Non-communicable diseases and health systems in the Asia-Pacific region: A review of the literature

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Disclaimer

The findings, interpretations and conclusions expressed in this paper are entirely those of the authors and should not be attributed in any manner whatsoever to the Western Pacific Regional Office of the World Health Organization.
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Acronyms

AIDS Acquired Immunodeficiency Syndrome
APR Asia Pacific Region
COPD Chronic Obstructive Pulmonary Disease
CRD Chronic Respiratory Disease
CVD Cardiovascular disease
LMICs Low- and Middle- Income Countries
MeSH Medical Subject Heading Terms
NCDs Non-communicable Diseases
PHC Primary health care
RCT Randomized Clinical Trial
RHD Rheumatic Heart Disease
RF Rheumatic Fever
VIA Visual Inspection with Acetic Acid
WHO World Health Organization
The growing burden of non-communicable diseases (NCDs) in low- and middle-income countries (LMICs) requires a multifaceted response involving health promotion and prevention interventions, as well as the delivery of treatment and care over long periods. It is increasingly being recognised that successful implementation and management of all these measures can be achieved only with well-functioning health systems. In LMICs, however, health systems are still generally fragile, with inadequate financial and human resources, poor governance, unsuitable service delivery models and weak information systems. Determining how these health systems can be better adapted or strengthened to cope with the rising burden of NCDs requires an understanding of how the systems and NCDs interact.

One concern of the September 2011 United Nations High Level Summit on NCDs summit was the poor evidence base on prevalence, risk factors and health systems response to NCDs. This paper reports on a comprehensive review of published literature on health systems issues related to NCDs in the Asia Pacific region (APR). Specifically, the review sought to:

- understand how LMICs in the APR are implementing health services and interventions aimed at primary-to-referral treatment of NCDs as well as secondary and tertiary care and prevention; and
- identify the main health system issues and bottlenecks encountered in interventions aimed at prevention, treatment and care of NCDs in LMICs in the APR.

A search of the published literature was conducted for the period 1990 to end of 2010. Eventually, information from 49 articles was analysed for quality of evidence regarding effective NCD services or interventions in the APR, and the health system bottlenecks encountered.

### Results

Among the 49 articles in the review, the most common were research articles with study designs consisting of surveys, followed by intervention studies, discussion papers and review papers. There were 15 multi-country studies, one dual country study and 33 single country studies. Cancer and cardiovascular disease (CVD) were the most commonly studied NCDs, followed by diabetes and then chronic respiratory disease (CRD). More than half of the literature reviewed addressed health service delivery. The next most common focuses were health financing and health information systems for NCD control, medicines and essential drugs, followed by human resources and multiple health system components.

**Health service delivery:** Six articles looked at clinical management of NCDs. Because the articles’ aims and quality of evidence varied, no consistent results were found. There is evidence from one review paper that long-term stroke management in LMICs is hindered by poor awareness among patients, a lack of monitoring facilities and equipment, limited access to rehabilitation facilities and poor compliance with treatment. Of two studies focused on delivery of NCD primary health care (PHC) services, only the conclusions of one were substantiated with appropriate and adequate evidence. This found that a lack of knowledge and skills to manage CVD and its risk factors among health care workers was an important barrier to delivery of NCD PHC services. Quality of care for diabetes was found to be poor in studies undertaken in Karachi, Pakistan, and in a specific hospital setting of Sri Lanka—though reasons for this were not explored. In addition, the latter study did not provide details on selection of the study site or recruitment of patients. Only one study looked at how NCD services are organised or managed in the APR. A case study on the establishment of a National Cancer Center in Singapore outlined that important challenges in setting up and running the centre comprised securing adequate financial resources, addressing cultural differences in perceptions of cancer, establishing and ensuring compliance with research protocols and management of human resources. Appropriate incentives to attract and retain staff, as well as support for ongoing training of clinicians, were deemed most important in advancing cancer care and control. Lastly, two studies set in Hong Kong found that patients’ concerns with cancer care were related to health systems: insufficient care and attention from doctors, lack of follow-up systems and standardised guidelines, poor access to information and concerns regarding legitimacy of financing schemes for health care.

