**Performance of retail pharmacies in low and middle-income Asian settings: a systematic review**

**Corresponding author:**

Rosalind Miller, Faculty of Public Health and Policy, London School of Hygiene and Tropical Medicine, 15-17 Tavistock Place, London, WC1H 9SH

Tel: +44 (0)207 927 4766

Email: Rosalind.miller@lshtm.ac.uk

**Authors:**

Rosalind Miller MPharm MSc, PhD student, Department of Global Health and Development, London School of Hygiene and Tropical Medicine, UK

Dr Catherine Goodman BA MSc PhD, Reader in Health Economics and Policy, Department of Global Health and Development, London School of Hygiene and Tropical Medicine, UK

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**Key messages:**

* Pharmacy practice in Asia is characterised by insufficient history taking; a lack of appropriate patient referral; poor adherence to treatment guidelines, inappropriate supply of medicines; and insufficient counselling.
* Adequate knowledge alone is not sufficient to ensure appropriate management of patients presenting at the pharmacy. Profit incentives and the regulatory environment must be taken into consideration when designing interventions to improve pharmacy practice in these settings.
* Intervention research in this area appears to be lacking and more research is particularly required on non pharmacist-run pharmacies and unregistered drug shops.

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**Abstract**

In low and middle-income countries (LMIC) in Asia, pharmacies are often patients’ first point of contact with the health care system and their preferred channel for purchasing medicines. Unfortunately, pharmacy practice in these settings has been characterised by deficient knowledge and inappropriate treatment. This paper systematically reviews both the performance of all types of pharmacies and drug stores across Asia’s LMIC, and the determinants of poor practice, in order to reflect on how this could best be addressed.

Poor pharmacy practice in Asia appears to have persisted over the past 30 years. We identify a set of inadequacies that occur at key moments throughout the pharmacy encounter, including: insufficient history taking; lack of referral of patients who require medical attention; illegal sale of a wide range of prescription only medicines without a prescription; sale of medicines that are either clinically inappropriate and/or in doses that are outside of the therapeutic range; sale of incomplete courses of antibiotics; and limited provision of information and counselling.

In terms of determinants of poor practice, firstly knowledge was found to be necessary but not sufficient to ensure correct management of patients presenting at the pharmacy. This is evidenced by large discrepancies between stated and actual practice; little difference in the treatment behaviour of less and more qualified personnel; and the failure of training programs to improve practice to a satisfactory level. Secondly, we identified a number of profit maximising strategies employed by pharmacy staff that can be linked to poor practices. Finally, whilst the research is relatively sparse, the regulatory environment appears to play an important role in shaping behaviour. Future efforts to improve the situation may yield more success than historical attempts, which have tended to concentrate on education, if they address the profit incentives faced by pharmacy personnel and the regulatory system.

**Introduction:**

The role of the private sector in the provision of medicines has traditionally been neglected by governments and the international public health community alike ([Bigdeli et al., 2014](#_ENREF_5)). Yet in most low and middle income countries (LMIC) it is widely established that private pharmacies and drug stores are typically patients’ first point of contact with the health care system and the preferred channel through which to purchase medicines ([Smith, 2009b](#_ENREF_82)). For example, in Asia, pharmacies have been found to be the dominant source of healthcare for all common problems amongst poor populations in Bangladesh ([Khan et al., 2012](#_ENREF_41)) and in Western Nepal, amongst mothers seeking care for their children, pharmacies were the most popular source (46.2%) ([Sreeramareddy et al., 2006](#_ENREF_83)). Their appeal lies in long opening hours, availability of medicines (including the possibility of credit and the option to purchase medicines in small quantities), geographic accessibility and personal familiarity ([Van der Geest, 1982](#_ENREF_91), [Kloos et al., 1986](#_ENREF_44), [Igun, 1987](#_ENREF_34), [Logan, 1983](#_ENREF_50), [Price, 1989](#_ENREF_66), [Greenhalgh, 1987](#_ENREF_27), [Haak, 1988](#_ENREF_28), [Mayhew et al., 2001](#_ENREF_54)). Further, many patients have neither the time nor money to consult a physician ([Haak, 1988](#_ENREF_28), [Ferguson, 1981](#_ENREF_24), [Seeberg, 2012](#_ENREF_79), [Wolffers, 1987](#_ENREF_98), [Saradamma et al., 2000](#_ENREF_78)). These drug shops range from high end outlets staffed by pharmacists, to small, rural, roadside stalls staffed by someone without formal health qualifications. Unfortunately, it is all too common that drug selling at these outlets meets the World Health Organization’s (WHO) criteria for being ‘irrational’. That is, patients do not receive the appropriate medicines, in doses that meet their individual requirements, for an adequate duration, and at the lowest cost ([Holloway and van Dijk, 2011](#_ENREF_30)). To develop appropriate interventions to address this, it is first necessary to understand the nature of the problem and also the determinants of provider behaviour to reflect on how this could best be changed.

Many papers have reported on the inadequacies of pharmacy practice in LMIC, and some reviews have been conducted ([Smith, 2009b](#_ENREF_82), [Wafula et al., 2012](#_ENREF_97)). However, no up to date systematic review is available on performance of pharmacies and drug stores across Asia’s LMIC. This paper aims to address that gap, and in addition, present the first systematic review of the determinants of poor practice in these settings, substantially updating and expanding previous reviews in this area ([Goel et al., 1996](#_ENREF_26), [Radyowijati and Haak, 2003](#_ENREF_69)).

**Methods:**

*Scope of review*

In many LMIC, there are a wide range of outlets selling medicines to their local communities. This review is concerned with the full range of establishments whose primary business is selling medicines. Papers reporting on pharmacist-run pharmacies (PRPs), non pharmacist-run pharmacies (NPRPs) and both registered and non-registered outlets were eligible for inclusion. Despite the legal requirement to have a trained pharmacist on duty at all times, in reality, in many countries in Asia, these pharmacies are typically operated by staff who are not authorised to do so ([Chuc and Tomson, 1999](#_ENREF_15), [Kamat and Nichter, 1998](#_ENREF_40), [Seeberg, 2012](#_ENREF_79), [Vu et al., 2012](#_ENREF_94), [Wolffers, 1987](#_ENREF_98)). In countries where a shortage of pharmacists exists, NPRPs are permitted; these are registered outlets but the presence of a graduate pharmacist is not mandatory. These pharmacies are typically staffed by personnel with limited medical training and are sometimes restricted in the repertoire of medicines they are permitted to sell. Unregistered drug shops sell medicines informally and are not legally recognised by the health system of the countries in which they operate ([Wafula and Goodman, 2010](#_ENREF_96)). From this point onwards, ‘pharmacy’ will be used as an umbrella term to denote all types of outlets selling medicines.

The first part of the review is concerned with performance of pharmacies which, in this instance, is conceptualised as behaviour relating to the sale of medicines, either with or without a prescription, or the provision of advice (the importance of the sale of substandard and counterfeit medicines in Asia is also recognised ([Cockburn et al., 2005](#_ENREF_16), [Institute of Medicines, 2013](#_ENREF_36), [Newton et al., 2006](#_ENREF_61), [World Health Organization, 2006](#_ENREF_100)), but considered beyond the scope of this review). The second part of the review concerns the determinants of poor practice, that is, the factors that contribute to practices that are deemed inappropriate.

*Search strategy*

A broad search strategy combining MeSH and free text terms was used to search PubMed, Embase, Econlit, PsychInfo, Web of Science, Global Health and International Pharmacy Abstracts with the aim of identifying all studies of pharmacies in LMIC in Asia ([World Bank, 2014](#_ENREF_99) ) (see table 1).

In addition to the aforementioned databases, the International Network for Rational Use of Drugs (INRUD) bibliography and the WHO’s essential medicines and health products information portal were searched.

The search was restricted to English language studies published between 01/01/1984 and 29/08/2014. A total of 21,898 papers were initially identified; after removing duplicates, 19,214 titles and abstracts were screened by RM; the full-text of 107 records were obtained; 53 met our inclusion criteria for part 1 of the review and 38 met the criteria for part 2 (see Fig.1). Bibliographies of eligible texts were scanned to identify any further relevant papers.

For part one, papers needed to report on performance relating to the sale of medicines, either with or without a prescription, or the provision of advice. This included studies employing both quantitative and qualitative methodologies. In order to collect the most accurate data on pharmacy practice, only studies utilising methods that collected data at the outlet and relied on a third party observation of practice were included (studies relying on self-reported practice were excluded due to the risk of desirability bias and those collecting data on medicine use through household surveys were excluded due to the high risk of recall bias). Intervention studies were included, only where they provided baseline data; this was thought to reflect standard practice. Where baseline data could not be disentangled from post-intervention results, studies were excluded from part one.

Eligible studies for part two reported on both pharmacy performance (applying the same method criteria as for part one) *and* possible determinants of that reported performance. Where changes in practice could be attributed to an intervention strategy, these intervention studies were included and strategies were viewed as determinants of practice. For example, a training intervention could shed light on the importance of knowledge as a determinant of practice. Additionally, qualitative studies which sought to understand the determinants of practice behaviours were also included. Of the studies included in part two, 31 of these were a subset of papers from part one; three papers were intervention studies where the baseline results were not clear; three papers were intervention studies where the baseline results were described by other papers from the same research study, and one paper reported results from a qualitative study solely focussing on determinants of poor practice.

Data from the included studies was extracted into an excel database under the following headings: date and location of study, which aspects of performance measured, sampling and study design, data collection methods, details of intervention, main findings- performance, main findings- determinants of performance. Key emergent themes recurring across the data were discussed between the authors and a narrative synthesis was conducted. See appendix 1 for a full list of included studies and key characteristics.

**Results**

**Part One: Performance of pharmacies in LMIC in Asia**

This literature review reveals a number of shortcomings in pharmacy practice. We have organised our findings according to the stages of an encounter in the pharmacy (Fig 2). Following an overview of the included studies, we report on six key stages, namely, the nature of requests from patients, filling of prescriptions, history taking, referral for medical attention, sale of medicines and advice giving.

*Overview of included studies*

This part of the review identified a total of 53 papers from 43 studies in 14 countries (some studies collected data in more than one country). Papers coming from the same research project have been grouped together and the term ‘study’ is used to denote distinct pieces of research. The most researched countries were India and Vietnam, with ten and nine studies respectively. Five studies reported on each of Thailand, Bangladesh and Nepal, three on Indonesia, two on Sri Lanka and Pakistan, and one on The Philippines, Mongolia, Malaysia, Yemen Arab Republic, Syria and Lao PDR. Bangladesh and Nepal are low income countries, Thailand and Malaysia are higher-middle and all the others are classified as lower-middle income economies ([World Bank, 2014](#_ENREF_99) ).

