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## ***Community pharmacists' Contribution to public health: assessing the global evidence base***

### **Abstract**

In the UK, community pharmacies are more accessible to the general population than general practices. Therefore, government white papers and briefing documents from pharmacy professional bodies have advocated the expansion of the role of community pharmacists, particularly in relation to the provision of services that contribute to disease prevention and health improvement. It is unknown whether the same evidence exists globally for the expansion of these roles.

This article attempts to appraise and summarise the global evidence for the public health roles that community pharmacists play. Barriers, as well as strategies that can enhance these roles, are also discussed.

Electronic databases were searched to retrieve relevant literature published since 1 January 2000. The selected literature included 2 meta-analyses, 7 literature reviews, 23 interventional studies and 41 descriptive studies. These were assessed according to health topics (i.e. smoking cessation, weight management, health promotion, disease screening and preventive activities, vaccination and immunisation, alcohol dependence advice and drug misuse, emergency hormonal contraception, and sexual health services).

The effectiveness of community pharmacy-based public health interventions was shown in smoking cessation, health promotion, disease screening and preventive activities, provision of emergency hormonal contraceptive, and vaccination services. Although there was mixed evidence with respect to weight management and alcohol dependence advice interventions, the available data suggest feasibility and acceptability of these services due to the perceived ease of access and convenience.

### **Key points:**

- The effectiveness of community pharmacy-based public health interventions was shown in smoking cessation, health promotion, disease screening and preventive activities, provision of emergency hormonal contraceptive, and vaccination services.
- Overall, the evidence demonstrates that pharmacists are capable of providing both population-based and individual level public health services.
- However, strategies that can help facilitate and enhance community pharmacists' public health roles are needed.
- Further studies on cost-effectiveness of community pharmacists' public health intervention are also needed.

## ***Introduction***

The World Health Organization (WHO) defines health as “A state of complete physical, mental and social wellbeing, and not merely the absence of infirmity”[1]. The main determinants of health include non-modifiable factors (e.g. age, sex and hereditary factors) and modifiable factors (e.g. individual lifestyle, social and community influences, living and working conditions, and general socio-economic, cultural and environmental conditions)[2]. Since these determinants were identified, there has been increased awareness of health as a global issue[3].

The UK Faculty of Public Health (FPH) defines public health as “The science and art of promoting and protecting health and wellbeing, preventing ill health and prolonging life through the organised efforts of society”[4]. Based on the FPH definition, public health is seen as population based; is focused on a collective responsibility for health, health protection and disease prevention; recognises the important role of the state, along with socio-economic and wider determinants of health; and stresses partnerships with all those whose actions contribute to the health of the population[4]. The FPH recognises three key domains of public health practice: health improvement, improving services and health protection. According to the WHO, activities that enhance public health capacities and services provide conditions that enable individuals to continue to be healthy, improve their wellbeing, or prevent the worsening of their health[5]. Therefore, public health focuses on the entire spectrum of health and wellbeing, not just the eradication of specific diseases[5]. While a number of activities are directed at specific populations (e.g. health campaigns), public health services also involve the provision of personal services, such as vaccinations, behavioural counselling and health advice [5].

Pharmaceutical public health is defined as “The application of pharmaceutical knowledge, skills and resources to the science and art of preventing disease, prolonging life, promoting, protecting and improving health for all, through organised efforts of society”[6]. British government white papers have advocated for the expansion of the role of the community pharmacist, particularly in relation to the provision of public health services [7], [8], [9], [10]. A key driver for this has been the increasing recognition of community pharmacists as one of the most accessible healthcare professionals with the ability to mitigate inequitable access to health services [11], [12], [13], [14]. One British government report indicates that >90% of the general population will visit a community pharmacy at least once in a given year [12]. Reports also show that health services in community pharmacies are more accessible to the general population than general practices in the UK, with the majority of the population living within a 20-minute walk of a community pharmacy[15],[16]. Community pharmacists are also readily

available and equipped with the knowledge and skills needed to meet the health-seeking behaviour of the society served, especially in relation to early disease prevention, health protection and health improvement[8],[12].

Even though pharmacy practice and education have evolved from an initial narrow, product-centred model to the present patient-centred model, it has done so to a varying degree in different countries [17]. While a number of meta-analyses and systematic literature reviews on the public health initiatives delivered by community pharmacists have been published in recent years[18],[19], these publications have primarily focused on the effectiveness of specific public health activities, such as smoking cessation[18],[19]; alcohol use, dependence and weight management[18]; and vaccination[20]. Some of these have focused on specific countries or regions [21]. This article aims to provide an overview of the global evidence (including UK studies) on the public health contributions of community pharmacists. Barriers, as well as strategies that can enhance these roles, will also be discussed.

### ***Methods***

The electronic databases SCOPUS, Web of Science, OvidSP, PubMed, MEDLINE and CINAHL were searched for relevant literature published since 1 January 2000. The keywords used were a combination of: community pharmacy, pharmacist, public health, health promotion, health improvement, health protection, disease prevention, and disease screening. A free text search using Boolean operators [OR & AND] to combine words was conducted for the databases. Keyword truncation (i.e. pharm\* and public\*) was also utilised to ensure all relevant articles were included in the search. Keyword searches were also conducted on the Google Scholar platform. The reference lists of retrieved literature were further searched for relevant articles. A schematic of the literature selection process using Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) is presented in Figure 1. Studies included were those that reported: effectiveness, cost-effectiveness, and overall involvement of community pharmacists' public health activities. These included interventional, descriptive, and public health evaluation studies involving community pharmacists. Studies on public health initiatives or activities not based in a community pharmacy setting, editorials and research papers that did not include a clearly defined population, intervention or target group were excluded.

