/A	Differences in population-level coverage	Multivariate regression models	PCT-level	Medium
Lambert 2016[76] Journal article	Observational study	3 health districts in North East England 30 months	101 practices	Not reported	Differences in population-level coverage	Univariate regression models	Area-level	Medium

Author / Year Publication type	Study design / Data source	Setting Study time period	Sample	Population characteristics	Comparison	Method	Unit of analysis	Overall quality
BEFORE AND AFTER STUDIES								
Artac 2013[77] *Effectiveness…* Journal article	Observational study Electronic medical records	Hammersmith and Fulham PCT July 2008 – March 2011 (32 months) (pre-2008 data was also used)	1,886 high risk patients (baseline) 1,574 (followup)	% aged>65: 34.2% % male:78.4% % white:71.4%	Change over time	Significance testing	Individual-level	Medium
Chang 2015[10] *Coverage..* Journal Article	Observational study CPRD data	England April 2009 - March 2013 (4 years)	95,571 patients (a random sample drawn from the national CPRD dataset)	% aged>60:60.2% % male:20.2% % British:35.8%	Change over time	Descriptive statistics only	Individual-level	High
Cochrane 2012[78] *NHS health check…* Journal article	Randomised trial[a] Trial data	38 (of 57) GP practices in Stoke on Trent Baseline: August 2009-January 2010 Follow-up: 1 year	365 patients in NHS Health Check arm of trial	Mean age:63.9 % male:90.1% %white:97%	Change over time	Significance testing	Individual-level	Medium
Dalton 2011[20] Journal Article	Observational study Electronic practice records	29 (of 86) GP practices in Ealing, London 2008-2009 (1 year)	5,294 high risk patients	Not reported	Change over time	Descriptive statistics only	Individual-level	High
Forster 2015[11] *Estimating.* Journal Article	Observational study CPRD data	England Baseline: 2010-2013 (3 years) Follow-up: 15 months	140,356 patients	Not reported	Change over time	Descriptive statistics only	Individual-level	High
Krska 2015[21] *Implementation..* Journal Article	Observational study Electronic practice records	13 (of 55) GP practices in Sefton, North West England Not reported (assumed first year of NHS Health Checks since high risk patients)	2,892 high risk patients	% aged >65:69.4% % male:78.3% % white:99.1%	Change over time	Univariate regression models	Individual-level	Medium

Author / Year Publication type	Study design / Data source	Setting Study time period	Sample	Population characteristics	Comparison	Method	Unit of analysis	Overall quality
Robson 2016[12] *...evaluation...*	Observational study QResearch data	England Baseline: April 2009 to March 2013 (4 years) Follow-up: 12 months	214,295 patients (attended NHS Health Check) 1,464,729 patients (did not attend)	% aged >60:22.2% % male:49.6% % white:63.4%	Change over time	Descriptive statistics only	Individual-level	High
STUDIES WITHOUT COMPARISON								
Baker 2015[15] Journal article	Cross-sectional review General practice feedback forms	83 of 85 GP practice in Gloucestershire July 2011-July 2012	20,973	%aged 45-49: 17.3% % male: 45.2% % white: 94.8%	None	Descriptive statistics only	Individual-level	Medium
Carter 2015[16] Journal Article	Observational cross sectional study Electronic medical records	65 GP practices in Leicester City Clinical Commissioning Group April 2009-March 2014 (5 years)	53,799 patients	Not reported	None	Descriptive statistics only	Individual-level	Medium
Cochrane 2013[17] *Cross sectional...* Journal article	Observational cross sectional study Electronic practice records	37 (of 57) GP practices in Stoke on Trent August 2009-January 2010 (6 months)	10483 high risk patients	Not reported	None	Descriptive statistics only	Individual-level	High
Coffey 2014[18]	Observation study Electronic database	40 general practices in Salford 2013-14	3933	%male: 47.7%	None	Descriptive statistics only	Individual-level	Medium
Hooper 2014[37] Short article	Observational study / NHS Health Checks data	40 GP practices offering NHS Health Checks in Warwickshire April 2010 – March 2013	37,236 patients	Not reported	None	Descriptive statistics only	Individual-level	Medium
Robson 2015[24] *..implementation...* Journal Article	Observational study Electronic practice records	139 (of 143) GP practices in North East London April 2009 to April 2012 (3 years)	144,451 patients	% aged >60:10.8% % male: Not reported % white:42.2%	None	Descriptive statistics only	Individual-level	Medium

[a]The intervention arm of the trial (additional lifestyle support) was not relevant to this review. Data reported on those trial participants who attended the NHS Health Check were extracted.

6.1 The effect on disease detection

Twelve studies reported data on disease detection. Only four had appropriate control groups and these are shown in Table 6.1.1.

Of those, two examined individual-level differences between attendees and non-attendees in national datasets[72,73]. The difference-in-differences/matching study by Chang *et al.*[72] showed that the following diseases were diagnosed significantly more frequently among NHS Health Check attendees during a two-year follow-up period following the NHS Health Check: chronic kidney disease (0.17%), familial hypercholesterolemia (0.09%), hypertension (2.99%), peripheral vascular disease (0.03%) and type 2 diabetes (1.31%). There were no significant differences in diagnoses of atrial fibrillation, coronary artery disease, heart failure or transient ischemic attack but a significant decrease in stroke (-0.03%), suggesting an early benefit of the programme on disease incidence. The study by Forster *et al.*[73] similarly showed that detection of raised blood pressure (>140/90mmHg) was statistically significantly more common in men who had attended an NHS Health Check (36% in attendees compared with 31% in non-attendees, $p<0.001$), and detection of raised cholesterol (>5mmol/L) was statistically significantly more common in both men (62% in attendees compared with 30% in non-attendees, $p<0.001$) and women (62% in attendees compared with 30% in non-attendees, $p<0.001$).

The two further studies used population-level data from individual general practices in Warwickshire[74] and the North East of England[76] to explore associations between NHS Health Check coverage and disease detection. The study by Caley *et al*.[74] identified no statistically significant associations between NHS Health Check coverage (the proportion of the eligible population who had completed an NHS Health Check) and change in the prevalence of type 2 diabetes, hypertension, coronary heart disease, chronic kidney disease and atrial fibrillation after controlling for various area-level characteristics (including age, gender, general practice list size, eligible proportion, area-level deprivation and baseline prevalence of the condition). However, the study only included 79 general practices and only 13.6% of the eligible population had received an NHS Health Check so it was under-powered to detect small differences. The second study by Lambert *et al.*[76] found an association between NHS Health Check coverage and incident high-risk cardiovascular disease and incident hypertension with the number of NHS Health Checks performed explaining 92% and 60% of the variance in numbers identified across the different practices respectively.

Table 6.1.1 Summary of results of studies reporting the impact of the NHS Health Check on disease detection

Author/ Year Publication type	Setting	Comparison	Disease detection
Caley 2014[74] Journal Article	79 GP practices in Warwickshire	Association between % eligible completing an NHS Health Check and change in prevalence of five conditions	Change in prevalence of T2DM, hypertension, CHD, CKD, AF: Not statistically significant
Chang 2016[72] *Impact* Journal Article	England	Differences between attendees and matched non-attendees	Change in AF: 0.02 (-0.02 to 0.06) Change in CKD: 0.17 (0.11 to 0.23)* Change in CAD: 0.02 (-0.04 to 0.08) Change in FH: 0.09 (0.07 to 0.11)* Change in heart failure: 0.01 (-0.01 to 0.03) Change in hypertension: 2.99 (2.77 to 3.21)* Change in PVD: 0.03 (0.01 to 0.05)* Change in stroke: -0.03 (-0.05 to -0.01)* Change in TIA: 0.008 (-0.01 to 0.03) Change in T2DM: 1.31 (1.17 to 1.45)*
Forster 2015[73] *Do health checks…* Journal article	England	Differences between attendees and matched non-attendees	Hypertension: Men: +5%* Women: Not significant FH: Men: +33%* Women +32%*
Lambert 2016[76] Journal article	3 health districts in North East England 30 months	Association between number of NHS Health Checks completed and outcomes	Association between NHS Health Check coverage and incident high risk cardiovascular disease and incident hypertension with the number of NHS Health Checks performed

