The role of community pharmacists in screening
and subsequent management of chronic
respiratory diseases: a systematic review

Mariam FATHIMA, Pradnya NAIK-PANVELKAR, Bandana SAINI, Carol L. ARMOUR.

ABSTRACT

Objective: The purpose of this review was to evaluate the role of community pharmacists in provision of screening with/without subsequent management of undiagnosed chronic obstructive pulmonary disease (COPD) and uncontrolled asthma.

Methods: An extensive literature search using four databases (ie. Medline, PubMed, International Pharmaceutical Abstracts (IPA) and Scopus) with search terms pharmacy, screening, asthma or COPD was conducted. Searches were limited to the years 2003-2013, those in English and those reporting research with humans. Data retrieval, analysis and result presentation employed a scoping review method.

Results: Seventeen articles met the inclusion/exclusion criteria, of which fifteen studies were based on people with asthma and two were based on people with COPD. Only seven asthma studies and one COPD study involved screening followed by subsequent management. More than half of the people screened were found to be poorly controlled and up to 62% of people were identified at high risk for COPD by community pharmacists. The studies varied in the method and type of asthma control assessment/screening, the type of intervention provided and the outcomes measured. The limitations of the reviewed studies included varying definitions of asthma control, different study methodologies, and the lack of long-term follow-up. While many different methods were used for risk assessment and management services by the pharmacists, all the studies demonstrated that community pharmacists were capable of identifying people with poorly controlled asthma and undiagnosed COPD and providing them with suitable interventions.

Conclusion: The literature review identified that community pharmacists can play an effective role in screening of people with poorly controlled asthma and undiagnosed COPD along with delivering management interventions. However, there is very little literature available on screening for these chronic respiratory conditions. Future research should focus on development of patient care delivery model incorporating a screening protocol followed by targeted management interventions delivered by the community pharmacist.

Keywords: Mass Screening; Lung Diseases, Obstructive; Outcome Assessment (Health Care); Community Pharmacy Services; Professional Practice; Professional Role
metodologías de estudio, y la falta de seguimiento a largo plazo. Aunque se utilizaron muchos métodos diferentes de evaluación del riesgo y de servicios de manejo de la enfermedad por los farmacéuticos, todos los estudios demostraron que los farmacéuticos comunitarios eran capaces de identificar personas con asma pobremente controlada y EPOC no diagnosticada y de realizar con ellos las intervenciones apropiadas.

Conclusión: La revisión de la literatura identificó que los farmacéuticos comunitarios pueden jugar un papel efectivo en el rastreo de personas con asma pobremente controlado y EPOC no diagnosticada así como realizarlasy las intervenciones de manejo. Sin embargo, hay muy poca literatura disponible sobre el rastreo de estas enfermedades respiratorias crónicas. La investigación futura debería centrarse en el desarrollo de modelos de atención a pacientes que incorporen un protocolo de rastreo seguido de intervenciones de manejo de la enfermedad proporcionadas por los farmacéuticos comunitarios.

Palabras clave: Rastreo Masivo; Enfermedades Pulmonares Obstructivas; Evaluación de Procesos y Resultados (Atención de Salud); Servicios de Farmacia comunitaria; Práctica Profesional; Rol Profesional

INTRODUCTION

Screening and case detection are a part of prevention strategies that seek to identify and limit the disability associated with chronic diseases by early detection and appropriate treatment. Screening may not only save lives but also improve quality of life by preventing the onset or reducing complications of chronic disease. In most developed nations, primary health care practitioners are encouraged to engage in early intervention through appropriate screening, and provide patient centred care and self-management. Conventionally, physicians located within primary care health settings (family physicians, general practitioners) have been central in conducting health screening and case detection. However, many people are unaware of the risks of chronic disease or early signs of the disease and so do not present to primary care health services.

Chronic respiratory diseases, such as asthma and chronic obstructive pulmonary disease (COPD), kill more than four million people every year world-wide and affect hundreds of millions more. Asthma is a common chronic inflammatory disease of the Airways characterized by variable and recurring symptoms, reversible airflow obstruction, and bronchospasm. Globally the economic burden of asthma has been estimated to be the highest among chronic diseases and includes both direct (e.g., hospital admissions and costs of medications) and indirect costs (e.g., days away from work). Despite the presence of widely disseminated guidelines and policies, asthma management is still sub-optimal, leading to poor symptom control, poor quality of life, and significant morbidity.

Complicating the problem of asthma control is non-adherence to long-term controller medications, maintenance of inhaler technique, lack of asthma knowledge, co-morbidities and concern about adverse effects. COPD on the other hand, is characterised by a slow progression of airflow limitation caused by chronic inflammation of the lung to noxious particles or gases. COPD is also accompanied by a major burden of symptoms, health care utilization, loss of productivity and cost of medications on the individual and the society. Further, many people suffer from this disease for years and die prematurely from it or from its complications. Early-stage COPD is often asymptomatic and so is often ignored, although coughing with sputum production is common. Smoking is by far the most important risk factor, accounting for 85-90% of all cases. Smoking cessation does not restore lost lung function but slows the rate of decline to that of a healthy, non-smoking individual and is the most effective intervention. Early detection of COPD is crucial for promoting smoking cessation and instituting pharmacological and non-pharmacological therapy before patients reach symptomatic and costly stages of disease which in turn can let individuals with COPD achieve a better quality of life.

Community pharmacists are a valuable component of the primary healthcare team. Given their skills and expertise, community pharmacists can play a vital role in offering opportunistic screening, referring the at-risk individuals to their general practitioners and can also provide ongoing support and management services to patients with chronic conditions such as asthma and COPD. Community pharmacy based screening and management services offer several advantages. Firstly, they are the first point of contact between patients and the healthcare system and they are suitably equipped to target people less likely to self-refer to other health services. Secondly, pharmacies are conveniently located, are open for long hours and offer consultations without any appointment.