Studies reported on the full range of pharmacies. PRPs were included in the majority of research projects. Several papers reported on outlets legally entitled to operate without a pharmacist, including type II pharmacies in Thailand, class II and III pharmacies in Lao PDR, type C pharmacies in Pakistan, drug stores in Indonesia and drug retailers in Nepal ([Saengcharoen and Lerkiatbundit, 2010](#_ENREF_76), [Hadi et al., 2010](#_ENREF_29), [Kafle et al., 1996](#_ENREF_39), [Stenson et al., 2001a](#_ENREF_84), [Hussain and Ibrahim, 2011](#_ENREF_32)). Only one study from Indonesia reported on unregistered outlets ([Hadi et al., 2010](#_ENREF_29)).

Researchers employed a range of methods to collect data on pharmacy practice. Simulated client methodology was used widely (31 studies) to investigate how a range of requests and conditions are managed. These included requests for specific prescription only medicines (POMs), contraceptives, and treatment for fever, skin abrasions, diarrhoea, sexually transmitted infections (STIs), respiratory tracts infections (RTIs), tuberculosis, asthma, migraine and anaemia. 12 studies used observation in order to record the details of transactions between pharmacy staff and customers. Exit interviews with patients were used less frequently (seven studies) to gather information about medicines purchased and staff behaviour.

*1) Nature of client requests*

Clients with health concerns visited the pharmacy for three main reasons: to fill a prescription following a medical consultation; to purchase a specific medicine(s); or to seek medical advice from the pharmacy staff. In order to examine staff behaviour and to put certain practices into perspective, it is useful to understand the frequencies of these different types of scenarios. Eight studies observed all transactions in sampled pharmacies for a fixed period of time, ranging from two hours to two weeks per pharmacy. The proportion of transactions where medicines were purchased without a prescription ranged from around half in studies from Pakistan and India ([Krishnaswamy et al., 1985](#_ENREF_46), [Hussain and Ibrahim, 2011](#_ENREF_32), [Basak and Sathyanarayana, 2010](#_ENREF_4), [Kamat and Nichter, 1998](#_ENREF_40), [Greenhalgh, 1987](#_ENREF_27)), to over 80% in a study from Lao PDR ([Syhakhang et al., 2001](#_ENREF_86)) and virtually all transactions in studies from Vietnam and Malaysia ([Chua et al., 2013](#_ENREF_12), [Chuc and Tomson, 1999](#_ENREF_15)). Of the medicines purchased without a prescription, three studies reported that around one third were recommended by the pharmacy staff ([Chua et al., 2013](#_ENREF_12), [Basak and Sathyanarayana, 2010](#_ENREF_4), [Syhakhang et al., 2001](#_ENREF_86)). Other studies reported that the vast majority of medicines sold without a prescription were requested by the client, with pharmacists advising on less than 5% of these purchases ([Krishnaswamy et al., 1985](#_ENREF_46), [Kamat and Nichter, 1998](#_ENREF_40), [Chuc and Tomson, 1999](#_ENREF_15), [Hussain and Ibrahim, 2011](#_ENREF_32)). Only studies from India reported on common ways patients requested medicines. These were by name, on a scrap of paper, or by bringing in an old sample ([Kamat and Nichter, 1998](#_ENREF_40), [Greenhalgh, 1987](#_ENREF_27), [Saradamma et al., 2000](#_ENREF_78)).

Studies from Vietnam, India and Bangladesh reported that at least half of clients were buying medicines for someone other than themselves, most commonly a family member ([Dua et al., 1994](#_ENREF_21), [Duong et al., 1997b](#_ENREF_23), [Kamat and Nichter, 1998](#_ENREF_40), [Roy, 1997](#_ENREF_75)). One study noted that domestic servants were commonly sent to purchase medications on behalf of their employers ([Kamat and Nichter, 1998](#_ENREF_40)).

*2) Filling prescriptions*

Only a few studies made reference to the handling and processing of prescriptions in the pharmacy. Several poor practices were reported. Prescriptions were rarely validated by dispensers ([Hussain and Ibrahim, 2011](#_ENREF_32)), old prescriptions were frequently honoured (at the extreme, patients were seen to be reusing prescriptions five years out of date) ([Kamat and Nichter, 1998](#_ENREF_40), [Greenhalgh, 1987](#_ENREF_27), [Basak and Sathyanarayana, 2010](#_ENREF_4)), and prescriptions were returned to customers after dispensing for reuse in the future ([Puspitasari et al., 2011](#_ENREF_67)). Further, doctors’ prescriptions were not always dispensed as intended. Some studies indicated that where patients cannot afford to buy all items on a prescription, the pharmacists played an important role in advising patients what they should purchase in light of their financial constraints ([Kamat and Nichter, 1998](#_ENREF_40), [Greenhalgh, 1987](#_ENREF_27), [Roy, 1997](#_ENREF_75)). Studies did not report a single example of a pharmacist querying a prescription with the doctor (despite ample description of inappropriate prescribing practices).

*3) History Taking*

In general, history taking in pharmacies was found to be inadequate. The majority of these data come from studies where mystery shoppers presented with symptoms of various conditions, including childhood diarrhoea and sexually transmitted infections. Most questioning was limited to enquiring about the presence of other related symptoms and often this was only observed in a subset of the study pharmacies ([Chuc et al., 2001](#_ENREF_13), [Bista et al., 2002](#_ENREF_6), [Saengcharoen and Lerkiatbundit, 2010](#_ENREF_76), [ROSS-DEGNAN et al., 1996](#_ENREF_74), [Minh et al., 2013](#_ENREF_55), [Van Sickle, 2006](#_ENREF_93)). It was rare for pharmacists to ask whether the patient suffered from any other conditions or allergies, took any other medication or had tried any treatments before consulting at the pharmacy ([Chuc et al., 2001](#_ENREF_13), [Wachter et al., 1999](#_ENREF_95), [Saengcharoen and Lerkiatbundit, 2010](#_ENREF_76), [Van Sickle, 2006](#_ENREF_93), [Hussain and Ibrahim, 2012](#_ENREF_33)). Worryingly, a common finding was that very few, if any, pharmacists enquired about danger signs that would indicate a more serious underlying cause and warrant immediate medical attention ([Wachter et al., 1999](#_ENREF_95), [Duong et al., 1997a](#_ENREF_22), [Modal T and L, 1994](#_ENREF_57), [Kafle et al., 1996](#_ENREF_39), [Rathnakar et al., 2012](#_ENREF_73), [Saengcharoen and Lerkiatbundit, 2010](#_ENREF_76)). At the extreme end of poor practice, some pharmacists were found to ask not a single question ([Rathnakar et al., 2012](#_ENREF_73), [Duong et al., 1997a](#_ENREF_22), [Chalker et al., 2000](#_ENREF_10)).

Only three studies measured pharmacists’ responses to direct requests for medications. Questioning was insufficient on who the medicine was for, what symptoms they were experiencing, whether they took any other medication or whether they suffered from drug allergies ([Puspitasari et al., 2011](#_ENREF_67), [Larsson et al., 2006](#_ENREF_48), [Ratanajamit et al., 2002](#_ENREF_72), [Ratanajamit and Chongsuvivatwong, 2001](#_ENREF_71)). Additionally, Kamat and Nichter, describe the ‘quick presentation of tablets and fast exchange of money’ ([Kamat and Nichter, 1998](#_ENREF_40)).

*4) Referral for medical attention*

Some studies used simulated clients to present with symptoms of conditions that necessitate referral for medical attention; these included diarrhoea (of 3 day duration) in an 11 month old, cystitis in a man, STIs, asthma and tuberculosis. These conditions require examination, diagnostic testing or POMs and hence their management is outside the remit of a pharmacist’s expertise. Referral practices of pharmacists were found to be unsatisfactory. Tuberculosis was the condition most commonly referred outside the pharmacy- 46% of 138 pharmacies in Vietnam, although only 9% of patients were directed to a designated TB facility ([Vu et al., 2012](#_ENREF_94)). For the other conditions, referral proportions ranged from 7% to 37% ([Wachter et al., 1999](#_ENREF_95), [Tuladhar et al., 1998](#_ENREF_89), [Van Sickle, 2006](#_ENREF_93), [Tomson and Sterky, 1986](#_ENREF_88), [Apisarnthanarak et al., 2008](#_ENREF_3), [Chalker et al., 2000](#_ENREF_10)).

*5) Sale of medicines*

In terms of medicine provision, a number of concerns are raised by the literature regarding the appropriateness of medicines sold (with attention to the legal, clinical and physical aspects of their sale), dosing and duration of treatment.

*a) Appropriateness of medicines*

*i) Legal appropriateness*

The sale of POMs without a prescription was a phenomenon found to be prevalent in *all* 14 countries reported on. A wide range of medicines, which are only legally permitted to be sold with a prescription, were freely available without a prescription including: antibiotics, steroids, antimalarials, narcotic analgesics, psychotropics, anti-epileptics, antihypertensives, anti-diarrhoels, antihistamines, sedatives, tranquilisers, hypoglycaemic medicines, anti-tuberculosis agents and even, on occasion, abortifacients ([Basak and Sathyanarayana, 2010](#_ENREF_4), [Cong et al., 1998](#_ENREF_17), [Duong et al., 1997b](#_ENREF_23), [Greenhalgh, 1987](#_ENREF_27), [Kamat and Nichter, 1998](#_ENREF_40), [Lansang et al., 1990](#_ENREF_47), [Larsson et al., 2006](#_ENREF_48), [Mac et al., 2006](#_ENREF_52), [Mamun et al., 2006](#_ENREF_53), [Nakajima et al., 2010](#_ENREF_60), [Ngo et al., 2012](#_ENREF_63), [Puspitasari et al., 2011](#_ENREF_67), [Rathnakar et al., 2012](#_ENREF_73), [Saradamma et al., 2000](#_ENREF_78), [Seeberg, 2012](#_ENREF_79), [Wolffers, 1987](#_ENREF_98), [Krishnaswamy et al., 1985](#_ENREF_46), [Dua et al., 1994](#_ENREF_21), [Chuc and Tomson, 1999](#_ENREF_15), [Roy, 1997](#_ENREF_75), [Wachter et al., 1999](#_ENREF_95), [Duong et al., 1997a](#_ENREF_22), [Tomson and Sterky, 1986](#_ENREF_88), [Modal T and L, 1994](#_ENREF_57), [Vu et al., 2012](#_ENREF_94), [Dineshkumar et al., 1995](#_ENREF_19), [Hussain and Ibrahim, 2012](#_ENREF_33), [Qidwai et al., 2006](#_ENREF_68), [Chuc et al., 2002](#_ENREF_14), [Hadi et al., 2010](#_ENREF_29), [Huda et al., 2014](#_ENREF_31), [Al-Faham et al., 2011](#_ENREF_1), [Nga et al., 2014](#_ENREF_62)). In Thailand, antibiotics are legally permitted to be sold by class I drug stores but not in lower class stores. This restriction is reportedly not observed in practice ([Saengcharoen and Lerkiatbundit, 2010](#_ENREF_76), [Podhipak et al., 1993](#_ENREF_65)). In Indonesia, antibiotics were found to be freely available through unregistered roadside kiosks ([Hadi et al., 2010](#_ENREF_29)).