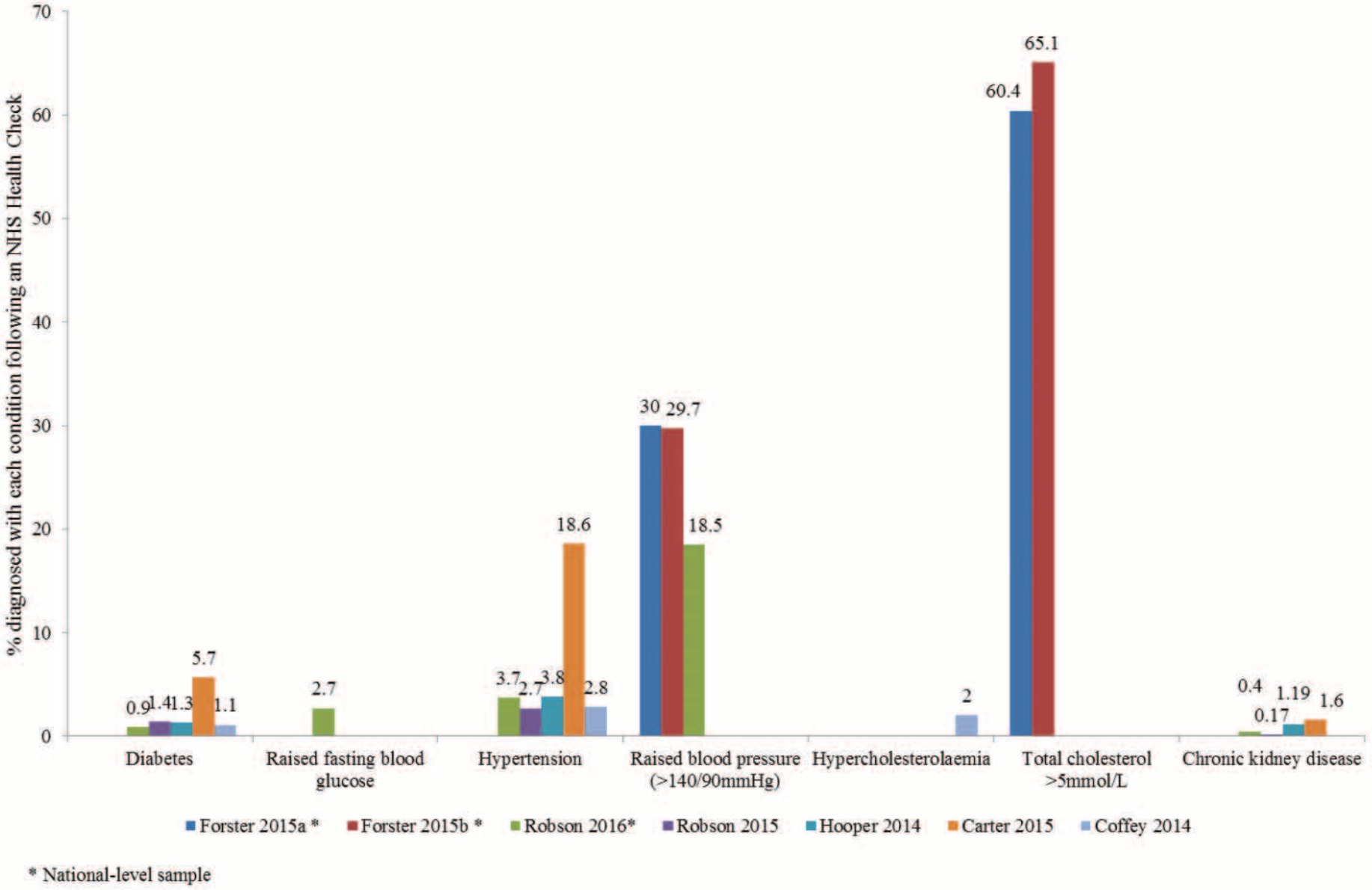
BP: blood pressure, CKD: chronic kidney disease, AF: atrial fibrillation, FH: familial hypercholesterolemia, PVD: Peripheral vascular disease, TIA: transient ischemic attack

The remaining eight studies[11,12,16,18,20,21,24,37] did not have control groups and therefore only provide data on the prevalence of disease in those attending the NHS Health Check. All used routinely collected data from electronic medical records to identify those with disease except the studies by Hooper *et al*.[37] and Coffey *et al*.[18] which used data collected at the time of the NHS Health Check. The case detection rates in each of those studies are shown in Figure 6.1.1. Direct comparison of the case detection rates is difficult as the studies included diagnoses made within a range of time periods after the NHS Health Check. For example, Robson *et al.* 2015 included diagnoses made in the six month period following the NHS Health Check, Robson *et al.* 2016 diagnoses up to 12 months after the NHS Health Check and Forster *et al.* 2015b diagnoses of diabetes within 60 days. Some also use Read codes to identify diseases whilst others rely on risk factor measurements.

The range of the estimated number needed to screen for each disease or condition in a non-selected population attending NHS Health Checks is shown in Table 6.1.2. This shows that one new case of raised blood pressure is found for approximately every three to four NHS Health Checks, with one new diagnosis of hypertension made for approximately every 30-40 NHS Health Checks. A new case of diabetes is made for every 80-200, chronic kidney disease between 60 to 600 and a person with a modelled cardiovascular disease risk ≥ 20% every six to ten. In the two studies that include only those with cardiovascular disease risk ≥ 20%, almost one in two NHS Health Checks resulted in a diagnosis of hypertension[20,21]. In all these studies though, is not possible to know how many of these are directly a consequence of the NHS Health Check or how many would have been identified within routine practice.

Only one study[79] addressed the costs of detecting disease within the NHS Health Check programme. It is a prospective audit in one rural general practice in Devon so may not be representative of England as a whole. The authors report that the costs of diagnosing hypertension within NHS Health Checks are double those for an opportunistic approach (£674.59 compared with £293.29).

Figure 6.1.1 Case detection rates amongst those attending NHS Health Checks



* National-level sample

Table 6.1.2. Estimates of the number needed to screen to detect a new case of a disease or condition across different studies

Disease	Forster 2015a[73] *	Forster 2015b[11] *	Robson 2016[12] *	Robson 2015[24]	Hooper 2014[37]	Carter 2015[16]	Coffey 2014[18]
Diabetes		125-333 (60 days)	110 (12 months)	80 (6 months)	79	18 (not clear)	91 (up to 12 months)
Raised fasting blood glucose			37 (12 months)				
Hypertension			27 (12 months)	38 (6 months)	26	5 (not clear)	36 (up to 12 months)
Raised blood pressure (>140/90mmHg)	3	3	5				
Hypercholesterolaemia							50 (up to 12 months)
Total cholesterol >5mmol/l	2	2					
Chronic kidney disease			265 (12 months)	568 (6 months)	84	63 (not clear)	
CVD risk ≥ 20%		6	8	10		9	8

* National datasets

Time periods in brackets are the time periods following the NHS Health Check in which the disease was detected. Where no time is given, data is up to and including only the NHS Health Check itself.

6.2 The effect on changing health-related behaviours

Smoking was the only health-related behaviour reported and was examined in four studies. One study[72] compared attendees with matched non-attendees using data from CPRD. They showed that change in the prevalence of smoking reported in the medical records was not significantly different among attendees than non-attendees a median of two years after the NHS Health Check. The data on smoking cessation was, however, collected from self-report entered into routine medical records which relies on patients both attending the general practice and being asked about their smoking status within that time.

The remaining three studies were before-and-after studies reporting change over time among NHS Health Check attendees. Two[11,78] showed a significant reduction in smoking whereas in the other the change was not statistically significant[77]. Without a comparison group, however, it is not possible to say whether these changes were causally related to the NHS Health Check.

Table 6.2.1 Summary of results of studies reporting the impact of the NHS Health Check on health-related behaviours

Author / Year Publication type	Setting	Comparison	Behaviour
Chang 2016[72] *Impact* Journal Article	England	Differences between attendees and matched non-attendees	Change in smoking prevalence: -0.11 (-0.35 to 0.13)
Artac 2013[77] *Effectiveness…* Journal article	Hammersmith and Fulham PCT	Change over time amongst NHS Health Check attendees	No significant change in smoking status
Cochrane 2012[78] *NHS health…* Journal article	38 (of 57) GP practices in Stoke on Trent	Change over time amongst NHS Health Check attendees	Significant reduction in smoking.
Forster 2015[11] *Estimating the yield…* Journal Article	England	Change over time amongst NHS Health Check attendees	Significant reduction in the proportion of males (-16%) and females (-15%) who reported being smokers

6.3 The effect on referrals to local risk management services

Six studies reported referrals to local risk management services following the NHS Health Check[11,12,15,17,18,21]. None reported comparisons with those not attending NHS Health Checks. Five used electronic health records to extract data on referrals whilst one[15] used data entry forms completed by general practices. Two used national datasets and the other three used regional samples of general practices. None distinguished between referrals to internal or external services or provided data on actual attendance at the lifestyle services.

A summary of the findings from those five studies is given in Table 6.3.1. It shows that there is wide variation both between different services and regions. The only national study to include data on referrals alone (as opposed to advice or referral) reported referral rates of only 5.7% for smokers at high-risk and between 33.1% and 42.4% of those at high-risk referred for alcohol, weight loss or exercise services[12]. As with the other studies relying on routinely collected data, however, this may not reflect actual practice due to lack of consistent coding and recording bias. As well as these variations between studies, Krska *et al.*[21] also found significant differences in the frequency of advice and referrals between healthcare professionals and general practices in North West England: Healthcare assistants offered the most referrals (45%) in 14% of the NHS Health Checks they conducted whilst nurses and GPs made referrals in only 5% of their NHS Health Checks.

Table 6.3.1. Summary of results of studies reporting the impact of the NHS Health Check on referrals to lifestyle services

Author/year	Setting	Data	Smoking cessation amongst smokers (%)	Diet/weight loss amongst those with BMI ≥30 (%)	Exercise amongst those with low physical activity or BMI ≥30 (%)	Alcohol amongst those with increased alcohol consumption(%)
Participants with cardiovascular risk ≥ 20%						
Krska 2015[21]	13 (of 55) GP practices in Sefton, North West England	Referrals	7.9	3.7	6.9	1.6
Robson 2016[12]	England QResearch database	Referrals	5.7	40.0	42.4	33.1
Cochrane 2013[17]	38 (of 57) GP practices in Stoke on Trent	Referrals	----------	9.7 referred to enhanced lifestyle support	----------	
Forster 2015[11]	England CPRD data	Advice or referrals	74.5	----------	70.7 ----------	
Participants with any cardiovascular risk						
Robson 2016[12]	England QResearch database	Referrals	6.8	38.7	41.4	33.9
Baker 2015[15]	83 of 85 general practices in Gloucestershire	Advice or referrals	66.9	40.8	44.2	0.7
Coffey 2014[18]	40 general practices in Salford	Referrals	0.5			

6.4 The effect on reductions in individual risk factors and cardiovascular disease risk

Five studies include data on the effect of the NHS Health Check on risk factor prevalence and cardiovascular disease risk (Table 6.4.1).

