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Systematic review of the effectiveness of Health Equity Audits: existing evidence and call for further research

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Systematic review of the effectiveness of Health Equity Audits: existing evidence and call for further research

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Manuscript word count: 3219
Number of figures: 1
Number of tables: 3
Supplement materials: 1 table

1   **Abstract**

2   *Objectives:* The purpose of this systematic review is to explore whether health

3   equity audits (HEA) are effective in improving the equity of service provision and

4   reducing health inequalities.

5   *Design:* Three databases (Ovid Medline, Embase, Web of Science) and grey

6   literature (Opengrey, Google Scholar) were systematically searched for articles

7   published after 2000, reporting on the effectiveness of health equity audits. Title

8   and abstracts were screened according to an eligibility criteria to identify studies

9   which included a full audit cycle (e.g. initial equity analysis, service changes and

10   review). Data were extracted from studies meeting the eligibility criteria after full

11   text review and risk of bias assessed using the ROBINS-I tool. The study was

12   registered prior to its conduction in PROSPERO (CRD 42020218642).

13   *Results:* The search strategy identified 596 articles. Three HEAs were included from

14   one peer-reviewed journal article, two published reports and one unpublished

15   report. This included 102,851 participants and over 148 practices/pharmacies

16   (information was not recorded for all records). One study reviewed health equity

17   impacts of HEA implementation in key indicators for coronary heart disease, type

18   2 diabetes, and chronic obstructive pulmonary disease. Two HEAs explored Stop

19   Smoking Services on program access and equity. All reported some degree of

20   reduction in health inequalities compared to prior HEA implementation. However,

21   impact of HEA implementation compared to other concurrent programmes and

22   initiatives was unclear. All included studies were judged to have moderate to

23   serious risk of bias.

24   *Conclusions*

25   There is an urgent need to identify effective interventions to address health

26   inequalities. While HEAs are recommended, we only identified limited weak

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1 evidence to support their use. More evidence is needed to explore whether HEA

2 implementation can reduce inequalities and which factors are influencing

3 effectiveness.

4

5 **Strengths and limitations of this study**

6 - This systematic review represents, to our knowledge, the most

7 comprehensive examination of the evidence on the effectiveness of

8 health equity audits (HEA) used to reduce inequalities in service provision

9 and clinical outcomes

10 - A broad, prospectively published rigorous search strategy (registered in

11 PROSPERO) - that included non-English articles and grey literature – was

12 used.

13 - All included studies were judged to be of moderate or serious risk of bias.

14 - The study design of the included studies meant that we were unable to

15 assess the impact of concurrent programmes of work.

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17 **Keywords**

18 Health Equity Audits, Equity, Public Health, Intervention

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1 **Introduction**

2 The COVID-19 pandemic has exposed and exacerbated structural, longstanding

3 and unjust drivers of health inequalities, including economic disparities,

4 geographical deprivation, occupational risks and systematic racism.[1] In the United

5 Kingdom, the most deprived areas of the country saw a 118% increased death rate

6 from COVID-19 compared with the least deprived.[2] Likewise, there have been

7 striking inequalities across minority ethnic groups with people from Pakistan and

8 Bangladesh living in the UK having higher death rates in both the first and second

9 waves.[3] However, the inequalities directly related to COVID-19 are likely to be

10 overshadowed by the inequalities across, for example, socio-economic, ethnic and

11 gender strata that will indirectly arise from the pandemic's impact on education,

12 income, welfare, investment, social care and health care.[1] COVID-19 has also

13 compounded existing healthcare inequalities. During 2019-20, the most deprived

14 decile had 7% fewer elective admissions than the least, but 51% more emergency

15 admissions.[4] Whilst there is now a significant body of data and research describing

16 the problem of health inequalities, there has limited research and data showing

17 what interventions could reduce them.

18

19 In response to the emerging inequalities related to COVID-19, Public Health

20 England recommended the use of Health Equity Audits (HEA).[5] HEA is a tool to

21 measure and address inequalities in the provision of and access to services, related

22 health outcomes and determinants of health between different population groups

23 in order to address inequalities by providing evidence to show whether local health

24 needs are being met, changing service delivery practices and ensuring resources

25 are distributed equitably. Compared to other countries the UK has been the

26 predominant implementer of HEAs, although they have also been used in other

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1   countries (e.g. Canada[6], Iran[7] and Italy[8]). Examples include an equity audit of the

2   Health Check programme which found lower uptake in men - especially younger

3   men in deprived areas, and those on the learning disability or severe mental illness

4   register.[9] Furthermore, an equity audit on a diabetic retinopathy screening

5   programme, found that screening was lower in more deprived areas.[10]

6

7   HEAs are not a new initiative. In 2002, as part of the UK national health inequalities

8   strategy, HEAs were recommended for all local health systems to address health

9   inequalities. At that time the use of them became widespread, until 2010 when a

10   change in the UK Government led to the cessation of many health inequalities

11   initiatives, in response to the 2008 recession and financial constraint. Their use was

12   further reduced after significant health care reforms in England in 2013.[11,12] More

13   recently, a number of equity audits have been undertaken in local health systems

14   and their utilisation is likely to continue expanding in response to the COVID-19

15   pandemic.

16

17   Despite the extensive use of HEAs in the past and current recommendations, there

18   is little research on their effectiveness or on the aspects that could make HEAs

19   successful. Therefore, the aim of this study was to assess the effectiveness of HEAs

20   in reducing inequalities and explore factors influencing effectiveness. Importantly

21   we focus on studies with a full audit cycle; those that assess existing inequalities,

22   implement changes/interventions and re-assess inequalities, rather than those

23   studies which only describe the inequalities and make recommendations.

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3   1   **Methods**
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6   2   We conducted a systematic review in accordance with established methodology[13]
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8   3   and reported in line with the Preferred Reporting for Systematic Reviews and
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10   4   Meta-analyses (PRISMA) statement.[14] This review was prospectively registered and
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12   5   published with PROSPERO (CRD 42020218642).
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16   7   *Search strategy and selection criteria*
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19   8   Three electronic databases (Ovid Medline, Embase, Web of Science) and grey
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21   9   literature (Opengrey, Google Scholar) were systematically searched from 2000 to
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23   10   February 2021 drawing upon existing inequality related search terms. Search terms
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25   11   included those related to audits and inequity (e.g. equity, access), see
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27   12   **supplementary table 1**. We applied forward and backward screening of all full text
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29   13   publications included and relevant publications (e.g. reviews and reports). After
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31   14   removing duplicate records, abstracts and titles were double-screened according
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33   15   to the selection criteria by two researchers (KvD, FD) using the software Rayyan.
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35   16   Discrepancies were resolved by a third researcher (JF). Inclusion criteria were i)
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37   17   reporting on audits of health equity, ii) focused on health settings, iii) assessing the
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39   18   effectiveness of the audit on reducing health inequity, iv) any study design and v)
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41   19   articles in English, Dutch, German, French and Spanish. Studies were excluded if
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43   20   they were i) published before 2000, ii) solely described the audit protocol and iii)
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45   21   did not assess the effectiveness of the audit, but only the results of the initial equity
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47   22   assessment. All full texts for studies that satisfied the selection criteria were
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49   23   retrieved and double-screened. Any divergences between authors on study
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51   24   eligibility were discussed until consensus was reached.
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1 Data from included studies were independently extracted by two researchers (KvD,

2 FD). A third researcher resolved any conflicts (CN). The following information was

3 extracted from each study: first author, year of publication, country, aim, study

4 design, data source, population characteristics (e.g. size), inequality measures (e.g.

5 gender, socioeconomic), health service changes, time of data collection, summary

6 of audit performed, and main findings. Terms/categories conflating race and

7 ethnicity are used throughout the paper as a consequence of being commonly used

8 in governmental designation and data collection, but we acknowledge that race

9 and ethnicity are different social concepts. Study authors were contacted for more

10 information where relevant.

11

12 *Quality Assessment*

13 Two authors (KvD, FD) independently assessed the quality of individual studies

14 using the ROBINS-I tool, which assess the risk of bias across seven domains

15 (https://www.riskofbias.info/).[16] Discrepancies between authors were adjudicated

16 by two authors (JF, CN). Due to the small number of studies it was deemed

17 inappropriate to perform a GRADE assessment.

18

19 *Synthesis*

20 The conduction of meta-analyses or the assessment of publication bias was

21 deemed inappropriate due to the limited number of studies and data

22 heterogeneity. Therefore, the studies were synthesised narratively.