### ***Data Extraction***

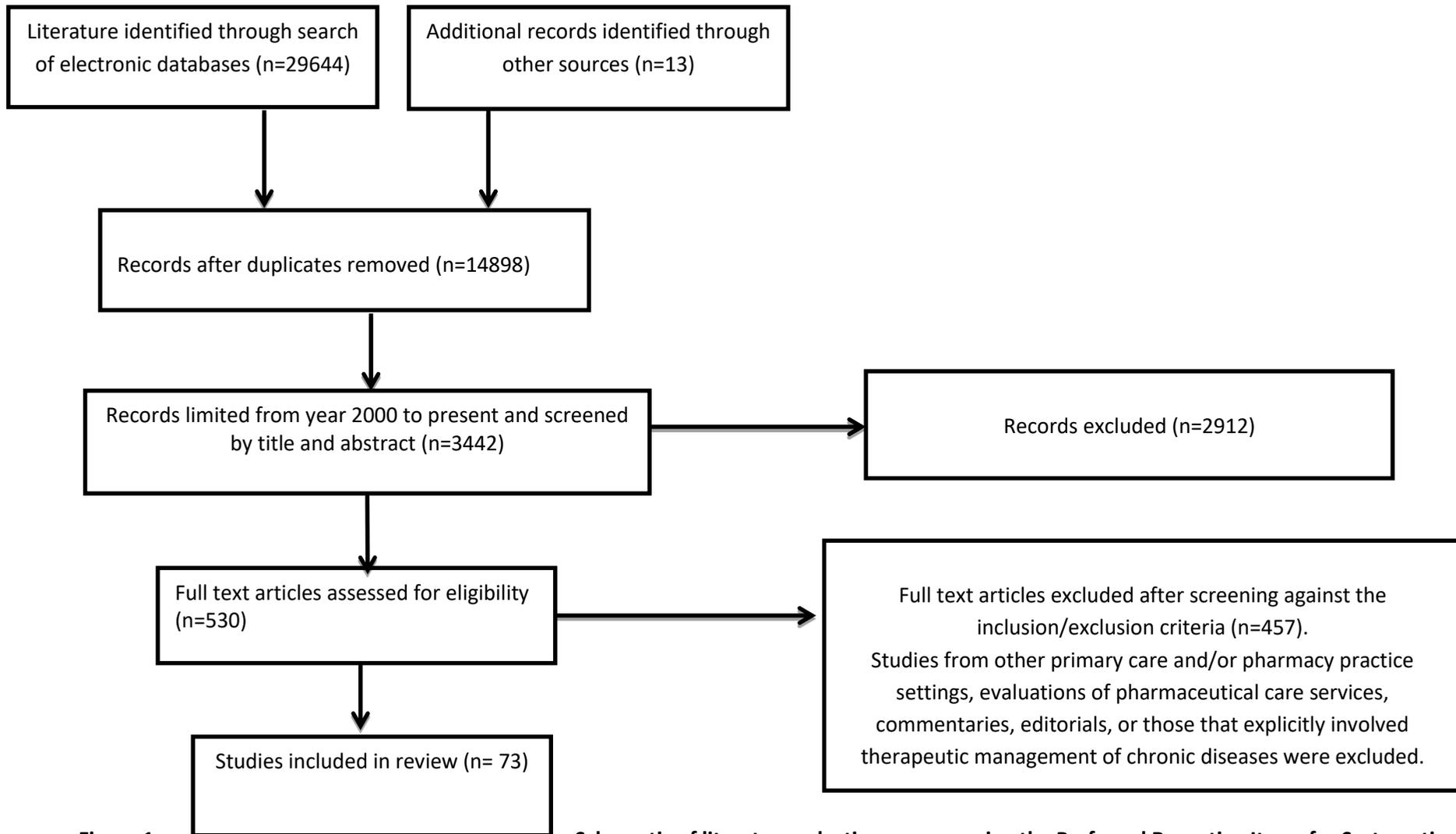
Two of the review authors (AU and CA) independently screened all identified titles and their abstracts for relevance (n= 3,442). Full-paper manuscripts (n=530) were then screened against the inclusion and exclusion criteria by AU, CA and EK, with the outcomes compared by JO-O to confirm consistency. The final list of selected papers was further assessed by JO-O to confirm the relevance of the identified studies with discrepancies resolved via consensus.

## **Results**

In total, 73 articles were selected and included in this review. Evidence from systematic reviews and meta-analyses of community pharmacy-based public health interventions were reviewed according to published guidelines [22], [23], [24], [25]. Original articles already included in existing meta-analysis and systematic reviews selected for this paper were not further reviewed. The selected papers (see Table 1) were graded according to the quality of evidence grading system used in other published public health literature [21], [26], [27]:

- Level A: Evidence from meta-analyses or systematic reviews that included at least one randomised controlled trial (RCT);
- Level B: Evidence from individual RCTs or non-RCT, experimental or interventional studies, and individual non-experimental studies;
- Level C: Descriptive and other research or evaluation not in level B, including case studies and examples of good practice;
- Level D: Summary review articles and discussion of relevant literature and conference proceedings not otherwise classified;
- Level E: Expert opinion, case reports, focus groups or qualitative studies.