In the changing paradigm of practice, where pharmacists move from a product to a patient care focus, many pharmacy based studies have demonstrated the pharmacist’s capacity to identify, counsel and refer patients with previously undiagnosed conditions. In developing nations, where the burden of disease is skewed towards infectious diseases such as tuberculosis, community pharmacies have been involved in supporting active case detection and management. In developed countries like the UK for example, a number of preventative health and public health programs delivered through local pharmacies (as well as through a number of other primary health care settings), including a men’s health check, targeted public health campaigns, vascular checks, and lifestyle risk assessment testing have been implemented. Pharmacists in Switzerland and USA have successfully provided screening and early intervention services for people at risk of sleep disorders, type 2 diabetes and breast cancer screening to women at risk. In Australia, pharmacy based screening and clinical
management programs have been successfully offered for various conditions e.g. Type 2 diabetes\textsuperscript{20}, osteoporosis\textsuperscript{21}, sleep disorders\textsuperscript{22} and assessment of cardiovascular risk.\textsuperscript{23,24} Pharmacists have also successfully provided screening for bowel cancer\textsuperscript{25} and chlamydia.\textsuperscript{26,27} These health screening services provided by pharmacists have also been supported by Australian consumers.\textsuperscript{28,29}

In the case of asthma, pharmacy-based studies have been conducted, the majority of which have demonstrated that pharmacist interventions can have a positive impact on clinical, humanistic and economic outcomes.\textsuperscript{30-32} Further, in the case of COPD, the Global Initiative for Chronic Obstructive Lung Disease (GOLD)\textsuperscript{11} report identified pharmacists as key health care professional collaborators in decreasing patient risk. The report described them as being well positioned to assist in early detection through screening of smokers, intervene by delivering smoking cessation messages, optimise medication delivery, refer patients to appropriate support services and present realistic expectations about the disease and its treatment.\textsuperscript{17} As many people with undiagnosed COPD and uncontrolled asthma often approach the community pharmacy for help with smoking cessation and for regular purchase of short acting beta agonists (SABA’s), community pharmacies are thus ideally placed as a suitable venue for risk assessment of uncontrolled asthma and undiagnosed COPD.

The purpose of this literature review is to scope the empirical literature and to provide a current overview of the role and the impact of community pharmacists in the screening/assessment for undiagnosed COPD and poorly controlled asthma with or without subsequent management.

**METHODS**

**Review Type**

A scoping review methodology was used for the literature review as the aim was broad and involved screening and management of two different chronic respiratory diseases by community pharmacists.

**Data bases Searched and Search Strategy**

The literature search was conducted to identify articles published between January 2003 and March 2013. Articles were obtained using four databases: Medline, PubMed, International Pharmaceutical Abstracts (IPA) and Scopus. Search strategies were formulated for individual databases using the following keywords: (“pharmacy” or “pharmacies” or “community pharmacy” or “pharmacist” or “pharmacy service” or “pharmaceutical service”) AND (“asthma” OR “COPD”) AND (“screening” OR “case detection” or “risk assessment” or “management”).

Operational Definitions: For the purpose of the review

- Assessment was defined as assessing asthma control/risk of COPD using an assessment tool without screening patients at risk.
- Screening was defined as assessing asthma control/risk of COPD using a screening tool to identify patients at risk.
- Management was defined as any intervention provided by community pharmacists to manage patients with asthma/COPD.

**Inclusion/exclusion criteria**

Studies were included if they:
- Were published in English language and were available in full-text.
- Were conducted in humans and adults.
- Were conducted by community pharmacists.

Studies were excluded if they:
- Were review articles, grey literature, correspondence to editors and conference proceedings.
- Were conducted by other health care professionals by utilizing pharmacy dispensing records.
- Were exploring the attitudes and behaviours of pharmacists providing interventions to people with respiratory diseases.

**Study selection and Analysis**

The database search conducted by the primary author retrieved titles and abstracts of potential studies. Abstracts were then screened and the full-text of only those abstracts which met the inclusion/exclusion criteria was downloaded for assessing eligibility. Further application of the inclusion/exclusion criteria to these full-text articles was done to identify the included articles in this review. These articles were reviewed independently by the two authors, followed by data abstraction and analysis. Any disagreement was resolved through discussion with the third author. Critical examination of the content of the included articles was conducted and the included articles were categorized as follows:

- Asthma control assessment or COPD risk assessment studies without subsequent management
- Asthma control assessment or COPD risk assessment studies with subsequent management
- Asthma control/COPD screening studies without subsequent management
- Asthma control/COPD screening studies with subsequent management.

This categorization was conducted and tabulated separately for asthma and COPD studies. For each individual article, the study design, the number of patients studied, the type and method of screening/assessment, the method of management (if delivered), the outcome measures, key findings and any unusual features of the study were identified and reported.

**RESULTS**

The database search identified 939 potential articles. After elimination of duplicates and screening as per inclusion/exclusion criteria, 42 studies were retrieved. Studies which lacked a screening/assessment component (n=25) were
excluded, which resulted in the inclusion of 17 articles in this review. Of these, 15 articles pertained to studies conducted on people with asthma and 2 articles focused on studies conducted on people at risk of COPD (Figure 1).

Asthma Studies

Table 1 summarizes all the asthma studies reviewed. Of the 15 studies, five focused on assessing asthma control, two involved assessment of asthma control followed by management, one looked at only screening for poor asthma control and the remaining seven focused on screening for poor control with subsequent management of those identified with poor asthma control.

Asthma control assessment studies without subsequent management:

Assessment of asthma control without subsequent management was conducted in five studies, of which three were national campaigns and the other two were cross-sectional studies. The number of asthma patients participating in these five studies varied from 166 - 5551. The three national campaigns surveyed people with asthma to evaluate the degree of asthma control, their perception of inadequate asthma control together with the factors responsible for it, and the extent of health care utilization specifically by those with poor control. The other two studies investigated the usefulness of asthma control assessment instruments in community pharmacies.