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3   1   **Results**
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6   2   After removal of duplicates our search identified 596 records. Fifteen records were
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8   3   reviewed in full text and three records were included in the final review. An
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10   4   additional HEA report was identified through contact with an author. A flow
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12   5   diagram of the screening and selection process can be found in **figure 1**. We
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14   6   included two HEAs[15,17,18] reviewing Stop Smoking Services on program access and
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16   7   equity arising from two published and one unpublished report, and one peer-
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18   8   reviewed intervention study[19] reviewing health equity impacts of HEA
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20   9   implementation in key indicators for coronary heart disease (CHD), type 2 diabetes
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22   10   (DMT2), and chronic obstructive pulmonary disease (COPD) (**Table 1**). All included
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24   11   records were conducted in the United Kingdom and utilised a sequential audit
25
26   12   design. Across all included HEA there were participants from 148 general practices
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28   13   in London (Newham, City and Hackney, Tower Hamlets) and from general practices
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30   14   and pharmacies participating in the two county Stop Smoking Service programs in
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32   15   Durham and Lewisham, including a total of 102,851 individuals. Data was collected
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34   16   between 2007 and 2017. The included HEAs assessed various inequalities
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36   17   (including inequalities in ethnicity, gender, age, socio-economic group, and
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38   18   location) in service delivery, service access and health outcomes.[15,17,19,18]
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44   20   The majority of published literature on HEAs were one cycle HEA reports that did
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46   21   not assess HEA effectiveness; we identified 56 records which reported only one
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48   22   HEA cycle from grey literature (n=43) and electronic databases (n=13). The majority
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50   23   of these (n=23) were conducted by local governments, local health care systems
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52   24   (n=21), or combinations of the former (n=4). A minority were carried out by
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54   25   hospitals (n=3), dental services (n=3) or by national health care organisations (n=2).
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56   26   A wide range of services were audited, but the most common were smoking
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1   cessation services (n=7), cancer screening (n=7) and health promotion

2   programmes (NHS Health Checks) (n=6).

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4   *Health Equity Audit implementation*

5   Badrick *et al.* implemented and evaluated HEAs in 38 practises in Tower Hamlets

6   Primary Care Trusts (PCT) which included facilitation sessions encouraging change,

7   identifying areas of expressed difficulty and engaging teams in finding solutions. The

8   intervention tracked four key indicators (blood pressure and haemoglobin A1c levels

9   in DMT2, % smoking in COPD and cholesterol levels in CHD). Changes in performance

10   over time were then examined for the intervention PCTs compared to neighbouring

11   non-intervention PCTs (n=110).[19] Roe *et al.*[15,18] and Pringle *et al.*[17] used a before-

12   and-after comparison rather than the inclusion of a comparison site. Roe et al. [15,18]

13   assessed the Durham NHS Stop Smoking Service's impact on health inequalities.

14   They explored the rate of access and rate of quitters providing a comparison with

15   audits conducted in 2007, 2014 and 2018. Slope and Relative Indices of Inequality

16   were calculated by the socio-economic dimension to inequalities in health.[15,18]

17   Similarly, Pringle *et al.* compared differences in access and quitting success rates by

18   through the Lewisham NHS Stop Smoking Service between 2000-2005 (first HEA)

19   and 2007/8-2011/12 (second HEA).[17]

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3   1   **Table 1: Study characteristics**
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First author, year and country	Aim	Study design	Data sources	Population	Inequality measures (e.g. SES, gender)	Resulting recommendations for service delivery changes	Time between data collection
Badrick, E. *et al.* (2014), United Kingdom[19]	The main aim of the study was to describe the development and implementation of practise equity audits, and an evaluation of changing inequalities over time for three project conditions in inner east London.	Sequential audits	Routine clinical and demographic data were collected from practice computer databases, using Morbidity Information Query and Export Syntax (MIQUEST) software and EMIS Web (Egton Medical Information Systems Ltd, 2010) from 148 of the 151 general practices in the three areas of London.	Three areas of London (Newham, City and Hackney and Tower Hamlets) with a combined GP-registered population of 829,710 in mid-2008.	Association between self-reported ethnicity, gender, age-band and four key indicators (cholesterol levels in CHD, blood pressure and haemoglobin A1c levels in diabetes and % smoking in COPD).	38 practices in the intervention arm (Tower Hamlets) received two health equity audits and facilitated time with a cardiovascular nurse specialist to review their results. The study authors recommended prioritizing monitoring inequalities by age, gender, and ethnic group; balancing rigorous, complete reports with simple, brief reports for reaching increased practice audiences; and implementation of HEA facilitation tailored to practice setting and needs to promote changes in clinical performance.	Cross-sectional data were extracted in April of every year between 2007 and 2010 for all patients on the CHD, diabetes and COPD registers.
Pringle, E. (2013), United Kingdom[17]	This health equity audit looks at the use and success of Lewisham's Stop Smoking Service from April 2007 to March 2012 by age, gender, ethnicity, socioeconomic group and location. In addition, the views of a small number of service users and advisers were sought on factors that may affect the use and success of the service.	Sequential audits	Smoking prevalence data is available from the Integrated Household Survey (IHS) which combines answers from a number of Office of National Statistics (ONS) surveys containing questions about smoking. Interviews with 15 smokers and 6 advisers. Quits dates set from April 1st 2007 to March 31st 2012 were extracted from Quit Manager. Smoking data is self-reported.	Lewisham residents accessing Stop Smoking services.	Association between age, gender, ethnicity, socioeconomic group, and location and service access rates and successful smoking cessation rates.	The HEA recommended adjusting marketing messages, targeting specific underrepresented groups, collaborating with African American churches to implement Stop Smoking Services, exploring use of innovative technology especially with young smokers, reallocating level 3 advisers to the underrepresented groups who benefit most from their counseling, and undertaking further research on groups not examined in the HEA	April 2007 to March 2012.

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| Roe, K. (2018), United Kingdom[15]

Roe, K. et al (2014), United Kingdom[18] | The purpose of these reports is to assess whether the County Durham NHS Stop Smoking Service is having an impact on health inequalities. It aims to identify how services are delivered relative to the deprivation levels across County Durham and provide analysis by the two Clinical Commissioning Groups within its borders. The reports analyse the rate of access and rate of quitters. This Health Equity Audit (HEA) also provides a comparison with previous audits conducted in 2007 and 2014. | Sequential audits | Source of the data is Durham County Council Public Health Intelligence Team (DCCPHIT). The raw data for the 2014 and 2018 HEAs is taken from Quit manager; a Stop Smoking Service web-based patient data management system. The 2007 data was collated from 5 different reports from localities within Co. Durham and the source of the quit dates is not stated. | 2014 – Durham residents accessing Stop Smoking services, 23,350 used records

2018 – Durham residents accessing Stop Smoking Services, 9,240 used records | Deprivation was measured at small area level and the Relative Index of Inequality (Rii) and the Slope Index of Inequality (Sii) were used to compare inequalities over time. | The HEA recommended targeting specific groups of people including routine and manual workers, Gypsy Roma Travellers (GRT), pregnant women, people with a diagnosed mental illness, long term conditions and people who live in the 30% most deprived areas. | 2014 - January 2011 to March 2013

2018 - April 2015 to March 2017 |

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1   *Changes in inequalities during audit period*

2   All HEAs reported baseline inequitable outcomes in physical health outcomes[19],

3   health behaviours, and access to or utilisation of health services by age, gender,

4   ethnicity, socio-economic status and location.[15,17,18] During the audit period,

5   some degree of reduced inequality was observed in all records compared to the

6   comparison group[19] or prior HEA data (**Table 2**).[15,17,18] In Tower Hamlets' PCTs,

7   reductions in gender and age group differences were found in DMT2 and CHD.

8   Yet, whilst al ethnic groups showed improvement over the years of HEA

9   implementation, there was no reduction in difference between ethnic groups.

10   Furthermore, some groups showed a widening of inequalities. For example, in

11   the CHD register South Asians increased from being 1.9 (1.6-2.2) times more

12   likely than White groups to have cholesterol levels < 4 mmol/L in 2007 to being

13   to 2.4 (2.0-2.8) more likely in 2010.

14

15   Similarly, smoking rates in COPD indicate increased disparity between White and

16   other ethnic groups in 2010.[19] The audit of the Lewisham Stop Smoking Service

17   found an increase in service access by black and ethnic minority groups as well

18   as by people from deprived areas (2007/2008 – 2011/12) as compared to prior

19   audits (2000-2005). However, the HEA report also identified several population

20   groups still underrepresented in access rates (e.g. younger smokers, older

21   women, Indian men, Chinese men, white Irish men and black African smokers)

22   and an overall lack of equity in program access and success rates.[17] The 2014 Stop

23   Smoking Service HEA in County Durham found a reduction in health inequalities

24   compared to prior audits (2007) as demonstrated by a consistent increase in the

25   relative index of inequality, the size of the gap between the least and the most

26   deprived areas expressed as the average rate over all wards, for access and

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1   smoking quit rates. Furthermore, a reduction in access rate to quit rate was

2   observed – gap of 69% to 16% in 2007 and 2014 respectively.[15] Reductions in the

3   equity gaps were observed again in the 2018 HEA compared to the 2007 and

4   2014 HEAs.[18]

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7   *Study quality assessment*

8   Study quality assessment was conducted using the ROBINS-I tool. Each included

9   record was found to have a serious or moderate risk of bias in the various

10   categories assessed (**Table 3**). Confounding may have influenced the results of

11   the reports due to the inadequacy of study designs to differentiate effectiveness

12   of HEA implementation from simultaneously implemented local improvement

13   initiatives, the "noise" of a changing NHS or other societal changes that may have

14   led to reduced or increased inequalities. The potential selection of health

15   practises that already established an equity-focus may have resulted in selection

16   bias, meaning that results may not be generalisable to most areas in the United

17   Kingdom. Likewise, as included studies have solely been performed in the UK

18   results may not be applicable to other countries.