The selected literature included 2 meta-analyses, 7 literature reviews, 23 interventional and 41 descriptive studies (see Table 1). Evidence from the literature is presented according to health topics, including smoking cessation, weight management, health promotion, disease screening and preventive activities, vaccination and immunisation, alcohol dependence advice and drug misuse, emergency hormonal contraception and sexual health services. Other papers that reported perceptions and barriers to community pharmacists' involvement in public health activities, as well as strategies that can enhance their public health roles, are also presented under the respective themes. The reviews by Brown et al [18] and Anderson et al [27] covered multiple public health topics; their findings are reported according to the themes of this paper, as shown in Table 1.



**Figure 1:**  
**Schematic of literature selection process using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA)**



**Table 1: Summary of Included papers**

Public Health Themes	Publication/study Type (N)	Author/year	Design	Country (N)	Level of Evidence	Summary
<b>Smoking cessation (N=12)</b>	Meta-analysis (2)	Saba et al 2014	Included 3 RCT, 2 before/after studies with control group	Sweden (1), UK (3), USA (1),	Level A	Conclusive evidence on the effectiveness of smoking cessation services delivered by community pharmacists. Cessation interventions that included provision of behavioural modification counselling were more effective. Time pressures and non-availability of appropriate training limited implementation of service in community pharmacies.
		*Brown et al 2016	Included 10RCT, 1 nRCT, 1 before/after study with control group	Australia (2), Japan (1), Canada (1), UK (4), USA (2), Netherlands (1) Denmark (1)		
	Literature review (2)	*Anderson et al 2003	Included 2RCT, 3 nRCT	Sweden (1), Germany (1), UK (2), Switzerland (1)	Level A	
		Agomo 2012	Included 4 Surveys, 1 report, 3 reviews, 1 guideline document	UK (4), USA (3), Malaysia (1), Turkey (1)	Level A	
	Descriptive (8)	William et al 2000, Çalgan 2007, Thananithisak et al 2008, Nimpitakpong et al 2010, Hoch et al 2012, Mohamed et al 2013, Kurko et al 2010, El Hajj et al 2012	Cross sectional survey	Qatar (1), UK (1), USA (1), Finland (1) Thailand (2), Turkey (1) and Sudan (1)	Level C	

\*Reviewed multiple public health topics with the findings reported according to themes in this paper

Public Health Themes	Publication/study Type (N)	Author/year	Design (N)	Country (N)	Level of Evidence	Summary
<b>Weight Management (N=7)</b>	Literature review (3)	*Anderson et al 2003	One before/after study with no control group	Denmark	Level B	Available evidence demonstrates the feasibility and acceptability of the service, however the data on effectiveness is mixed relative to reduction in weight and BMI compared to other primary care settings and/or commercial providers. Interventions that included lifestyle advice on diet, physical activity and behavioural changes were more effective. Privacy concerns, time constraints and perceived lack of expertise and specialist knowledge were key barriers identified from consumer surveys.
		*Brown et al 2016,	Included 3RCT, 1 before/after study with control group, 1 nRCT	UK (2), USA (2), Thailand (1)	Level A	
		Hermansyah et al 2016	1 RCT	Thailand (1)		
	Intervention (1)	Boardman and Avery 2014	Before and after study with no control group	UK (1)	Level B	
		Descriptive (5)	Newlands et al 2011,	Cross sectional survey (3), qualitative interviews (2)	UK (3), Australia (2)	
Weidmann et al 2012, Um et al 2012, Um et al 2013, Weidmann et al 2015						

\*Reviewed multiple public health topics with the findings reported according to themes in this paper

Public Health Themes	Publication/study Type (N)	Author/year	Design	Country (N)	Level of Evidence	Summary
<b>Health promotion and education campaigns (N=8)</b>	Intervention (2)	Castillo-García et al 2011	Before/after evaluation plus cross sectional survey	Spain	Level B	Effective in improving public knowledge and awareness of targeted health related issue. Although pharmacists were generally positive about role, they indicated lack of knowledge and inadequate training limited their involvement in providing the service
		Murphy and Dipietro 2012	Before/after with no control group	USA		
	Descriptive (6)	Laliberte et al 2012, Schmiedel et al 2013, Beshir and Bt Hamzah 2014, Real et al 2014, Ayoub et al 2016, Mizoguchi et al 2016	Cross sectional survey and one participatory research	Malaysia (1), Jordan (1), Canada (1), Argentina (1), Germany (1), Japan (1)	Level C	
<b>Disease Screening and prevention activities (N=13)</b>	Intervention (9)	Houriha et al 2003, Krass et al 2003, Krass et al 2007, Peterson et al 2010, Fuller et al 2011, Perraudin et al 2015, Sushilkumar 2015, Tsuyuki et al 2016, Sandhu et al 2016	1RCT, Cohort study with follow up (8)	Canada (2), Australia (4), France (1), New Zealand (1) India (1)	Level B	Intervention increased access and was effective in early identification of at-risk group with subsequent referral to physician. Also provides an avenue for lifestyle modification counselling to service users
	Descriptive (4)	Watson et al 2003, Weidle et al 2014, Lowres et al 2015, Schmiedel et al 2016	Cross sectional survey and one qualitative interview	Australia (1), USA (1), Germany (1), UK (1)	Level C	

