



Review Article

The effects of community pharmacy-delivered public health interventions on population health and health inequalities: A review of reviews



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ABSTRACT

Community pharmacies have great potential to deliver services aimed at promoting health and preventing disease, and are well placed in deprived communities. This review of reviews aimed to assess the effectiveness of community pharmacy-delivered public health services and assess how they impact on inequalities in health using PROGRESS-Plus characteristics. Twenty databases were searched from their start date until January 2018. The quality of the included articles was determined using the Assessment of Multiple Systematic Reviews tool (AMSTAR 2). Fifteen systematic reviews were identified reporting 157 unique primary studies. There were a number of community pharmacy initiatives with positive intervention effects on health outcomes. These services were predominantly focused on primary disease prevention, and included smoking cessation, weight management programmes, syringe exchange programmes, and inoculation services. This review supports the development of some community pharmacy public health services. At present, little is known how community pharmacy-delivered public health interventions impact on health inequalities. It would be prudent for future studies to address this by explicitly reporting outcomes according to the PROGRESS-Plus framework.

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1. Background

Community pharmacies have emerged as strategically important settings that have great potential to deliver services aimed at promoting health, and preventing disease. In many countries, the community pharmacist is the most accessible healthcare provider to the general public: they are available without an appointment, are open evenings and weekends, and are often located in the most deprived communities (the 'positive pharmacy care law' (Todd et al., 2014)). Community pharmacies are thereby ideally placed to offer public health and healthcare services to the most deprived communities.

In recent decades, the role of the community pharmacist has undergone rapid expansion, with many services moving away from the traditional supply function to more patient-focused services (Anderson,

2007). Indeed, many community pharmacists now offer a range health promotion activities aimed at either primary or secondary disease prevention. Accompanying this shift, the literature surrounding the extended role of the community pharmacist has also expanded – with many groups producing systematic reviews examining the effectiveness of such interventions (Brown et al., 2016). Previous systematic reviews have predominantly focused on single interventions, and have not explored intervention effectiveness at the primary or secondary prevention level, making it challenging to determine where community pharmacy-delivered interventions fit within the wider disease prevention agenda. At present, there is no comprehensive review that seeks to examine the effectiveness of all community pharmacy-delivered public health services, or explore how the effects of these services are moderated by socio-demographic factors. This later point has been

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highlighted by the UK National Institute of Health and Care Excellence (NICE) as a research priority to ensure the potential of community pharmacy-delivered public health interventions in reducing health inequalities can be maximised (NICE, 2018). A wide, and comprehensive, review of community pharmacy-delivered public health interventions is needed to inform policy, but also to identify gaps and inform future research endeavours. In this paper, we undertake a ‘review of reviews’ of community pharmacy-delivered public health services and seek to determine how they impact on health and inequalities in health. A review of reviews is an established and effective way of bringing together and summarising a broad evidence-base (Becker and Oxman, 2008) and has been used for a number of public health topics (Bambra et al., 2010; Cairns et al., 2015; Hill et al., 2014; Main et al., 2008).

2. Methods

The full methodology for this work has been previously described in the published protocol (Hillier-Brown et al., 2017). The review is also registered with PROSPERO (CRD42017056264), while a completed PRISMA checklist is also included in Appendix S1.

2.1. Research questions

1. What is the effectiveness of community pharmacy-delivered public health interventions?
2. How are the intervention effects moderated according to PROGRESS-Plus factors?

2.2. Inclusion criteria

Following standard evidence synthesis approaches (Kavanagh et al., 2008), the inclusion criteria for the review were determined a priori in terms of PICOS (Population, Intervention, Comparison, Outcome and Study design (Higgins and Green, 2011)).

- **Population:** Children and adults (all ages) in any country.
- **Intervention:** Public health interventions delivered in community pharmacy settings. For the purposes of the review, a public health intervention was described as any intervention designed to prevent disease, promote health and prolong life; specifically, we focused on interventions aimed at the primary prevention (preventing the onset of disease) or secondary prevention level (detecting disease in the early stages). A community pharmacy was defined as a pharmacy set in the community, which is accessible to all and not based in a hospital, clinic or GP surgery.
- **Comparison:** Systematic reviews that included studies with and without controls, including randomized and nonrandomized controlled trials, randomized and nonrandomized cluster trials, prospective and retrospective cohort studies (with and/or without control groups), prospective repeat cross-sectional studies (with and/or without control groups) and interrupted time series analysis (with and/or without control groups).
- **Outcomes:** To answer our primary research question, we included health outcome data, and to answer our secondary research question, we included health inequality outcomes. Primary outcomes included health outcomes, physiology and biochemical outcomes, and behavioural outcomes. Secondary outcomes related to how the effects of the interventions were moderated in terms of PROGRESS-Plus factors: place of residence, race/ethnicity, occupation, gender, religion, education, socio-economic status (defined as: individual income, wealth, education, employment or occupational status, benefit receipt; as well as area-level economic indicators), social capital, age, disability and sexual orientation. When available, cost effectiveness data was also collected.
- **Study design:** Only systematic reviews were included in the analysis. Following the methods of previous review of reviews (Bambra

et al., 2010; Cairns et al., 2015), publications needed to meet two of the three mandatory criteria of Database of Abstracts of Reviews of Effects (DARE): (i) that there is a defined review question (with definition of at least two of, the participants, interventions, outcomes or study designs) and (ii) that the search strategy included at least one named database, in conjunction with either reference checking, hand-searching, citation searching or contact with authors in the field.