*ii) Clinical appropriateness*

The majority of the literature paints a dismal picture of treatment practices in pharmacies across Asia. More often than not, medicines that are dispensed are not clinically appropriate for the patients’ needs. Table 2 shows treatment choices by pharmacy staff for a number of conditions in response to visits from simulated clients. At best, studies report that recommended practices are followed in less than half of encounters ([Chuc et al., 2001](#_ENREF_13), [Bista et al., 2002](#_ENREF_6)). At worst, only a handful, and in some cases no staff were found to follow best practice guidelines ([Duong et al., 1997a](#_ENREF_22), [Hussain and Ibrahim, 2012](#_ENREF_33), [Van Sickle, 2006](#_ENREF_93), [Vu et al., 2012](#_ENREF_94)).

These studies also reveal that a number of inappropriate treatments are given, either in addition to, or, instead of recommended treatments. Some of the medicines, such as tonics for anaemia, have no therapeutic value ([Kafle et al., 1996](#_ENREF_39)). Others can be harmful, for example the use of antidiarrhoels and antitussives in infants and children ([Chuc et al., 2001](#_ENREF_13), [Duong et al., 1997a](#_ENREF_22), [Hussain and Ibrahim, 2012](#_ENREF_33), [Minh et al., 2013](#_ENREF_55), [Modal T and L, 1994](#_ENREF_57), [Podhipak et al., 1993](#_ENREF_65), [Qidwai et al., 2006](#_ENREF_68), [ROSS-DEGNAN et al., 1996](#_ENREF_74), [Saengcharoen and Lerkiatbundit, 2010](#_ENREF_76), [Tomson and Sterky, 1986](#_ENREF_88)).

Another concern is the overuse of antibiotics. A number of papers, report that antibiotics were commonly sold for young babies through to adults for a host of symptoms and conditions for which they are not indicated, including: diarrhoea, asthma, upset stomachs, coughs, colds, runny noses, influenza and (non-infected) skin abrasions ([Chuc et al., 2001](#_ENREF_13), [Duong et al., 1997a](#_ENREF_22), [Hussain and Ibrahim, 2012](#_ENREF_33), [Minh et al., 2013](#_ENREF_55), [Modal T and L, 1994](#_ENREF_57), [Podhipak et al., 1993](#_ENREF_65), [Qidwai et al., 2006](#_ENREF_68), [ROSS-DEGNAN et al., 1996](#_ENREF_74), [Saengcharoen and Lerkiatbundit, 2010](#_ENREF_76), [Tomson and Sterky, 1986](#_ENREF_88), [Apisarnthanarak et al., 2008](#_ENREF_3), [Duong et al., 1997b](#_ENREF_23), [Thamlikitkul, 1988](#_ENREF_87), [Wachter et al., 1999](#_ENREF_95), [Van Sickle, 2006](#_ENREF_93), [Chuc et al., 2002](#_ENREF_14)). Further, even where antibiotics are indicated, inappropriate choices were made ([Tuladhar et al., 1998](#_ENREF_89), [Bista et al., 2002](#_ENREF_6)). In studies from the Philippines, India, Vietnam and Lao PDR antibiotics were found to make up between a fifth and a third of all purchases ([Basak and Sathyanarayana, 2010](#_ENREF_4), [Lansang et al., 1990](#_ENREF_47), [Syhakhang et al., 2001](#_ENREF_86), [Dua et al., 1994](#_ENREF_21), [Nga et al., 2014](#_ENREF_62)). Tetracycline was reportedly sold to children (for whom it is contraindicated) in studies from Vietnam, India and Thailand ([Thamlikitkul, 1988](#_ENREF_87), [Dua et al., 1994](#_ENREF_21), [Chuc and Tomson, 1999](#_ENREF_15)). Further, the widespread use of chloramphenicol for minor conditions is a concern due to the risk of bone marrow suppression ([Thamlikitkul, 1988](#_ENREF_87), [Syhakhang et al., 2001](#_ENREF_86), [Greenhalgh, 1987](#_ENREF_27)).

Vitamins, tonics and nutritional products with dubious pharmacological value were found to constitute a significant proportion of medication costs in studies from India, Bangladesh, Vietnam and Nepal ([Dineshkumar et al., 1995](#_ENREF_19), [Greenhalgh, 1987](#_ENREF_27), [Kafle et al., 1996](#_ENREF_39), [Roy, 1997](#_ENREF_75), [Saradamma et al., 2000](#_ENREF_78), [Chuc and Tomson, 1999](#_ENREF_15), [Krishnaswamy et al., 1985](#_ENREF_46), [Duong et al., 1997b](#_ENREF_23), [Basak and Sathyanarayana, 2010](#_ENREF_4)). They were often seen as an essential accompaniment to antibiotics ([Greenhalgh, 1987](#_ENREF_27), [Roy, 1997](#_ENREF_75), [Saradamma et al., 2000](#_ENREF_78), [Dua et al., 1994](#_ENREF_21)). A final observation was the popularity of (often irrational) combination products ([Chuc and Tomson, 1999](#_ENREF_15), [Dineshkumar et al., 1995](#_ENREF_19), [Greenhalgh, 1987](#_ENREF_27), [Wachter et al., 1999](#_ENREF_95), [Saengcharoen and Lerkiatbundit, 2010](#_ENREF_76), [Lansang et al., 1990](#_ENREF_47), [Kafle et al., 1996](#_ENREF_39), [Tomson and Sterky, 1986](#_ENREF_88)).

*iii) Physical appropriateness*

Few studies investigated or commented on the physical state of the medicines sold to patients. Those that did, reported that drugs were often sold in loose strips, as opposed to in their original package; they were rarely labelled; and different medicines were mixed together in the same package ([Hussain and Ibrahim, 2011](#_ENREF_32), [Stenson et al., 2001a](#_ENREF_84), [Van Sickle, 2006](#_ENREF_93), [Kamat and Nichter, 1998](#_ENREF_40), [Hadi et al., 2010](#_ENREF_29)). As a result, information regarding dose, expiry date and active ingredients was not clear. In six of 28 shops visited in Sri Lanka, tetracycline was not stored in a refrigerator as it should be ([Wolffers, 1987](#_ENREF_98)).

*b) Appropriateness of dose and duration of treatment*

Several studies report that medicine dosing was outside of the therapeutic range for a variety of conditions (both sub-therapeutic and over dose) ([Thamlikitkul, 1988](#_ENREF_87), [Bista et al., 2002](#_ENREF_6), [Tuladhar et al., 1998](#_ENREF_89), [Rahman et al., 2000](#_ENREF_70)). Saradamma and colleagues study of antibiotic purchases in India found that those without a prescription were three times more likely to purchase an inadequate dose than those with a prescription (66% vs 40%) ([Saradamma et al., 2000](#_ENREF_78)). The problem of incomplete courses of antibiotics was reported in India, Thailand, Vietnam, Bangladesh, The Philippines and Sri Lanka ([Basak and Sathyanarayana, 2010](#_ENREF_4), [Chuc and Tomson, 1999](#_ENREF_15), [Cong et al., 1998](#_ENREF_17), [Duong et al., 1997b](#_ENREF_23), [Greenhalgh, 1987](#_ENREF_27), [Lansang et al., 1990](#_ENREF_47), [Mamun et al., 2006](#_ENREF_53), [Saradamma et al., 2000](#_ENREF_78), [Tomson and Sterky, 1986](#_ENREF_88), [Duong et al., 1997a](#_ENREF_22), [Chalker et al., 2000](#_ENREF_10)). At the extreme, more than half of antibiotic purchases were for less than two days ([Chuc and Tomson, 1999](#_ENREF_15), [Thamlikitkul, 1988](#_ENREF_87), [Greenhalgh, 1987](#_ENREF_27)). An interesting finding from Vietnam was that a higher percentage of incomplete antibiotic courses were sold for under 1s ([Chuc and Tomson, 1999](#_ENREF_15)).

*6) Advice Giving*

Clients purchasing medicines in the pharmacy were found to receive very little counselling and advice from pharmacy staff. Provision of any unsolicited advice ranged widely from 2.5% to over 70%. Where it was given, however, it was usually limited to dose and frequency instructions; very few staff mentioned potential side effects, drug or food interactions, or advised to visit a physician if symptoms continued, worsened or complications arose ([Basak and Sathyanarayana, 2010](#_ENREF_4), [Chuc et al., 2001](#_ENREF_13), [Dua et al., 1994](#_ENREF_21), [Duong et al., 1997a](#_ENREF_22), [Hussain and Ibrahim, 2011](#_ENREF_32), [Kafle et al., 1996](#_ENREF_39), [Puspitasari et al., 2011](#_ENREF_67), [Ratanajamit and Chongsuvivatwong, 2001](#_ENREF_71), [ROSS-DEGNAN et al., 1996](#_ENREF_74), [Saengcharoen and Lerkiatbundit, 2013](#_ENREF_77), [Van Sickle, 2006](#_ENREF_93), [Wachter et al., 1999](#_ENREF_95), [Modal T and L, 1994](#_ENREF_57), [Chalker et al., 2000](#_ENREF_10), [Huda et al., 2014](#_ENREF_31)). Disease and medicine-specific advice and counselling was also poor, especially for STIs and contraceptive requests ([Ratanajamit and Chongsuvivatwong, 2001](#_ENREF_71), [Tuladhar et al., 1998](#_ENREF_89), [Chalker et al., 2000](#_ENREF_10), [Minh et al., 2013](#_ENREF_55), [Rahman et al., 2000](#_ENREF_70)). Advice regarding dietary and fluid intake for clients suffering from diarrhoea or anaemia was given by a minority of pharmacy staff ([Duong et al., 1997a](#_ENREF_22), [Kafle et al., 1996](#_ENREF_39), [Minh et al., 2013](#_ENREF_55), [Saengcharoen and Lerkiatbundit, 2010](#_ENREF_76), [Wachter et al., 1999](#_ENREF_95)). Finally, there was little evidence of signposting to other health services. This is highlighted by a study from Vietnam where simulated clients requested an abortifacient. None of the 30 pharmacies visited offered referral materials or contact details for a specialist service ([Ngo et al., 2012](#_ENREF_63)).