Public Health Themes	Publication/study Type (N)	Author/year	Design	Country (N)	Level of Evidence	Summary
<b>Vaccination and immunization (N=6)</b>	Literature review	Burson et al 2016)	Included 25 cross sectional surveys, 4 cohort studies, 4 case control studies, 4 experimental studies, 3 modelling studies, 7 single-subject design	USA (47)	Level A	Data indicates that community pharmacists' involvement in service provision improved coverage, expanded access and increased likelihood of uptake
	Intervention (2)	Iseñor et al 2016, Buchan et al 2017	Before/after with no control group	Canada (2)	Level B	
	Descriptive (3)	Valiquette and Bédard 2015, Evans et al 2016, Kulczycki et al 2017	Qualitative interviews and one cross sectional survey	UK (1), Canada (1), USA (1)	Level C	
<b>Alcohol dependence advice and drug misuse services (N=6)</b>	Literature review (2)	Watson and Blenkinsopp 2009	3 before/after studies with no control group	UK (3)	Level B	Limited evidence on effectiveness of service. The literature also reports poor uptake by the public and limited overall involvement by community pharmacists. This was primarily due to lack of training, adequate knowledge and confidence in providing the service. However, the evidence suggests feasibility and acceptability of the service.
		*Brown et al 2016	2 RCT	UK (2)	Level A	
	Intervention (2)	Khan et al 2013	Before/after study with no control group	UK	Level B	
		Cochran et al 2016	Cohort study	USA		
Descriptive (3)	McCaig et al 2011, Horsfield et al 2011, Sheridan et al 2012	Cross sectional survey and one qualitative interview	USA (1), New Zealand (2)	Level C		

\*Reviewed multiple public health topics with the findings reported according to themes in this paper.

Public Health Themes	Publication/study Type (N)	Author/year	Design	Country (N)	Level of Evidence	Summary
<b>Emergency contraception and sexual health (N=4)</b>	Literature review (3)	*Anderson et al 2003	3 before/after study with no control group, 2 cross sectional surveys, one qualitative interview	UK (4), USA (2)	Level B	Promoted improved access to emergency contraception with users indicating they valued the ease and convenience of the service.
		Anderson and Blenkinsopp 2006	Included one RCT, 5 before/after studies, 9 qualitative interviews/focus groups and cross sectional surveys	Canada (3), Sweden (2), South Africa (1), Europe (1), France (1), Norway (1), Portugal (1) USA (6), UK (7)	Level A	
		Agomo, 2012	One RCT, 2 reviews, cohort study and cross sectional surveys	USA (4), Belgium (1), UK (2)	Level A	
	Descriptive (2)	Baraister et al 2007	Service evaluation plus qualitative interview	UK (1)	Level C	
		Gale and Watson 2011	Cross sectional survey	UK (1)	Level C	
<b>Cost effectiveness studies (N=8)</b>	Descriptive (3)	Pharmacy Research UK 2014, Royal Pharmaceutical Society 2014, Oswald & Adcock 2016	Commissioned reports (3)	UK (3)	Level B	Community pharmacy-based public health services such as smoking cessation and disease screening are cost effective. Intervention cost are off-set by reduction in use of other health services and increased quality adjusted life gained (QALYs)
		Thavorn & Chaiyakunapruk 2008, Perraudin et al 2013, Lowres et al 2014, Wright et al 2015a & 2015b	Cohort studies and one economic modelling estimate	UK (2), Thailand (1), France (1), Australia (1)	Level B	

\*Reviewed multiple public health topics with the findings reported according to themes in this paper

<b>Public Health Themes</b>	<b>Publication/study Type (N)</b>	<b>Author/year</b>	<b>Design</b>	<b>Country (N)</b>	<b>Level of Evidence</b>	<b>Summary</b>
<b>Perceptions, public views and barriers to implementation of public health services (N=5)</b>	Descriptive (5)	Bush et al 2009, Agomo 2012a, Agomo and Ogunleye 2014, Agomo 2012c, Saramunee 2014	Qualitative interview, focus group, 3 cross sectional surveys	UK (5)	Level C	Community pharmacists generally had positive views about their involvement in public health activities. Barriers to participation in these services include time constrains, lack of training and inadequate knowledge and skills.
<b>Strategies that can enhance the public health roles of community pharmacists (N=4)</b>	Descriptive (4)	Agomo and Ogunleye 2014, Agomo et al 2016a, Agomo et al 2016b, Agomo et al 2016c	Cross sectional survey and qualitative interview	UK (4)	Level C	Strategies that can enhance public health these roles of community pharmacists including provision of appropriate training, availability and familiarity with guidelines, availability of regulatory support and policies that encourage participation in these activities.