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1 **Table 2: Study results**

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First author, year	Summary of audit	Main findings
Badrick, E. *et al.* (2014), United Kingdom[19]	The audit aimed to reduce health inequalities by ethnicity, age and gender in the management of three common chronic diseases (coronary heart disease, type 2 diabetes mellitus and chronic obstructive pulmonary disease).	Baseline inequalities in each condition across the three east London areas were identified. At a crude level, performance in cholesterol, BP and HbA1c improved in all areas over time. All ethnic groups showed improvement, but there was no evidence of a reduction in differences between ethnic groups. Over the three-year study, a reduction in health inequalities was measured in some groups (such as patients over 85 years with diabetes) with only slight reductions in, continued, or worsened inequalities observed in most other groups. Compared to the neighbouring areas, Tower Hamlets (receiving the intervention) had smaller improvement levels in CHD, higher absolute changes in both diabetes measures, and small but similar changes in rates of smoking in COPD patients. The study reported positive GP responses to the intervention providing assistance in conducting/interpreting HEAs. Reductions in gender and age group differences were noted in DMT2 and CHD.
Pringle, E. (2013), United Kingdom[17]	This health equity audit looks at the use and success of Lewisham's Stop Smoking Service from April 2007 to March 2012 by age, gender, ethnicity, socioeconomic group and location. In addition, the views of a small number of service users and advisers were sought on factors that may affect the use and success of the service.	Since the last equity audit more smokers from black and ethnic minority groups were using the service. In addition, this health equity audit shows that over the last five years the Stop Smoking Service was reaching an increasing number of people from deprived areas. More quit dates were set by smokers from deprived areas than from less deprived areas. Overall, this health equity audit shows that there was not equity across Lewisham's smokers in the use and success of Lewisham's Stop Smoking Service in terms of the need for stop smoking services. The population groups that seemed to be underrepresented in their use of the service were: younger smokers, older women, Indian men, Chinese men, white Irish men and black African smokers. Additionally, smokers from more deprived areas, routine and manual workers, students and unemployed smokers were less likely to successfully quit smoking.
Roe, K. *et al* (2014), United Kingdom[15] Roe, K. (2018), United Kingdom[18]	This HEA assesses the distribution of the Durham Stop Smoking Service (SSS) and its effectiveness relative to deprivation levels within County Durham and the two Clinical Commissioning Groups (CCGs) within its borders.	2014 - Compared to the results of the 2007 HEA there has been an increase in the relative index of inequality for access and quit rates as well as a reduction in the difference between the two, indicating that the County Durham SSS is contributing to a reduction in health inequalities. 2018 - The County Durham SSS has been successful in contributing to a reduction in the equity gap, seeing a consistent increase in the relative index of inequality for access and quit rates. This was true for services accessed in pharmacies, primary care, and specialist Stop Smoking Service. The audit found a higher rate of pregnant smokers in more deprived areas, but also a higher quit rate for pregnant smokers who accessed the services in more deprived areas. This indicates that the County Durham Stop Smoking Service is contributing to a reduction in health inequalities.

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Table 3: Risk of bias – ROBINS-I tool

Study	Bias due to confounding	Bias due to selection of organisations into study	Bias in classification of interventions	Bias due to deviations from intended interventions	Bias due to missing data	Bias in measurement of outcomes	Bias in selection of reported result
Badrick, E. *et al.* (2014), United Kingdom[19]	Serious	Serious	Low	No information	Low	Moderate	Low
Pringle, E. (2013), United Kingdom[17]	Serious	Serious	Low	No information	Moderate	Moderate	Moderate
Roe, K. *et al* (2014), United Kingdom[15]	Serious	Serious	Low	No information	Moderate	Moderate	Low
Roe, K. (2018), United Kingdom[18]							

3

4 **Discussion**

5 This systematic review represents, to our knowledge, the most comprehensive

6 examination of the evidence on the effectiveness of health equity audits. We

7 identified three HEAs[15,17, 19, 18] based in health care or public health settings with

8 serious to moderate risk of bias. All showed the presence of baseline inequalities

9 and found reductions in health inequalities across various strata in the subsequent

10 years of initial HEAs. Only one study used comparison sites.[19]

11

12 *Meaning of the results*

13 There has been little research undertaken to explore the effectiveness of HEAs,

14 despite them being widely used in the UK during the 2000s and currently being

15 recommended by PHE.[5,11] This may be because of methodological challenges in

16 assessing effectiveness or an assumption that they are the right strategy. The

17 majority of HEAs we identified only undertook one cycle, suggesting that

18 practitioners tend to use HEAs as a tool to assess the existing inequalities within a

19 service rather than a tool to record or reduce inequalities over time. Although HEAs

20 may be useful at identifying areas of health inequity or greater need, without

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3   1   repeating the data collection it is not possible to say whether the HEA resulted in
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6   2   any meaningful service change or targeted intervention, let alone whether this
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8   3   resulted in a reduction in inequities.
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13   5   We only identified three HEAs that completed the audit cycle to assess if the
14
15   6   recommendations and changes resulted in a reduction in inequalities over time.
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17   7   The lack of peer reviewed research assessing HEA effectiveness may reflect the lack
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19   8   of health care and public health services to evaluate the impact and effectiveness
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21   9   of decisions, with a much greater focus on addressing problems. It may also reflect
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24   10   difficulties presented by frequently changing priorities and frequent turnover of
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26   11   staff. Furthermore, a reluctance to publish HEAs may exists as they could cause
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28   12   reputational damage to organisations or even a concern that the findings may
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31   13   leave the organisation open to legal challenge under equality legislation.
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33   14   Qualitative research around clinical audit has shown that audit is seen as "a time-
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35   15   consuming, additional chore and a managerially driven exercise"[20] that is
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38   16   hampered by a lack of resources, lack of expertise, lack of audit plan, and
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40   17   organisational impediments.[21] Organisational change and austerity measures have
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42   18   meant that local authority Public Health teams have faced increased
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44   19   responsibilities and real-terms funding cuts.[22]
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46   20
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48   21   The single peer-reviewed article was undertaken in a number of general practices
49
50   22   in London. The authors found that it was possible to undertake equity analysis in
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53   23   general practice using routine data. While all of the included studies identified
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55   24   some reductions in health inequalities during the HEA process, only Badrick *et al.*
56
57   25   had a suitable comparison group. Furthermore, in the absence of randomised
58
59   26   intervention studies and further high-quality observational studies, attributing
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2

1   changes in equities to HEAs based on the included reports is inappropriate due to

2   the potential confounding and biases introduced. No evidence was found to

3   suggest that HEAs result in harm or should not be undertaken in the absence of

4   further evidence.

5

6   *Comparison with existing literature*

7   Aspinall and Jacobson[23] undertook a baseline survey in 2004 of practitioners'

8   experiences across England in the first HEA implementation year of undertaking

9   nationally mandated. The authors found that national target-setting, national

10   guidance on self-assessment and the inclusion of HEAs within a ratings system

11   influenced whether the process and, in a significant minority, implementation of

12   the findings of HEAs became part of healthcare systems' routine business.[23]

13

14   There is a sizable body of research looking at the effectiveness of clinical audits

15   (i.e. non-equity focused). For example, a Cochrane review examined the impact

16   of audit and feedback on professional behaviour. The authors identified 140

17   randomised controlled trials and found that audit and feedback has small but

18   important improvements in professionals behaviour.[24] Similarly there is

19   evidence for the use of quality improvement methods with some consideration

20   to equity. Lu *et al.* found that about a third of quality improvement projects in

21   diabetes care included an equity perspective.[25]

22

23   However, these findings are not necessarily transferable to HEAs as clinical

24   audits and quality improvement programmes are generally undertaken at a

25   smaller organisation-level and focus on adherence to evidence-based best

26   practice guidance. HEAs are generally implemented at a higher organisational

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1 level, such as across a local government level or health care system, and it is not

2 always clear what actions are needed to reduce the inequalities gap. To illustrate,

3 Regmi *et al.* undertook a review of factors that support the reduction of

4 inequalities in local health care systems in the UK and found that there was little

5 evidence that local health care arrangements alone were effective in reducing

6 health inequalities.[26]

7

8 However, there are a number of principles drawn from clinical audit and quality

9 improvement methods which may be effective in HEAs. Grimshaw *et al.* argue

10 for an implementation laboratory where there is a continual cycle of testing

11 different interventions and implementation strategies through audit and

12 feedback which may be effective in reducing health inequalities through HEA

13 implementation.[27]

14

15   *Strengths and limitations*

16 Our research used a prospectively published rigorous systematic review strategy

17 that included non-English articles and grey literature. We had a robust process

18 for screening titles/abstracts and full-texts, extracting data and determining the

19 risk of bias using a validated tool for quality assessment. However, only one HEA

20 with multiple years of data was found in the peer reviewed literature and all

21 reports included were of low to moderate quality. It is likely that there are a

22 number of HEAs not in the public domain. Yet, based on our research, most of

23 these are likely to only contain one HEA cycle. There may be a publication bias

24 towards studies reporting positive results (i.e. reductions in inequalities).