2.3. Exclusion criteria

We excluded interventions that focused on promoting medicine adherence, or medicine optimisation; we also excluded any intervention aimed at tertiary disease prevention (reducing symptoms of an established disease).

2.4. Search strategy

Twenty databases were searched until January 2018 (host sites given in parentheses): Medline (Ovid), Embase (Ovid), Cumulative Index to Nursing and Allied Health Literature (CINAHL; EBSCOhost), PsycINFO (EBSCOhost), Social Science Citation Index (Web of Science), Applied Social Sciences Index and Abstracts (ASSIA; ProQuest), International Bibliography of the Social Sciences (IBSS; ProQuest), Sociological Abstracts (ProQuest), Social Services Abstracts (ProQuest), Prospero (Centre for Reviews and Dissemination, University of York), Campbell Collaboration Library of Systematic Reviews (The Campbell Library), Cochrane Library (includes Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, Cochrane Methodology Register, Database of Abstracts of Reviews of Effects, Health Technology Assessment Database, NHS Economic Evaluation Database; Wiley), Database of Promoting Health Effectiveness Reviews (DoPHER; EPPI-Centre), Social Care Online (SCIE) and Health Systems Evidence.

Searches were tailored to the specific host site (full search strategies are shown in Appendix S2). In addition, citation follow up from the bibliographies and reference lists of all included articles was conducted. Searches were limited to peer-reviewed publications only. No language or publication date restrictions were applied. Authors were contacted to obtain relevant information that was missing. If systematic reviews did not have sufficient data, they were excluded from further analysis.

2.5. Study selection, data extraction and quality appraisal

Study selection was conducted by three reviewers independently with cross-checking (FHB, NW, KT). Agreement between the reviewers was 99% with a kappa score of good ($\kappa = 0.68$) (Higgins and Deeks, 2011). The methods and main findings were extracted using a bespoke data extraction form (detailed in Appendix S3). The quality of each systematic review was determined using the updated version of the Assessment of Multiple Systematic Reviews: AMSTAR 2 (Shea et al., 2017). Data extraction and quality appraisal was conducted by three reviewers (KT, FHB and NW) and checked in full by KT or AT. Any discrepancies were resolved through discussion and consensus.

2.6. Data synthesis

The systematic reviews were narratively synthesised by intervention type. Effect sizes from meta-analyses were considered when available.

3. Results

A total of 16,827 citations were retrieved from the twenty databases searched. Deduplication resulted in 12,066 unique citations. Reasons for exclusion at the full text stage are detailed in Appendix S4. In total, 15 systematic reviews (Tables 1–8) were included in our review, reporting 157 unique primary studies (Fig. 1).

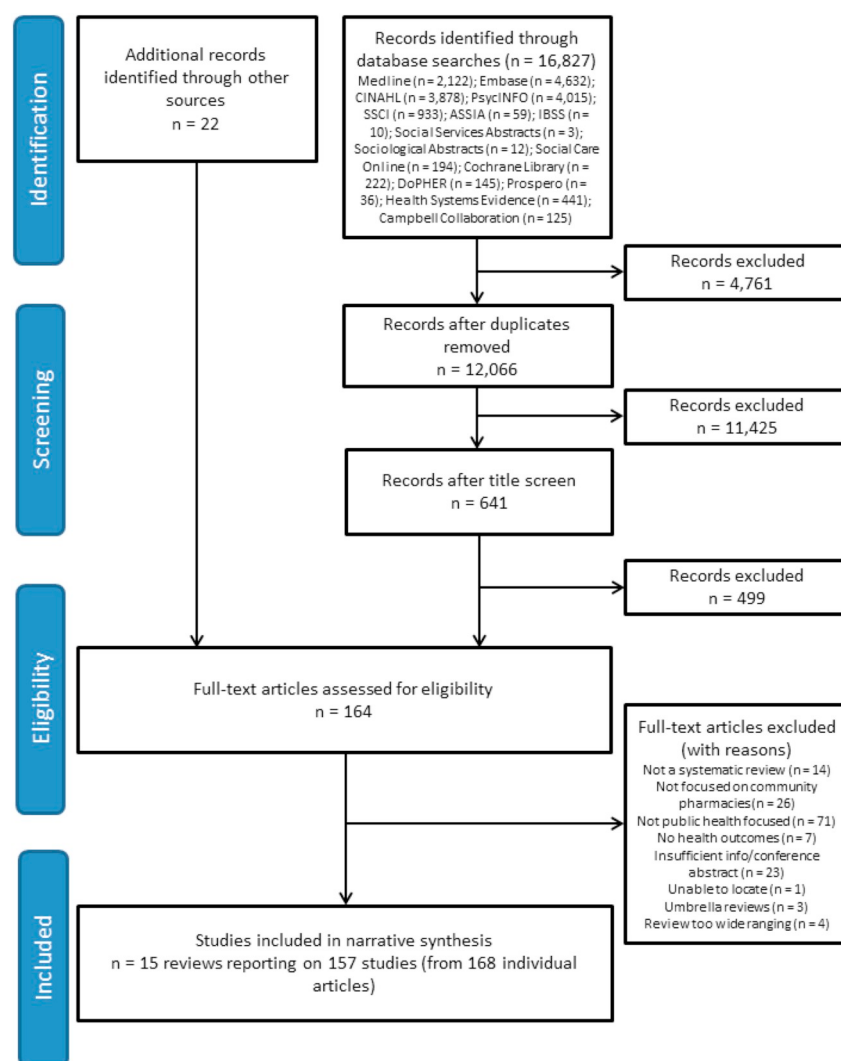


Fig. 1. PRISMA flow diagram.