### **Smoking cessation services**

Two meta-analyses of community pharmacy-based smoking cessation interventions were included in this paper[18],[19]. The meta-analysis by Saba et al. with a total of 1,426 smokers demonstrated better abstinence rates in the intervention group compared with usual care (relative risk [RR]: 2.21; 95% confidence interval [CI]: 1.49–3.29)[19]. The paper by Brown et al., including more than 11,000 smokers, showed higher odds to quit smoking with community pharmacists' interventions. The odds of quitting varied depending on whether the metaregression model used accounted for the use of an active comparator group (pooled odds ratio [OR]: 1.21; 95% CI: 0.86–1.71) or a non-active and usual care comparator (pooled OR: 2.56; 95% CI: 1.45 to 4.53)[18]. The usual care and non-active comparators in the meta-analyses were primarily observation only, ad hoc smoking cessation advice, use of placebo nicotine patches and standard smoking cessation counselling. The findings are similar to the conclusions of two literature reviews that indicate community pharmacists' smoking cessation initiatives are effective in helping patients stop smoking[26],[27]. The review by Anderson et al. also showed that interventions incorporating counselling and behavioural change methods by community pharmacists were more effective[27]— a finding that was supported by a scoping review[26]. Evidence from six survey studies indicate that community pharmacists had positive perceptions of their roles in providing smoking cessation services, although self-reported involvement in these activities ranged from 21% in Qatar[28], 39% in the United States[29], 51–71% in Thailand[30],[31], 73% in Turkey[32] and 76% in Sudan[33]. Two studies showed that training[34], and availability, access to and familiarity with smoking cessation guidelines[35] improved community pharmacists' knowledge and involvement in providing smoking cessation services.

### **Weight management**

Three literature reviews showed mixed evidence on the effectiveness of community pharmacy-based weight-management interventions [18], [21], [27]. One of the reviews concluded that although there was a reduction in body mass index (BMI), waist circumference and weight loss with community pharmacy-based weight-management interventions, the service did not result in a statistically significant difference in these outcomes when compared with other settings. A before/after UK study involving the provision of one-to-one advice and a weight loss handbook (n=281) in the intervention arm demonstrated a significant reduction in weight and waist circumference from baseline (mean change: –3.07kg and –3.87cm, respectively) [36]. The review by Anderson et al. and an Australian study that involved semi-structured interviews with experts demonstrates that multi-component community pharmacy-based weight-management interventions that included advice on diet, physical activity and behavioural changes were likely to be more effective[27],[37]. The review by Hermansyah

et al. demonstrates that while there was no improvement in BMI, waist circumference and weight for the intervention group that received counselling, routine monitoring and comprehensive treatment, their theory of planned behaviours sum score significantly increased from baseline, including the intention to implement healthy eating behaviour ( $P < 0.05$ ) and overall knowledge ( $6.42 \pm 1.94$  to  $8.75 \pm 0.68$ ;  $P < 0.05$ ) compared with the control group [21]. Overall, the weight-management services offered by community pharmacists included the supply of weight-loss medication and advice, provision of dietary and physical activity counselling, and BMI measurement [38]. Generally, community pharmacy staff were positive and confident about providing the service, although they reported that their involvement in weight-management activities were mostly opportunistic and customer driven [39]. A survey designed to gather the views of the general public indicated that community pharmacy-based weight-management services were perceived to be easier and more convenient to access than in GP practices, although up to a quarter of the respondents expressed reservations about speaking to community pharmacy staff about their weight-related concerns[40]. Similar findings were reported by a patient survey conducted in Australia; most of the respondents had never sought weight-management advice from their community pharmacist, and those who had done so in the past expressed their willingness to support and pay for the service[41]. However, respondents also viewed the service as being primarily profit driven and perceived community pharmacists as lacking in expertise and time [41].

### **Health Promotion Services and Educational Campaigns**

Two studies that evaluated the effectiveness of community health education campaigns delivered by community pharmacists demonstrate improvement in public knowledge [42] and awareness of the self-care needed to prevent diseases [43]. An interventional study evaluating knowledge and perceptions after the implementation of a similar campaign also demonstrated an increase in patient satisfaction and knowledge on the health issue targeted [44]. Patients who participated in the campaign had better perceptions of the pharmacist and recognised the community pharmacy as a reference point for resolving health problems [44]. Studies from Malaysia [45], Jordan [46], Argentina [47] and Canada [48] showed that while community pharmacists generally had positive attitudes about their role in health promotion and education, actual involvement in these activities was limited. This was in contrast to a study that showed that up to 51% of community pharmacies in a province in Germany conduct a health campaign at least once per year [49]. Factors identified as barriers to community pharmacists' involvement in delivery of health promotion and education campaigns included lack of time, poor training, lack of physical space, and inadequate knowledge and skill specific to the target subject [45], [46], [47], [48].