25 Importantly, as the reports included are sequential audits rather than well-

26 designed randomised studies, they may not have been equipped to differentiate

4

1   HEA effectiveness from simultaneously implemented local improvement

2   initiatives, the "noise" of a changing NHS or other societal changes that may have

3   led to reduced or increased inequalities.

4

5   *Implications for research and policy*

6   While the efforts to address inequalities in health care are not new, the impacts of

7   the pandemic have starkly delineated the imperative to do so. There is an urgent

8   need to find effective interventions to reduce health inequalities. Public Health

9   England recommends the use of HEAs and has published accompanying guidance

10   describing step-by-step processes of HEA implementation.[5] Yet, thus far, it is

11   unclear whether this has been supported by scientific evidence. It is likely that

12   there are key factors that will make HEA undertaking effective in inequality

13   reduction and factors that will not. For example, previous research has found that

14   audits tend to be more effective when feedback is given by respected colleagues,

15   there is frequent data presentation, both goals and action-plans are included and

16   the recipients are non-physicians.[28] Therefore, further well-designed studies with

17   suitable comparison groups are essential to further inform on the effectiveness of

18   HEAs. Process evaluation are needed to understand the factors that optimise HEA

19   effectiveness and implementation processes. Decision-makers may be more likely

20   to change behaviour based on case examples of how HEAs have been used to

21   reduce inequalities.

22

23   While there is limited evidence for use of HEAs, we do believe that they should still

24   be used until further research is undertaken because we did not find any evidence

25   of harm and there is a logical rationale by which they could reduce inequalities.

26   The priority for policy makers is evaluating ongoing HEA and generating the

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3   1   evidence base to understand if they work and, if so, what makes them most
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5   2   effective.
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10   4   **Conclusion**
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12   5   Research and practice demonstrate that meaningfully impacting inequalities in both health
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14   6   outcomes and healthcare delivery is a complicated, challenging task faced by already
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16   7   overburdened and under-resourced health systems. Whilst HEA implementation is
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18   8   currently recommended, evidence for their effectiveness in reducing inequalities is sparse.
19
20   9   This evidence gap requires action. Efforts to reduce inequalities must neither be avoided
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22   10   nor delayed because of their complicated nature; nor should they be undertaken
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24   11   haphazardly without much needed, evidence-based guidelines. Further research is needed
25
26   12   to assess their effectiveness and understand what makes them effective (or not).
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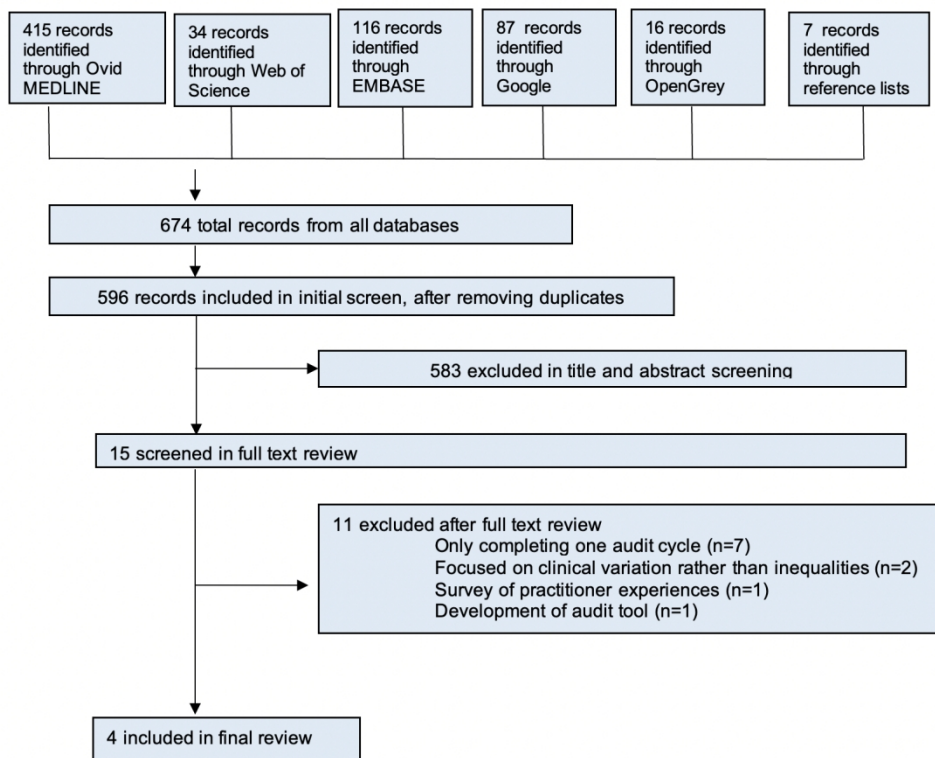57
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Figure 1: Study selection process

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Figure 1: Study selection process

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Supplement Material to Systematic Review on the Effectiveness of Health Equity Audits: existing evidence and call for further research.

Supplementary Table 1: Search Strategy

Database	Search Strategy
Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R)	(Audit*).ti. or exp *management audit/ or exp *clinical audit/ AND (Health* adj3 (equit* or inequit* or equalit* or inequalit* or disparit* or access* or inaccess*)).ti. or (socioeconomic).ti. or exp *health services accessibility/ or exp *socioeconomic factors/ or exp *health status disparities/ or exp *healthcare disparities/
Embase	(Audit*).ti. or exp *management/ or exp *clinical audit/ AND (Health* adj3 (equit* or inequit* or equalit* or inequalit* or disparit* or access* or inaccess*)).ti. or (socioeconomic).ti. or exp *health services access/ or exp *socioeconomics/ or exp *health disparity/
Web of Science	TI=(Audit*) AND TI=(Health* near/3 (equit* or inequit* or equalit* or inequalit* or disparit* or access* or inaccess*)) or TI=(socioeconomic)
OpenGrey	Health* equi* audit health* inequali* audit health* disparit* audit health* inaccessibility audit health* accessibility audit
Google	allintitle: audit "healthcare inequalities" filetype:pdf allintitle: audit "healthcare disparities" filetype:pdf allintitle: audit "healthcare inaccessibility" filetype:pdf allintitle: audit "health equity" filetype:pdf allintitle: audit "health inequalities" filetype:pdf

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 4-5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 5
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 6
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 6
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Supplement materials table 1
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 6-7
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 6-7
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Page 6-7
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Page 6-7
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 7
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Page 10-12
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 6-7
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Page 6-7
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 6-7
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Page 6-7
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	NA / Page 7
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	NA / Page 7
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Page 7

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Page 7
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 8 / Figure 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Page 8
Study characteristics	17	Cite each included study and present its characteristics.	Page 9-13
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Page 13
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Page 10-11
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Page 15
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	NA (Page 7)
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	NA (Page 7)
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	NA (Page 7)
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	NA (Page 7)
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	NA (Page 7)
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 15
	23b	Discuss any limitations of the evidence included in the review.	Page 18-19
	23c	Discuss any limitations of the review processes used.	Page 18-19
	23d	Discuss implications of the results for practice, policy, and future research.	Page 19-20
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 6
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Page 6
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	NA
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 1
Competing	26	Declare any competing interests of review authors.	Page 1

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
interests			
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Page 1

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: http://www.prisma-statement.org/

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Health Equity Audits: a systematic review of the effectiveness

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Health Equity Audits: a systematic review of the effectiveness

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Manuscript word count: 3219
Number of figures: 1
Number of tables: 3
Supplement materials: 1 table

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1 **Abstract**

2 *Objectives:* The purpose of this systematic review is to explore whether health

3 equity audits (HEA) are effective in improving the equity of service provision and

4 reducing health inequalities.

5 *Design:* Three databases (Ovid Medline, Embase, Web of Science) and grey

6 literature (Opengrey, Google Scholar) were systematically searched for articles

7 published after 2000, reporting on the effectiveness of health equity audits. Title

8 and abstracts were screened according to an eligibility criteria to identify studies

9 which included a full audit cycle (e.g. initial equity analysis, service changes and

10 review). Data were extracted from studies meeting the eligibility criteria after full

11 text review and risk of bias assessed using the ROBINS-I tool. The study was

12 registered prior to its conduction in PROSPERO (CRD 42020218642).