All five studies in this category assessed asthma control using validated instruments. The Asthma Control Test (ACT) was used by four of these studies while Nishiyama et al. used the Jones Morbidity Index (JMI) for assessment of asthma control. In addition, two studies also used objective methods for assessing asthma control including peak expiratory flow rate (PEFR) readings and medication dispensing history.

The two national surveys from France conducted by Laforest et al. found more than 70% of the asthma population had inadequate control of asthma. In a national campaign from Portugal, Mendes et al. identified that 61% of asthma patients had uncontrolled asthma. The studies conducted by Mehuy et al. and Nishiyama et al. found that approximately 50% of the people assessed had poor asthma control. Just one study by Nishiyama et al. trained the participating pharmacists by providing information on the study procedure and aspects of inhalation technique.

Asthma control assessment studies with subsequent management:

Assessment of asthma control with subsequent management was delivered in two studies, one of which was an observational study involving 727 asthma patients, while the other was a randomized controlled trial involving 24 asthma patients. In both studies, asthma control was assessed using validated instruments by community pharmacists followed by asthma management interventions in patients with asthma.

Giraud et al. used the Asthma Control Questionnaire (ACQ6), while Barbanel et al. used the North of England asthma symptom scale to assess asthma control. Only one study reported the percentage (51%) of assessed patients with poor control.

The management intervention by Giraud et al. involved inhaler technique education and review, and provision of an individualized self-stick instruction form for the inhaler device, to asthma patients, while Barbanel et al. provided training in self-management decision making based on PEFR readings or asthma symptoms. Both these pharmacist led management interventions resulted in significant improvement in asthma control.

Training was provided to the participating pharmacists in both the studies and consisted of either a 2-hour training session on asthma treatment principles and inhaler technique review, or a 3-day multidisciplinary course on asthma care.

Asthma control screening study without subsequent management:

There was only one study in this category, conducted by Armour et al. which screened for people with poor asthma control and identified the contributing factors, but did not involve provision of any management intervention. This was a cross sectional study involving 570 people with asthma. A validated screening tool, Jones Morbidity Index (JMI) was used which identified that 77% of the people who were screened had poor asthma control. Participating pharmacists were trained in recruitment, asthma management and in lung function testing using spirometry.

Asthma control screening studies with subsequent management:

Seven studies involved screening of patients for poor asthma control with subsequent management of those identified with poor control. The two studies conducted by Saini et al. had a parallel group design with and without a control arm, and investigated 102 and 570 participants respectively. The two studies by Bereznicki et al. were multi-site controlled trials which studied 1551 and 173 patients respectively. The study conducted by Mehuy et al. was a randomized controlled parallel group trial with 201 participants. Armour et al. conducted two studies, one of which was a multi-site randomized controlled trial and the other was a cluster-randomized trial comparing three versus four visit interventions provided by the pharmacist. These studies involved 396 and 570 asthma patients respectively.

All seven studies in this category utilised different tools/ instruments for screening patients with poor asthma control. In one study, Saini et al. screened patients using signs and symptoms of asthma control based on the National Asthma Council severity score (NAC Score), but did not report the proportion of people identified at risk of poor control. Three studies used the JMI, a validated screening tool and identified 77% and 79% of the screened patients to have poor control. Both
In five studies, from this category, patients who were screened for poor control were allocated to either intervention or control groups. Different asthma management interventions were then delivered to patients within the intervention group. In the studies by Bereznicki et al., community pharmacists mailed asthma educational information to intervention patients together with a letter encouraging them to see their general practitioner for review. Based on their asthma knowledge, intervention patients in the study conducted by Mehuys et al. received a tailored intervention that focused on improving inhaler technique and medication adherence. Intervention pharmacists, in the study by Saini et al., delivered the Australian Six Step Asthma Management Plan based on individual patient needs analysis followed by collaborative goal setting while those in the study conducted by Armour et al. provided a comprehensive asthma care program. This program consisted of an ongoing cycle of asthma control assessments, adherence assessments, lung function testing, medication and inhaler technique review, goal setting and patient education and regular follow-up. The other two studies, which did not have a control arm, did a pre-post test analysis to measure the change in asthma outcomes after provision of pharmacist delivered interventions. One study provided a tailored intervention based on individual patient needs and goals, while the other delivered a comprehensive individualized asthma management service focusing on medication adherence, inhaler technique, asthma knowledge/beliefs, asthma control, triggers, quality of life and action plan ownership.

In all the studies, from this category, community pharmacists were trained in different aspects of asthma treatment and management. Two studies specifically trained pharmacists in the use of the data-mining software. Four studies provided comprehensive training to pharmacists consisting of asthma education, risk assessment, goal setting, adherence assessment, recruitment and motivational interventions. Additionally, in three of these studies, pharmacists were also trained to measure lung function by spirometry. The training was provided through educational manuals, training sessions and workshops conducted by the research team.

All the studies involving screening and subsequent management demonstrated significant improvements in asthma control in the intervention group compared to control, or improvements in the post-test results compared to baseline, irrespective of the type of intervention delivered by the pharmacists.

**COPD studies**

Table 2 summarizes the two COPD studies reviewed. Of the 2 studies, one involved screening for patients at risk of COPD, while the other focused on screening with subsequent management of COPD. Our search did not identify any studies in the other two categories.

**COPD screening study without subsequent management:**

The study conducted by Castillo et al. was a community pharmacy-based study, which evaluated the feasibility of a COPD screening program to identify high risk patients using spirometry. This pilot cross-sectional study included 161 participants with no prior history of lung disease. The participants were initially recruited by their pharmacists based on their age, smoking status and respiratory symptoms. The validated Global Initiative for Obstructive Lung Disease (GOLD) screening questionnaire was used for identifying the at-risk individuals and 62% of the screened participants were found to be at high risk of COPD. Pharmacists found airflow limitation in 24% of these patients using spirometry, who were then referred to the hospital for further assessment. Participating pharmacists attended a 4-day training course where they were trained in patient recruitment and spirometry testing.