## Health Screening and Disease Prevention Activities

Several published studies demonstrate the effectiveness of community pharmacy-based disease screening in promoting early detection and identification of patients at risk of stroke[50], diabetes[51], diabetes and hypertension[52],[53], sleep disorders[54],[55], cardiovascular risk[56],[57],[58],[59] and HIV[60]. A screening programme involving 30 pharmacies and 1,145 participants in Canada showed that an integrated stroke screening programme identified a high prevalence of individuals who could benefit from stroke-prevention therapies [50]. High-risk participants in the study were offered lifestyle advice and counselling, and were referred for confirmatory testing with a physician. Three months' follow-up showed 17% of participants identified as at risk of atrial fibrillation (AF) started on treatment with an anticoagulant and 50% had improved blood pressure, while 71% had confirmatory diabetic testing. Similar findings were shown in a diabetes screening programme in Australia [51] and a combined diabetic and hypertension screening programme in Germany [52]. The Australian study showed that screening for diabetic risk factors combined with capillary blood glucose testing in community pharmacies improved the rate of diagnosis for the disease ( $P = 0.008$ ) and resulted in fewer and higher uptake of referrals to GPs[51]. The findings were similar to that of the study conducted in Germany that was effective in identifying up to 190 participants with high blood pressure referring them for further assessment and treatment [52].

One RCT that included health screening, lifestyle advice and follow-up showed a 21% difference in change in risk for cardiovascular events ( $P < 0.001$ ) at three months, along with changes in low-density lipoprotein cholesterol, systolic blood pressure and glycosylated haemoglobin (HbA1c 0.2mmol/l, 9.37mmHg, 0.92%, respectively [ $P < 0.001$ ]) in the intervention group[57]. A similar study also demonstrated a statistically significant improvement in the knowledge of cardiovascular disease risk factors at follow-up, with almost half of the identified high-risk subjects reporting lifestyle changes or being started on a medication following referral to their GP [56].

Other studies also suggest that a community pharmacy-based intervention involving health promotion and screening for cardiovascular risk factors increased access and was effective in early identification of at-risk patients when combined with follow-up confirmatory testing[58],[59]. A pilot project in the United States that tested the feasibility of offering a rapid, point-of-care HIV testing service showed that availability of the service in community pharmacies and retail clinics was a feasible model [60]. In addition, the study confirmed that staff at community pharmacies and retail clinics were willing and able to provide confidential HIV testing to clients [60]. An Australian study that developed, implemented and evaluated a community pharmacist-led sleep health and screening programme

(n=325) identified 44% of the target population to be at risk of one or more sleep disorders [54]. Further diagnosis from the referrals provided showed that community pharmacists could raise awareness and assist in initiating behavioural changes in those at risk of developing a sleep disorder [54]. A related study showed that the intervention was associated with higher odds of undergoing a diagnostic test for sleep disorders (adjusted OR: 2.24; 95% CI: 1.25–4.01) [61]. A qualitative study of participants' views of an AF screening service using an electrocardiogram (ECG) app in community pharmacies in Australia suggests that the service is acceptable, easy to use and feasible. However, the authors mentioned that the service would only be sustainable if adequately remunerated and combined with other cardiovascular screening services [62]. A UK study assessing current practice, knowledge and attitudes demonstrated that there is untapped potential for community pharmacists to become a focus for advice and information relating to prevention of HIV and hepatitis B and C [63].

### **Vaccination and Immunization**

A retrospective study demonstrates an increase in vaccination coverage rate from 35.8% to 41.8% ( $P < 0.001$ ) for those aged 5 years and under, and 9.8% ( $P < 0.001$ ) for individuals aged 65 years and older in the province of Nova Scotia, Canada, one year after a policy change that allowed community pharmacists to administer influenza vaccine [64]. Similar findings were reported by another study that showed a 2.2% increase in influenza vaccine coverage and in individual likelihood of uptake (adjusted prevalence ratio: 1.05; 95% CI 1.02–1.08) [65]. A literature review of 47 studies from the United States suggested that increased uptake and coverage for adult vaccination at community pharmacies was facilitated by regulatory changes and training programmes that allowed community pharmacists to administer vaccines [20]. The review also showed that vaccination services at community pharmacies were generally acceptable to patients, and could improve vaccination rates and increase coverage. The findings of surveys from the United States [66], UK [67] and Canada [68] indicate that community pharmacists were positive about providing vaccination services, but reported adequate training, remuneration and a collaborative relationship with general practitioners as factors that would improve implementation and uptake of the service.

### **Alcohol Dependence Advice and Drug Misuse Services**

A review of two RCTs showed limited evidence on the effectiveness of community pharmacy-based alcohol dependence advice and counselling services [18]. The two studies involved provision of a brief alcohol advice service in a community pharmacy, compared with usual care. One of the studies (n=407) showed no difference in the alcohol use disorder identification test (AUDIT) score ( $-0.57$ ; 95% CI:  $-1.59$  to  $-0.40$ ) between the intervention and control group, while the other (n=69) showed no

statistically significant difference in the fast alcohol screening tool (FAST) score ( $-1.84$ ; 95% CI:  $-4.49$  to  $-0.82$ ) [18]. Similar findings were reported by another review of three studies showing that while there was a reduction in alcohol consumption in the intervention arm, it was not statistically significant [69].

Another intervention study showed poor uptake of the service with 21% of eligible participants agreeing to the service [70], although the study findings also demonstrated a significant reduction in seven-day alcohol unit consumption but no reduction in AUDIT scores [70]. A cross-sectional survey showed that while community pharmacists generally had positive views about their roles as providers of alcohol dependence advice services[71],[72], direct practice involvement was limited, with one study reporting just 5% of the respondents provided the service[39],[40].