**Part Two: Determinants of poor pharmacy performance in LMIC in Asia**

*Overview of included studies*

The literature search yielded 38 relevant papers, from 28 distinct studies which conducted research in 11 countries: Pakistan (two), Thailand (five), Nepal (four), India (seven), Bangladesh (three), Lao PDR (one), Sri Lanka (one), Yemen Arab Republic (one), Vietnam (six), The Philippines (one), and Indonesia (one). The studies included in this review are very varied in terms of methodology and approach but they all shed some light on the determinants of pharmacy practice in these settings. Ten studies collected data on both ‘actual’ pharmacy practice (for example using mystery shopper surveys or spending time observing transactions) and knowledge and stated practice (through semi-structured interviews with store staff), with discordance between the two providing insight into factors affecting certain poor practices. In uncontrolled analyses, three studies tested for associations between a number of predictor variables and provider practices. Four studies conducted regression analyses using aspects of practice as the dependent variable and tested a number of explanatory variables (such as retailer characteristics or attitudes) as potential predictors of behaviour. Twelve studies evaluated the effectiveness of an intervention strategy and this provided evidence for whether or not these were important determinants of practice. Finally, ten studies employed qualitative methodology, including in-depth interviews, participant and non-participant observation, and focus group discussions.

From the literature, information on determinants of poor pharmacy practice can be distilled into three main categories: knowledge, profit motives and state intervention. The role of each is discussed.

1) *Knowledge*

One possible explanation for the poor pharmacy practice observed in Asia is simply lack of knowledge. There is wealth of evidence, however, to suggest that knowing what constitutes good performance, whilst necessary, is not sufficient to ensure that this knowledge is employed in practice. A number of studies report vast discrepancies between knowledge or stated practice and actual practice; the qualifications of staff or level of training accomplished appears to make little difference to treatment behaviour; and finally, educational programs, whilst improving practice in the short-term, do not improve practice to a satisfactory level in the long-term. Each of these bodies of evidence will be examined in turn.

a) Discrepancies between knowledge and practice

Several studies employed different methods in order to elicit information on both provider knowledge or stated practice and actual practice. Vast discrepancies were noted between the two, suggesting that knowledge is not the key determinant of poor practice. Differences between stated practice and actual practice were observed for the sale of medicines, referral for medical advice, history taking and advice giving. For example, in hypothetical scenarios, 32% of pharmacists said they would sell any drugs for a man with urethral discharge and pain on urinating (the recommended management would be referral to a physician) ([Chalker et al., 2000](#_ENREF_10)), 20% antibiotics for a child with a viral upper respiratory tract infection ([Chuc et al., 2001](#_ENREF_13)), 40% corticosteroids and 0% antiepileptic medicines without a prescription ([Larsson et al., 2006](#_ENREF_48), [Mac et al., 2006](#_ENREF_52)). In mystery shopper surveys, however, these actions were carried out by 85%, 83%, 98% and 21% respectively. Adherence to recommended treatment practices was also found to be poorer in practice. Compared to the stated medication treatments for childhood diarrhoea, fewer pharmacy staff sold oral rehydration salts (ORS) and more sold inappropriate antibiotics and antidiarrhoels ([Minh et al., 2013](#_ENREF_55), [ROSS-DEGNAN et al., 1996](#_ENREF_74), [Saengcharoen and Lerkiatbundit, 2010](#_ENREF_76)). Similar patterns were observed in the management of other conditions, such as STIs ([Khan et al., 2006](#_ENREF_42)). One study reported that despite 81% of pharmacists knowing that antibiotics were not effective in short courses, 48% of courses dispensed were for less than 5 days. Stated referral practices of patients presenting with conditions that need to be treated by a doctor were three to four times higher than in reality ([Chalker et al., 2000](#_ENREF_10), [Khan et al., 2006](#_ENREF_42)). Finally, history taking and advice giving in questionnaires was found to be superior to the service simulated clients experienced ([Khan et al., 2006](#_ENREF_42), [Ratanajamit and Chongsuvivatwong, 2001](#_ENREF_71)).

b) Qualifications/training and experience

Studies from Thailand and Nepal, using simulated shoppers to investigate the management of childhood diarrhoea, pregnancy-related anaemia and requests for contraceptives, revealed that staff with higher levels of training or qualifications asked more questions and gave better advice but little differences were observed in terms of appropriate medication dispensing ([Kafle et al., 1996](#_ENREF_39), [Ratanajamit and Chongsuvivatwong, 2001](#_ENREF_71), [Saengcharoen and Lerkiatbundit, 2010](#_ENREF_76)). Other studies found no association between qualifications of pharmacy personnel and the quality of history taking and counselling ([Saengcharoen and Lerkiatbundit, 2013](#_ENREF_77), [Hussain and Ibrahim, 2011](#_ENREF_32)). Despite, recording no differences in actual practice, one of these papers reported that, in interviews designed to measure their knowledge, pharmacists achieved significantly higher scores compared to non-pharmacists in the areas of history taking and advice provision ([Saengcharoen and Lerkiatbundit, 2013](#_ENREF_77)). Experience was shown not to be a predictor of appropriate dispensing in the two studies which collected data on this variable ([Saengcharoen and Lerkiatbundit, 2010](#_ENREF_76), [Apisarnthanarak et al., 2008](#_ENREF_3)).

c) Impact of education programmes

Nine studies report the findings of educational interventions. All of these studies employed simulated client methodology to assess the impact of training; only four assessed performance by comparing outcomes to a control group. On the whole, training was found to improve the treatment behaviour of various conditions, including diarrhoea and STIs, as well as provision of contraceptives ([Minh et al., 2013](#_ENREF_55), [Qidwai et al., 2006](#_ENREF_68), [Ratanajamit et al., 2002](#_ENREF_72), [ROSS-DEGNAN et al., 1996](#_ENREF_74), [Tuladhar et al., 1998](#_ENREF_89), [Pham et al., 2013](#_ENREF_64), [Kafle, 1998](#_ENREF_37), [Kafle et al., 2013](#_ENREF_38)). Despite the improvements noted, inadequacies in treatment practice remained. For example, in Indonesia, 46% of staff continued to sell antidiarrhoels for children with diarrhoea ([ROSS-DEGNAN et al., 1996](#_ENREF_74)); and in Nepal, 55% of drug sellers continued to prescribe an STI treatment regimen that was inconsistent with national guidelines ([Tuladhar et al., 1998](#_ENREF_89)). Further, most of the study follow-up times were less than 6 months. One study with follow-up at 7-9 months noted the waning of effect ([Tuladhar et al., 1998](#_ENREF_89)), and another at 32 months reported no sustained improvements in the use of ORS, antidiarrhoels or antibiotics for the treatment of diarrhoea, despite promising results at 6 months post intervention ([Minh et al., 2013](#_ENREF_55), [Pham et al., 2013](#_ENREF_64)). In Nepal, small group training led to significant improvements in a number of aspects of management of childhood diarrhoea, ARI and anaemia in pregnancy at two months but most of these effects were not sustained at the five month follow-up ([Kafle, 1998](#_ENREF_37)). One study did not report baseline data but the post-training results concerning the management of STIs were very poor ([Khan et al., 2006](#_ENREF_42)). Another showed no significant impact of training on ORS use for the treatment of diarrhoea or dysentery, but it did show improvements in antibiotic dispensing, only for drug sellers, however, not for pharmacists ([Podhipak et al., 1993](#_ENREF_65)).

2) *Profit motives*

Pharmacies are retail businesses operating within a competitive marketplace. Several papers described the proliferation of medicine outlets over recent decades, especially in countries that underwent economic liberalisation. For example, in Vietnam following the privatisation of drug provision in 1986, the number of private pharmacies increased from none to more than 6,000 by 1996 ([Chuc et al., 2002](#_ENREF_14)). These papers also noted the intensified competition that resulted ([Chuc et al., 2002](#_ENREF_14), [Chuc and Tomson, 1999](#_ENREF_15), [Kamat and Nichter, 1998](#_ENREF_40), [Stenson et al., 2001b](#_ENREF_85)). An illustration of the nature of competition comes from Mumbai, India, where pharmacies hire agents to persuade patients leaving hospitals to patronise their pharmacy ([Kamat and Nichter, 1998](#_ENREF_40)). Qualitative work confirms that pharmacies report feeling intense competition and staff seek to maximise profit in order to survive in the market ([Chuc and Tomson, 1999](#_ENREF_15), [Dua et al., 1994](#_ENREF_21), [Kamat and Nichter, 1998](#_ENREF_40), [Seeberg, 2012](#_ENREF_79), [Kotwani et al., 2012](#_ENREF_45)). Essentially there are three ways to maximise profits: maximising the number of customers, maximising the revenue from each individual customer, and minimising costs. From the literature, we identified a number of strategies employed by pharmacy staff to achieve these goals, each of which can also be linked to poor practice.

a) Complying with customer demands

The literature reveals that pharmacy staff are very responsive to patients wishes, adhering to a ‘customer is king’ mentality. In the name of maintaining clients, inducing loyalty and preventing customers from fulfilling their requests elsewhere, pharmacies resort to a number of poor practices. These include honouring improper prescriptions, such as those that are out of date, and selling POMs without a prescription ([Dua et al., 1994](#_ENREF_21), [Larsson et al., 2006](#_ENREF_48), [Kotwani et al., 2012](#_ENREF_45), [Nga et al., 2014](#_ENREF_62)). Further, incomplete courses of antibiotics are frequently sold. Patients request these short courses due to economic constraints, a desire to test the therapeutic efficacy and presence of side-effects before purchasing larger quantities, and a belief that a full course is unnecessary ([Dineshkumar et al., 1995](#_ENREF_19), [Duong et al., 1997b](#_ENREF_23), [Kamat and Nichter, 1998](#_ENREF_40), [Lansang et al., 1990](#_ENREF_47), [Roy, 1997](#_ENREF_75), [Mamun et al., 2006](#_ENREF_53), [Dua et al., 1994](#_ENREF_21)).