**COPD screening study with subsequent management:**

Fuller et al. implemented a spirometry-based COPD screening program through community pharmacies and evaluated the role of pharmacists in screening for patients at risk. This was a prospective study in which 185 people with no prior history of COPD were included. The COPD Population Screener questionnaire, a validated screening tool was used, which identified 19% of the participants to have an increased risk of COPD. Through spirometry, pharmacists identified 9% of screened participants to have airflow obstruction indicative of obstructive lung disease. Management interventions included referral to physicians, smoking cessation advice and follow-up after two to six months. This resulted in 22% of the patients successfully quitting smoking. The participating pharmacists were provided training and were assessed in spirometry testing, analysis and interpretation of results.

Overall, both studies demonstrated that community pharmacists were successful in screening patients at high risk of COPD through spirometry testing. Castillo et al. and Fuller et al. found that 73% and 99% of the spirometry tests conducted by the community pharmacists, were judged acceptable after review by pulmonary experts.

**DISCUSSION**

This review broadly scopes the literature and provides an overview of the role of community pharmacists in screening and subsequent management of chronic respiratory diseases: a systematic review. Pharmacy Practice 2013 Oct-Dec;11(4):228-245.
pharmacists in the screening/assessment of undiagnosed COPD and poorly controlled asthma with or without subsequent management. The study highlights that community pharmacists can successfully screen and manage patients with poor asthma control and those at risk of COPD. The majority of the reviewed studies used validated screening/assessment tools, which were effective in identifying poor asthma control or undiagnosed COPD. Further, all the studies in which pharmacists provided assessment/screening with subsequent management showed significant improvements in patients with asthma control or in COPD management outcomes.

Strengths and limitations

The study highlights the important role of community pharmacists in screening and/or management of the two most prevalent chronic respiratory diseases. This is one of the first reviews to evaluate this role of community pharmacists in providing screening with/without subsequent management to patients with asthma and COPD. The strength of our study was that the search strategy was extensive and covered a large number of relevant databases. To reduce the risk of selection bias and incorrect categorization all the included articles were analysed and critically examined by three reviewers independently. Further, this review gives a true representation of the value of screening, because we were able to categorise studies into those that were using the community pharmacy to screen for asthma/COPD as opposed to those studies that assessed all patients and included them.

Our study had some limitations. Only articles written in the English language were included, which might have introduced language bias. A further source of potential bias was publication bias since only published studies available in full-text were included. Also, we had limited our search to the last 10 years, which may have affected the number of articles identified. However, this was intentional as we wanted to review and document the recent developments in this area. Another limitation of our study was the exclusion of the grey literature, which may have led to some relevant papers not being included in our review.

Asthma Studies

Our preliminary search identified a number of articles on asthma studies, but several had to be excluded as they did not screen or assess patients, although some of them claimed to be assessing/screening asthma control, or was a follow-up study. The review also found that although all of the included studies suggested screening for poor asthma control, critical examination of the content revealed that seven of the fifteen studies were actually assessing asthma control in every one presenting to the pharmacy with a prior diagnosis of asthma and only eight of the studies involved screening. For a study to be considered as a screening study, it had to identify the patients at increased risk of poor control using a screening tool. Therefore we chose to categorize the asthma studies into four categories depending on whether the patients were being assessed or screened for poor control and whether they were/they were not provided with subsequent management by the pharmacist.

Assessment/screening of asthma control

Early identification of poor asthma control through screening is highly important in the management of asthma as asthma control is not only reflective of the patients’ clinical status but is also predictive of the patients’ future risk of exacerbations and thus, it has cost and health implications. Effective screening can help reduce this mortality and morbidity, improve the quality of life as well as reduce health care costs and resources. Our review found that community pharmacies present an ideal venue for screening those with poorly controlled asthma, as often patients with poor control tend to visit their pharmacies to obtain their reliever medications. This is especially true in countries like Australia and UK, where the availability of reliever medications, confers a higher likelihood on community pharmacy as being a worthwhile asthma control-screening venue.

In the reviewed asthma studies, several different methods were utilised for assessment and screening of poor asthma control. These included symptom-based measures such as patient questionnaires and objective tools including lung function testing and dispensed medication history. In general, it was found that patients were able to self-administer, self-assess and report their symptoms successfully irrespective of the questionnaire used. This indicates that the ACQ6/ACT/JMI assessment tools are convenient to administer in the pharmacy setting and are sensitive to change. This is consistent with other studies in primary care where these instruments were found to be useful and practical in assessing/screening of poor asthma control.

Among the reviewed studies, the most commonly used validated questionnaire for assessing asthma control was the Asthma Control Test (ACT) while the Jones Morbidity Index (JMI) was the most commonly used asthma control screening tool. There were only three studies which measured lung function by spirometry testing along with the screening questionnaire as part of the risk assessment for asthma control. These studies showed that community pharmacists also have the capacity to provide lung function assessment and to get patients to focus on their lung health.

The decision concerning the choice of a particular screening questionnaire is best informed by considering the intended purpose and setting where the tool will be used. Further, additional factors such as the content, practicality, response burden, availability of benchmark scores, and adaptability to multiple administration modes of each questionnaire should also be considered when deciding which tool to use. From a content perspective, the ACT, the JMI and the ACQ6 are comparable, in that, they contain questions on activity limitations due to asthma, shortness of breath, impact of asthma symptoms on sleep, and rescue medication use.
The ACT asks respondents to rate their asthma control; the JMI categorizes the respondents into low, medium or high morbidity; while the ACQ6 has separate questions on wheezing, severity of morning asthma symptoms, and requires lung function testing. The ACQ6 was primarily designed for use in clinical research trials while the ACT and the JMI were designed for clinical use with patients. Irrespective of the method used for identification, all the studies showed that more than half of the population screened or assessed had poor asthma control.

In some studies, however, the screening questionnaires were sent home to at-risk people, which resulted in a very low return rate (15%). Therefore, it would seem that 'on site' risk assessment in the pharmacies would be the more appropriate method for screening as a significant number (59-88%) of the people screened were identified by the pharmacist at risk of poor control.