The difference-in-differences/matching study by Chang *et al.*[72] showed that changes in modelled cardiovascular disease risk, blood pressure (systolic and diastolic), total cholesterol and BMI observed among NHS Health Check attendees were significantly larger in directions that would be expected than among matched non-attendees during a two-year period following the NHS Health Check. For example, whereas the QRISK2 mean score fell from 5.1 to 4.9 amongst non-attendees, the reduction was larger among attendees from 6.7 to 6.2. The resulting difference-in-differences matching estimator of -0.21 was reported by the authors to be equivalent to one additional cardiovascular event being prevented per year for every 4,762 NHS Health Check attendees. However, as described above, there was substantial missing data with only 2.3% of non-attendees having a follow-up QRISK2 score recorded and in a complete case analysis this difference in modelled cardiovascular risk was not seen. The estimated number needed to screen to prevent one additional cardiovascular event of 4,762 also assumes any reduction in event risk is reflected in a change in QRISK2 score, with any benefits of statins being only through a reduction in total cholesterol. As statin prescribing increased among attendees (see section 6.5), this estimate is therefore likely to be an overestimate.

Three studies used individual-level data to examine changes over time amongst NHS Health Check attendees[11,77,78]. All identified a significant reduction in diastolic blood pressure and cholesterol level with two also reporting a significant reduction in obesity, cardiovascular disease risk and systolic blood pressure (Table 6.4.2). However, all three studies had missing data for follow-up (over 50% in the study by Artac *et al* and 85% for repeat cardiovascular risk in the study by Forster *et al*.). These data are likely to be missing not at random. Together with the absence of a control group, these findings therefore need to be interpreted with caution.

Table 6.4.2. Changes in individual risk factors and cardiovascular disease risk in studies reporting changes over time amongst people who had attended NHS Health Checks

Risk factor	Artac 2013	Cochrane 2012	Forster 2015
Cardiovascular disease risk score	↓	↓	↔
Systolic blood pressure	↔	↓	↓
Diastolic blood pressure	↓	↓	↓
Cholesterol	↓	↓	↓
BMI / obesity	↔	↓	↓

Table 6.4.1. Summary of results of studies reporting the impact of the NHS Health Check on reductions in individual risk factors and cardiovascular disease risk

Author / Year Publication type	Setting	Comparison	Individual risk factor or cardiovascular risk reductions
Chang 2016[72] *Impact* Journal Article	England	Differences between attendees and matched non-attendees	Change in QRISK2 CVD risk: -0.21% (-0.24 to -0.19)* Change in SBP: -2.51mmHg (-2.77 to -2.25)* Change in DBP: -1.46mmHg (-1.62 to -1.29)* Change in BMI: -0.27 (-0.34 to -0.20)* Change in Cholesterol: -0.15mmol/L (-0.18 to -0.13)*
Artac 2013[77] *Effectiveness…* Journal article	Hammersmith and Fulham PCT	Change over time among NHS Health Check attendees	Significant reduction in: CVD risk score (JBS) (from 28.2% to 26.2%), DBP (but not SBP), Cholesterol, Lipid ratios. No significant change in: BMI or obesity
Cochrane 2012[78] *NHS health…* Journal article	38 (of 57) GP practices in Stoke on Trent	Change over time among NHS Health Check attendees	Significant reduction in CVD risk, DBP and SBP, cholesterol and obesity.
Forster 2015[11] *Estimating the yield…* Journal Article	England	Change over time among NHS Health Check attendees	Significant reduction in: SBP (-5.53mmHg in males and -2.33mmHg in females), DBP (-3.84mmHg in males and -1.94mmHg in females) Cholesterol (-0.39mmol/l in males and -0.28 in females) BMI (-0.28 kg/m^2 in males, -0.19 kg/m^2 in females). No significant reduction in CVD risk score.

6.5 The effect on prescribing

Twelve studies reported data on prescribing after the NHS Health Check. A summary of the results of those studies are given in Table 6.5.1.

6.5.1 Prescribing of statins

Two studies examined differences in prescribing between NHS Health Check attendees and matched non-attendees using individual-level data from national datasets[72,73]. Both reported statistically significantly larger increases in statin prescribing in those attending an NHS Health Check: in the study by Chang *et al.* the proportion of attendees prescribed statins rose from 9.7% to 15.3% compared with 3.1% to 4.3% in the non-attendees with a difference-in-differences matching estimator of 3.83 and these differences greatest among those attendees with cardiovascular risk ≥20%; and in the study by Forster *et al*. 11% of attendees were newly prescribed statins compared to 7.6% of non-attendees in the first four years of the programme with a hazard ratio adjusted for age, gender and deprivation 1.58 (1.53 to 1.63).

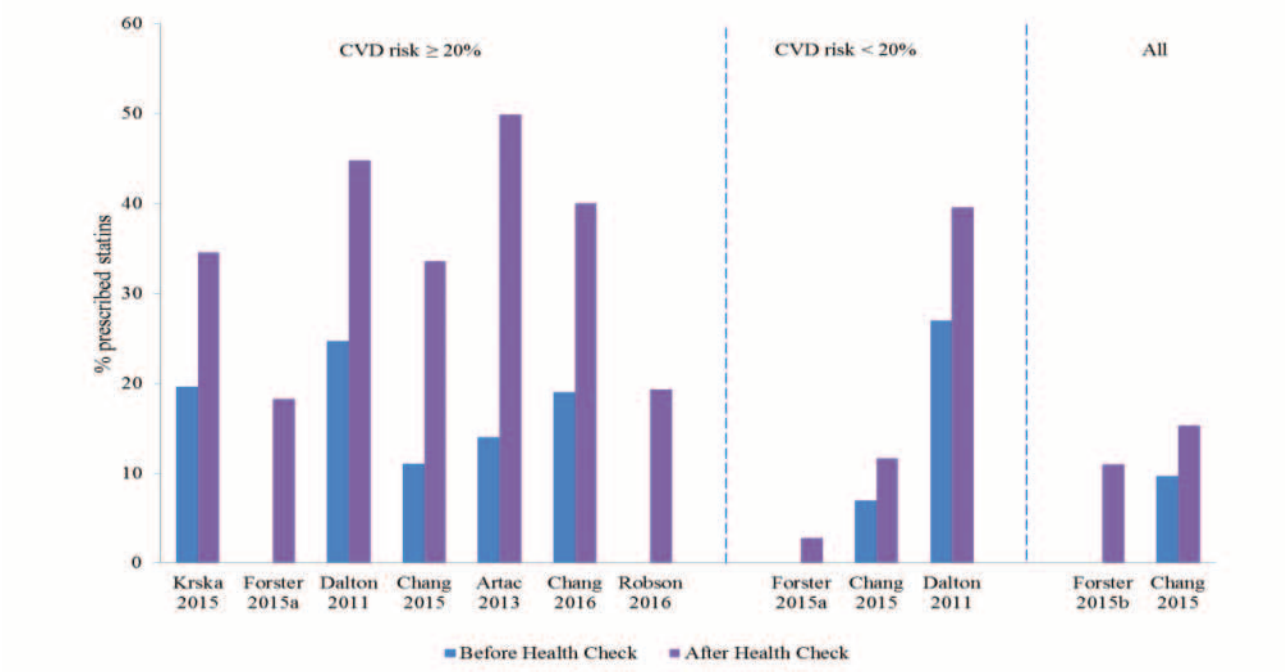
A third study by Robson *et al.*[12] also showed that prescriptions for statins were more common among attendees than non-attendees. However, these were unadjusted comparisons and due to missing data and differences at baseline between the groups this finding should be interpreted with caution.

A fourth ecological study by Jamet *et al.*[75] used national data on prescribing and showed a statistically significant association between NHS Health Check coverage and high-dose statin prescribing at the Primary Care Trust level in 2011 (regression coefficient for NHS Health Check coverage 0.094 ($p<0.01$)). This association between NHS Health Check coverage and statin prescribing was not significant for low dose statins. However, that may be explained by the fact that guidance at the time recommended initiation of statins classified as high-dose in this study for primary prevention.

The remaining seven studies used either before-and-after data to report new prescriptions[11] or changes in prescribing[10,20,21,77] for statins following the NHS Health Check, or data from the NHS Health Checks to describe the percentage of patients with a prescription for a statin after the NHS Health Check[16–18]. Figure 6.5.1.1 shows the change in prescribing of statins following an NHS Health Check for these studies along with the equivalent data from the attendees in the above matched studies. All show an increase in the percentage of individuals being prescribed statins following attendance at an NHS Health Check, with proportionally greater increases amongst those with an estimated cardiovascular risk ≥20%. The percentage of people at high risk being prescribed a statin after the NHS Health Check varied from 18.3% in the national study using CPRD by Forster *et al.* to 49.9% in the study in Hammersmith and Fulham by Artac *et al*[77] and 63% for men in the study by Carter *et al*.[16] which did not report prescribing before the NHS Health Check and so is not included in

Figure 6.5.1.1. All were lower than the estimated 85% uptake of statins and 70% compliance in the initial modelling for the NHS Health Check programme.