13 *Results:* The search strategy identified 596 articles. Fifteen records were reviewed

14 in full-text and three records were included in final review. An additional HEA

15 report was identified through contact with an author. Three different HEAs were

16 included from one peer-reviewed journal article, two published reports and one

17 unpublished report (n= 4 records on n=3 HEAs). This included 102,851 participants

18 and over 148 practices/pharmacies (information was not recorded for all records).

19 One study reviewed health equity impacts of HEA implementation in key indicators

20 for coronary heart disease, type 2 diabetes, and chronic obstructive pulmonary

21 disease. Two HEAs explored Stop Smoking Services on program access and equity.

22 All reported some degree of reduction in health inequalities compared to prior HEA

23 implementation. However, impact of HEA implementation compared to other

24 concurrent programmes and initiatives was unclear. All included studies were

25 judged to have moderate to serious risk of bias.

26 *Conclusions*

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1   There is an urgent need to identify effective interventions to address health

2   inequalities. While HEAs are recommended, we only identified limited weak

3   evidence to support their use. More evidence is needed to explore whether HEA

4   implementation can reduce inequalities and which factors are influencing

5   effectiveness.

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7   **Strengths and limitations of this study**

8   - This systematic review represents, to our knowledge, the most

9   comprehensive examination of the evidence on the effectiveness of

10   health equity audits (HEA) used to reduce inequalities in service provision

11   and clinical outcomes

12   - A broad, prospectively published rigorous search strategy (registered in

13   PROSPERO) - that included non-English articles and grey literature – was

14   used.

15   - All included studies were judged to be of moderate or serious risk of bias.

16   - The study design of the included studies meant that we were unable to

17   assess the impact of concurrent programmes of work.

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19   **Keywords**

20   Health Equity Audits, Equity, Public Health, Intervention

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3   1   **Introduction**
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6   2   The COVID-19 pandemic has exposed and exacerbated structural, longstanding
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8   3   and unjust drivers of health inequalities, including economic disparities,
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10   4   geographical deprivation, occupational risks and systematic racism.[1] In the United
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12   5   Kingdom, the most deprived areas of the country saw a 118% increased death rate
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14   6   from COVID-19 compared with the least deprived.[2] Likewise, there have been
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16   7   striking inequalities across minority ethnic groups with people from Pakistan and
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18   8   Bangladesh living in the UK having higher death rates in both the first and second
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21   9   waves.[3] However, the inequalities directly related to COVID-19 are likely to be
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23   10   overshadowed by the inequalities across, for example, socio-economic, ethnic and
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25   11   gender strata that will indirectly arise from the pandemic's impact on education,
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27   12   income, welfare, investment, social care and health care.[1] COVID-19 has also
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29   13   compounded existing healthcare inequalities. During 2019-20, the most deprived
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31   14   decile had 7% fewer elective admissions than the least, but 51% more emergency
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33   15   admissions.[4] Whilst there is now a significant body of data and research describing
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35   16   the problem of health inequalities, there has limited research and data showing
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37   17   what interventions could reduce them and ensure a fair distribution of health
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39   18   resources.
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45   20   In response to the emerging inequalities related to COVID-19, Public Health
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47   21   England recommended the use of Health Equity Audits (HEA).[5] HEA is a tool
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49   22   conducted by public health professionals and/or screening providers to measure
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51   23   and address inequalities in the provision of and access to services, related health
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53   24   outcomes and determinants of health between different population groups. They
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55   25   are conducted to address inequalities by providing evidence to show whether local
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57   26   health needs are being met, to identify service delivery practices and to ensure
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1   resources are distributed equitably (resources are distributed fairly in relation to

2   need, not necessarily equally). HEAs typically use a sequential audit design in which

3   they collect data on the relevant health and health services outcomes, and

4   inequalities across a range of different factors (e.g. socio-economic differences,

5   area or regional variations, ethnicity, sexuality). The audits are tailored to specific

6   health outcomes/services and are often supplemented with published data on e.g.

7   screening performance. Compared to other countries the UK has been the

8   predominant implementer of HEAs, although they have also been used in other

9   countries (e.g. Canada[6], Iran[7] and Italy[8]). Examples include an equity audit of the

10   Health Check programme which found lower uptake in men - especially younger

11   men in deprived areas, and those on the learning disability or severe mental illness

12   register.[9] Furthermore, an equity audit on a diabetic retinopathy screening

13   programme, found that screening was lower in more deprived areas.[10]

14

15   HEAs are not a new initiative. In 2002, as part of the UK national health inequalities

16   strategy, HEAs were recommended for all local health systems to address health

17   inequalities. At that time the use of them became widespread, until 2010 when a

18   change in the UK Government led to the cessation of many health inequalities

19   initiatives, in response to the 2008 recession and financial constraint. Their use was

20   further reduced after significant health care reforms in England in 2013.[11,12] More

21   recently, a number of equity audits have been undertaken in local health systems

22   and their utilisation is likely to continue expanding in response to the COVID-19

23   pandemic.

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25   Despite the extensive use of HEAs in the past and current recommendations, there

26   is little research on their effectiveness or on the aspects that could make HEAs

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successful. Therefore, the aim of this study was to assess the effectiveness of HEAs in reducing inequalities and increasing equity, and to explore factors influencing effectiveness. Importantly we focus on studies with a full audit cycle; those that assess existing inequalities, implement changes/interventions to achieve equity and re-assess inequalities, rather than those studies which only describe the inequalities and make recommendations.

Methods

We conducted a systematic review in accordance with established methodology[13] and reported in line with the Preferred Reporting for Systematic Reviews and Meta-analyses (PRISMA) statement.[14] This review was prospectively registered and published with PROSPERO (CRD 42020218642).

Search strategy and selection criteria

Three electronic databases (Ovid Medline, Embase, Web of Science) and grey literature (Opengrey, Google Scholar) were systematically searched from 2000 to February 2021 drawing upon existing inequality and inequity related search terms. Search terms included those related to audits and inequity (e.g. equity, access, equality), see **supplementary table 1**. We applied forward (a search to find all of the articles that cite back to an article) and backward (a search to find all the cited references in an article) screening of all full text publications included and relevant publications (e.g. reviews and reports). After removing duplicate records, abstracts and titles were double-screened according to the selection criteria by two researchers (KvD, FD) using the software Rayyan by March 2021. Discrepancies were resolved by a third researcher (JF). Inclusion criteria were i) reporting on audits of health equity, ii) focused on health settings, iii) assessing the effectiveness

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1   of the audit on reducing health inequalities, iv) any study design and v) articles in

2   English, Dutch, German, French and Spanish. Studies were excluded if they were i)

3   published before 2000, ii) solely described the audit protocol and iii) did not assess

4   the effectiveness of the audit, but only the results of the initial inequality

5   assessment. All full texts for studies that satisfied the selection criteria were

6   retrieved and double-screened. Any divergences between authors on study

7   eligibility were discussed until consensus was reached.

8

9   Data from included studies were independently extracted by two researchers (KvD,

10   FD). A third researcher resolved any conflicts (CN). The following information was

11   extracted from each study: first author, year of publication, country, aim, study

12   design, data source, population characteristics (e.g. size), inequality measures (e.g.

13   gender, socioeconomic), health service changes, time of data collection, summary

14   of audit performed, and main findings. Terms/categories conflating race and

15   ethnicity are used throughout the paper as a consequence of being commonly used

16   in the health equity audits and subsequent data collection, but we acknowledge

17   that race and ethnicity are different social concepts. Study authors were contacted

18   for more information where relevant.

19

20   *Quality Assessment*

21   Two authors (KvD, FD) independently assessed the quality of individual studies

22   using the ROBINS-I tool, which assess the risk of bias across seven domains

23   (https://www.riskofbias.info/).[15] Discrepancies between authors were adjudicated

24   by two authors (JF, CN). Due to the small number of studies it was deemed

25   inappropriate to perform a GRADE assessment.