b) Selling medicines based on perceived efficacy

Several studies reported that pharmacy staff chose medicines based on their ability to produce a rapid recovery or temporary relief from symptoms, even where they were not appropriate ([Kafle et al., 1996](#_ENREF_39), [Saengcharoen and Lerkiatbundit, 2010](#_ENREF_76), [Van Sickle, 2006](#_ENREF_93)). For example, antidiarrhoels for the treatment of childhood diarrhoea ([Saengcharoen and Lerkiatbundit, 2010](#_ENREF_76)) or airway relaxers for the respiratory symptoms associated with asthma ([Van Sickle, 2006](#_ENREF_93)). In addition, they sold medicines in which clients were believed to have great confidence, again, even if such medicines were not necessary. Examples include tonics as an accompaniment to antibiotics, and complex vitamin preparations ([Dua et al., 1994](#_ENREF_21), [Kafle et al., 1996](#_ENREF_39)).

c) Mimicking doctors

Four studies reported that it was common practice for medicine retailers to study the prescriptions bought in by patients and then model their own prescribing on the practices of local doctors ([Greenhalgh, 1987](#_ENREF_27), [Kafle et al., 1996](#_ENREF_39), [ROSS-DEGNAN et al., 1996](#_ENREF_74), [Seeberg, 2012](#_ENREF_79)). This may simply be a way to improve knowledge. It could, however, be inferred that it is a strategy used by pharmacies in order to be viewed as more legitimate by customers.

d) Maintaining good relationships with doctors

When presented with clinically inappropriate prescriptions, pharmacies in Asia tended to dispense them rather than query their appropriateness with the doctor. Pharmacists interviewed in Kotwani et al’s qualitative study of irrational antibiotic use in Delhi described their low status in the medical hierarchy and how doctors would rebuke them for challenging their authority ([Kotwani et al., 2012](#_ENREF_45)). Other research, also in India, has identified symbiotic relationships between doctors and chemist shops, and doctors have been observed to mention names of shops where patients should fill their prescriptions ([Kamat and Nichter, 1998](#_ENREF_40), [Seeberg, 2012](#_ENREF_79)). Further, at the request of medical representatives, doctors reportedly prescribe more of particular products when local pharmacies experience an overstock ([Kamat and Nichter, 1998](#_ENREF_40)). It is understandable, in such a context, that pharmacists do not query more prescriptions for fear of aggravating local physicians.

e) Medicine sales

Two explicit strategies for maximising profits from medicine sales were identified from the literature; selling large volumes of low priced drugs and recommending medicines that yield the greatest profit ([Chuc and Tomson, 1999](#_ENREF_15), [ROSS-DEGNAN et al., 1996](#_ENREF_74), [Saengcharoen and Lerkiatbundit, 2010](#_ENREF_76)). Antibiotics are singled out as high profit generators ([Chuc et al., 2001](#_ENREF_13), [Chuc and Tomson, 1999](#_ENREF_15), [Saengcharoen and Lerkiatbundit, 2010](#_ENREF_76), [Nga et al., 2014](#_ENREF_62)); this may partly explain their rampant overuse.

f) Medicine purchasing

The pharmaceutical industry employs aggressive marketing techniques which involve promotional offers to pharmacies. This includes bonus schemes whereby the purchase of x amount of a product includes y amount for free ([Kamat and Nichter, 1998](#_ENREF_40)). Retailers are then incentivised to sell more of this product, regardless of its appropriateness, because it will yield high profits. The following quote from Kamat and Nichter’s (1998) ethnographic study of pharmacies and pharmaceutical-related behaviour in India gives an insight into such practice (the product mentioned, Superaction, an OTC product for cough, cold, fever and pain, is sold on a buy 12 strips get 7 free basis):

*‘I make a profit of anything between 75% and 100% on “Superaction”. During the past two week, I sold two boxes (20 strips) of this item for which I got a pocket calculator worth 80 rupees from the company. I make a lot of profit on this product, but I have to counter-push it because local doctors do not prescribe it. I do not recommend this product to every customer who asks for medicines for headache or body pain but mostly to* angutachapwallas *(illiterates) who come and ask me to give some medicine for cold and pain (*[*Kamat and Nichter, 1998*](#_ENREF_40)*).’*

Dineshkumar and colleagues comment on the aggressive marketing of vitamins which are used extensively in India ([Dineshkumar et al., 1995](#_ENREF_19)). Seeberg describes how chemists in Orissa purchase substandard medicines from local production facilities at a 50% discount and then sell them on to customers thus making additional profit ([Seeberg, 2012](#_ENREF_79)).

It is important to note that there are examples in the literature which illustrate that medicine retailers are only prepared to go so far in risking the health of their patients in the name of making a quick profit. Pharmacists described how it was not suitable to use substandard medicines for patients who had undergone surgery or faced life-threatening conditions ([Seeberg, 2012](#_ENREF_79)). Additionally, when patients sought pharmacists’ advice in the event of not being able to afford all medicines on a prescription, they were found to recommend the medicines which ‘cure’ over those with the highest profit ([Kamat and Nichter, 1998](#_ENREF_40)).

3) *State intervention*

A few studies in this review provide information on the impact of government intervention on pharmacy performance.

a) Regulation

Two intervention studies reported on the effect of regulation on service quality. An intervention in Lao PDR involving inspection visits, punishments in the case of gross violations of the sanctions, up-to-date supply of regulatory documents, and reinforcement of the rules found marked improvements in the availability of essential medicines, order in the pharmacy and provision of information; and less mixing of different drugs in the same package ([Stenson et al., 2001b](#_ENREF_85)). The regulatory component of a multi-component (sequentially applied), intervention on dispensing practices in Bangkok (Thailand) was the only component of the intervention that resulted in a significant change in practice (reduced dispensing of a prescription-only steroid compared to the control group). This intervention focussed on the illegality of the act and the threat of punishment should such practice be observed. The same study reported that in Hanoi (Vietnam), where less focus was placed on sanctions, the regulatory component of the intervention did not lead to an immediate change in behaviour ([Chalker et al., 2005](#_ENREF_11)).

b) National Public Health Programmes

A study from Vietnam investigating the management of tuberculosis patients in the pharmacy found, in a multivariate analysis, that staff who were aware both of the National Tuberculosis Program (NTP) and that tuberculosis medicines were provided for free were 5.8 times more likely to refer a suspect directly to a tuberculosis facility than those who were not ([Vu et al., 2012](#_ENREF_94)). Another study concerned with management of childhood diarrhoea investigated practice in three countries: Bangladesh, Sri Lanka and Yemen Arab Republic. The authors reported that ORS was more commonly dispensed in Bangladesh and they noted the presence of a national ORS programme as one potential explanation ([Tomson and Sterky, 1986](#_ENREF_88)).

**Discussion**

Combined, the reviews identified 60 papers reporting on pharmacy practice and/or determinants of poor practice in 15 LMICs in Asia. The majority of studies were from lower middle-income countries. Asides from studies from Mongolia, Yemen Arab Republic and Syria, all other studies focussed on countries from South and South-East Asia. As such, the results tell us little about pharmacy practice in North Asia, Central Asia, West Asia or the Middle East. Most research was carried out on PRPs, with less on NPRPs and research on unregistered shops was found to be practically non-existent.

Given the diversity of studies found in the search, quality appraisal proved to be a particular challenge. Relevant papers included a range of designs including randomised controlled trials, cross-sectional descriptive surveys and ethnographies. The lack of clear criteria by which qualitative studies should be judged in the systematic review process has been raised by others but remains an unresolved issue ([Dixon-Woods et al., 2006](#_ENREF_20)). In light of this, it was decided to include all papers which met the inclusion criteria providing the methodology employed was clear. Data on both methods and study design were extracted and any potential threats to validity were recorded. The main concerns noted were small sample sizes and non-random sampling (quantitative papers). The findings of poorer quality studies, however, were found to be consistent with more rigorously designed ones. In interpreting the findings, care has been taken to emphasise those which were found in a number of studies and across countries.

In terms of pharmacy performance, the findings across countries and over time are remarkably consistent. Pharmacy practice in Asia appears to have changed little in the past 30 years. The same problems documented by studies in the 1980s are true of practice in recent times ([Chua et al., 2013](#_ENREF_12), [Greenhalgh, 1987](#_ENREF_27), [Hussain and Ibrahim, 2012](#_ENREF_33), [Minh et al., 2013](#_ENREF_55), [Saengcharoen and Lerkiatbundit, 2013](#_ENREF_77), [Seeberg, 2012](#_ENREF_79), [Tomson and Sterky, 1986](#_ENREF_88), [Vu et al., 2012](#_ENREF_94)). Practice appears to fall short throughout the pharmacy encounter. The key inadequacies documented throughout the literature are: insufficient history taking prior to the sale of medicines; a lack of referral of patients whose management is outside of the remit of a pharmacist’s expertise; the illegal sale of a wide range of POMs without a prescription; the sale of medicines that are either clinically inappropriate and/or in doses that are outside of the therapeutic range; the sale of incomplete courses of antibiotics; and finally, limited provision of information and counselling to accompany the sale of medicines. Similar challenges have also been documented in Sub-Saharan Africa ([Wafula et al., 2012](#_ENREF_97))

Staff working in pharmacies can be seen as the gatekeepers of medicines. They stand at the interface between producers and consumers of medicines and their role is to ensure that they are used safely, effectively and rationally ([Anderson, 2002](#_ENREF_2)). When used correctly, medicines can save lives and improve people’s health; irrational use, however, can have harmful consequences. A number of conditions were found to be treated inadequately in the pharmacy, including diarrhoea, asthma, anaemia, tuberculosis, STIs, RTIs and migraine. This mistreatment can lead to unnecessary morbidity and mortality. For example, many studies reporting on the management of childhood diarrhoea found under-provision of ORS and over-provision of anti-diarrhoeals and antibiotics. The use of anti-diarrhoels in infants has been shown to be harmful ([Minton and Smith, 1987](#_ENREF_56), [Li et al., 2007](#_ENREF_49)) and it is estimated that correct treatment with ORS may prevent 93% of diarrhoeal deaths in children under 5 ([Munos et al., 2010](#_ENREF_59)). In South Asia, diarrhoea is thought to account for 23% of all deaths in children under 5 ([Morris et al., 2003](#_ENREF_58)).