Asthma management interventions

Management interventions were provided in nine of the asthma studies by the community pharmacists and varied from simple interventions like providing referral to general practitioners to more complex and varied from simple interventions like providing the asthma studies by the community pharmacists. Management interventions were provided in nine of the studies. It is evident from the review that there has been a substantial increase in the number of pharmacist based asthma studies involving only management interventions (that were excluded due to lack of the screening component). In some studies, however, the screening questionnaires were sent home to at-risk people, which resulted in a very low return rate (15%). Therefore, it would seem that 'on site' risk assessment in the pharmacies would be the more appropriate method for screening as a significant number (59-88%) of the people screened were identified by the pharmacist at risk of poor control.

Duration of Interventions

Asthma is a chronic condition often influenced by seasonal variations and thus, a specific period of time may not adequately reflect symptomatic control. In order to highlight the effect of asthma screening and management interventions, such intervention studies need to be conducted over longer durations or need to have a control group so as to account for these seasonal variations in asthma. Our review found that most of the asthma assessment/screening, intervention and follow up studies were conducted over a short time period, ranging from a few weeks to a few months and so they did not account for the impact of seasonal variation in asthma. Only four of the asthma studies reviewed included a control group. Thus it would be appropriate to incorporate a control group or have proper duration of intervention when designing future studies. This would also help in evaluating long-term sustainability of the intervention, which is also important if these models are to be implemented and adopted on a wider scale.

Training of pharmacists

One of the barriers reported by pharmacists in providing interventions successfully is the lack of sufficient knowledge and confidence. Therefore, training program incorporating provision of asthma information and skills development may help the pharmacists in providing screening and management services more confidently. This is evident in the review as out of fifteen asthma studies analysed for the review, eleven studies provided training to the participating pharmacists on study protocol, screening/assessment and management of people with poorly controlled asthma. In only two studies, pharmacists completed an accreditation assessment after training. Although in many studies, the training was not followed by an assessment of the pharmacist’s performance, this could be incorporated in the planning of future asthma studies. Provision of a structured training program followed by skill assessment maintains competency of the participating pharmacists, which is in turn important for the successful implementation and maintenance of the screening and management service.

Study design

Within the included studies, a variety of study designs were evident, ranging from national surveys, cross-sectional studies to randomized controlled trials. The number of asthma patients participating in these studies varied from 24 to 5551 and a total of 12,547 asthma patients participated in the fifteen studies reviewed. Regardless of the study design or the size of the population studied all of the studies showed that community pharmacists can play an important role in identifying people at risk of poor asthma control with or without subsequent management.

It is also evident from the review that there has been a substantial increase in the number of research reports supporting pharmaceutical care in asthma patients which is consistent with the expanding role of pharmacists in this field, in different parts of the world. However only seven studies were found in the last ten years that evaluated pharmacists’ impact on screening for poor asthma control with subsequent management in community settings world-wide. Out of the seven studies, six were from Australia. It is also notable that similar structured services for asthma offered in other Australian primary healthcare venues have shown less objective evidence of improvement in patient management and outcomes as compared to those delivered through the community pharmacy. Although a number of screening services have been provided by community pharmacies for other chronic conditions internationally, our review found that little has been done in asthma. The systematic review conducted by Ayorinde et al. also identified a number of studies for screening of various chronic conditions like cardiovascular disease, musculoskeletal disease, diabetes, or osteoporosis, but very few for asthma.
COPD Studies
Similar to the asthma studies, our initial search had identified a number of COPD studies, but many had to be excluded from our review due to the fact that they exclusively focussed on management of COPD rather than screening by pharmacists. Ultimately only two COPD studies were included in our review, one from Spain which involved screening of COPD and the other was from USA which involved screening with subsequent intervention by the community pharmacist.

COPD Screening
Often, COPD remains undiagnosed especially in the mild/moderate stages and early detection through screening can help improve morbidity and slow the progression of the disease. Our review found that trained community pharmacists can have a positive impact on COPD patients, through the provision of screening to high-risk individuals. In the reviewed studies, COPD detection rates were found to be similar to those previously reported for other primary care providers, indicating that community pharmacy can provide a complementary setting for COPD case finding. Further, the accuracy of pharmacist-performed spirometry was very promising compared to other care providers. In the two COPD studies included in our review, 70% and 99% of the spirometry tests conducted by pharmacists were judged acceptable in comparison to 46% by primary care physicians and 76% by trained nurses. This thus highlights that there is an opportunity for community pharmacists to not only manage but also screen patients for undiagnosed COPD.

COPD Management
Several pharmacy-based studies (although excluded from our review due to lack of screening) which have provided COPD management interventions involving medication adherence, inhaler technique, smoking cessation and immunisations, have demonstrated significant improvements in different aspects of COPD management.

Our review found there was just one study that conducted screening followed by subsequent management and demonstrated the potential role of community pharmacist in COPD management. The main management intervention in this study focussed around smoking cessation, which has been shown to be an effective strategy in other studies conducted globally. Given that smoking is a major risk factor for the development of COPD, pharmacists can target patients seeking help with smoking cessation, screen for undiagnosed COPD and recommend identified at-risk individuals for COPD management.

In countries with high obstructive lung disease burden, smoking remains a problem. It has been found that the level of awareness and understanding about the disease in the general population is inadequate and many patients believe that the symptoms of COPD, particularly coughing and difficulty in exercising or daily activities because of shortness of breath, are part of the ageing process. Thus there is an unmet need for targeted and effective pharmacist delivered interventions that could form part of the risk assessment and risk reduction spectrum.

CONCLUSIONS
This review identified that community pharmacists can play an effective role in screening and management of undiagnosed COPD and screening/assessment and management of poorly controlled asthma. The study also shows that whilst effort has been expended by pharmacy care researchers in pursuing management service models in people with asthma or COPD, basic risk assessment or screening followed with management has not been as intensively investigated. Our findings can be used to inform future research focusing on development of a feasible patient care delivery model in pharmacy that would involve screening to identify patients with the greatest need, that is, those with poor asthma control or patients at risk of COPD and then provide them with targeted management interventions.