Figure 6.5.1.1 Change in the percentage of people being prescribed statins before and after attending an NHS Health Check



6.5.2. Prescribing of anti-hypertensives

Prescribing of anti-hypertensive medication was only reported in four studies[11,12,72,73]. Findings were similar to those for statins with the two studies examining differences in prescribing between NHS Health Check attendees and matched non-attendees using individual-level data from national datasets[72,73] reporting statistically significantly larger increases in anti-hypertensive prescribing among those attending an NHS Health Check. The differences were, however, smaller with a difference-in-difference estimate from the study by Chang *et al*. of 1.37% (95%CI 1.08-166) and a hazard ratio in the study by Forster *et al*. of 1.06 (95%CI 1.03-1.10, p<0.001). The other two studies reported new prescriptions amongst attendees and showed that between 8.8% and 12.1% of those with a cardiovascular risk ≥20% started a new anti-hypertensive medication following an NHS Health Check.

Table 6.5.1. Summary of results of studies reporting the impact of the NHS Health Check on prescribing

Author / Year Publication type	Setting	Comparison	Outcome: Prescribing
Chang 2016[72]	England	Differences between attendees and matched non-attendees	Increase in statin prescribing: Attendees: 9.7% to 15.3% (difference 5.6 (95%CI 5.29 -5.90) Non-attendees: 3.1% to 4.3% (difference 1.2 (95%CI 1.11 – 1.28) Difference in difference matching estimate: 3.83 (3.52 to 4.14)* Increase in anti-hypertensive prescribing: Attendees: 4.8% to 9.9% (difference 5.05 (95%CI 4.76 – 5.33) Non-attendees: 1.8% to 4.4% (difference 2.59 (95%CI 2.59 – 2.70) Difference in difference matching estimate: 1.37 (1.08 to 1.66)*
Forster 2015[73]	England	Differences between attendees and matched non-attendees	New statin prescribing: HR 1.58 (1.53 to 1.63)* New antihypertensive drug prescribing: HR 1.06 (1.03 to 1.10)*
Jamet 2014[75]	England	Association between number of NHS Health Checks completed and statin prescribing	Prescriptions of high dose statins: regression coefficient for NHS Health Check 0.094* Prescriptions of low dose statins: Not significant
Robson 2016[12]	England April 2009 to March 2013 (4 years)	New prescriptions amongst Health Check attendees and descriptive comparisons with non-attendees	New statin prescription: Attendees: 5.1% Non-attendees: 1.0%; Attendees ≥20% risk: 19.3% New anti-hypertensive prescription: Attendees: 3.9% Non-attendees: 1.8%; Attendees ≥20% risk: 8.8%
Artac 2013[77] *Effectiveness…*	Hammersmith and Fulham PCT	Change amongst NHS Health Check attendees	Increase in statin prescribing: ≥20% risk: Male 13.8% to 51.3% Female 15.0% to 42.2% All 14% to 49.9%
Chang 2015[10] *Coverage of*	England	Change amongst NHS Health Check attendees	Increase in statin prescribing: ≥20% risk: Male 11.7% to 34.6% Female 7.8% to 27.8% All 11.1% to 33.6% <20% risk: Male 7.8% to 13.6% Female 6.4% to 10.3% All 7.0% to 11.7%
Dalton 2011[20]	29 (of 86) GP practices in Ealing, London	Change amongst NHS Health Check attendees	Increase in statin prescribing: High risk: 24.7% to 44.8% Low risk: 27.0% to 39.6%
Forster 2015[11] *Estimating…*	England	New prescriptions amongst NHS Health Check attendees	New statin prescription: ≥20% risk: Male 17.6% Female 21.4% All: 18.3% <20% risk: Male 2.9% Female 2.7% All: 2.8% New anti-hypertensive prescription: ≥20% risk: Male 11.1% Female 16.3% All: 12.1% <20% risk: Male 3.4% Female 3.4% All: 3.4%
Krska 2015[21]	13 (of 55) GP practices in North West England	Change amongst NHS Health Check attendees	Increase in statin prescribing: ≥20% risk: 19.6% to 34.6%
Carter 2015[16]	65 GP practices in Leicester	Prescriptions following NHS Health Check	Statin prescribing after NHS Health Check: ≥20% risk: Male 63% Female 67.8%
Cochrane 2013[17]	37 (of 57) GP practices in Stoke on Trent	Prescriptions following NHS Health Check	Statin prescribing after NHS Health Check: ≥20% risk: 17.1%
Coffey 2014[18]	40 (of 47) GP practices in Salford	Prescriptions following NHS Health Check	Statin prescribing after NHS Health Check: All 11%

6.6 Modelling studies

Although not providing primary data addressing the effect of the NHS Health Check programme, three microsimulation studies have assessed the cost-effectiveness of the programme with different approaches to targeted (rather than universal) invitations and so provide estimates of the impact of the programme[80–82]. The first study by Crossan *et al*.[81] used an individual-level discrete-event simulation to model the impact of different case-finding strategies. After ranking individuals according to modelled cardiovascular risk the authors concluded that it would be most cost-effective to invite the 8% of patients at highest cardiovascular disease risk. This was patients with ≥12.8% predicted 10-year cardiovascular disease risk. This strategy would yield 17.5 QALYs at a cost of £162,280. Alternative strategies which involved inviting more than 8% of patients ranked at highest cardiovascular disease risk would result in higher cost per QALY. For example, if the 50% of patients at highest risk of cardiovascular disease were invited, the cost per QALY would be £65,273, which exceeds what is ordinarily deemed to be cost effective in the NHS. The modelling, however, only included the effects of pharmacological treatments on outcomes and not the effect of any lifestyle interventions and so does not truly represent the full extent of an NHS Health Check.

The second study by Baker *et al.*[82] simulated the cost-effectiveness of targeting screening at those in the most deprived quintile compared with mass screening. It focused on the costs of identifying individuals at high risk rather than any impact on health outcomes. It demonstrated that targeted screening of those in the most deprived quintile was more efficient and cost-effective at identifying high-risk individuals in all ethnic minority groups compared with the general population, particularly in the Pakistani/Bangladeshi group where the number needed to screen would be 2.5 to identify one person at high cardiovascular risk compared with 6.5 for mass screening. That approach would also result in greater coverage of high-risk individuals among ethnic minority groups.

The final study by Kypridemos *et al.*[80] used a microsimulation model to estimate the potential impact of a universal NHS Health Check programme compared with a concentrated approach targeting those in the two most deprived quintiles and population-wide interventions. They estimated that current universal NHS Health Checks might prevent approximately 1,000 non-fatal and 200 fatal cases of CVD annually. This was more effective than screening targeted at deprived populations but estimates for population-wide interventions were consistently better, raising the debate about the balance of investment on individual versus collective level interventions.

6.7 Key findings and interpretation

- Data on the effect of the NHS Health Checks on health outcomes are limited due to a lack of randomised controlled trials. The best data available is from matched studies using electronic primary care record databases. Whilst their strengths are size, longitudinal follow-up and breadth of data, they are limited by a lack of standardised Read codes for attendance at the NHS Health Check and for clinical diagnoses or lifestyle factors, and missing data at baseline and follow-up.
- There is evidence that NHS Health Checks do detect risk factors and disease in patients who attend: a new case of raised blood pressure is found approximately every three to four NHS Health Checks, with a new diagnosis of hypertension made approximately every 30-40; a new diagnosis of diabetes is made for every 80-200 NHS Health Checks; and a person with a cardiovascular disease risk ≥ 20% identified every six to ten.
- Increases in detection rates above detection rates in routine practice in the two years following an NHS Health Check have been shown for chronic kidney disease, familial hypercholesterolaemia, hypertension, peripheral vascular disease and type 2 diabetes with the estimated number needed to screen to detect one additional case between 20 to 33 for hypertension, 76 for diabetes, 588 for chronic kidney disease, and over 3000 for peripheral vascular disease.
- The only quantitative data on possible beneficial effects of NHS Health Checks on health-related behaviour is for smoking, for which the only study that compared cessation rates in attendees with non-attendees showed no benefit over routine practice. Further research is needed to explore the impact of attending an NHS Health Check on physical activity, diet, and alcohol consumption.
- Data on referral to risk management services are of poor methodological quality with none assessing referral rates over and above routine clinical practice. The data that does exist, however, suggests referrals to smoking cessation, weight loss, exercise, and alcohol cessation services varies widely and all are below the estimated uptake rates used in the initial modelling for the NHS Health Check programme[1]. This finding may in part be due to poor recording but suggests there may be lost opportunities for disease prevention.
- Data on reductions in prevalence of individual risk factors and cardiovascular disease risk is similarly limited with only one published study using a control group design. In that study modelled cardiovascular disease risk, blood pressure and body mass index are all reduced more in attendees than matched non-attendees. However, the incremental decrease in risk over and above routine care is small with that study suggesting a number needed to screen of 4,762 to prevent one additional cardiovascular event.
- The overall percentage of people at high risk (≥20% modelled cardiovascular risk) prescribed statins following NHS Health Checks varies between studies from 18.3% to 63%. All are lower than the estimated 85% uptake of statins and 70% compliance in the initial modelling for the NHS Health Check programme.