Lack of knowledge and confidence in providing the service were identified as barriers[71], a finding that is similar to that from another survey involving community pharmacists in New Zealand and England[73]. A study from the United States, that recruited and screened a convenience sample of patients with the use of a tablet computer-based assessment protocol, showed a high prevalence of drug misuse in the study population and considered the feasibility of implementing regular opioid misuse screening protocols within community pharmacies[74]. Taken together, these studies indicate the viability of providing alcohol dependence advice and drug misuse services in community pharmacies, although further studies on effectiveness are needed.

### **Emergency Hormonal Contraception and Sexual Health**

Three reviews demonstrated increased access to emergency hormonal contraceptives through community pharmacists' involvement in service provision, with a survey of user perception showing that the service was rated highly[26],[27],[75]. The review by Anderson et al. also reported an association between an observed reduction in attendance at the accident and emergency unit for emergency hormonal contraceptives services and availability in community pharmacies [75]. An evaluation of a Chlamydia testing service showed that service users valued the speed and convenience of accessing this through the community pharmacy, with 16% of the participants indicating they would not have taken up the service otherwise [76]. The review by Anderson et al. also showed that window displays were effective for raising client awareness of the availability of the service [27]. One survey that explored community pharmacists' views and perceptions as providers of sexual health services reported that the respondents were generally positive, but suggested that a lack of appropriate training, and inadequate knowledge and skills, limited implementation[77].

### **Cost effectiveness of public health role of community pharmacists.**

A report by the UK Pharmaceutical Services Negotiating Committee indicates 12 services carried out by community pharmacies that delivered £3.0bn in savings in 2015, offsetting the £2.8bn of total funding from the Department of Health [78]. Self-care support contributed the largest share of overall value at 40%, followed by 31% for medicines support and 29% for public health [78]. Cost savings from community pharmacists' public health activities are also supported by the findings of other reports [79], [80], which show that the cost of treating common ailments, such as head lice, threadworms and athlete's foot, in community pharmacies was significantly lower at around £29.30 per patient, compared with £147.09 per patient to treat the same ailments at accident and emergency units and £82.34 per patient at GP surgeries [79].

A UK study that screened patients at risk of chronic obstructive pulmonary disease (COPD) with validated tools reported that smoking cessation initiatives provided by community pharmacists gave a projected life gain of 38.62 years, 19.92 quality-adjusted life years (QALY) and a cost saving of £392.67 per patient screened [81]. A related study that evaluated the effect of a community pharmacy-based COPD service on patient outcomes reported significant improvements in patient adherence, utilisation of rescue packs, quality of life and a reduction in the number of routine GP visits [82], with the intervention cost offset by reductions in the use of other NHS services (GP, accident and emergency visits, and hospital admissions) [82]. Similar findings were reported by a smoking cessation service that showed overall cost savings to the healthcare system and life gains of 0.18 years for men and 0.24 years for women in Thailand [83]. This was also in line with a modelling estimate from a simulated sleep disorder screening service provided by community pharmacists that showed an estimated maximal incremental cost of €455 (£398.56) per QALY gained [84]. Another study that aimed to extend AF screening via a community pharmacy-based intervention using an iPhone ECG showed an incremental cost-effectiveness ratio of AU\$5,988 (£2,753.17) per QALY and AU\$30,481 (£14,013.85) for preventing one stroke. Sensitivity analysis indicates that cost-effectiveness of the intervention improved with increased treatment adherence [85].

### **Barriers to the public health role of community pharmacists**

A number of barriers to community pharmacists' involvement in public health activities have been identified [86]. These include the community pharmacy environment, which sometimes may not be suitable for the delivery of public health services — particularly with respect to privacy and confidentiality — as well as the perceptions of both the general public and other health providers of pharmacists' competencies [26], [87], [88], [89]. These barriers have also been reported in relation to

provision of weight management [39], [40]; prevention of HIV, and hepatitis B and C [63]; and smoking cessation services [31]. Time pressure and high dispensing workload were also identified by studies on smoking cessation [31], flu vaccination uptake [67] and alcohol advice services [72]. Regulatory policies, inadequate training and lack of reimbursement for services were identified as barriers to public health service provision in community pharmacy by three UK studies [87], [88],[89]. Inadequate knowledge and skills specific to the target subject were also reported as limiting community pharmacists' involvement in delivery of health promotion and education campaigns[45], [46], [47], [48], weight management[38], sexual health[77] and alcohol dependence advice services[71]. Other challenges faced by community pharmacists included the structure and layout of community pharmacies[90], a lack of a well-defined career structure and progression channels, unacceptable work-life balance (leading to high stress levels)[91], the unavailability of individually contracted community pharmacists[92], and the declining ownership of community pharmacies by independent pharmacists [88], [93].

### **Strategies that can enhance the public health role of community pharmacists**

The main themes identified in a UK study that could enhance the role of community pharmacists were: enhancing the public health content of the pharmacy training curricula; promoting interdisciplinary initiatives in pharmacy education and practice; promoting patients' self-management capacities and pharmacists' involvement through policies; remunerating pharmacists directly for providing public health services; and advancing the pharmaceutical public health practice experience of students [87]. These findings were also confirmed in other UK studies[94],[95], with evidence from the literature on specific public health interventions included in this paper showing that training[34], availability, access to, and familiarity with guidelines [34], [35] improved community pharmacists' knowledge, thus facilitating their involvement in providing public health services.