CONFLICT OF INTEREST
The Authors have no conflicts of interest to disclose.

Funding: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

References


<table>
<thead>
<tr>
<th>Citation, Country</th>
<th>Purpose of study</th>
<th>Study description</th>
<th>Type and Method of assessment</th>
<th>Outcomes measures</th>
<th>Key findings</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Laforest et al.,34 2007. France</td>
<td>To investigate whether patients’ ability to identify asthma control varied with personal characteristics or factors related to disease management</td>
<td>Design: Cross-sectional study N: 1048 Duration: 7 months</td>
<td>Questionnaire: Validated questionnaire (Asthma Control Test ACT) Number of visits: 2</td>
<td>Primary: level of asthma control Secondary: patients perception of control</td>
<td>&gt; 70% of people had inadequate control. 68.5% failed to perceived inadequate control. Patients with most uncontrolled asthma have difficulty in properly perceiving their level of disease control Study suggests improving knowledge about asthma, medication adherence and identification of signs of exacerbation can improve asthma control</td>
<td>Convenience sampling (regular pharmacy customers), multi-site setting (nine cities), validated screening tool. Screening questionnaire sent home. The study does not mention if the pharmacists were trained</td>
</tr>
<tr>
<td>2. Laforest et al.35 2005. France</td>
<td>To describe the disease management and health care utilization of people with poorly controlled asthma</td>
<td>Design: Retrospective observational study N: 1559 Duration: 7 months</td>
<td>Questionnaire: Validated questionnaire (ACT), Lung function test: peak expiratory flow rate (PEFR) Medical history: pharmacy dispensing records Number of visits: 2</td>
<td>Primary: Level of asthma control. Secondary: measure the type of medication and doctor visits utilized</td>
<td>28% were adequately controlled. 89% of people were on anti-inflammatory asthma control treatments, and 59% were on combinations of long acting beta-agonists (LABA) and inhaled corticosteroids (ICS). However, asthma control therapies were not being used properly or adequately by the patients as majority of patients with asthma were poorly controlled. Therefore improvement in the management of asthma and better patient education are necessary.</td>
<td>Convenience sampling (regular pharmacy customers), multi-site setting (nine cities), validated screening tool. Screening questionnaire sent home. The study does not mention if the pharmacists were trained</td>
</tr>
<tr>
<td>3. Mendes et al.36 2010. Portugal</td>
<td>To evaluate the prevalence of asthma control at a national level in a campaign carried out by Portuguese pharmacists.</td>
<td>Design: Cross-sectional National Campaign N: 5551 Duration: 1 week</td>
<td>Questionnaire: Validated Questionnaire (ACT)</td>
<td>Primary: level of asthma control Secondary: effect of age, gender and regional factors on asthma control</td>
<td>Pharmacists led screening identified that only 39% of the screened population had controlled asthma, higher proportion of females (58% vs 42%) and progressively lower control with age (over twice in 61-70 years). Lower control of asthma in regional areas</td>
<td>Convenience sampling multi-site setting (Portugal and islands of Azores and Madeira), validated screening tool. Does not mention if the pharmacists were trained.</td>
</tr>
</tbody>
</table>
Table 1 - Screening and management of poorly controlled asthma by community pharmacists

<table>
<thead>
<tr>
<th>Citation, Country</th>
<th>Purpose of the study</th>
<th>Study description</th>
<th>Type and method of asthma control assessment</th>
<th>Type and method of management</th>
<th>Outcome measure</th>
<th>Key findings</th>
<th>comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Mehuys et al.(^{37}) 2006. Belgium</td>
<td>To assess the use of ACT to measure asthma control by community pharmacists and to describe medication use and disease management of patients with asthma</td>
<td>Design: Cross-sectional retrospective study N: 166 Duration: 1 year</td>
<td>Medication history: last 12 months Questionnaire: Validated Questionnaire (ACT) Lung function test: PEFR</td>
<td>Primary: level of asthma control Secondary: perception of control</td>
<td>49% were poorly controlled. 82% believed their asthma to be totally or well controlled. 63% used combination product containing corticosteroid and long-acting ( \beta )-agonist. 22% consulted general practitioner (GP), 41% consulted pneumologist and 41% consulted both.</td>
<td>Multi-site setting. Patients were randomly selected. Convenience sampling. Pharmacists were not provided any training</td>
<td></td>
</tr>
<tr>
<td>5. Nishiyama et al.(^{38}) 2003. UK</td>
<td>To determine if JMI can be used to identify people with poor control</td>
<td>Design: cross-sectional study Community pharmacies throughout UK N: 306 Duration: 3 years</td>
<td>Questionnaire: Jones Morbidity Index (JMI)</td>
<td>Primary: assessing asthma control using JMI Secondary: relationship between control and usage of medicine, knowledge and their attitudes.</td>
<td>&gt;50% were identified with poor control. More people with poor control overused reliever (p&lt;0.01) and were less compliant with their preventer (p&lt;0.001), less happy with their medication and had less asthma knowledge.</td>
<td>Convenience sampling, multi-site setting. Screening tool not validated at the time of the study. Pharmacists were trained</td>
<td></td>
</tr>
</tbody>
</table>