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3   1   *Synthesis*
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6   2   The conduct of meta-analyses or the assessment of publication bias was deemed
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8   3   inappropriate due to the limited number of studies and data heterogeneity.
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10   4   Therefore, the studies were synthesised narratively.
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14   6   *Patient and public involvement*
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17   7   Due to the nature of the study (systematic review, no patients were involved in
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19   8   conceptualising or conducting the study.
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24   10   **Results**
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26   11   After removal of duplicates our search identified 596 records. Fifteen records were
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28   12   reviewed in full text and three records were included in the final review. An
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30   13   additional follow-up report on a same HEA was identified through contact with an
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32   14   author. This resulted in a total of four included records on three different HEAs. A
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34   15   flow diagram of the screening and selection process can be found in **figure 1**. We
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36   16   included two HEAs[16,17,18] reviewing Stop Smoking Services on program access and
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38   17   equity arising from two published and one unpublished report, and one peer-
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40   18   reviewed intervention study[19] reviewing health equity impacts of HEA
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42   19   implementation in key indicators for coronary heart disease (CHD), type 2 diabetes
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44   20   (DMT2), and chronic obstructive pulmonary disease (COPD) (**Table 1**). All included
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46   21   records were conducted in the United Kingdom and utilised a sequential audit
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48   22   design. Across all included HEA there were participants from 148 general practices
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50   23   in London (Newham, City and Hackney, Tower Hamlets) and from general practices
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52   24   and pharmacies participating in the two county Stop Smoking Service programs in
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54   25   Durham and Lewisham, including a total of 102,851 individuals. Data were
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57   26   collected between 2007 and 2017. The included HEAs assessed various inequalities
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1   (including inequalities in ethnicity, gender, age, socio-economic group, and

2   location) in service delivery, service access and health outcomes.[16,17,19,18]

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4   The majority of published literature on HEAs were one cycle HEA reports that did

5   not assess HEA effectiveness; we identified 56 records which reported only one

6   HEA cycle from grey literature (n=43) and electronic databases (n=13). The majority

7   of these (n=23) were conducted by local governments, local health care systems

8   (n=21), or combinations of the former (n=4). A minority were carried out by

9   hospitals (n=3), dental services (n=3) or by national health care organisations (n=2).

10   A wide range of services were audited, but the most common were smoking

11   cessation services (n=7), cancer screening (n=7) and health promotion

12   programmes (NHS Health Checks) (n=6).

13

14   *Health Equity Audit implementation*

15   Badrick *et al.* implemented and evaluated HEAs in 38 practices in Tower Hamlets

16   Primary Care Trusts (PCT) which included facilitation sessions encouraging change,

17   identifying areas of expressed difficulty and engaging teams in finding solutions. The

18   intervention tracked four key indicators (blood pressure and haemoglobin A1c levels

19   in DMT2, % smoking in COPD and cholesterol levels in CHD). Changes in performance

20   over time were then examined for the intervention PCTs compared to neighbouring

21   non-intervention PCTs (n=110).[19] Roe *et al.*[16,18] and Pringle *et al.*[17] used a before-

22   and-after comparison rather than the inclusion of a comparison site. Roe et al. [16,18]

23   assessed the Durham NHS Stop Smoking Service's impact on health inequalities.

24   They explored the rate of access and rate of quitters providing a comparison with

25   audits conducted in 2007, 2014 and 2018. Slope and Relative Indices of Inequality

26   were calculated by the socio-economic dimension to inequalities in health.[16,18]

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3   1   Similarly, Pringle *et al.* compared differences in access and quitting success rates
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5   2   through the Lewisham NHS Stop Smoking Service between 2000-2005 (first HEA)
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8   3   and 2007/8-2011/12 (second HEA).[17]
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1   **Table 1: Study characteristics**

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First author, year and country	Aim	Study design	Data sources	Population	Inequality measures (e.g. SES, gender)	Resulting recommendations for service delivery changes	Time between data collection
Badrick, E. *et al.* (2014), United Kingdom[19]	The main aim of the study was to describe the development and implementation of practice equity audits, and an evaluation of changing inequalities over time for three project conditions in inner east London.	Sequential audits	Routine clinical and demographic data were collected from practice computer databases, using Morbidity Information Query and Export Syntax (MIQUEST) software and EMIS Web (Egton Medical Information Systems Ltd, 2010) from 148 of the 151 general practices in the three areas of London.	Three areas of London (Newham, City and Hackney and Tower Hamlets) with a combined GP-registered population of 829,710 in mid-2008.	Association between self-reported ethnicity, gender, age-band and four key indicators (cholesterol levels in CHD, blood pressure and haemoglobin A1c levels in diabetes and % smoking in COPD).	38 practices in the intervention arm (Tower Hamlets) received two health equity audits and facilitated time with a cardiovascular nurse specialist to review their results. The study authors recommended prioritizing monitoring inequalities by age, gender, and ethnic group; balancing rigorous, complete reports with simple, brief reports for reaching increased practice audiences; and implementation of HEA facilitation tailored to practice setting and needs to promote changes in clinical performance.	Cross-sectional data were extracted in April of every year between 2007 and 2010 for all patients on the CHD, diabetes and COPD registers.
Pringle, E. (2013), United Kingdom[17]	This health equity audit looks at the use and success of Lewisham's Stop Smoking Service from April 2007 to March 2012 by age, gender, ethnicity, socioeconomic group and location. In addition, the views of a small number of service users and advisers were sought on factors that may affect the use and success of the service.	Sequential audits	Smoking prevalence data is available from the Integrated Household Survey (IHS) which combines answers from a number of Office for National Statistics (ONS) surveys containing questions about smoking. Interviews with 15 smokers and 6 advisers. Quits dates set from April 1st 2007 to March 31st 2012 were extracted from Quit Manager. Smoking data is self-reported.	Lewisham residents accessing Stop Smoking services.	Association between age, gender, ethnicity, socioeconomic group, and location and service access rates and successful smoking cessation rates.	The HEA recommended adjusting marketing messages, targeting specific underrepresented groups, collaborating with African American churches to implement Stop Smoking Services, exploring use of innovative technology especially with young smokers, reallocating level 3 advisers to the underrepresented groups who benefit most from their counseling, and undertaking further research on groups not examined in the HEA	April 2007 to March 2012.

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Roe, K. (2018), United Kingdom[16] Roe, K. *et al* (2014), United Kingdom[18]	The purpose of these reports is to assess whether the County Durham NHS Stop Smoking Service is having an impact on health inequalities. It aims to identify how services are delivered relative to the deprivation levels across County Durham and provide analysis by the two Clinical Commissioning Groups within its borders. The reports analyse the rate of access and rate of quitters. This Health Equity Audit (HEA) also provides a comparison with previous audits conducted in 2007 and 2014.	Sequential audits	Source of the data is Durham County Council Public Health Intelligence Team (DCCPHIT). The raw data for the 2014 and 2018 HEAs is taken from Quit manager; a Stop Smoking Service web-based patient data management system. The 2007 data was collated from 5 different reports from localities within Co. Durham and the source of the quit dates is not stated.	2014 – Durham residents accessing Stop Smoking services, 23,350 used records 2018 – Durham residents accessing Stop Smoking Services, 9,240 used records	Deprivation was measured at small area level and the Relative Index of Inequality (Rii) and the Slope Index of Inequality (Sii) were used to compare inequalities over time.	The HEA recommended targeting specific groups of people including routine and manual workers, Gypsy, Roma and Travellers (GRT), pregnant women, people with a diagnosed mental illness, long term conditions and people who live in the 30% most deprived areas.	2014 - January 2011 to March 2013 2018 - April 2015 to March 2017

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3   1   *Changes in inequalities during audit period*
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6   2   All HEAs reported baseline inequitable outcomes in physical health outcomes[19],
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8   3   health behaviours, and access to or utilisation of health services by age, gender,
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10   4   ethnicity, socio-economic status and location.[16,17,18] During the audit period,
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12   5   some degree of reduced inequality was observed in all records compared to the
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14   6   comparison group[19] or prior HEA data (**Table 2**).[16,17,18] In Tower Hamlets' PCTs,
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16   7   reductions in gender and age group differences were found in DMT2 and CHD.
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18   8   Yet, whilst all ethnic groups showed improvement over the years of HEA
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20   9   implementation, there was no reduction in difference between ethnic groups.
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22   10   Furthermore, some groups showed a widening of inequalities. For example, in
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24   11   the CHD register South Asians increased from being 1.9 (1.6-2.2) times more
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26   12   likely than White groups to have cholesterol levels < 4 mmol/L in 2007 to being
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28   13   to 2.4 (2.0-2.8) more likely in 2010.
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34   15   Similarly, smoking rates in COPD indicate increased disparity between White and
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36   16   other ethnic groups in 2010.[19] The audit of the Lewisham Stop Smoking Service
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38   17   found an increase in service access by 'black and ethnic minority groups' as well
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40   18   as by people from deprived areas (2007/2008 – 2011/12) as compared to prior
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42   19   audits (2000-2005). However, the HEA report also identified several population
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44   20   groups still underrepresented in access rates (e.g. younger smokers, older
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46   21   women, Indian men, Chinese men, white Irish men and black African smokers)
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48   22   and overall inequality in program access and success rates.[17] The 2014 Stop
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50   23   Smoking Service HEA in County Durham found a reduction in health inequalities
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52   24   compared to prior audits (2007) as demonstrated by a consistent increase in the
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54   25   relative index of inequality, the size of the gap between the least and the most
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57   26   deprived areas expressed as the average rate over all wards, for access and
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3 1   smoking quit rates. Furthermore, a reduction in access rate to quit rate was
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5 2   observed – gap of 69% to 16% in 2007 and 2014 respectively.[16] Reductions in the
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8 3   inequality gaps were observed again in the 2018 HEA compared to the 2007 and
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10 4   2014 HEAs.[18]
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14 7   *Study quality assessment*
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17 8   Study quality assessment was conducted using the ROBINS-I tool. Each included
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19 9   record was found to have a serious or moderate risk of bias in the various
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21 10   categories assessed (**Table 3**). Confounding may have influenced the results of
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23 11   the reports due to the inadequacy of study designs to differentiate effectiveness
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25 12   of HEA implementation from simultaneously implemented local improvement
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27 13   initiatives, the "noise" of a changing NHS or other societal changes that may have
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29 14   led to reduced or increased inequalities. The potential selection of health
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31 15   practices that already established an equity-focus may have resulted in selection
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33 16   bias, meaning that results may not be generalisable to most areas in the United
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35 17   Kingdom. Likewise, as included studies have solely been performed in the UK
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37 18   results may not be applicable to other countries.
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Table 2: Study results