Assessment with AMSTAR2 revealed: two reviews had one weakness (Elias et al., 2011; Sinclair et al., 2004), three reviews had two weaknesses (Brown et al., 2016; Gordon et al., 2011; Sawangjit et al., 2016), three reviews had three weaknesses (Blenkinsopp et al., 2003; Gudka et al., 2013; Lindsey et al., 2015), three reviews had four critical domain weaknesses (Ayorinde et al., 2013; Saba et al., 2014; Watson and Blenkinsopp, 2009), while four reviews (Burson et al., 2016; Kapadia, 2013; Nacopoulos et al., 2010; Nguyen, 2017) had weaknesses in five out of the seven possible critical domains (no reviews had zero critical domain weaknesses) (Appendix S5).

The reviews covered six different public health intervention areas. Interventions aimed at primary prevention included: smoking cessation (n = 2) (Saba et al., 2014; Sinclair et al., 2004); weight management (n = 1) (Gordon et al., 2011); alcohol misuse (n = 1) (Watson and Blenkinsopp, 2009); syringe/needle exchange programmes (n = 2) (Nacopoulos et al., 2010; Sawangjit et al., 2016); inoculation services (n = 1) (Burson et al., 2016). Two of the included reviews were multi-component, exploring a range of public health interventions (n = 2) (Blenkinsopp et al., 2003; Brown et al., 2016). Interventions aimed at secondary prevention included those directed at screening services, which ranged from cancer to osteoporosis screening (n = 4) (Ayorinde et al., 2013; Elias et al., 2011; Lindsey et al., 2015; Nguyen, 2017), and chlamydia testing (Gudka et al., 2013; Kapadia, 2013). Seven of the reviews looked at health inequalities (Brown et al., 2016; Burson et al., 2016; Elias et al., 2011; Gudka et al., 2013; Kapadia, 2013; Lindsey

et al., 2015; Nacopoulos et al., 2010) and 16% of primary studies were reported in more than one systematic review (see Appendix S6).

3.1. Primary prevention

3.1.1. Smoking cessation

Two reviews (reporting five unique studies) focused on smoking cessation interventions and included a combination of advice, education or nicotine replacement therapy (NRT). Both reviews showed improvements in health as measured by cessation rates (Table 1). The first review by Sinclair et al. (2004) found two relevant primary studies, both of which were RCTs conducted in the UK. These studies compared a support programme of counselling with a control group who received normal service from community pharmacy personnel. Both studies reported an improvement in self-reported cessation rates: one study reported at 12 months (14.3% versus 2.7%, $p < 0.001$), while the other study showed a positive outcome at 9 months (12.0% versus 7.4%, $p = 0.09$).

The second review, a meta-analysis by Saba et al. (2014), also assessed the effectiveness of smoking cessation interventions in community pharmacies. It included five relevant studies (three RCTs and two controlled before and after studies) from the USA, UK and Sweden. The interventions in these studies provided advice and counselling to patients, either on a one-to-one basis or in group sessions. The results suggested that smoking cessation interventions delivered by community

Table 1
Summary of systematic reviews exploring the effects of smoking cessation interventions.

Study	No. of relevant studies (number of articles if different)	Context (country, search timeframe)	Intervention(s)	Summary of results	Health inequalities assessed/reported	Quality rating of review
Sinclair et al. (2004)	2 (6)	Northern Ireland and Scotland; searches from inception to October 2007.	Smoking cessation intervention involving training with the Stages of Change Model and a support programme of counselling and record keeping. <i>Two studies were duplicated in Saba et al. (2014). Two studies were duplicated in Blenkinsopp et al. (2003).</i>	One study reported a significant effect in self-reported cessation rates at 12 months. The other study showed a positive but non-significant effect at 9 months.	Not mentioned as an outcome in the review. No health inequality data presented.	1
Saba et al. (2014)	5	USA, UK and Sweden; searches from inception to May 2013.	Smoking cessation intervention providing advice and counselling to patients, either on a one-to-one basis or within group sessions (one study offered nicotine replacement therapy (NRT) in addition). <i>Two studies were duplicated in Sinclair et al. (2004). Three reviews were duplicated in Blenkinsopp et al. (2003). Three reviews were duplicated also in Brown et al. (2016).</i>	Smoking cessation interventions resulted in better abstinence rates compared with controls (RR 2.17, 95% CI 1.43, 3.31). The use of NRT and biochemical validation yielded higher abstinence rates.	Not mentioned as an outcome in review. No health inequality data presented.	4

Table 2
Summary of systematic reviews on weight management programmes.