- Two high-quality studies using national data show a 3% to 4% increase in statin prescribing amongst attendees of the NHS Health Check compared with matched non-attendees[a].
- Similar trends have been observed for antihypertensive prescribing. However, the differences in this group is smaller than for statins.
- Modelling based on data from the NHS Health Check programme have estimated that the current universal NHS Health Check approach might prevent approximately 1,000 non-fatal and 200 fatal cases of cardiovascular disease annually. This is similar to the Department of Health modelling which estimated the programme would prevent 1,600 non-fatal cardiovascular disease cases and 650 deaths annually. Population-wide interventions were, however, more cost-effective, raising the debate about the balance of investment on individual versus collective level interventions.

[a] An additional matched analysis comparing comorbidity in NHS Health Check attendees and non-attendees using data from 139 of 143 general practices in three clinical commissioning groups in east London has also been published by Robson *et al.*[96] since the electronic literature search. The findings in that study support those in the studies included in this evidence synthesis: attendees were older than non-attendees and more likely to be from more deprived quintiles or from South Asian ethnic groups; overall 7.1% had an estimated cardiovascular risk ≥ 20%; new statin prescriptions were 3.3% higher in attendees than in non-attendees (11.5% compared with 8.2%); and among attendees there were more new diagnoses of diabetes (OR 1.30 (95%CI 1.22-1.39)), hypertension (OR 1.50 (95%CI 1.43-1.57), and CKD (OR 1.83 (95%CI 1.52-2.21).

DISCUSSION

The aim of this commissioned rapid evidence review was to bring together evidence from published and grey literature sources to synthesize what has been written about the first eight years of the NHS Health Check programme. The review was guided by six research questions specified by Public Health England (Box 7.1).

Box 7.1 Questions addressed in this report

1. Who is and who is not having an NHS Health Check?
2. What are the factors that increase take-up among the population and sub-groups?
3. Why do people not take up an offer of an NHS Health Check?
4. How is Primary Care managing people identified as being at risk of CVD or with abnormal risk factor results?
5. What are patients' experiences of having an NHS Health Check?
6. What is the effect of the NHS Health Check on disease detection, changing behaviours, referrals to local risk management services, reductions in individual risk factor prevalence, reducing CVD risk and on statin and antihypertensive prescribing?

Following an extensive literature search we identified 68 studies relevant to one or more of the research questions. These ranged from large quantitative studies including over 100,000 patients from electronic primary care databases to qualitative studies with less than ten participants and local evaluations and case studies. By including this full range of studies, we therefore provide the first comprehensive summary of published data on the NHS Health Check programme.

7.1 Main findings

The main findings are summarised in Box 7.1.1. In absolute numbers, more women and those in the areas of highest deprivation are recorded as having had NHS Health Checks than men or those in the areas of lowest deprivation. Coverage, defined as the proportion of the eligible population having an NHS Health Check, is also consistently higher in older people, females and more deprived populations and comparable with or higher than in white British groups for many ethnic groups. Coverage across all groups, however, was lower than that originally anticipated when the programme was introduced[1]. This is due in part to lower uptake rates. Where reported in regional studies the uptake (the proportion of those invited who have an NHS Health Check) is between 27% and 53% in different general practice settings, compared with an initial estimate of 75%[1]. There is no national level data on the characteristics of those who have been invited for an NHS Health Check. Assessment of the factors associated with increased uptake are therefore limited to regional studies. These show that older people and those from the least deprived areas are consistently more likely to take up invitations and there may be an interaction between age and gender, with women being more likely to take up an invitation at younger ages and men being more likely to take up an invitation at older ages.

Of those evaluated, the most promising methods for increasing uptake are simple modifications to the invitation letter, such as including a deadline commitment or statement that 'you are *due* to attend your Health Check' as opposed to 'you are *invited* to attend a Health Check', which are associated with a 3-4% higher uptake. These would be simple to introduce and involve minimal cost or time. On a national level a 3% increase in uptake would have resulted in an additional 87,000 NHS Health Checks taking place in 2015-16. Text message invites or reminders may also improve uptake by up to 9%. With the proportion of the population using mobile phones now 93%[83] and many general practices already using text messages to communicate with patients, this would also potentially be straight-forward to implement if proven to be successful in subsequent trials. Given the potential impact of small changes in uptake, the range of approaches to increase uptake that have been evaluated is limited.

Based on studies among those who had not taken up the offer of an NHS Health Check, the main reasons participants gave for not attending were lack of awareness or knowledge, competing priorities, misunderstanding the purpose, or an aversion to screening and preventive medicine. This suggests that the publicity around the programme has not reached all those eligible and that greater clarity about the purpose of the NHS Health Check is needed. Emphasising the potential benefits of prevention and early detection might also encourage those who are fearful of receiving bad news. However, lessons learned from screening programmes highlight the need to provide appropriately balanced evidence concerning benefits and harms to enable informed decision-making. Difficulty getting, or anticipating difficulty getting, an appointment with a GP, and concerns about taking up general practice time were also reasons given for not taking up invitations within general practice. Clarifying the distinction between appointments for NHS Health Checks and appointments for routine care and considering offering NHS Health Checks during extended hours may, therefore, also improve uptake.

A complementary approach would be to encourage uptake within community-settings. There is a lack of quantitative evidence for the effect of community-settings on uptake generally, largely because the nature of the community initiatives means that the denominator is unknown. Evidence from local evaluations and case reports, however, shows that outreach services are being run successfully in a wide range of community-settings and suggests that they may be effective at targeting particular socio-demographic groups. Whether these initiatives are associated with changes in behaviour, risk factors and modelled risk and are cost-effective compared to delivery within general practice and whether they truly do reach different populations is, however, not known. Concerns were also raised by both attendees and healthcare professionals about privacy and confidentiality in these settings so venues need to be chosen carefully.

Among those who had attended an NHS Health Check there are consistently high levels of reported satisfaction in surveys, with over 80% feeling that they had benefited from the process. The findings from qualitative research with attendees, however, showed that despite these positive responses a significant minority had been left with a feeling of unmet

expectations, were confused about or unable to remember their risk scores, and found the lifestyle advice too simplistic and un-personalised. This discrepancy is consistent with previous research in other areas of health care which has found that positive survey responses can mask important negative dimensions which patients subsequently express qualitatively[84,85]. The interpretation of 'good' absolute patient feedback scores should, therefore, not lead to complacency and the conclusion that substantial improvements need not be considered. The particular areas mentioned by attendees related to the information provided prior to and during the NHS Health Check. Many had expected the NHS Health Check to include a more general wide ranging assessment of health and not just refer to risk of cardiovascular disease. Whether these people would still have attended had they understood the scope of the NHS Health Check is not known. There was also confusion about the role of the risk score within the process with many not understanding or being able to recall their risk and it appearing to have little meaning or significance among those who could recall it. The challenges of communicating risk are well known[86] and the provision of the risk score itself may have more impact on healthcare professional behaviour and prescribing than on patient behaviour[87,88]. Nevertheless, if cardiovascular risk estimates are presented to patients within the NHS Health Check, healthcare professionals should be encouraged to draw on best practice guidance[89,90].

Research with healthcare professionals shows there is evidence of wide variations in the process, delivery and content of NHS Health Checks across the country, with individuals experiencing important differences. This is in part due to different local implementation strategies which have been encouraged by local commissioning of the NHS Health Check programme and a lack of standardization of process. This has the advantage of allowing individual areas to tailor the programme to their population. However, with poor characterisation and evaluation of these variations, the opportunity for generalisable learning has been limited. Regardless of region or setting, those delivering the NHS Health Checks reported challenges with workload, information technology, funding, and training. Additionally, amongst general practice professionals there were concerns about the inequality of uptake and doubts about the evidence behind the overall programme and its cost-effectiveness. In the context of the current financial crisis within the NHS and reports of Primary Care services being stretched beyond safe limits by the needs of those with existing morbidity[5], these concerns are likely to increase. Improving the evidence and being able to provide healthcare professionals with concise up-to-date summaries of the evidence therefore appears to be particularly important.

Unfortunately, the evidence on the effects of the NHS Health Check programme on population health is limited by the absence of any data from randomised controlled trials and on-going difficulties with consistent recording of both NHS Health Check attendance and health outcomes. Studies comparing attendees with matched non-attendees show that NHS Health Checks are associated with small increases above routine practice in detection of diseases such as chronic kidney disease, familial hypercholesterolaemia, hypertension, peripheral vascular disease and type 2 diabetes, with the estimated number needed to screen to detect one additional case between 20 to 33 for hypertension, 76 for diabetes, 588 for chronic kidney

disease, and over 3,000 for peripheral vascular disease. There is also consistent evidence of a 3-4% increase in prescribing of statins among attendees and smaller increases in prescribing of anti-hypertensives which may lead to a reduction in cardiovascular events at the population level.