Overuse of antibiotics is a particular concern for public health, as misuse of antibiotics over recent decades has led to the selection and spread of resistant bacteria. As a result, antibacterial drugs have become less effective and in some cases, ineffective. Earlier this year, a WHO global report on the surveillance of antibiotic resistance described the problem as a ‘global health security emergency’ ([World Health Organization, 2014](#_ENREF_101)).

A further concern is the economic impact of spending on households, especially the poor. Customers typically pay for the medicines purchased at pharmacies out of their own pocket and where these medicines are inappropriate or ineffective this represents a waste of scarce resources. Work in Asia has shown that, in many countries, a large proportion of out of pocket payments is spent on medicines. For example, in Bangladesh, Vietnam and India, this share is 70% ([Van Doorslaer et al., 2007](#_ENREF_92)). Further, in these countries, out of pocket payments for health care can be ‘catastrophic’, accounting for more than 25% of household resources (excluding food costs) in at least 10% of all households (ibid).

Turning to the determinants of the poor practice documented above, the picture is less clear. Despite the importance of pharmacies and the potential benefit for public health if practice were to improve, efforts to understand and address the problem have been surprisingly few. Historically, the small number of attempts to improve pharmacy practice in Asia has focussed on training interventions. This review finds that whilst a necessary condition, adequate knowledge alone is not sufficient to ensure appropriate management of patients presenting at the pharmacy. Profit motives and the regulatory environment appear to play a role but the research evidence is relatively sparse. In terms of the methods used to unpick the underlying determinants of pharmacy behaviours, we found that in-depth qualitative studies, particularly those employing an ethnographic approach, provided the richest data ([Kamat and Nichter, 1998](#_ENREF_40), [Seeberg, 2012](#_ENREF_79)). Unfortunately, studies using this approach are rare.

Whilst a number of studies have been published in the two decades since Goel and colleagues first reviewed this literature, there is little new insight into the problem of poor pharmacy practice. They noted that regulatory factors had been ‘strikingly neglected by researchers’ and called for new research on the ‘impact of professional ownership on professional freedom’. Researchers have, on the whole, continued to neglect these areas. The pursuit of regulatory enforcement is, however, not a straightforward solution and we must be aware that enforcing laws surrounding the sale of POMs would potentially deny many people access to essential medicines, thus violating a basic principle of public health.

Based on the intervention literature both within and outside Asia, the menu of evidence-based options for professional bodies and policy-makers to inform improvement and development of pharmacy services is limited ([Smith, 2009a](#_ENREF_81)). Arguably, some cadre of trained pharmacy workers should be in place in order to provide a basis for improvement, yet in many settings human resource limitations undermine the ability to provide this ([Smith, 2009b](#_ENREF_82)). Asides from training and regulation, other schemes that have been implemented include peer review, accreditation (such as the Accredited Drug Dispensing Outlets scheme in Tanzania) and social franchising ([Wafula and Goodman, 2010](#_ENREF_96), [Chalker et al., 2005](#_ENREF_11)). However, the evidence on the impact and sustainability of these strategies remains quite limited, highlighting this area as an important priority for future research ([Center for Pharmaceutical Management, 2008](#_ENREF_9), [Valimba et al., 2014](#_ENREF_90), [Wafula and Goodman, 2010](#_ENREF_96)).

It is worth noting that new organisational arrangements of pharmacy retail in the form of chains and franchises are a growing phenomenon in LMIC both in Asia and elsewhere ([Lowe and Montagu, 2009](#_ENREF_51), [ims consulting group, 2014](#_ENREF_35)). This phenomenon raises important questions about the impact of professional and organised ownership on pharmacy practice. Further, theoretical literature suggests that the organisational structure of the pharmacy firm may affect both the regulatory environment and financial incentives, as well as provider knowledge ([Bloom et al., 2008](#_ENREF_8), [Frant, 1996](#_ENREF_25), [Blair and Kaserman, 1994](#_ENREF_7), [Klein, 1980](#_ENREF_43)).

Cross and Macgregor (2010) have criticised the current debates around ‘informal providers’ (including drug sellers) which, they argue, are myopically focused on ‘small time economic actors’ rather than giving attention higher up in the pharmaceutical supply chain ([Cross and MacGregor, 2010](#_ENREF_18)). This focus indeed leads to a distraction away from the pharmaceutical industry, which, thus far, has largely remained absent from discussions of inappropriate medicines use. A few papers in this review touch on the pressures that providers face from industry but this does not come out strongly. Whilst it is necessary to study frontline behaviours, research upstream is also a necessity.

**Conclusion**

Pharmacies are an important component of the health system in LMIC in Asia. In many areas they act as ‘*de facto* primary healthcare providers’ ([Seeberg et al., 2014](#_ENREF_80)). The service they provide, however, does not live up to international expectations of pharmacy practice. The consequences of poor practice can have harmful effects for public health and, as such, these outlets warrant more attention from public health researchers. The nature of the problem with pharmacies in Asia is well established, although more attention could be paid to NPRPs pharmacies and unregistered drug shops. Future research efforts should focus their attention on investigating the underlying causes and ways to improve the current situation. The little evidence that is available suggests that intervention strategies should take into account the regulatory environment and profit incentives faced by pharmacy personnel and not continue to focus solely on improving knowledge. If efforts are focussed accordingly it is hoped that the realities of the past 30 years of poor pharmacy practice in Asia will not continue for the next 30.

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Table 1: Search strategy

|  |  |  |  |
| --- | --- | --- | --- |
| Target population (combined by ‘OR’) | | Geographic location (combined by ‘OR’) | |
| **Free text terms**  chemist  drug retailer\*  drug shop\*  drug seller\*  drug vendor\*  drug store\*  drug dispensing  drug outlet\*  druggist  medicine retailer\*  medicine shop\*  medicine seller\*  medicine vendor\*  medicine store\*  medicine dispensing shop\*  medicine outlet\*  medicine dealer\*  pharmacies  pharmacy  pharmacy service\*  pharmacist\*  pharmaceutical service\* | **MeSH terms**  pharmacy  pharmacies | **Free text terms**  developing countries  developing country  low-income country  low-income countries  middle-income country  middle-income countries  asia | **MeSH terms**  developing countries  asia |

Figure 1: PRISMA flow diagram

Excluded references from part 1 of review (N= 54)

-no information on performance of drug sellers (24)

-methods did not meet inclusion criteria (14)

- outside geographical area of interest (3)

-intervention study without clear baseline data (3)

-not empirical research paper (8)

-could not access full text (2)

21,898 records identified through database searching

Title and abstract screen (N= 19,214)

Full text review (N= 107)

Excluded references

(N= 19,107)

Duplicate references (N = 2684)

Included in part 1 of review (N=53)

Included in part 2 of review (N= 38)

Excluded references from part 2 of review (N= 68)

-no information on determinants (58)

-methods did not meet inclusion criteria (5)

-outside geographical area of interest (2)

-not empirical research paper (1)

-could not access full text (2)

Additional records identified through reference lists (N=1)

**MC900045094[1]Figure 2: Appropriate retail pharmacy practices for patients with and without a prescription**

**Key**

1 = Nature of client request

2 = Filling prescriptions

3 = History taking

4 = Referral for medical attention

5 = Sale of medicines

6 = Advice giving

2

6

5

1

4

3

2

1

1

1

Pharmacist asks **history** questions in order to establish:

 Who the medicine is for

 What is wrong with the patient

 Whether they have a more serious condition that requires medical attention

 What action they have already taken

 Whether they have any other medical conditions/ take any other medications/ have any allergies

Pharmacist checks prescription is valid

Provides patient with **advice and counsels** regarding use of medicine including:

 Explanation of what medicine is for

 How much to take and when

 Duration of treatment

 Possible side effects

 Possible interactions with food or other medicines

 Instances in which medical advice should be sought

 Any other condition-specific advice

Pharmacist **sells** or **dispenses**:

 Appropriate medicine

**•** In the appropriate dose

  For an appropriate duration

Query any discrepancies with prescribing physician

**Refer** to physician

Patient presents symptoms / seeks advice of pharmacist

Patient requests medicine

Patient does not have a prescription

Presents a prescription for dispensing

Table 2: Treatment choices for a range of conditions presented at pharmacies in Asia by simulated clients