Study	No. of relevant studies (number of articles if different)	Context (country, search timeframe)	Intervention(s)	Summary of results	Health inequalities assessed/reported	Quality of review
Gordon et al. (2011)	10 (12)	USA, UK, Switzerland, Spain, Denmark; searches from January 1999 to June 2009.	Weight management interventions delivered in community pharmacy settings. <i>One study was duplicated in Brown et al. (2016).</i>	Weight management interventions can produce modest but significant weight loss. Two studies reported clinically significant weight loss at 3–6 months, three studies reported weight losses between 1.1 and 4.1 Kg at one year.	Not mentioned as an outcome in review. No subgroup analysis reported based on inequalities.	2

Table 3
Summary of systematic reviews on alcohol misuse.

Study	No. of relevant studies (number of articles if different)	Context (country, search timeframe)	Intervention(s)	Summary of results	Health inequalities assessed/reported	Quality of review
Watson and Blenkinsopp (2009)	3 (5)	UK; searches from 1996 to 2007.	Using screening tools (AUDIT/FAST) to identify hazardous and harmful drinkers and offering advice to reduce consumption.	Non-significant reductions in alcohol consumption.	Not mentioned as an outcome in review. No health inequality data presented.	4

Table 4
Summary of systematic reviews on syringe/needle exchange programmes.

Study	No. of relevant studies (number of articles if different)	Context (country, search timeframe)	Intervention(s)	Summary of results	Health inequalities assessed/reported	Quality of review
Nacopoulos et al. (2010)	16	USA; included studies published since 2000.	Pharmacy-based SEPs. One study was duplicated in Sawangjit et al. (2016).	Shown to improve the health outcomes of injection drug users by decreasing the transmission of blood-borne disease and lowering high-risk injective behaviours.	Not mentioned as an outcome in review. Minority men represent the largest portion of participants of SEPs. Women appear to be under represented among SEP participants.	5
Sawangjit et al. (2016)	13	USA, Australia, Estonia, Canada and the UK; searches from inception to January 2016.	Pharmacy-based SEPs. One study was duplicated in Nacopoulos et al. (2010).	Pharmacy SEPs appear to be effective for reducing risk behaviours among people who inject drugs, although their effect on HIV/Hepatitis C prevalence and economic outcomes is unclear. Sharing-syringe behaviour was significantly better in pharmacy-based SEPs compared to no SEPs. For all studies the odds ratio was 0.50 (95% CI = 0.34, 0.73; I^2 = 59.6%). The odds ratio was 0.52 (95% CI = 0.32, 0.84; I^2 = 41.4%) when excluding studies with a high risk of bias.	Not mentioned as an outcome in review. No health inequality data presented.	2

Table 5
Summary of systematic reviews on inoculation services.

Study	No. of relevant studies (number of articles if different)	Context (country, search timeframe)	Intervention(s)	Summary of results	Health inequalities assessed/reported	Quality of review
Burson et al. (2016)	17	USA (and one based in Puerto Rico); searches from 1992 to 2016.	Pharmacy-based Inoculation Service (PBIS).	Review provides evidence that PBIS increases vaccination rates, and is more accessible to medically underserved populations, especially when compared to physician-based vaccinations.	Included 'health disparities and access among medically at-risk or underserved populations' as part of effectiveness primary outcome. One primary study showed that pharmacies located in poor and/or ethnically diverse areas were both less likely to offer inoculation services and have lower vaccination rates. However, another study demonstrated that different ethnicities who collected prescriptions at community pharmacies had higher vaccination rates compared to respondents who did not. One primary study demonstrated that patients living in smaller towns were more likely to receive vaccinations in non-traditional settings.	5

pharmacists resulted in better abstinence rates when compared with controls (RR 2.17, 95% CI 1.43, 3.31). There was also evidence that the use of NRT alongside counselling yielded higher abstinence rates (RR 3.46, 95% CI 1.66, 7.23).

3.1.2. Weight management

A systematic review by Gordon et al. (2011) explored the effectiveness of community pharmacy-delivered weight management interventions (Table 2) and concluded there was insufficient evidence for their effectiveness. Of the 10 primary studies included, one was also reported in the multi-component review, undertaken by Brown et al. (2016). Studies from this review were conducted in the USA, UK, Switzerland, Spain and Denmark. All of the interventions included in this review had multiple components and focused on dietary advice, improving physical activity, meal replacement, or using pharmacotherapy to promote weight loss. Overall, modest, but significant, weight loss among participants was reported in all of the studies, although the review acknowledged the included studies had reporting and methodological weaknesses. In view of this, the authors of the review concluded that there was insufficient evidence for the effectiveness and cost effectiveness of community pharmacy-based weight management initiatives to support investment in their provision.

3.1.3. Alcohol misuse

A single review by Watson and Blenkinsopp (2009) examined the feasibility of providing community pharmacy-based services for alcohol misuse (Table 3). The review included three relevant primary studies conducted in the UK that used approaches to identify hazardous and harmful drinking. The studies found non-significant reductions in alcohol consumption following brief interventions.

3.1.4. Syringe/needle exchange programmes

Two reviews examined the impact of syringe/needle exchange programmes (SEPs) based in community pharmacies for intravenous drug users (Table 4), and showed a clear effect in improving health outcomes. In total, twenty-eight unique primary studies were identified by the two reviews (one study was duplicated in both reviews).