The effects of the NHS Health Check programme on patient behaviour change is largely unknown. There was evidence from interviews that attending had acted as a wake-up call for many participants and a number of those individuals reported making substantial lifestyle changes which they attributed to the NHS Health Check. However, there are no quantitative studies reporting the effects on diet, physical activity or alcohol and only one comparative study reporting the effects on recorded smoking status. There are also no studies that have compared rates of referral to lifestyle services in attendees with non-attendees and, where reported, recorded referrals are relatively low (<50% of those at high risk). Together with findings from studies with healthcare professionals, this suggests that the lifestyle aspects of the programme may not currently be being prioritised or the lifestyle services available are either unattractive or inaccessible for patients. The effectiveness of the programme could, therefore, be enhanced by the definition and implementation of clear pathways for individuals to interventions of known effectiveness according to the particular characteristics of the individual and their level of risk.

Finally, modelling based on data from the NHS Health Check programme has estimated that the current universal NHS Health Check approach might prevent approximately 1,000 non-fatal and 200 fatal cases of cardiovascular disease annually. This is similar to the Department of Health modelling which estimated the programme would prevent 1,600 non-fatal cardiovascular disease cases and 650 deaths annually. Population-wide interventions were, however, more cost-effective, raising the debate about the balance of investment on individual versus collective level interventions.

Box 7.1.1 Key findings

- Coverage, defined here as the proportion of the eligible population having an NHS Health Check, varies substantially across different regions of the country and in different settings. It is consistently higher in older people, females and more deprived populations and whilst there is some evidence that outreach services in the community can be effective at targeting particular socio-demographic groups, that is mostly from local evaluations and case reports.
- There is also a notable lack of national level studies reporting the characteristics of those who take-up the invitation to an NHS Health Check and those who do not. Where reported in regional studies the uptake (the proportion of those invited who have an NHS Health Check) is between 27% and 53% in different general practice settings. These are all lower than the 75% used in the original modelling for the programme but similar to the national reported uptake of 48.3%.
- Older people, women in younger age groups, men in older age groups, and those from the least deprived areas are more likely to take up invitations. The most promising methods for increasing uptake are simple modifications to the invitation letter which are associated with a 3-4% increase, and text message invites or reminders which may improve uptake by up to 9% but this finding is based on only one study.
- There is a lack of quantitative evidence for the effect of community settings on uptake but qualitative evidence suggests a benefit of community ambassadors and increased convenience.
- The main reasons participants who had not taken up the offer of an NHS Health Check gave for not attending were lack of awareness or knowledge, competing priorities, misunderstanding the purpose, an aversion to preventive medicine, difficulty getting an appointment with a GP, and concerns about privacy and confidentiality of pharmacies.
- Amongst those who had attended there are consistently very high levels of reported satisfaction, with over 80% feeling that they had benefited from the process. There was also evidence from interviews that attending had acted as a wake-up call for many participants and a number of those reported making substantial lifestyle changes which they attributed to the NHS Health Check. However, a significant minority had been left with a feeling of unmet expectations, were confused about or unable to remember their risk scores, and found the lifestyle advice too simplistic and un-personalised.
- There is evidence of wide variations in the process, delivery and content of NHS Health Checks across the country with individuals experiencing important differences. This is in part due to different local implementation strategies.
- Regardless of region or setting those delivering the NHS Health Checks reported challenges with workload, IT, funding, and training. Additionally, amongst general practice professionals there were concerns about the inequality of uptake and doubts about the evidence behind the programme and the cost-effectiveness.

Box 7.1.1 Key findings continued..

- Studies comparing attendees with matched non-attendees show that NHS Health Checks are associated with small increases above routine practice in detection of diseases such as chronic kidney disease, familial hypercholesterolaemia, hypertension, peripheral vascular disease and type 2 diabetes with the estimated number needed to screen to detect one additional case between 20 to 33 for hypertension, 76 for diabetes, 588 for chronic kidney disease, and over 3000 for peripheral vascular disease.
- Recorded referrals to lifestyle services are relatively low and no studies have compared referral rates in attendees with non-attendees. There are also no studies reporting the effects of NHS Health Checks on diet, physical activity or alcohol or on psychological outcomes or the potential for false reassurance.
- There is consistent evidence of a 3-4% higher frequency of prescribing of statins among attendees than matched non-attendees and smaller increases in prescribing of anti-hypertensives. This may lead to a reduction in cardiovascular events at the population level.
- Modelling based on data from the NHS Health Check programme has estimated that the current universal NHS Health Check approach might prevent approximately 1,000 non-fatal and 200 fatal cases of cardiovascular disease annually. This is similar to the Department of Health modelling which estimated the programme would prevent 1,600 non-fatal cardiovascular disease cases and 650 deaths annually. Population-wide interventions were, however, more cost-effective.

7.2 Strengths and limitations

The main strength of this evidence synthesis is the extensive search strategy across multiple electronic databases and sources and manual searching of the reference lists of all included studies. Whilst we cannot exclude the possibility that additional local evaluations may have been performed and are not included in this review, we think it unlikely that they would substantially alter the main findings. We also employed double data extraction for all quantitative data and triple data extraction from researchers with different background for all qualitative data to reduce the risk of introducing bias at the synthesis stage. A potential limitation is that all titles and abstracts were only reviewed by one researcher (a senior information scientist at Public Health England for the original searches conducted by Public Health England, and one reviewer from our research team for the additional Web of Science and OpenGrey searches).

The main limitations relate to the available evidence. Almost all included studies used data from prior to 2013 when the programme became a statutory requirement and the studies varied considerably in terms of study design, method, size, sampling and recruitment strategies, region, data sources, measures included and quality. This meant that the findings do not necessarily reflect current practice and pooling findings across studies was difficult, with meta-analytic approaches not appropriate. An additional general limitation across many of the

studies was the absence of a standard method of identifying attendance at an NHS Health Check. Some studies used self-report, others electronic patient health records, and others data provided locally for payment purposes. The absence of a universally agreed and implemented Read code specific for attendance at an NHS Health Check means that those studies using electronic patient health records, either at practice level or within anonymised datasets, have, therefore, also used different ways of identifying those who have had an NHS Health Check. These include the measurement of blood pressure, body mass index, cholesterol ratio and smoking status within a six month period and the use of additional codes for cardiovascular risk assessment. It is, therefore, not possible to be certain either that all patients classified as having had an NHS Health Check have actually had an NHS Health Check and not a cardiovascular risk assessment as part of routine practice, or that patients who have not had a record of those assessments in their medical records have not received an NHS Health Check.

Similar limitations exist with the measurements of participant characteristics and health outcomes. Almost all studies relied on routinely collected data for these measures. This results in variations in data quality as such data is not collected in a standardised way and is prone to error and bias. Missing data, both at baseline and follow-up, is a particular problem when assessing the impact of a prevention initiative such as the NHS Health Check programme as it is not missing at random. Data are less complete in those people who have not attended an NHS Health Check so those who have not attended but have a disease or risk factor recorded may be those in whom healthcare professionals have suspected disease or those who consult more often. Furthermore, those who have attended an NHS Health Check and have follow-up data present may be those in whom follow-up was advised or those who were more health conscious compared with those without follow-up data. Data on ethnicity are also missing in up to 40% of medical records, making findings about differential coverage and uptake among different ethnic groups at risk of bias, the direction of which is uncertain.

As a result of these differences between attendees and non-attendees, the only studies to provide data comparing attendees and non-attendees used primary care databases of anonymised medical records: the CPRD[33] and QResearch[34] databases. The strengths of these are the breadth of the data, including information on both health conditions and lifestyle risk factors, the large sample size, and longitudinal follow up for the data. The included patients are also broadly representative of the UK population in terms of age, sex and ethnicity but the general practices contributing data are less representative. For example, comparing CPRD data to general practice data in 2011, the median list size was higher in CPRD compared with English practices as a whole; 8,355 vs 5,918[33] and in 2013 the North West of England and London provide 80-89 practices each to CPRD, compared with 12-19 practices from the North East[32]. Contributing data to one of these databases also requires achieving a minimum standard of medical record keeping and it is possible that the practices that meet this standard are more engaged with preventive medicine than those that do not. Whilst these studies provide the best available data on the impact of the NHS Health Check programme nationally, it is therefore possible that the size of the measured effects are underestimates or overestimates of the overall impact across the whole country.

A large number of included studies were also service evaluations or audits which, whilst providing important data on local practice, are not generalizable. Furthermore, there is a high risk of publication bias favouring positive results. The findings from the surveys tended to have low response rates, between 23% and 43%, so are all at risk of responder bias and may represent the views of those with particularly strong opinions.

As with all qualitative research, the qualitative studies included in this review also include small, selected groups of participants. The descriptions patients gave of their experiences of the NHS Health Check are likely to be affected by both recall bias and social desirability bias. By virtue of the fact they have chosen to take part in medical research participants may also be more interested in their health than the general population. Recruiting GPs was also consistently reported to have been difficult, particularly from those practices completing less NHS Health Checks. The healthcare professionals who did take part and whose views are reflected in the findings may, therefore, have been particularly enthusiastic or have strong views about the NHS Health Check.