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First author, year	Summary of audit	Main findings
Badrick, E. *et al.* (2014), United Kingdom[19]	The audit aimed to reduce health inequalities by ethnicity, age and gender in the management of three common chronic diseases (coronary heart disease, type 2 diabetes mellitus and chronic obstructive pulmonary disease).	Baseline inequalities in each condition across the three east London areas were identified. At a crude level, performance in cholesterol, BP and HbA1c improved in all areas over time. All ethnic groups showed improvement, but there was no evidence of a reduction in differences between ethnic groups. Over the three-year study, a reduction in health inequalities was measured in some groups (such as patients over 85 years with diabetes) with only slight reductions in, continued, or worsened inequalities observed in most other groups. Compared to the neighbouring areas, Tower Hamlets (receiving the intervention) had smaller improvement levels in CHD, higher absolute changes in both diabetes measures, and small but similar changes in rates of smoking in COPD patients. The study reported positive GP responses to the intervention providing assistance in conducting/interpreting HEAs. Reductions in gender and age group differences were noted in DMT2 and CHD.
Pringle, E. (2013), United Kingdom[17]	This health equity audit looks at the use and success of Lewisham's Stop Smoking Service from April 2007 to March 2012 by age, gender, ethnicity, socioeconomic group and location. In addition, the views of a small number of service users and advisers were sought on factors that may affect the use and success of the service.	Since the last equity audit more smokers from 'black and ethnic minority groups' were using the service. In addition, this health equity audit shows that over the last five years the Stop Smoking Service was reaching an increasing number of people from deprived areas. More quit dates were set by smokers from deprived areas than from less deprived areas. Overall, this health equity audit shows inequality across Lewisham's smokers in the use and success of Lewisham's Stop Smoking Service in terms of the need for stop smoking services. The population groups that seemed to be underrepresented in their use of the service were: younger smokers, older women, Indian men, Chinese men, white Irish men and black African smokers. Additionally, smokers from more deprived areas, routine and manual workers, students and unemployed smokers were less likely to successfully quit smoking.
Roe, K. *et al* (2014), United Kingdom[16] Roe, K. (2018), United Kingdom[18]	This HEA assesses the distribution of the Durham Stop Smoking Service (SSS) and its effectiveness relative to deprivation levels within County Durham and the two Clinical Commissioning Groups (CCGs) within its borders.	2014 - Compared to the results of the 2007 HEA there has been an increase in the relative index of inequality for access and quit rates as well as a reduction in the difference between the two, indicating that the County Durham SSS is contributing to a reduction in health inequalities. 2018 - The County Durham SSS has been successful in contributing to a reduction in the equity gap, seeing a consistent increase in the relative index of inequality for access and quit rates. This was true for services accessed in pharmacies, primary care, and specialist Stop Smoking Service. The audit found a higher rate of pregnant smokers in more deprived areas, but also a higher quit rate for pregnant smokers who accessed the services in more deprived areas. This indicates that the County Durham Stop Smoking Service is contributing to a reduction in health inequalities.

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Table 3: Risk of bias – ROBINS-I tool

Study	Bias due to confounding	Bias due to selection of organisations into study	Bias in classification of interventions	Bias due to deviations from intended interventions	Bias due to missing data	Bias in measurement of outcomes	Bias in selection of reported result
Badrick, E. *et al.* (2014), United Kingdom[19]	Serious	Serious	Low	No information	Low	Moderate	Low
Pringle, E. (2013), United Kingdom[17]	Serious	Serious	Low	No information	Moderate	Moderate	Moderate
Roe, K. *et al* (2014), United Kingdom[16]	Serious	Serious	Low	No information	Moderate	Moderate	Low
Roe, K. (2018), United Kingdom[18]							

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Discussion

5 This systematic review represents, to our knowledge, the most comprehensive

6 examination of the evidence on the effectiveness of health equity audits. We

7 identified three HEAs[16,17, 19, 18] based in health care or public health settings with

8 serious to moderate risk of bias. All showed the presence of baseline inequalities

9 and found reductions in health inequalities across various strata in the subsequent

10 years of initial HEAs. Only one study used comparison sites.[19]

11

12 *Meaning of the results*

13 There has been little research undertaken to explore the effectiveness of HEAs,

14 despite them being widely used in the UK during the 2000s and currently being

15 recommended by PHE.[5,11] This may be because of methodological challenges in

16 assessing effectiveness or an assumption that they are the right strategy. The

17 majority of HEAs we identified only undertook one cycle, suggesting that

18 practitioners tend to use HEAs as a tool to assess the existing inequalities within a

19 service rather than a tool to record or reduce inequalities over time. Although HEAs

20 may be useful at identifying areas of health inequality or greater need, without

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1 repeating the data collection it is not possible to say whether the HEA resulted in

2 any meaningful service change or targeted intervention, let alone whether this

3 resulted in a reduction in inequities.

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5 We only identified three HEAs that completed the audit cycle to assess if the

6 recommendations and changes resulted in a reduction in inequalities over time.

7 The lack of peer reviewed research assessing HEA effectiveness may reflect the lack

8 of health care and public health services to evaluate the impact and effectiveness

9 of decisions, with a much greater focus on addressing problems. It may also reflect

10 difficulties presented by frequently changing priorities and frequent turnover of

11 staff. Furthermore, a reluctance to publish HEAs may be present as they could

12 cause reputational damage to organisations or even a concern that the findings

13 may leave the organisation open to legal challenge under equality legislation.

14 Qualitative research around clinical audit has shown that audit is seen as "a time-

15 consuming, additional chore and a managerially driven exercise"[20] that is

16 hampered by a lack of resources, lack of expertise, lack of audit plan, and

17 organisational impediments.[21] Organisational change and austerity measures have

18 meant that local authority Public Health teams have faced increased

19 responsibilities and real-terms funding cuts.[22]

20

21 The single peer-reviewed article was undertaken in a number of general practices

22 in London. The authors found that it was possible to undertake equity audits in

23 general practice using routine data. While all of the included studies identified

24 some reductions in health inequalities during the HEA process, only Badrick *et al.*

25 had a suitable comparison group. Furthermore, in the absence of randomised

26 intervention studies and further high-quality observational studies, attributing

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3   1   changes in equities to HEAs based on the included reports is inappropriate due to
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6   2   the potential confounding and biases introduced. No evidence was found to
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8   3   suggest that HEAs result in harm or should not be undertaken in the absence of
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10   4   further evidence.
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14   6   *Comparison with existing literature*
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17   7   Aspinall and Jacobson[23] undertook a baseline survey in 2004 of practitioners'
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19   8   experiences across England in the first HEA implementation year of undertaking
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21   9   nationally mandated. The authors found that national target-setting, national
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24   10   guidance on self-assessment and the inclusion of HEAs within a ratings system
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26   11   influenced whether the process and, in a significant minority, implementation of
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28   12   the findings of HEAs became part of healthcare systems' routine business.[23]
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32   14   There is a sizable body of research looking at the effectiveness of clinical audits
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35   15   (i.e. non-equity focused). For example, a Cochrane review examined the impact
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37   16   of audit and feedback on professional behaviour. The authors identified 140
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39   17   randomised controlled trials and found that audit and feedback has small but
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41   18   important improvements in professionals behaviour.[24] Similarly there is
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43   19   evidence for the use of quality improvement methods with some consideration
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45   20   to equity. Lu *et al.* found that about a third of quality improvement projects in
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47   21   diabetes care included an equity perspective.[25]
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52   23   However, these findings are not necessarily transferable to HEAs as clinical
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54   24   audits and quality improvement programmes are generally undertaken at a
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56   25   smaller organisation-level and focus on adherence to evidence-based best
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58   26   practice guidance. HEAs are generally implemented at a higher organisational
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1   level, such as across a local government level or health care system, and it is not

2   always clear what actions are needed to reduce the inequalities gap. To illustrate,

3   Regmi *et al.* undertook a review of factors that support the reduction of

4   inequalities in local health care systems in the UK and found that there was little

5   evidence that local health care arrangements alone were effective in reducing

6   health inequalities.[26]

7

8   However, there are a number of principles drawn from clinical audit and quality

9   improvement methods which may be effective in HEAs. Grimshaw *et al.* argue

10   for an implementation laboratory where there is a continual cycle of testing

11   different interventions and implementation strategies through audit and

12   feedback which may be effective in reducing health inequalities through HEA

13   implementation.[27]

14

15   *Strengths and limitations*

16   Our research used a prospectively published rigorous systematic review strategy

17   that included non-English articles and grey literature. We had a robust process

18   for screening titles/abstracts and full-texts, extracting data and determining the

19   risk of bias using a validated tool for quality assessment. However, only one HEA

20   with multiple years of data was found in the peer reviewed literature and all

21   reports included were of low to moderate quality. It is likely that there are a

22   number of HEAs not in the public domain. Yet, based on our research, most of

23   these are likely to only contain one HEA cycle. There may be a publication bias

24   towards studies reporting positive results (i.e. reductions in inequalities).