The first review, by Nacopoulos et al. (2010), which synthesised evidence from 16 primary studies conducted in the USA, concluded that such interventions can have a positive effect on health outcomes by reducing high-risk injecting behaviours. The work also demonstrated that people using SEPs had lower rates of injection frequency, unemployment, jail time, homelessness, smoking, and alcohol use compared with intravenous drug users who do not participate in SEPs.

The second review, by Sawangjit et al. (2016), included evidence from 13 studies – the majority of which were undertaken in the USA, although studies from the UK, Australia, Estonia, and Canada were also included. The review found that community pharmacy-based SEPs were effective in reducing high-risk behaviours among intravenous drug users (e.g. syringe-sharing behaviour). When only higher quality studies were considered, syringe-sharing behaviour was significantly better in community pharmacy-based SEPs compared to no SEPs (OR = 0.52; 95% CI = 0.32, 0.84; I^2 = 41.4%).

3.1.5. Inoculation services

One systematic review examined the health effects of inoculation services offered by community pharmacies (Table 5). The review, by Burson et al. (2016), concluded that pharmacy-based immunisation interventions are capable of improving access to immunisation services, which has the potential to increase vaccination rates. In total, 17 primary studies included in this review were relevant to our review; 16 of the studies were conducted in the USA, and one was conducted in Puerto Rico. Most notably, community pharmacy-based services were effective in increasing influenza vaccination rates among people who had missed vaccination the previous year, or would have not otherwise received a vaccine. Evidence from the review also showed that nearly

Table 6
Summary of systematic reviews on multi-targeted interventions.

Study	No. of relevant studies (number of articles if different)	Context (country, search timeframe)	Intervention(s)	Summary of results	Health inequalities assessed/reported	Quality of review
Blenkinsopp et al. (2003)	11 (13)	USA, UK, Switzerland, Sweden, Canada; searches from 1990 to 2001.	Pharmacy-based activity in the reduction of risk behaviours and risk factors for coronary heart disease (smoking cessation and lipid-lowering treatments). Interventions include, counselling, advice, cholesterol screening, lipid management, blood pressure and weight management. <i>Two studies were duplicated in Ayorinde et al. (2013). Three reviews were duplicated in Saba et al. (2014). Two studies were duplicated in Brown et al. (2016). Two studies were duplicated in Sinclair et al. (2004).</i>	Review highlighted the clinical and cost-effectiveness of community pharmacies in smoking cessation and lipid management.	Not mentioned as an outcome in review. No health inequality data presented.	3
Brown et al. (2016)	Narrative synthesis: 19 (23 ^a) Meta-analysis: 10	UK, USA, Australia, Canada, the Netherlands, Japan, Denmark; searches from inception to May 2014.	Alcohol reduction (brief advice) (n = 2); smoking cessation (NHS smoking cessation service, NRT, training for pharmacists, advice giving, behavioural counselling/support) (n = 12); weight management (n = 5) (meal replacement, low calorie diet, diet and physical activity, orlistat plus support, individual or group support). <i>Two studies were duplicated in Sinclair et al. (2004). Three reviews were duplicated also in Saba et al. (2014). One review was duplicated in Gordon et al. (2011). Two reviews were duplicated in Blenkinsopp et al. (2003).</i>	Insufficient evidence to assess the effectiveness of community pharmacy-based interventions for alcohol reduction. Smoking cessation interventions are effective and cost effective, particularly when compared with usual care. Weight management interventions appear to be as ineffective as similar interventions in other health care settings, although have similar provider costs.	Mentioned as an outcome in review. Three primary studies adopted a targeted approach (recruiting participants from deprived areas). Two studies involving weight management and smoking cessation found there were demographic and socioeconomic differences between participants who self-selected treatment by setting.	2

^a Although review states 19 studies were included from 23 articles, only 19 references are included in text/tables and therefore reported here in total number of primary studies.

Table 7
Summary of systematic reviews on screening programmes.