Finally, by focusing on published evidence of the NHS Health Check programme specifically, this review does not include the substantial wider literature around health checks in general. These include trials of primary prevention programmes such as the Inter99 study[91] and Västerbotten Intervention Programme (an individual and wider public health campaign)[92], and modelling studies[93]. The Danish Inter99 study was a randomised trial of screening and lifestyle counselling including all 61,301 people born in selected years living in southwest Copenhagen. Mortality was 37% lower and risk factors were significantly lower among attendees compared with non-attendees. However, in an intention-to-treat analysis in which 35% of those randomised to the intervention attended, this mortality difference was not seen[91]. In contrast, the Västerbotten Intervention Programme which combined individual risk assessment and interventions with a population-wide strategy targeting wider collective determinants of cardiovascular disease in the whole community was associated with a lower rate of all-cause and cardiovascular disease mortality compared with non-participating regions of Sweden[92]. Modelling of a health check consisting of assessments for diabetes, hypertension, lipids and smoking also showed a gain of 40 Quality Adjusted Life Years (QALYs) at 30 years per 1,000 individuals offered a health check at a cost of 2426 euros per QALY and a number needed to screen of 59 to prevent one major adverse cardiovascular event[93].

Additionally, there is growing evidence that the provision of risk information is unlikely to lead to sustained changes in habitual health behaviours such as diet and physical activity at the same time as evidence is accruing of the importance of the environment in influencing such behaviours. Public health strategies to alter the environment to enable the adoption and maintenance of healthy behaviours and shifts in the population distribution of cardiovascular disease risk factors, as well as being effective in their own right, may enhance the effectiveness of individual-based approaches such as the NHS Health Check.

7.3 Implications for research

Public Health England has already developed priorities for research to support the NHS Health Check programme[94]. The studies within this review address some of these questions to some degree but, in doing so, identify additional gaps in the literature. In particular, there is an urgent need for better characterisation of local variations in practice and robust evaluations of the outreach programmes being introduced across the country. We are aware of two abstracts due to be presented at the NHS Health Check conference in February 2017. They report the results of a service evaluation of the difference in uptake and outcomes of NHS Health Checks between general practice, pharmacies and community settings in one London borough and a matched cohort study of two practice populations comparing the uptake and costs of NHS Health Check appointments offered in community pharmacies versus general practice in North West England. These will be important additions to the literature but further research in this area is needed. Follow-up studies are also needed to quantify the impact of the NHS Health Check programme on practitioner and patient health-related behaviours and, crucially, potential psychological or physical harms or false reassurance occurring as a result of test results or medication initiation[95]. These and other suggested areas for future research are listed in Box 7.4.

Box 7.4 Suggested areas for future research

- Better characterisation of the local variations in how the programme has been implemented to allow comparisons and sharing of best practice
- Robust evaluations of the numerous outreach programmes being run across the county, including measures of uptake, experience and outcome
- Randomised controlled trials of text message invitations, text message reminders, telephone invitations and face-to-face invitations compared to invitation letters
- Follow-up studies using precise measures to quantify the impact of attending an NHS Health Check on physical activity, diet, alcohol consumption and smoking
- Studies to quantify potential harms including false reassurance
- Systematic evaluation of referral patterns and lifestyle service provision alongside data on patient engagement with those services and health outcomes

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Appendix 1 – Search strategies

Database	Search strategy
Ovid Medline	1. health check*.tw. 2. (diabetes adj3 screen*).tw. 3. (cardiovascular adj3 screen*).tw. 4. (population adj2 screen*).tw. 5. (risk factor adj3 screen*).tw. 6. (opportunistic adj3 screen*).tw. 7. medical check*.tw. 8. general check*.tw. 9. periodic health exam*.tw. 10. annual exam*.tw. 11. annual review*.tw. 12. NHSHC.tw. 13. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 14. cardiovascular adj3 prevention.tw. 15. (primary care or general practice or primary healthcare).tw 16. 14 and 15 17. Cardiovascular Diseases/ AND Primary Prevention/ 18. 16 or 17 19. 13 or 18
PubMed	1. health check* 2. diabetes screen* 3. cardiovascular screen* 4. population screen* 5. risk factor screen* 6. opportunistic screen* 7. medical check* 8. general check* 9. periodic health exam* 10. annual exam* 11. annual review* 12. NHSHC 13. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 14. Cardiovascular Diseases AND Primary Prevention[MeSH Terms] 15. "primary care"[Text Word] OR "general practice"[Text Word] OR "primary healthcare"[Text Word]) 16. (cardiovascular[Text Word] AND prevention[Text Word]) 17. #15 and #16 18. #14 or #17 19. #13 or #18
Ovid Embase	1. health check*.tw. 2. (diabetes adj3 screen*).tw. 3. (cardiovascular adj3 screen*).tw. 4. (population adj2 screen*).tw. 5. (risk factor adj3 screen*).tw.

6. (opportunistic adj3 screen*).tw.
7. medical check*.tw.
8. general check*.tw.
9. periodic health exam*.tw.
10. annual exam*.tw.
11. annual review*.tw.
12. NHSHC.tw.
13. periodic medical examination/
14. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13
15. cardiovascular adj3 prevention.tw.
16. (primary care or general practice or primary healthcare).tw
17. 15 and 16
18. cardiovascular disease/ AND primary prevention/
19. 17 or 18
20. 14 or 19

Ovid HMIC

1 "health check*".af.
2 health checks/
3 (cardiovascular or vascular or heart or diabetes or stroke).af.
4 (screen* or risk).af.
5 3 AND 4
6 1 OR 2 or 5
7 cardiovascular adj3 prevention.tw.
8 (primary care or general practice or primary healthcare).tw
9 7 and 8
10 Cardiovascular diseases/ AND exp preventive medicine/
11 9 or 10
12 6 or 11

EBSCO CINAHL

S10 S1 OR S2 OR S9
S9 S5 OR S8
S8 S6 AND S7
S7 (MH "Preventive Health Care+")
S6 (MH "Cardiovascular Diseases+")
S5 S3 AND S4
S4 "primary care" or "general practice" or "primary healthcare"
S3 TX cardiovascular N3 prevention
S2 (diabetes N3 screen*) OR (cardiovascular N3 screen*) OR (population N2 screen*) OR (risk factor N3 screen*) OR (opportunistic N3 screen*) OR “medical check*” OR “general check*” OR “periodic health exam*” OR “annual exam*” OR "annual review*" OR NHSHC
S1 health check*

EBSCO Global Health

S10 S6 OR S19 OR S3 Limiters - Publication Year: 2016
S9 S7 AND S8
S8 DE "preventive medicine"
S7 DE "cardiovascular diseases"
S6 S4 AND S5
S5 "primary care" or "general practice" or "primary healthcare"
S4 TX cardiovascular N3 prevention
S3 S1 OR S2

	S2 (diabetes N3 screen*) OR (cardiovascular N3 screen*) OR (population N2 screen*) OR (risk factor N3 screen*) OR (opportunistic N3 screen*) OR “medical check*” OR “general check*” OR “periodic health exam*” OR “annual exam*” OR "annual review*" OR NHSHC S1 health check*
HDAS PsycInfo	1 "health check*".af. 2 PHYSICAL EXAMINATION/ 3 HEALTH SCREENING/ 4 "diabetes screen*".af 5 "cardiovascular screen*".af 6 "population screen*".af 7 ("opportunistic* screen*" OR "risk factor screen*").af 8 ("medical check*" OR "general check*" OR "periodic health exam*" OR "annual exam*" OR "annual review*" OR NHSHC).af 9 1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8 10 cardiovascular.ti,ab 11 prevention.ti,ab 12 10 AND 11 13 CARDIOVASCULAR DISORDERS/ 14 PREVENTIVE MEDICINE/ 15 13 AND 14 16 12 OR 15 17 9 OR 16
Web of Science, Science Citation Index	“health check*” OR “diabetes screen*” OR “cardiovascular screen*” OR “population screen*” OR “risk factor screen*” OR “Opportunistic screen*” OR “medical check*” OR “general check*” OR “periodic health exam*” OR “annual exam*” OR “annual review*” OR NHSHC OR (Cardiovascular NEAR/3 prevention) AND (“primary care” OR “general practice” OR “primary healthcare”) Limit to: England, Scotland, Wales, North Ireland
Cochrane Library (Wiley)	#1 "health check*" #2 (diabetes next/3 screen*) or (cardiovascular next/3 screen*) or (population next/2 screen*) or (opportunistic next/2 screen*) or ("risk factor" next/3 screen*) or "medical check*" or "general check*" or "periodic health exam*" or "annual exam*" or "annual review*" or NHSHC #3 cardiovascular adj3 prevention.tw. #4 (primary care or general practice or primary healthcare).tw #5 #3 and #4 #6 MeSH descriptor: [Cardiovascular Diseases] this term only #7 MeSH descriptor: [Primary Prevention] explode all trees #8 #6 and #7 #9 #5 or #8 #10 #1 or #2 or #9
NHS Evidence	“health check*” OR cardiovascular prevention primary care

TRIP database	“health check*” OR cardiovascular prevention primary care
Google Scholar	"nhs health check" cardiovascular “health check” cardiovascular prevention “primary care”
Google	"nhs health check" cardiovascular prevention “primary care” cardiovascular “health check”
Clinical trials.gov and ISRCDN registry	“health check”