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Condition** | **Countries, number of distinct studies and references** | **Recommended treatment** | **Sample percent giving appropriate treatment** | **Details of inappropriate treatment** |
| Watery diarrhoea  (in children and adults) | -Pakistan, Thailand, India, Sri Lanka, Bangladesh, Yemen Arab Republic, Indonesia, Vietnam, Nepal  -11 studies  -([Duong et al., 1997a](#_ENREF_22), [Hussain and Ibrahim, 2012](#_ENREF_33), [Minh et al., 2013](#_ENREF_55), [Modal T and L, 1994](#_ENREF_57), [Podhipak et al., 1993](#_ENREF_65), [ROSS-DEGNAN et al., 1996](#_ENREF_74), [Saengcharoen and Lerkiatbundit, 2010](#_ENREF_76), [Tomson and Sterky, 1986](#_ENREF_88), [Wachter et al., 1999](#_ENREF_95), [Qidwai et al., 2006](#_ENREF_68), [Pham et al., 2013](#_ENREF_64), [Kafle et al., 2013](#_ENREF_38)) | International recommendations (WHO)  - Oral rehydration salts (ORS)  - Zinc supplementation | -Pharmacies recommending ORS ranged from 3-45%  (two studies <10%; three studies 10-19%; six studies 20-45%) | -unnecessary antibiotics were recommended in every study and anti-diarrhoels in nine studies  -pharmacies recommending antibiotics ranged from 2% to 97% and anti-diarrhoeals from 19% to 88%  -other unnecessary medicines recommended were anti-spasmodics and anti-motility drugs |
| Sexually transmitted infections | -Nepal, Vietnam, Bangladesh  - 5 studies  -([Bista et al., 2002](#_ENREF_6), [Tuladhar et al., 1998](#_ENREF_89), [Wachter et al., 1999](#_ENREF_95), [Chalker et al., 2000](#_ENREF_10), [Rahman et al.](#_ENREF_70))} | National guidelines (Nepal- not stated for Vietnam or Bangladesh):  -uncomplicated cystitis in men: course of antibiotics\*  -Gonorrhoea: ciprofloxacin 500mg stat  -Chlamydia: doxycycline 100mg twice a day  (patients with vaginal or urethral discharge in Nepal are to be treated for chlamydia and gonorrhoea) | -Three studies where clients presented with discharge, treated with correct medicines in 34% and 2% of cases in Nepal and 0% in Vietnam  -Dysuria (indicative of cystitis) was treated with antibiotics in 38% of cases  -0% treated according to national standardised guidelines for urethral discharge or genital ulcer in Bangladesh | -injection recommended for urethral discharge  - urinary alkalizers commonly sold  -other medicines recommended included vitamins, topical antibiotics, antihistamines and, occasionally, disinfectants |
| Mild respiratory tract infection in children | -Vietnam  -1 study  -([Chuc et al., 2001](#_ENREF_13)) | National guidelines: (Vietnam)  -In absence of danger symptoms advise to treat: -fever with paracetamol  -chesty cough with expectorants  -sore throat and cough with traditional medicines -do not prescribe antibiotics or remedies containing codeine or antihistamine | -36% of advice was in line with national guidelines | -antibiotics were given in 42% of encounters  -83% of pharmacies gave antibiotics in at least one encounter  -Antitussives commonly prescribed, of which 40% contained codeine or an antihistamine |
| Asthma | -India  -1 study  -([Van Sickle, 2006](#_ENREF_93)) | International guidelines for mild asthma:  - daily inhaled corticosteroid  - inhaled β2­- agonist for symptom relief when required | -93% of pharmacies dispensed medication; 0% gave either of the recommended inhalers | -most commonly recommended medicines were oral β2­- agonists, methylxanthines, antibiotics and oral corticosteroids  -40 unique combinations of drugs were sold to clients |
| Tuberculosis | -Vietnam  -1 study  -([Vu et al., 2012](#_ENREF_94)) | National guidelines:  -combination treatment with anti-tuberculosis drugs (isoniazid, rifampicin, pyramzinamide and ethambutol) | -53% of pharmacists dispensed drugs; 0% gave anti-tuberculosis medicines | -details of drugs dispensed not given |
| Pregnancy-related anaemia | - Nepal  -2 studies  -([Kafle et al., 1996](#_ENREF_39), [Kafle et al., 2013](#_ENREF_38)) | International recommendations:  - simple iron-folate combination  -ferrous sulphate | -1% of pharmacies gave iron-folate alone and none gave ferrous sulphate  -58-71% gave an iron preparation of some kind (whilst not the recommended product, still clinically effective, but more costly) | -12% gave a vitamin or mineral product that was not therapeutic for pregnancy-related anaemia  -9% dispensed tonics that were not therapeutic |
| Migraine | -Thailand  -1 study  -([Saengcharoen and Lerkiatbundit, 2013](#_ENREF_77)) | International recommendations:  -NSAID for mild migraine  -Ergotamine for moderate migraine | -33% dispensed appropriately for mild migraine  -54% dispensed appropriate medicine for moderate attack | -inappropriate prophylactic medicines such as propranolol and atenolol were recommended by 28% and 18% for moderate and mild attacks respectively |