Study	No. of relevant studies (number of articles if different)	Context (country, search timeframe)	Intervention(s)	Summary of results	Health inequalities assessed/reported	Quality of review
Ayorinde et al. (2013)	50 (51)	Various (USA, Australia, UK, Thailand, Switzerland, Spain, Canada, South Africa, Ireland); searches from 1990 to August 2012.	A range of screening tools including questionnaires or risk assessment forms, medical equipment and psychological measurements. A range of diseases were assessed including cardiovascular risk factors, musculoskeletal diseases, diabetes or diabetes risk factors, depression, sleep disorders, respiratory diseases, colon, breast or bowel cancer. <i>Three studies were duplicated in Lindsey et al. (2015). Eight studies were duplicated in Nguyen (2017). Two studies were duplicated in Elias et al. (2011). Two studies were duplicated in Blenkinsopp et al. (2003).</i>	The evidence suggests that screening for some diseases in community pharmacies is feasible, although the quality of many of the studies is poor. Between 4 and 89% of screened individuals were identified with disease risk factors.	Not mentioned as an outcome in review. No health inequality data presented.	4
Lindsey et al. (2015)	12	Various (USA, Australia, Italy, Germany, Korea and Spain); searches from inception to June 2015.	<i>Educational interventions (n = 4)</i> Three focused on educating women about breast and cervical cancer and a fourth study on colorectal cancer investigated educational handouts and advice versus screening. <i>Screening interventions (n = 10)</i> Six studies used a test kit and four studies provided screening through questionnaires or checklists. <i>Three studies were duplicated in Ayorinde et al. (2013).</i>	Review demonstrates scope to use community pharmacies as a setting to deliver education and screening for early cancer detection. The studies, which focused on a variety of different cancers, showed it was feasible to recruit patients to these interventions, however the primary studies were poorly described.	Not mentioned as an outcome in review. Reported one primary study which looked at breast and cervical cancer screening in low and moderate income women and concluded community pharmacies could be used to identify 'at risk' patients and to refer them on for further investigation.	3
Elias et al. (2011)	3	Australia, USA and Canada; searches conducted up to April 2010.	A range of enhanced care for osteoporosis management interventions were utilised including education, bone mineral density testing, medication reviews and a heel quantitative ultrasound. <i>Two studies were duplicated in Ayorinde et al. (2013). Two studies were duplicated in Nguyen (2017).</i>	Mixed results highlighted: one study showed no significant difference between groups, one found significant improvements (though the results could have been influenced by a high level of bias) and the final study found significant improvements for the intervention group with a low risk of bias.	Not mentioned as an outcome in review. One primary study was targeted at suburban and rural communities only.	1
Nguyen (2017)	9	USA, Canada, Australia; search timescale not specified.	Osteoporosis screening by dual X-ray absorptiometry (DXA) and/or quantitative ultrasound with one study that used peripheral instantaneous X-ray (PIXI). Osteoporosis education and/or counselling was offered in addition in most of the studies. <i>Two studies were duplicated in Elias et al. (2011). Eight studies were duplicated in Ayorinde et al. (2013).</i>	Community osteoporosis screening services showed positive outcomes in osteoporosis identification, risk identification, calcium intake, service satisfaction, primary care physician perspective, and financial sustainability.	Not mentioned as an outcome in review. No health inequality data presented.	5

Table 8
Summary of systematic reviews on chlamydia testing.

Study	No. of relevant studies (number of articles if different)	Context (country, search timeframe)	Intervention(s)	Summary of results	Health inequalities assessed/reported	Quality of review
Kapadia (2013)	11	UK, USA, Netherlands and Australia; searches from 1995 to June 2011.	Chlamydia screening offered mainly to women attending an emergency contraception appointment or displaying self-test kits which were offered to clients presenting for any sex-related product or consultation. <i>Eight studies were duplicated in Gudka et al. (2013).</i>	The reported acceptance of chlamydia screening was between 10 and 47%. The proportion subsequently who returned a kit was between 12 and 64%. Meta-analysis demonstrated a chlamydia positivity of 8.1% (95% CI 7.3, 8.9).	Not mentioned as an outcome in review. Reported that young women were more likely to be reached than young men. Also, women who were older than 24 years old, who had received the minimum Year 12 or equivalent qualification, were working full-time and were from a less deprived area were more likely to accept the offer of a screening kit. With regards preferential uptake by ethnic minorities, the evidence was mixed.	5
Gudka et al. (2013)	10	UK, Australia, USA and the Netherlands; searches up to October 2011.	Consumers could request a chlamydia test as part of a population-based intervention (n = 3), or pharmacists could offer a chlamydia test to consumers attending the pharmacy for a sexual health-related consultation (opportunistic screening, n = 4). Some studies used both population-based and opportunistic chlamydia screening. <i>Eight studies were duplicated in Kapadia (2013).</i>	The rate of return was greatest for population-based chlamydia testing (38–63.9%). Opportunistic screening was generally lower, with a rate of return between 12 and 28%.	Not mentioned as an outcome in review. Five of the pharmacy-based chlamydia screening interventions targeted men as well as women. Two studies from the UK showed that 21% of the tests distributed and 36% of the tests purchased were from men.	3

one third of the vaccines were administered outside the traditional working day (such as evenings and weekends), highlighting the unique accessibility of the community pharmacy network.

3.1.6. Reviews examining multiple interventions

Two systematic reviews examined a variety of public health interventions undertaken by community pharmacies (Table 6). The review by Blenkinsopp et al. (2003) examined the effectiveness of community pharmacy interventions to reduce risk behaviours and risk factors associated with coronary heart disease (smoking cessation, lipid management and blood pressure management). The review included 11 relevant studies, which were conducted in the USA, UK, Switzerland, Sweden, and Canada. The authors concluded that, through a combination of testing and counselling approaches, improvements in health could result from smoking cessation and lipid lowering interventions conducted in community pharmacies. Another review, by Brown et al. (2016), explored the effectiveness of community pharmacy-delivered interventions for alcohol reduction, smoking cessation and weight management. Nineteen relevant studies were included from the UK, USA, Australia, Canada, Netherlands, Denmark, Japan and Thailand. Pharmacy-based smoking cessation interventions (n = 12) including behavioural support and/or nicotine replacement therapy were shown to be both effective and cost-effective, particularly when compared with usual care. The pooled odds ratio for the intervention effects for smoking cessation was 2.56 (95% CI 1.45, 4.53). Evidence from two alcohol-reduction interventions was, however, limited, while community pharmacy-based weight management interventions (n = 5) were shown to be as effective as similar interventions in other primary care settings (at least in the short term), and had similar provider costs.