25   Importantly, as the reports included are sequential audits rather than well-

26   designed randomised studies, they may not have been equipped to differentiate

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3   1   HEA effectiveness from simultaneously implemented local improvement
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5   2   initiatives, the "noise" of a changing NHS or other societal changes that may have
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8   3   led to reduced or increased inequalities.
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13   5   *Implications for research and policy*
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16   6   While the efforts to address inequalities in health care are not new, the impacts of
17
18   7   the pandemic have starkly delineated the imperative to do so. There is an urgent
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20   8   need to find effective interventions to reduce health inequalities. Public Health
21
22   9   England recommends the use of HEAs and has published accompanying guidance
23
24   10   describing step-by-step processes of HEA implementation.[5] Yet, thus far, it is
25
26   11   unclear whether this has been supported by scientific evidence. It is likely that
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28   12   there are key factors that will make HEA undertaking effective in inequality
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30   13   reduction and factors that will not. For example, previous research has found that
31
32   14   audits tend to be more effective when feedback is given by respected colleagues,
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34   15   there is frequent data presentation, both goals and action-plans are included and
35
36   16   the recipients are non-physicians.[28] Therefore, further well-designed studies with
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39   17   suitable comparison groups are essential to further inform on the effectiveness of
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41   18   HEAs. Process evaluation is needed to understand the factors that optimise HEA
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43   19   effectiveness and implementation processes. Decision-makers may be more likely
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45   20   to change behaviour based on case examples of how HEAs have been used to
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47   21   reduce inequalities.
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52   23   While there is limited evidence for use of HEAs, we do believe that they should still
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54   24   be used until further research is undertaken because we did not find any evidence
55
56   25   of harm and there is a logical rationale by which they could reduce inequalities.
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58   26   The priority for policy makers is evaluating ongoing HEA and generating the
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1   evidence base to understand if they work and, if so, what makes them most

2   effective.

3

4   **Conclusion**

5   Research and practice demonstrate that meaningfully impacting inequalities in both health

6   outcomes and healthcare delivery is a complicated, challenging task faced by already

7   overburdened and under-resourced health systems. Whilst HEA implementation is

8   currently recommended, evidence for their effectiveness in reducing inequalities is sparse.

9   This evidence gap requires action. Efforts to reduce inequalities must neither be avoided

10   nor delayed because of their complicated nature; nor should they be undertaken

11   haphazardly without much needed, evidence-based guidelines. Further research is needed

12   to assess their effectiveness and understand what makes them effective (or not).

13
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Figure 1: Study selection process

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| 415 records identified through Ovid MEDLINE | 34 records identified through Web of Science | 116 records identified through EMBASE | 87 records identified through Google Scholar | 16 records identified through OpenGrey | 7 records identified through reference lists |

674 total records from all databases

596 records included in initial screen, after removing duplicates

583 excluded in title and abstract screening

15 screened in full text review

11 excluded after full text review
  Only completing one audit cycle (n=7)
  Focused on clinical variation rather than inequalities (n=2)
  Survey of practitioner experiences (n=1)
  Development of audit tool (n=1)

4 included in final review on three HEAs

Figure 1: Study selection process

298x188mm (144 x 144 DPI)

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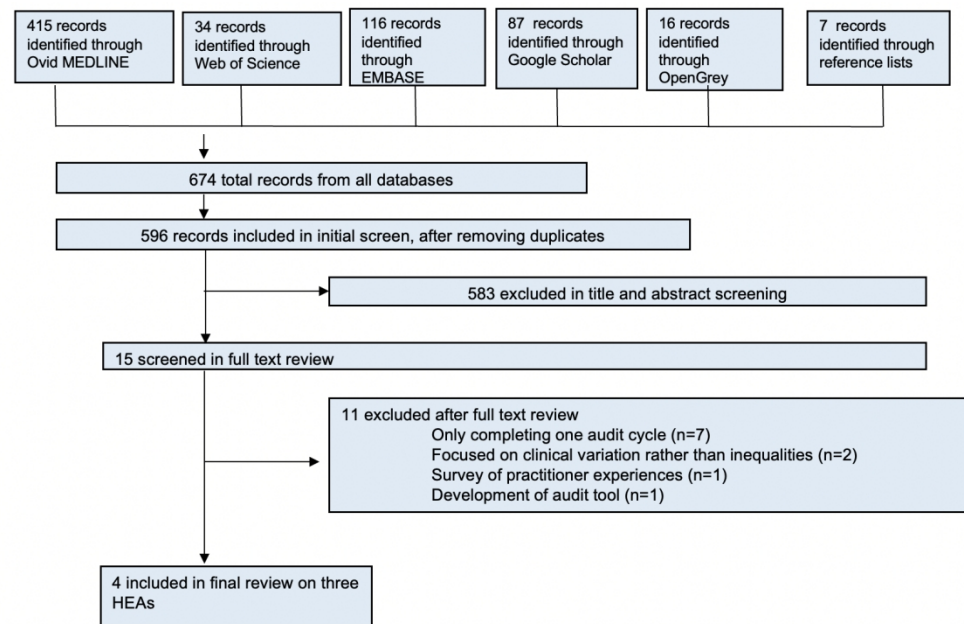41
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Supplement Material to Systematic Review on the Effectiveness of Health Equity Audits: existing evidence and call for further research.

Supplementary Table 1: Search Strategy

Database	Search Strategy
Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R)	(Audit*).ti. or exp *management audit/ or exp *clinical audit/ AND (Health* adj3 (equit* or inequit* or equalit* or inequalit* or disparit* or access* or inaccess*)).ti. or (socioeconomic).ti. or exp *health services accessibility/ or exp *socioeconomic factors/ or exp *health status disparities/ or exp *healthcare disparities/
Embase	(Audit*).ti. or exp *management/ or exp *clinical audit/ AND (Health* adj3 (equit* or inequit* or equalit* or inequalit* or disparit* or access* or inaccess*)).ti. or (socioeconomic).ti. or exp *health services access/ or exp *socioeconomics/ or exp *health disparity/
Web of Science	TI=(Audit*) AND TI=(Health* near/3 (equit* or inequit* or equalit* or inequalit* or disparit* or access* or inaccess*)) or TI=(socioeconomic)
OpenGrey	Health* equi* audit health* inequali* audit health* disparit* audit health* inaccessibility audit health* accessibility audit
Google	allintitle: audit "healthcare inequalities" filetype:pdf allintitle: audit "healthcare disparities" filetype:pdf allintitle: audit "healthcare inaccessibility" filetype:pdf allintitle: audit "health equity" filetype:pdf allintitle: audit "health inequalities" filetype:pdf

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 4-5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 5
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 6
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 6
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Supplement materials table 1
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 6-7
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 6-7
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Page 6-7
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Page 6-7
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 7
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Page 10-12
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 6-7
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Page 6-7
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 6-7
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Page 6-7
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	NA / Page 7
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	NA / Page 7
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Page 7

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Page 7
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 8 / Figure 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Page 8
Study characteristics	17	Cite each included study and present its characteristics.	Page 9-13
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Page 13
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Page 10-11
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Page 15
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	NA (Page 7)
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	NA (Page 7)
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	NA (Page 7)
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	NA (Page 7)
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	NA (Page 7)
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 15
	23b	Discuss any limitations of the evidence included in the review.	Page 18-19
	23c	Discuss any limitations of the review processes used.	Page 18-19
	23d	Discuss implications of the results for practice, policy, and future research.	Page 19-20
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 6
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Page 6
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	NA
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 1
Competing	26	Declare any competing interests of review authors	Page 1

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
interests			
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Page 1

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: http://www.prisma-statement.org/