### **Discussion**

The literature demonstrates that community pharmacy-based public health interventions have benefitted five key areas: smoking cessation, health promotion, disease screening and preventive activities, provision of emergency hormonal contraceptives, and vaccination services. There was mixed evidence with respect to the effectiveness of weight-management and alcohol-dependence advice interventions; however, the available data do suggest feasibility and acceptability of these service owing to the perceived ease of access and convenience[39], [40], [71], [72], [73]. These global findings add to the argument for the expansion of the public health roles of community pharmacists, as suggested by existing government reports and briefing documents [7], [10], [12]. Heterogeneity in

pharmacy-based interventions in areas such as in smoking suggests the need for a standardised approach to service provision [18], [19]. This would ensure consistency in the quality of services provided [96], [97], [98]. However, it is important to highlight from the included descriptive studies that while community pharmacists were generally positive about their public health roles, they acknowledged the need for appropriate training targeted to these services. This may entail both updating the public health content of undergraduate pharmacy curricula[99],[100] and providing continuing professional development designed specifically for these services[34]. Such training would also need to be standardised, particularly as reports have shown variations in skill level of graduates from different countries as a result of disparities in undergraduate pharmacy training programmes [101]. There is also a need for policies that recognise community pharmacists as providers of public health services, as well as regulatory guidelines that provide a framework for service provision. This is of particular importance in view of emerging evidence from the UK that demonstrates the positive impact of government policy and professional guidelines on provision of flu vaccination by community pharmacists [102]. Similar findings from Canada and the United States[20],[64],[65] further emphasise this point, and are also consistent with evidence indicating that provision of and familiarity with practice guidelines facilitates the implementation and effectiveness of public health activities[35].

While the pharmacy profession is transitioning towards patient-centred care, with pharmacists contributing to micro-level public health activities (such as disease screening and preventive activities), there is a need to extend this role to macro-level public health functions, such as involvement in health planning, policy development and evaluation [103]. This must be done while also tackling many of the identified barriers in the public health role of community pharmacists.

## **Limitations**

Although the authors aimed to provide an overview of the global evidence, the included literature were mainly from high-income countries (e.g. the UK, Canada and the United States). As a result, the generalisability of these findings to middle- and low-income countries with severe workforce shortages is likely to be limited. There were also observed limitations in the studies included in this paper. Only two studies in the Saba et al. meta-analysis [19] and five in the review by Brown et al. validated self-reported smoking abstinence via biochemical measures [18].

Details on the sampling method used for recruiting participating community pharmacies were also lacking in most of the smoking cessation intervention studies. Where reported, pharmacists and pharmacy recruitment was mainly via self-selection or purposive sampling — a finding that limits generalisability, given the inherent bias. Observed variability in the design of pharmacy-based weight-management interventions in the included studies biases the overall findings and conclusions. For example, the duration of weight-management intervention in the studies in the Brown et al. review [18] varied between 15 to 52 weeks. The intervention also involved the use of weight-management medication in one study, in contrast to the others that compared a combination of diet, physical activity and lifestyle counselling in different settings, including community pharmacies [18]. Demographics of study participants also varied between settings in one study [18]— a feature that further confounds the overall findings reported. Only one study on the effectiveness of pharmacy-based health promotion and educational campaigns included in this paper provided specific details on the implementation of the intervention [43]. Where provided, the intervention involved the use of a convenience sample, further limiting generalisability. In addition, the studies on pharmacists' contribution to vaccination and immunisation [20] were primarily observational, with just one RCT included. This suggests limitations in internal validity and challenges with inferring causality, especially given the outcome measure of self-reported vaccination status [20]. Similar limitations were also observed in the studies on emergency hormonal contraception [75]. The difficulties in recruitment into one of the studies that evaluated the effectiveness of pharmacy-based alcohol advice services indicate that the research [70] was not statistically powered to detect an effect. Consequently, further work in this area is needed to explore factors that could improve uptake of the service. In general, the non-random sampling approach used in the recruitment of participating community pharmacists and pharmacies, as well as the small sample size in most of the descriptive studies, is another source of bias and suggests that the views of the respective study participants may not be representative.

Furthermore, evidence from the included studies must be interpreted in relation to the healthcare context in the respective countries, and therefore may not be generalisable to other countries with different healthcare systems. Overall, the evidence demonstrates that pharmacists are capable of providing both population-based and individual level public health services. However, strategies that can help facilitate and enhance community pharmacists' public health roles are needed.

## **Conclusion**

This article discusses global evidence of community pharmacists' contributions to public health in the areas of smoking cessation, weight management, health education and promotion, disease screening

and prevention, vaccination and immunisation, alcohol and drug misuse, and sexual health. There is evidence of cost savings resulting from community pharmacists' providing some of these services, but additional studies are needed to confirm the cost-effectiveness of all services, as well as whether the models proposed can be translated between different healthcare systems. However, time pressure, excessive workload, inadequate training, a poor community pharmacy environment, and a lack of reimbursement, among other factors, have been identified as barriers in the delivery of these roles. There is a need to address these in order facilitate efficient and effective delivery of these services by community pharmacists. Enhancing the public health content of undergraduate pharmacy curricula, remunerating pharmacists adequately and designing appropriate continuing professional development programmes are strategies that can enhance public health services delivered by community pharmacists.

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