3.2. Secondary prevention

3.2.1. Screening

Four systematic reviews examined the impact of screening interventions from a community pharmacy setting: one for major diseases (Ayorinde et al., 2013), one on cancer screening (Lindsey et al., 2015), and two on osteoporosis screening (Elias et al., 2011; Nguyen, 2017) (Table 7). Overall, the results demonstrated that it was feasible to deliver screening interventions from community pharmacies, although it was not clear how these interventions impacted on health outcomes in terms of early diagnosis of disease.

The review by Ayorinde et al. (2013) included 50 relevant studies drawn from the USA, Australia, Germany, Korea and Spain. The review focused on a variety of major diseases, including cardiovascular, musculoskeletal, diabetes, depression, sleep disorders, respiratory diseases, and some cancers. Some screening approaches targeted 'at risk' individuals, while others screened an apparently healthy population; some interventions used both approaches, and targeted normal populations and 'at risk' individuals. The proportion of individuals that screened positively for either disease or disease risk factors ranged between 4% and 89%. Although patient satisfaction was high, the review authors noted it was common for patients who screened positive to ignore pharmacist referral to seek further medical attention in order to confirm the presence of disease through diagnostic testing.

The second review, by Lindsey et al. (2015), investigated education and screening interventions to promote the early detection of cancer (colorectal, prostate, breast and cervical cancer). The review included 12 primary studies conducted in the USA, Australia, Italy, Germany, Korea, and Spain. The work concluded that, although it was feasible to recruit patients to screening interventions in a community pharmacy setting, the interventions were poorly described (particularly in terms of delivery, education and fidelity) and that more evidence was needed to ascertain how such interventions impact on overall cancer survival.

Two reviews focused on osteoporosis screening by community pharmacies, both drawing from studies conducted in the USA, Canada and Australia. The review by Elias et al. (2011) included three primary

studies. Interventions were shown to improve the uptake of bone mineral density testing (diagnostic test of osteoporosis); people who were identified as being at a high risk of developing osteoporosis were also shown to increase their daily calcium intake. A similar review by Nguyen (2017) included nine relevant primary studies, although all but one of the studies was reported in the reviews by either Elias et al. (2011) or Ayorinde et al. (2013). This review found community pharmacy-based osteoporosis screening services to provide a cost-effective approach to preventing osteoporotic fractures for population health. Improvements relating to osteoporosis knowledge, risk identification, and increasing calcium intake were identified as integral components of a successful intervention.

3.2.2. Chlamydia testing

Two reviews reported on interventions to promote chlamydia testing (*Chlamydia trachomatis*) through community pharmacies (Table 8), and found a high level of patient acceptance and use. The review by Kapadia (2013) focused on assessing chlamydia prevalence, and included 11 relevant primary studies conducted in the UK, USA, The Netherlands or Australia; the majority of the testing programmes were aimed at people seeking emergency hormonal contraception from community pharmacies. The meta-analysis showed a chlamydia positivity of 8.1% (95% CI 7.3, 8.9%) when testing was undertaken in community pharmacies, which was similar to that reported from general practices (Adams et al., 2004), but lower than that reported for internet-based testing (Gaydos et al., 2011).

The second review, undertaken by Gudka et al. (2013), included ten relevant studies from the USA, UK, Australia and the Netherlands, and compared two different community pharmacy approaches to chlamydia testing: (i) population-based; and (ii), opportunistic chlamydia testing. The review showed that population-based screening had a higher rate of return (38–63%), compared to opportunistic testing (12–28%).

3.2.3. Differential effects by demographic or socioeconomic factors

Out of the 15 included systematic reviews, seven reviews included studies that reported the effects of community pharmacy interventions by demographic or socioeconomic factors (Brown et al., 2016; Burson et al., 2016; Elias et al., 2011; Gudka et al., 2013; Kapadia, 2013; Lindsey et al., 2015; Nacopoulos et al., 2010).

Kapadia (2013) examined the profile of patients undertaking chlamydia screening and concluded the service was targeted mainly at young people < 24 years of age, women receiving emergency contraception or gay men. One of the included primary studies showed that women who were older than 24 years, had received Year 12 or equivalent education, were working full-time and were from a less deprived area were more likely to accept the offer of a testing kit. This review also highlighted that there were mixed results in terms of uptake of the test according to ethnic group. In terms of differences in the uptake of SEPs, review-level evidence by Nacopoulos et al. (2010) demonstrated that ethnic minority men represented the largest portion of participants using such a service, while women were less likely to use the service. The review on cancer screening by Lindsey et al. (2015) identified one primary study that examined breast and cervical cancer screening uptake among low and moderate income women, and concluded community pharmacies could be used to identify ‘at risk’ patients. A targeted approach to osteoporosis screening was reported in the review by Elias et al. (2011), whereby people living in suburban and rural communities were the main focus of the intervention. Burson et al. (2016), who reviewed pharmacy-based immunisation services, showed the impact of vaccination uptake on social and geographical inequalities was mixed: some studies showed that community pharmacies located in poor and/or ethnically diverse areas were less likely to offer inoculation services; these pharmacies also had lower vaccination rates, compared to pharmacies located in more affluent areas. However, the review also showed there was a broad uptake of vaccination services delivered through community pharmacies across a variety of ethnic

groups. Finally, the review by Brown et al. (2016) was unique in comparison to the other included reviews in that it set to explicitly explore how the interventions affected inequalities in health: while none of the included studies reported subgroup analysis of treatment effect by socioeconomic status, three primary studies adopted a targeted approach to address inequality and specifically recruited participants from deprived areas.