Asthma control assessment studies with subsequent management component

<table>
<thead>
<tr>
<th>Citation, Country</th>
<th>Purpose of the study</th>
<th>Study description</th>
<th>Type and method of asthma control assessment</th>
<th>Type and method of management</th>
<th>Outcome measure</th>
<th>Key findings</th>
<th>comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Giraud et al.(^{39}) 2011. France</td>
<td>To identify people with poorly controlled asthma and evaluate the feasibility and acceptability of education on inhaler technique in community pharmacies</td>
<td>Prospective observational Study N: 727 Duration: 4 month</td>
<td>Questionnaire: Validated Questionnaire (ACQ6)</td>
<td>Inhaler technique assessment and training and provision of personalized self-stick instructions for the inhaler.</td>
<td>Relationship between poor asthma control and inhalation technique and adherence to medication. Short-term effects of education by pharmacists on inhaler technique, asthma control and adherence to treatment</td>
<td>51% of people with asthma had poor control at baseline. Both ACQ (p&lt;0.001) and self-reported adherence (Morisky score, p&lt;0.01) were worse when inhaler technique was not optimal at baseline. Optimal inhaler technique resulted in improved ACQ score (p&lt;0.01) and Morisky score (p&lt;0.001).</td>
<td>Multi-site setting (throughout France). Convenience sampling. Pharmacist was trained. Large sample size, but high dropout rate.</td>
</tr>
</tbody>
</table>
### Table 1: Screening and management of poorly controlled asthma by community pharmacists

<table>
<thead>
<tr>
<th>Citation, Country</th>
<th>Purpose of the study</th>
<th>Study design</th>
<th>Type and method of screening</th>
<th>Outcome measure</th>
<th>Key findings</th>
<th>comments</th>
</tr>
</thead>
</table>
| **7. Barbanel et al.**<sup>40</sup> 2003. UK | To determine if community pharmacist could improve asthma control using self-management advice | Design: randomized controlled trial  
N: 24  
(I: 12, C: 12)  
Duration: 3 months  
Questionnaire: Validated North of England asthma symptom scale  
Intervention focusing on self-management decision making based on PEFR readings. Provision of educational leaflets and personalized self-management plans  
Review of inhaler technique | Asthma symptom score | Significant improvement in the intervention group in the asthma symptom score (p<0.001) | Small sample size. Randomized at patient level. Single site setting. Pharmacist was trained. |

### Asthma control screening study without subsequent management component

<table>
<thead>
<tr>
<th>Citation, Country</th>
<th>Purpose of the study</th>
<th>Study description</th>
<th>Type and method of screening</th>
<th>Outcome measure</th>
<th>Key findings</th>
<th>comments</th>
</tr>
</thead>
</table>
| **8. Armour et al.**<sup>41</sup> 2011. Australia | To describe a population recruited in community pharmacy identified by trained community pharmacists as being at risk for poor asthma outcomes and to identify factors | Cross-sectional study  
N: 570 | Questionnaire: Validated Questionnaire (JMI)  
Primary: Level of asthma control  
Secondary: Identify factors that contribute to poor control. | 77% of people were identified with severe asthma. Community pharmacists were able to identify factors that contributed to this. These were smoking, incorrect inhaler technique and low medication adherence | Cluster sampling. Multi-site setting (regional and metropolitan areas in 4 states). Validated screening tool. |

### Asthma control screening studies with subsequent management component

<table>
<thead>
<tr>
<th>Citation, Country</th>
<th>Purpose of the study</th>
<th>Study description</th>
<th>Type and method of screening</th>
<th>Type and method of management</th>
<th>Outcome measures</th>
<th>Key findings</th>
<th>comments</th>
</tr>
</thead>
</table>
| **9. Saini et al.**<sup>42</sup> 2011. Australia | To identify those with poorly controlled asthma and to assess any improvements in knowledge of these patients after a tailored education program delivered by pharmacists and measure the sustainability of any improvements | Design: parallel group design  
N: 570  
(Group 1: 292, Group 2: 278)  
Duration: 6 months+12 months follow-up | Questionnaire: Validated questionnaire Jones Morbidity Index (JMI),  
Interventions focusing on asthma knowledge improvement, based on individual patient’s need and goals (counseling on asthma triggers, role of preventer and clarifying misunderstanding about asthma). Number of visits: 3-4  
Primary: level of asthma control  
Secondary: level of asthma knowledge | 77% of people with asthma had poor control. Asthma knowledge interventions provided by pharmacists significantly decreased from baseline to the end of the service (p<0.001). Improvements in knowledge are achievable and sustainable if pharmacists used targeted Educational interventions. | Convenience sampling, randomization of pharmacies. Multi-site (regional and metropolitan areas in 4 states). Validated screening tool. Pharmacists were trained. Asthma control was not reported at the end of the study. The study does not mention clearly how improvement in asthma knowledge changes in asthma control following pharmacist intervention. No control group. Two different interventions. |
<table>
<thead>
<tr>
<th>Study Details</th>
<th>Objective</th>
<th>Design</th>
<th>N</th>
<th>Duration</th>
<th>Signs and Symptoms of Asthma Control</th>
<th>Clinical Outcome</th>
<th>Economic Outcome</th>
<th>Convenience Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saini et al. 2004, Australia</td>
<td>To measure the impact of asthma management provided by community pharmacists on clinical, humanistic, and economic outcomes of people with asthma.</td>
<td>Parallel group controlled trial</td>
<td>102</td>
<td>6 months</td>
<td>Three visits involving a needs analysis, intervention, collaborative goal setting and monitoring. Number of visits: 3-4</td>
<td>Asthma severity score, peak flow index, risk of non-adherence, inhaler technique, action plan ownership</td>
<td>Quality of life, perceived level of control, asthma knowledge</td>
<td>Convenience sampling, pharmacists in the intervention group were trained, difficulty retaining patients in control group.</td>
</tr>
<tr>
<td>Bereznicki et al. 2008, Australia</td>
<td>To identify patients with sub-optimal asthma management using community pharmacy medication records and then implement and evaluate a multi-disciplinary educational intervention to improve asthma management</td>
<td>Multi-site controlled study</td>
<td>1551</td>
<td></td>
<td></td>
<td>Significant improvement in asthma severity score, PEF index, use of corticosteroids, inhaler technique, perceived control and knowledge in the intervention group (p&lt;0.001). Bronchodilator use also improved significantly (p&lt;0.015).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 1: Screening and management of poorly controlled asthma by community pharmacists**