\*details of specific antibiotics unspecified by study

**Appendix 1: Key characteristics of papers included in the review**

| **Author & date, country** | **Number and type of shops** | **Study design** | **Data collection methods** | **Part of review** |
| --- | --- | --- | --- | --- |
| Al-Faham et al 2011, Syria | 200 private pharmacies | Cross-sectional study | \*Simulated client presenting as the sibling of a woman with sinusitis. \*Questionnaire survey to ascertain information on pharmacy and staff characteristics and knowledge and practice regarding menstrual regulation. | 1 |
| Apisarnthanarak et al 2008, Thailand | 280 1st class drug stores | Cross-sectional study | \*Simulated clients presenting with various conditions (acute viral pharyngitis; influenza; acute viral sinusitis; acute gastroenteritis; non-infected skin abrasion; acute UTI). | 1&2 |
| Basak and Sathyanarayana 2010, India | 24 private pharmacies | Cross-sectional study | \*4 hours of observation per pharmacy \*Structured interviews with pharmacy staff regarding medicines. | 1 |
| Bista et al 2002\*, Nepal | 37 private pharmacies | Cross-sectional study (unclear if baseline results for Khan 2006) | \*Simulated client presenting with history of urethral or vaginal discharge.  \*Review of registry data kept on all STI clients by pharmacies. | 1 |
| Chalker et al 2000\*, Vietnam | 60 private pharmacies | Cross-sectional study | \*Simulated client presenting on behalf of a friend suffering from pain on urinating and a urethral discharge for past 3-4 days (5 clients per shop- 300 encounters). \*Semi-structured interview questionnaire to assess reported management of an STD client. | 1&2 |
| Chalker et al 2005\*, Vietnam and Thailand | 68 private pharmacies in Vietnam, 78 private pharmacies in Thailand | Multi-component intervention study (regulatory enforcement, training, peer influence) evaluated using a cluster randomised controlled trial with a time series design. | \*Simulated client for 2 scenarios (request to purchase antibiotic without a prescription, request to purchase steroid without a prescription). \*4 rounds (a baseline and after 1 month of each of the 3 interventions). | 2 |
| Chua et al 2013, Malaysia | 10 (5 corporate, 5 independent) | Cross-sectional study | \*Observation of interactions between pharmacist and customers for 4 days in each pharmacy. Data recorded according to structured data collection form. | 1 |
| Chuc and Tomson 1999, Vietnam | 2 pharmacies | Case study | \*Observation (observed all encounters for 2 weeks) and interviews with customers. \*Inventory and observation of operation. \*Informal chats and in-depth interviews with staff regarding economic issues and good pharmacy practice. | 1&2 |
| Chuc et al 2001\*, Vietnam | 60 private pharmacies | Cross-sectional study | \*Simulated client presenting as the mother of a 3-5 year old at home with cough for 2 days (uncomplicated RTI). \* Semi-structured interview questionnaire to assess reported management of RTI client. | 1&2 |
| Chuc et al 2002\*, Vietnam | 68 registered private pharmacies | Multi-component intervention study (regulatory enforcement, training, peer influence) evaluated using a RCT with a time series design. | \*Simulated client for 4 tracer conditions (upper RTI in a child, a STD, request to purchase an antibiotic without a prescription, request to purchase a steroid without a prescription). 4 rounds (a baseline and after 1 month of each of the 3 interventions). | 1&2 |
| Cong et al 1998 , Vietnam | 125 private sector drug vendors also known as alternative treatment providers (ATPs), including private doctors, private pharmacies, government and private drug outlets (breakdown not given) | Cross-sectional study | \* Structured interviews with drug vendors. \*Observation of storage, handling and sale of antimalarials. \* Simulated patient presenting with 3-day long fever which subsides and keeps returning. | 1 |
| Dineshkumar et al 1995\*, India | 32 retail pharmacy outlets | Cross-sectional study | \*Observation and record of all sales for 2 complete days per pharmacy. \*Structured interviews with patients who purchased medicine. | 1&2 |
| Dua 1994, India | 34 private pharmacies | Cross-sectional study | \*Structured interview questionnaires for providers to elicit information on ownership and structure of business. \*Structured interview questionnaires for clients to elicit demographic information and information concerning the pharmacy encounter. \*Observation of sales (4-5 hrs per pharmacy). | 1&2 |
| Duong et al 1997b\*, Vietnam | 25 private pharmacies | Cross-sectional study | \*Interviews with customers based on structured questionnaire. | 1&2 |
| Duong et al 1997a\*, Vietnam | 29 private pharmacies | Cross-sectional study | \*Simulated client presenting as the mother of a child with diarrhoea. | 1 |
| Greenhalgh 1987, India | 12 private pharmacies | Cross-sectional study | \*Observation of interactions in the pharmacy. | 1&2 |
| Hadi et al 2010, Indonesia | 75 pharmacies, 10 drug stores, 39 roadside kiosks | Cross-sectional study | \*Simulated clients requesting first line antibiotics with and without a prescription. | 1 |
| Huda et al 2014, Bangaldesh | 331 private pharmacies | Cross-sectional study | \*Simulated clients presenting with various scenarios relating to menstrual regulation/medical abortion. | 1 |
| Hussain and Ibrahim 2011\*, Pakistan | 371 private pharmacies (96 type A, 186 type B and 66 type C) | Cross-sectional study | \*Observation of 1113 patient-dispenser interactions (2 hours per pharmacy). | 1&2 |
| Hussain and Ibrahim 2012\*, Pakistan | 371 private pharmacies (96 type A, 186 type B and 66 type C) | Cross-sectional study | \*Simulated client presenting as older sibling of a 5 year old with diarrhoea. | 1 |
| Kafle 1998\*, Nepal | 352 private pharmacies (baseline), 314 by second follow-up | Randomised controlled trial (combinations of training, mailed materials and audit feedback) | \*Simulated clients presenting with various scenarios (parent of a child with diarrhoea, husband of a pregnant woman, parent of a child with a cough).  \*Structured interview questionnaire for retailers to asses socioeconomic indicators at baseline and changes in knowledge. | 2 |
| Kafle et al 2013\*, Nepal | 342 private pharmacies (baseline), 314 by second follow-up | Randomised controlled trial (combinations of training, mailed materials and audit feedback) | \*Simulated clients presenting with various scenarios (parent of a child with diarrhoea, husband of a pregnant.woman, parent of a child with a cough).  \*Structured interview questionnaire for retailers to asses socioeconomic indicators at baseline and changes in knowledge. | 2 |
| Kafle et al 1996, Nepal | 112 registered drug retailers | Cross-sectional study | \*Simulated client presenting as the husband of a woman who 'is pale and looking weak'. \*Structured interview questionnaire to assess knowledge of pregnancy problems. \*Focus group discussions with drug retailers to explore motivations for current practice. | 1&2 |
| Kamat and Nichter 1998, India | 75 pharmacies (interviews); 6 pharmacies (observation and sales data) | Ethnography | \*Semi-structured interviews with pharmacy owners.  \*Participant observation for minimum of 10 days in 6 pharmacies. \*Drug sales data for 3 full days in each of 6 pharmacies. \*Exit interviews with customers who purchased a scheduled medicine without a prescription. \*In-depth interviews with medical representatives. | 1&2 |
| Khan et al 2006\*, Nepal | 37 private pharmacies | Cross-sectional study (presents 'after' results from a training programme) | \*Simulated client presenting with history of urethral discharge (35 year old male) or vaginal discharge (inquiring for wife).  \*Structured interview questionnaire to assess knowledge and reported practice. | 2 |
| Kotwani et al 2012, India | 40 pharmacists (retail, public sector, and office bearers of pharmacists' associations) | Exploratory single-site case study | \*Focus group discussions. | 2 |
| Krishnaswamy et al 1985\*, India | 33 retail pharmaceutical shops | Cross-sectional study | \*Observation and record of all sales for 4 complete days per pharmacy. | 1 |
| Lansang 1990,  Phillipines | 59 private drug stores | Cross-sectional study | \*Observation of transactions (monitored sales of all drugs for 3 days in small, single owned shops and for 2 days in larger branches of chain stores). \*Structured interview questionnaire with all customers who asked for or bought antibiotic. | 1&2 |
| Larsson et al 2006\*, Vietnam | 60 private pharmacies | Randomised control trial (baseline results only) | \*Simulated patient requesting steroid tablets.  \*Semi-structured questionnaire interview (mainly multiple choice, few open-ended questions) to gain info on reported practice. | 1&2 |
| Mac et al 2006, Vietnam | 33 public and private pharmacies (breakdown not given) | Cross-sectional study | \*Simulated client requesting 10 units of the cheapest anti-epileptic drug (AED). \*Structured survey questionnaire to establish a list of AEDs available and their prices. | 1&2 |
| Mamun et al 2006, Bangladesh | 5 private medicine-dispensing shop (main focus of study on rural medical practitioners) | Cross-sectional study | \*Interviews with drug sellers. \*Interviews with customers. \*Reviewed sale books of shops. \*Observation of medicine sales. | 1&2 |
| Minh et al 2013\*, Vietnam | 220 private pharmacies | Before and after intervention study (training) | \*Structured questionnaire with pharmacy staff (281) recording knowledge and reported practice for diarrhoea management.  \*Simulated client seeking advice for 14 month old child with diarrhoea (baseline and 6-months post intervention). | 1&2 |
| Mondal et al 1994, India | 30 private pharmacies | Cross-sectional study | \*Simulated client presenting as the father of a 2 year old boy with diarrhoea. | 1 |
| Nakajima et al 2010, Mongolia | 250 private pharmacies | Cross-sectional study | \*Structured interview questionnaire for pharmacy workers mainly focussed on antibiotic medicines. \*Structured interview questionnaire customers to elicit demographic information and details of medicine purchases. | 1 |
| Nga et al 2014, Vietnam | 30 private pharmacies | Cross-sectional study | \*Observation of all drug sales at each pharmacy for 3 days. \*Semi-structured questionnaire for pharmacy staff focussing on antibiotic sales. \*In-depth interviews and focus group discussions with pharmacy staff regarding perceptions of factors affecting inappropriate antibiotic dispensing. | 1&2 |
| Ngo et al 2012, Vietnam | 100 registered private pharmacies | Cross-sectional study | \*Structured interview questionnaire with pharmacy staff to assess knowledge of medical abortion. \*Simulated clients presenting as either a young female seeking medical abortion or a young male seeking abortifacients for his girlfriend. | 1 |
| Pham et al 2013\*, Vietnam | 220 private pharmacies | Before and after intervention study (training) | \*Structured questionnaire with pharmacy staff recording knowledge and reported practice for diarrhoea management. \*Simulated client seeking advice for 14 month old child with diarrhoea (baseline and 6-months post intervention). | 2 |
| Podhipak et al 1993, Thailand | 240 private pharmacies. 120 type I and 60 type II pharmacies in Intervention area. 60 of each type in control area | Before and after intervention study (training) | \*Simulated clients presenting as mothers of children with watery diarrhoea and dysentery. | 1&2 |
| Puspitasari et al 2011,Indonesia | 105 private pharmacies | Cross-sectional study | \*Simulated clients presenting with various scenarios (request for 10 tablets of ciprofloxacin; request for 2 capsules of tetracycline; prescription for paediatric amoxicillin dry syrup). | 1 |
| Qidwai et al 2006, Pakistan | 6 private drug sellers | Before and after intervention study (training) | \*Structured questionnaire to obtain shop and drug seller characteristics. \*Simulated clients presenting with various scenarios of diarrhoea. | 1&2 |
| Rahman et al 2000, Bangladesh | 157 private pharmacies | Cross-sectional study | \*Self-administered questionnaires for medicine sellers exploring knowledge and reported practices relating to STD/AIDS management. \*Simulated clients presenting with an STD. | 1 |
| Ratanajamit et al 2001\*, Thailand | 30 pharmacist-owned and 30 non-pharmacist owned drug stores | Baseline results of randomised controlled trial | \*Structured interview questionnaire to measure knowledge of oral and emergency contraception. \*Simulated clients requesting oral contraception and emergency contraception (on different occasions) | 1&2 |
| Ratanajamit et al 2002\*, Thailand | 30 pharmacist-owned and 30 non-pharmacist owned drug stores | Randomised controlled trial (educational intervention) | \*Simulated client presenting as college student who experienced unprotected mid-cycle sex 24 hours earlier. \*Structured interview questionnaire to assess knowledge. | 1&2 |
| Rathnakar et al 2012, India | 60 private pharmacies | Cross-sectional study | \*Simulated clients presenting with various scenarios (URTI, acute bronchitis, diarrhoea accompanied with pain and fever). | 1 |
| Ross-Degnan et al 1996, Indonesia | 87 private pharmacies (43 intervention, 44 control) | Randomised control trial (educational intervention) | \*Structured interview questionnaires to assess knowledge of diarrhoea management. \*Simulated clients presenting as the mother of a child under 5 with diarrhoea (before and after intervention). \*Focus group discussions with pharmacy staff to understand factors underlying treatment behaviours. | 1&2 |
| Roy J 1997, Bangladesh | Sample of village 'doctors' (pally chikitshak/pharmacy salespersons). Numbers not given. | Cross-sectional study | \*Interviews.  \*Direct observation of practice. | 1&2 |
| Saencharoen and Lerkiatbundit 2013\*, Thailand | 142 private pharmacies | Cross-sectional study | \*Simulated clients presenting with mild or moderate migraine. \*Structured interview questionnaire to assess knowledge regarding migraine management. | 1&2 |
| Saengcharoen and Lerkiatbundit 2010\*, Thailand | 115 private pharmacies (96 type I and 29 type II) | Cross-sectional study | \*Simulated client presenting as the aunt of a 4 year old with watery diarrhoea. \*Written questionnaire collecting data on demographics and knowledge and attitudes towards diarrhoea management. | 1&2 |
| Saradamma et al, India | 11 private pharmacies | Cross-sectional study | \*4 hours of observation per pharmacy. \*Structured interviews with customers who purchased antibiotics. | 1 |
| Seeberg 2012, India | 20 private practitioners and chemists | Ethnography | \*In-depth interviews and clinical observations over an 18-month period. | 1&2 |
| Stenson et al 2001a\*, Lao PDR | 106 private pharmacies (mostly class 3) | Cross-sectional study | \*Structured interviews with the drug sellers. \*Facility-specific indicator survey of the pharmacies.  \*Semi-structured exit interviews with customers outside the pharmacies. \*Inspection of drug purchases. \*Recording of prices of sample drugs. \*Structured interviews with district drug inspectors. | 1 |
| Stenson et al 2001b\*, Lao PDR | 92 private pharmacies - mostly class 3 (46 regular intervention, 46 active intervention) | Randomised controlled trial (regulatory intervention) | \*Structured interview with drug seller and inspection of premises to assess facility-specific indicators. \*Semi-structured exit interviews and review of medicines purchased to obtain dispensing indicators. | 2 |
| Syhakhang et al 2001\*, Lao PDR | 92 private pharmacies (mostly class 3) and 13 public pharmacies | Cross-sectional study | \*Structured interviews with the drug sellers. \*Facility-specific indicator survey of the pharmacies.  \*Semi-structured exit interviews with customers outside the pharmacies. \*Inspection of drug purchases. | 1 |
| Thamlikitkul 1988, Thailand | 40 1st class drug stores | Cross-sectional study | \*Simulated clients presenting with various conditions (urethral discharge in adult male; cut wound in 4 year old, impetigo in 2 year old; acute watery diarrhoea in 6 month old; acute watery diarrhoea in adult; fever with sore throat in adult; fever, rhinorrhoea and cough in a 2 month old; fever with rhinorrhoea in adult; acute dysuria in adult female. | 1 |
| Tomson and Sterky 1986, Bangladesh, Sri Lanka and Yemen Arab Republic | 25 private pharmacies in each country setting | Cross-sectional study | \*Simulated client (Caucasian man) presenting as the father of a 11 month old with diarrhoea of 3 days duration. | 1&2 |
| Tuladhar et al 1998, Nepal | 160 private pharmacies | Before and after intervention study (training) | \*Simulated clients reporting urethral discharge. | 1&2 |
| Van Sickle 2006, India | 52 private pharmacies | Cross-sectional study | \*Simulated client presenting with symptoms of asthma for preceding 2-3 weeks in themselves or a child (aged 10 or 14). | 1&2 |
| Vu et al 2012, Vietnam | 138 private pharmacies | Cross-sectional study | \*Simulated client presenting with symptoms of tuberculosis and request for anti-TB drugs. \*Structured interview questionnaire to record information on pharmacy, provider, management of a fictious case and knowledge of the national tuberculosis programme. | 1&2 |
| Wachter et al 1999, Nepal | 100 private pharmacies listed in Nepal Chemists' and Druggists' Association | Cross-sectional study | \*Simulated clients presented two scenarios (a case of cystitis in 25 year old male, 5 year old son with loose stools for 1 day). | 1 |
| Wolffers 1987, Sri Lanka | 28 private pharmacies | Cross-sectional study | \*Simulated clients requesting 2 tablets of tetracycline. | 1 |

\*One of several papers from the same research study. The following sets of papers appear to come from the same research projects:

- Stenson et al 2001a, Stenson et al 2001b, Syhakhang et al 2001

- Saencharoen and Lerkiatbundit 2013, Saencharoen and Lerkiatbundit 2010

- Ratanajamit et al 2001, Ratanajamit et al 2002

- Pham et al 2013, Minh et al 2013

- Krishnaswamy et al 1985, Dineshkumar et al 1995

- Khan et al 2006, Bista et al 2002

- Larsson et al 2006, Chalker et al 2000, Chalker et al 2005, Chuc et al 2001, Chuc et al 2002

- Kafle 1998, Kafle et al 2013

- Hussain and Ibrahim 2011, Hussain and Ibrahim 2012

- Duong et al 1997a, Duong et al 1997b