4. Discussion

This review presents the best available evidence on the effectiveness of community pharmacy delivered public health interventions. Fifteen systematic reviews were included in this review of reviews, comprising 157 unique primary studies. There were a number of community pharmacy initiatives with clear positive intervention effects on primary disease prevention: those focusing on smoking cessation, weight management, SEPs, and inoculation services. The intervention effects of services focusing on secondary prevention (e.g. screening interventions) were less clear, given many studies did not report how such interventions supported the early diagnosis of disease. There was limited review-level evidence examining the effects of the interventions on health inequalities, as few studies reported sub-group analyses based on the PROGRESS-Plus framework. While this may be the result of the systematic reviews failing to report all relevant published subgroup outcomes, it is more likely to reflect that the primary study evidence base has not considered outcomes according to PROGRESS-Plus. The majority of the studies reporting health inequalities described in this review evaluated targeted interventions (i.e. interventions targeted towards people of low SES). Other types of interventions used to target health inequalities include interventions focused upon narrowing the gap between the least and most disadvantaged (the gap approach), while others can focus on reducing the social gradient in health (the gradient approach), although our review did not find any examples of these in the literature. Our review has also highlighted limited evidence that suggests some interventions have potential to increase health inequalities – potentially leading to so-called ‘intervention generated inequalities’ (Lorenc et al., 2013). One such example was chlamydia testing, whereby older, more educated women, from less deprived areas were more likely to access the service.

This review has many strengths: our search strategy was broad and wide-ranging, which included an inclusive database and grey literature search. In addition, no language or date restrictions were applied to our search strategy. We also did independent study selection and applied a well-validated quality appraisal tool. Consequently, the reviews presented here, and the list of primary studies for which they report, detail the health effects for the majority of the relevant studies available at the time of our search.

A limitation of the final included reviews was their study designs, as several did not assess the quality of the included primary studies. Furthermore, the differential effects of the interventions by demographic or socioeconomic factors were limited, in part due to the reporting practices by both the primary study and systematic review authors. Therefore, like all review of reviews, we have only synthesised the results of existing systematic reviews and the relevant primary studies included within them (Thomson et al., 2018). It is likely that in a number of intervention areas, additional primary evaluations have been conducted either after the systematic reviews have been completed, or perhaps they did not fit the inclusion criteria for the systematic reviews. Furthermore, it is possible that there is publication bias (that negative results are less likely to be published) with regards to the primary studies. Positive intervention effects in primary studies are compounded in systematic reviews (and thus review of reviews) as the primary study evidence base may be distorted. This review of reviews is, therefore, a synthesis of the findings from published systematic reviews, not a synthesis of all primary studies of such interventions. Finally, the included systematic reviews in this review of

reviews were focused almost exclusively on high-income countries, despite an inclusive PICOS, which sought to include studies from any country. Only four primary studies were from low or middle income countries (Thailand and South Africa) representing 2.5% of the unique primary studies identified here. In view of this, the findings from this review of reviews are not necessarily transferable to community pharmacies located in low or middle income countries and further primary studies and subsequent reviews should seek to address this important gap.

This review supports the policy shift of community pharmacies delivering public health programmes to improve health, and prevent disease – particularly those aimed at primary prevention. It is clear that any future initiatives regarding community pharmacy and public health should be underpinned by the best available evidence; for example, previous community pharmacy campaigns have employed interventions focused on reducing alcohol misuse when the literature suggests such interventions have no impact on health or health behaviour.

This work also highlighted some important gaps in the literature regarding community pharmacy and public health services. The majority of the included systematic reviews included interventions directed towards physical health; there were no systematic reviews that exclusively focused on public mental health interventions. We note that a number of primary studies have been undertaken exploring the role of the community pharmacist in screening for depression (see, for example, (Kondova et al., 2018; Wilson and Twigg, 2018)), with others focusing on interventions preventing the development of depression (ISRCTN registry, 2017), but as yet, no systematic reviews have explored the effect of community pharmacy-based services on public mental health. Given the association between mental and physical health, and that mental health conditions are a significant cause of overall disease burden worldwide, it would be sensible for future systematic reviews to explore this.

5. Conclusions

This review supports the development of some community pharmacy public health services – particularly those focused on the primary disease prevention. At present, little is known how community pharmacy-delivered public health interventions impact on health inequalities. It would be prudent for future studies to address this by explicitly reporting outcomes according to the PROGRESS-Plus framework.

Abbreviations

AMSTAR 2	Assessment of Multiple Systematic Reviews
DARE	Database of Abstracts of Reviews of Effects
PICOS	criteria for inclusion and exclusion of studies
PROGRESS-Plus	acronym to identify population and individual characteristics across which health inequities may exist
PROSPERO	international prospective register of systematic reviews
RCT	randomized controlled trial
SEPs	syringe/needle exchange programmes

Competing interests

The authors declare they have no competing interests.

Authors' contribution

AT designed and oversaw the study with KT and FHB. KT, FHB and NW conducted the searches, reviewed articles for inclusion, extracted data and conducted quality appraisal. KT, FHB and NW independently reviewed the extracted data. KT and AT drafted the manuscript with input from CB, FHB, NW and MB. All authors read and approved the final manuscript.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ypmed.2019.04.003>.

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