<table>
<thead>
<tr>
<th>Design</th>
<th>N</th>
<th>Duration</th>
<th>Signs and Symptoms of Asthma Control</th>
<th>Clinical Outcome</th>
<th>Economic Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parallel group controlled trial</td>
<td>102</td>
<td>6 months</td>
<td>Three visits involving a needs analysis, intervention, collaborative goal setting and monitoring. Number of visits: 3-4</td>
<td>Asthma severity score, peak flow index, risk of non-adherence, inhaler technique, action plan ownership</td>
<td>Quality of life, perceived level of control, asthma knowledge</td>
</tr>
<tr>
<td>Multi-site controlled study</td>
<td>1551</td>
<td></td>
<td></td>
<td>Significant improvement in asthma severity score, PEF index, use of corticosteroids, inhaler technique, perceived control and knowledge in the intervention group (p&lt;0.001). Bronchodilator use also improved significantly (p&lt;0.015).</td>
<td></td>
</tr>
<tr>
<td>12. Bereznicki et al. 45 2008. Australia</td>
<td>To assess the impact of an intervention initiated by community pharmacists, involving the provision of educational material and general practitioner (GP) referral, on asthma knowledge and self-reported asthma control and asthma-related quality of life (QOL) in patients who may have suboptimal management of their asthma</td>
<td>Sub-study of Bereznicki et al. 39 N: 173 (I: 116, C: 57) Duration: 6 months</td>
<td>Patients identified with sub-optimal asthma management (based on P:R ratio) in the intervention group, were referred to their GP for review. Educational material on asthma was also mailed to the patient along with asthma knowledge, asthma control and asthma-related QOL questionnaires</td>
<td>Asthma knowledge (Consumer Asthma Knowledge Questionnaire), asthma control (ACT) and asthma-related quality of life score (mini-AQLQ)</td>
<td>Asthma control and asthma-related QOL scores were significantly higher in intervention patients (p&lt;0.001) after 6 months. (pre-post test comparison) No significant change in asthma knowledge was observed.</td>
</tr>
<tr>
<td>13. Mehuys et al. 46 2008. Belgium</td>
<td>To assess the impact of a community pharmacist intervention in promoting optimal asthma medication use in patients identified with asthma control.</td>
<td>Design: Randomized controlled parallel group trial N: 201 (I: 107, C: 94) Duration: 6 months</td>
<td>Prescription for an asthma medication Questionnaire: Validated questionnaire (ACT)</td>
<td>Tailored intervention based on the asthma knowledge, inhaler device and medication use.</td>
<td>Primary: level of asthma control (ACT) Secondary: diary data, asthma exacerbation, adherence to controller medication, asthma quality of life, Inhaler technique and asthma knowledge</td>
</tr>
<tr>
<td>Table 1- Screening and management of poorly controlled asthma by community pharmacists</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>14. Armour et al.</strong> 2007. Australia</td>
<td>To investigate if pharmacist-delivered asthma care program based on national guidelines improves asthma control</td>
<td>Multi-site randomized intervention vs control trial N: 396 (I: 191, C: 205) Duration: 6 months</td>
<td>Questionnaire: Validated Questionnaire (JMI)</td>
<td>Interventions focusing on ongoing cycle of assessment, goal setting, monitoring and review. Counseling and education on disease, medication, triggers and inhaler technique</td>
<td>Clinical outcomes: Asthma control/severity, Medication profile Daily dose of medication Inhaler technique Adherence Action plan ownership Humanistic outcomes: Asthma related quality of life Perceived control of asthma and Asthma knowledge</td>
</tr>
<tr>
<td><strong>15. Armour et al.</strong> 2013. Australia</td>
<td>To test the feasibility, effectiveness and sustainability of a pharmacy asthma service in primary care.</td>
<td>Design: Cluster randomized trial N: 570 Duration: 6+12 months follow-up</td>
<td>Questionnaire: Validated Questionnaire (JMI)</td>
<td>Interventions and counseling which focused on medication use and adherence, asthma knowledge and beliefs, asthma triggers and use of an asthma action plan. Goal setting.</td>
<td>Level of asthma control (ACQ) Asthma quality of life (IAQLQ) Perceived control of asthma (PCAQ), asthma Knowledge (Q), drug regimen, risk of non-adherence, lung function (spirometry) and inhaler technique. Assess whether clinical and humanistic outcomes could be achieved by 3 vs 4 consultations over 6 months and assess if the service is sustainable after 12 months</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Citation, Country</td>
<td>Purpose of study</td>
<td>Description of study</td>
<td>Type and method of screening</td>
<td>Outcome measure</td>
<td>Key findings comments</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------</td>
<td>----------------------</td>
<td>-----------------------------</td>
<td>----------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>1. Castillo et al.2008, Spain</td>
<td>To evaluate the feasibility of a community pharmacy program for COPD case finding in high risk customers by means of spirometry</td>
<td>Design: Pilot cross-sectional descriptive study N: 161 Duration: 1 month</td>
<td>Questionnaire: Validated GOLD screening questionnaire Lung function test: spirometry</td>
<td>Referral to the hospital for further assessment</td>
<td>62% were identified at high risk of COPD. 24% had an FEV1/FVC ratio&lt;0.7 indicative of airflow limitation. 70% of spirometries were rated as being of acceptable quality</td>
</tr>
<tr>
<td>2. Fuller et al.2012, USA</td>
<td>To determine if pharmacists can accurately perform spirometry screening and interpret results</td>
<td>Design: prospective study N: 185 Duration: 4 months</td>
<td>Questionnaire: Validated COPD screener questionnaire Lung function test: spirometry</td>
<td>Referral of people with obstruction to their physician for review and follow-up. Lung age calculation for active smokers based on their spirometry result and counseling provided on smoking cessation. Patients were followed-up after 2-6 months by phone or email</td>
<td>9% of people screened had airflow obstruction FEV1/FVC&lt;LLN (lower limit of Normal) indicative of obstructive lung disease. 99% of the spirometry tests were judged acceptable by pulmonary experts. 78% reported some attempt at smoking cessation and 22% had successfully quit smoking after screening. 33% of the participants with obstruction had seen their physician for treatment</td>
</tr>
</tbody>
</table>