Appendix 2 – Quality assessment of quantitative studies

Author, date	Study addressed a clearly focused issue	Use of an appropriate method / Randomisation (for RCTs)	Recruitment / comparability of study groups at baseline	Blinding (for RCTs)	Exposure measurement	Outcome measurement	Comparability of study groups during study (for RCTs)	Follow up (for longitudinal studies)	Confounding factors (for non-RCTs):	Applicability to England	Overall
'A picture of Health'[51]	⬤	•	•	n/a	•	•	•	n/a	•	•	Low
Alpsten 2015[40]	⬤	⬤	n/a	•	•	•	•	n/a	n/a	⬤	Medium
Artac 2013[9] *Primary..*	⬤	⬤	⬤	n/a	⬤	⬤	n/a	n/a	⬤	⬤	High
Artac 2013[13] *Uptake..*	⬤	⬤	⬤	n/a	⬤	⬤	n/a	n/a	⬤	⬤	High
Artac 2013[77] *Effective..*	⬤	⬤	⬤	n/a	⬤	⬤	n/a	⬤	⬤	⬤	Medium
Attwood 2015[14]	⬤	⬤	⬤	n/a	⬤	⬤	n/a	n/a	⬤	•	Medium
Baker 2013[82]	⬤	⬤	n/a	n/a	⬤	⬤	n/a	⬤	n/a	⬤	High
Baker 2014[58]	⬤	⬤	⬤	n/a	⬤	⬤	n/a	n/a	•	⬤	Medium
Baker 2015[57] *Percept..*	⬤	⬤	⬤	n/a	n/a	⬤	n/a	n/a	•	•	Low
Baker 2015[15] *A process..*	⬤	⬤	⬤	n/a	⬤	⬤	n/a	n/a	•	⬤	Medium
Caley 2014[74]	⬤	⬤	⬤	n/a	⬤	⬤	n/a	⬤	⬤	⬤	High
Carter 2015[16]	⬤	⬤	⬤	n/a	⬤	⬤	n/a	n/a	⬤	⬤	Medium
Chang 2015[10]	⬤	⬤	⬤	n/a	⬤	⬤	n/a	n/a	⬤	⬤	High
Chang 2016[72]	⬤	⬤	⬤	n/a	⬤	⬤	n/a	⬤	⬤	⬤	High
Clark 2014[79]	⬤	⬤	•	n/a	⬤	⬤	n/a	⬤	•	•	Low

Author, date	Study addressed a clearly focused issue	Use of an appropriate method / Randomisation (for RCTs)	Recruitment / comparability of study groups at baseline	Blinding (for RCTs)	Exposure measurement	Outcome measurement	Comparability of study groups during study (for RCTs)	Follow up (for longitudinal studies)	Confounding factors (for non-RCTs):	Applicability to England	Overall
Cochrane 2012[78]	●	●	●	n/a	●	●	n/a	●	●	●	Medium
Cochrane 2013[17]	●	●	●	n/a	●	●	n/a	n/a	●	●	High
Coffee 2015[36]	●	•	•	n/a	●	●	n/a	n/a	•	•	Low
Coffey 2014[18]	●	●	●	n/a	●	●	n/a	n/a	●	●	Medium
Coghill 2016[38]	●	•	•	n/a	•	•	n/a	n/a	•	●	Low
Cook 2016[19]	●	•	•	n/a	●	●	n/a	n/a	•	●	Low
Corlett 2015[26]	●	●	•	n/a	●	●	n/a	n/a	•	•	Medium
Cowper 2013[67]	●	•	•	n/a	•	•	•	n/a	•	•	Low
Crossan 2016[81]	●	●	n/a	n/a	●	●	n/a	●	n/a	●	High
Dalton 2011[20]	●	●	●	n/a	●	●	n/a	n/a	●	●	High
Forster 2015[73] ***Do…***	●	●	●	n/a	●	●	n/a	n/a	●	●	High
Forster 2015[11] ***Estimat…***	●	●	●	n/a	●	•	n/a	n/a	●	●	High
Hooper 2014[37]	●	●	●	n/a	●	●	n/a	n/a	●	●	Medium
Jamet 2014[75]	●	●	●	n/a	●	●	n/a	n/a	●	●	High
Krska 2015[52] ***Views and.***	●	●	•	n/a	●	●	n/a	n/a	●	●	Medium

Author, date	Study addressed a clearly focused issue	Use of an appropriate method / Randomisation (for RCTs)	Recruitment / comparability of study groups at baseline	Blinding (for RCTs)	Exposure measurement	Outcome measurement	Comparability of study groups during study (for RCTs)	Follow up (for longitudinal studies)	Confounding factors (for non-RCTs):	Applicability to England	Overall
Krska 2015[21] ***Implement..***	●	●	●	n/a	●	●	n/a	n/a	•	●	Medium
Kumar 2011[22]	●	●	•	n/a	●	●	n/a	n/a	•	•	Low
Kypridemos 2016[80]	●	●	n/a	n/a	●	●	n/a	●	n/a	●	High
Lambert 2016[76]	●	●	●	n/a	●	●	n/a	n/a	●	●	Medium
LGA – East Riding 2015[68]	●	•	•	n/a	•	•	•	n/a	•	•	Low
Loo 2011[64]	●	●	●	n/a	n/a	n/a	n/a	n/a	•	●	Medium
McDermott 2016[41]	●	●	●	●	●	●	●	●	n/a	●	High
Nicholas 2013[54]	●	●	●	n/a	n/a	●	n/a	n/a	●	●	Medium
Roberts 2016[23]	●	n/a	•	n/a	●	●	n/a	n/a	•	●	Medium
Robson 2015[24]	●	●	●	n/a	●	●	n/a	n/a	●	●	Medium
Robson 2016[12]	●	●	●	n/a	●	●	n/a	n/a	●	●	High
Sallis 2016[39]	●	●	●	•	●	●	●	n/a	n/a	●	Medium
Taylor 2012[49]	●	●	•	n/a	●	●	n/a	n/a	•	●	Medium
Trivedy 2016[29]	●	●	•	n/a	●	●	n/a	n/a	•	•	Low
Usher-Smith 2015[25]	●	●	●	n/a	●	●	n/a	n/a	•	•	Low
Visram 2014[30]	●	●	•	n/a	●	●	n/a	n/a	•	●	Medium

Author, date	Study addressed a clearly focused issue	Use of an appropriate method / Randomisation (for RCTs)	Recruitment / comparability of study groups at baseline	Blinding (for RCTs)	Exposure measurement	Outcome measurement	Comparability of study groups during study (for RCTs)	Follow up (for longitudinal studies)	Confounding factors (for non-RCTs):	Applicability to England	Overall
Woringer 2015[31]	●	●	●	n/a	●	●	n/a	n/a	•	●	Medium

• Low ● Medium ● High

Appendix 3 – Quality assessment of qualitative studies

Author and date	Study addressed a clearly focused issue	Appropriateness of qualitative method	Design	Recruitment	Consideration of relationship between research and participants	Ethical issues	Rigor of data analysis	Clarity of statement of findings	Overall
Alford 2010[69]	●	●	●	•	•	•	•	●	Medium
Baker 2015[57]	●	●	●	•	•	●	●	●	Medium
Baker 2014[58]	●	●	●	●	n/a	•	●	●	High
Burgess 2015[48]	●	●	●	●	•	●	●	●	Medium
Chipchase 2011[70]	●	●	●	●	●	●	●	●	High
Corlett 2015[26]	●	●	●	●	•	●	●	●	Medium
Cowper 2013[67]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Low
Crabtree 2010[63]	●	●	•	•	•	●	•	●	Medium
Ellis 2015[53]	●	●	●	●	●	●	●	●	High
Graley 2011[61]	●	●	●	●	n/a	●	●	●	High
Greenwich 2011[28]	●	●	●	●	•	•	•	●	Medium
Ismail and Atkin 2015[44]	●	●	●	●	●	●	●	●	High
Ismail and Kelly 2015[62]	●	●	●	●	●	●	●	●	High
Jenkinson 2015[47]	●	●	●	●	•	●	●	●	High
Krska 2015[60] *Views of…*	●	●	●	●	n/a	●	●	●	Medium

Author and date	Study addressed a clearly focused issue	Appropriateness of qualitative method	Design	Recruitment	Consideration of relationship between research and participants	Ethical issues	Rigor of data analysis	Clarity of statement of findings	Overall
LGA - Buckinghamshire 2015[27]	•	•	n/a	n/a	n/a	n/a	n/a	n/a	Low
LGA East Riding 2015[68]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Low
LGA – Stoke-on-Trent 2015[42]	•	•	n/a	n/a	n/a	n/a	n/a	n/a	Low
McDermott 2016[41]	●	●	●	•	•	●	●	●	Medium
McNaughton 2011[65]	●	●	●	●	•	●	●	●	High
McNaughton 2015[71]	●	●	●	●	•	●	●	●	High
Nicholas 2013[54]	●	●	●	●	n/a	•	●	●	High
Oswald 2010[50]	●	●	●	●	•	●	●	●	Medium
Perry 2014[45]	●	●	●	●	•	•	●	●	High
Research Works 2013[59]	●	●	●	●	•	•	•	●	Medium
Riley 2015[66] ***Experiences..***	●	●	●	●	●	●	●	●	High
Riley 2015[43] ***Provision of..***	●	●	●	●	●	●	●	●	High
Shaw 2015[56]	●	●	●	●	•	●	●	●	High
Shaw 2016[55]	●	●	●	●	•	●	●	●	High
Strutt 2011[46]	●	●	●	●	●	●	●	●	High
Taylor 2012[49]	●	●	●	●	•	●	●	●	High

Author and date	Study addressed a clearly focused issue	Appropriateness of qualitative method	Design	Recruitment	Consideration of relationship between research and participants	Ethical issues	Rigor of data analysis	Clarity of statement of findings	Overall
Visram 2015[30]	●	●	●	●	•	●	●	●	High

• Low ● Medium ● High