Ten studies looked at screening for cancer. No consistent results were found across these studies as different programs or issues were assessed; or,
when programs were similar, results were conflicting. One study in Thailand, however, found that a single ‘screen and treat’ approach for cervical cancer was feasible, safe and acceptable to women. A study in India found that follow-up home visits and an emphasis on counselling and explanation helped to ensure high compliance rates for further diagnostic investigations and treatment. Two studies reported that NCD registries can positively impact on primary prevention and early detection, if case finding is combined with prevention and screening. One study reported that integration of care for diabetes and hypertension with that for HIV/AIDS at hospitals of two provincial capitals in Cambodia was feasible and acceptable to patients.

Health information systems: Seven studies addressed health information system issues. Three looked at telemedicine, but the results are unclear due to lack of evidence in two studies and risk of bias in the other. Two urban studies in India found that the WHO STEPS stroke instrument can be implemented to guide development of stroke surveillance. In rural India, surveillance of risk factors for NCDs was implemented through the routine health care system by using health workers for data collection. The last study, in a survey of quality control indicators from 225 population-based cancer registries, found issues of data accuracy and completeness. Reasons for this, however, were not explored.

Health financing: Expenditure on NCD/chronic disease and the protection offered by medical insurance were the focus of two studies in China. Aggregation of results is not straightforward because one study looked at chronic diseases, and the definition of ‘catastrophic spending’ differed between the studies. Still, there is evidence that patients with chronic diseases in rural and urban China incur significant expenditure on health care and that insurance affords protection from these costs, though the extent may vary. A study in Vietnam on out-of-pocket payments on health care for communicable and non-communicable diseases found that the former accounted for a larger proportion of health care expenditure across all income groups. Four studies exploring access to services and support for NCDs found that barriers comprised high costs of health services, remoteness of services and inadequately equipped facilities.

Medicines and essential drugs: Six studies addressed medicines and essential drugs. Two studies reported overall poor availability of NCD drugs in the APR, particularly in the public sector, and high costs of drugs in the private sector. In a review of literature, a high cost of asthma medication was found to be a significant barrier in accessing treatment in developing countries. One study found that barriers to accessing NCD drugs were related to policies governing purchase, distribution and tendering, as well as the level of the health system at which drugs were available. Two studies looked at overcoming these costing and distribution challenges through the use of an essential medicines list. The findings from one study were poorly explained, however, and thus there is evidence from only a single study to suggest that a medicines list can reduce costs of drugs and improve distribution.

Human resources: Two studies in Hong Kong found that increasing staffing on programs through the addition of nurses equipped with additional skills or tools can help to improve outcomes for NCD patients (Burapadaja, Kawasaki et al 2007; Beran and Yudkin 2010).

Discussion
The published literature on NCD services and interventions in the APR shows considerable heterogeneity. There was little consistency in methods or outcomes under each health system component, which made aggregation of results difficult. The quality of evidence emerging from the studies also varied greatly. We found that many studies did not provide adequate or appropriate evidence to support arguments or conclusions (particularly in discussion and review papers), while outcomes of some studies were based on incomplete data. In addition, several studies were deemed to have selection bias. Another limitation in the reviewed literature was the lack of control groups in studies on implementation of services or interventions, which made it difficult to judge impact. In data analyses, confounding factors were not taken into account in quantitative analyses or implications discussed in qualitative studies. Lastly, the majority of studies were undertaken in specific settings with small sample sizes, thus limiting generalisation of findings.

However, we were still able to find certain patterns of evidence. Some evidence from India and the Pacific Islands suggests that NCD registries can contribute to early detection of disease when implemented alongside prevention and screening activities. As the
two studies looked at different NCDs and populations (urban and rural), findings may also be applicable to other NCDs and different settings. The studies that looked at integration of care for diabetes, hypertension and HIV/AIDS, at implementation of a ‘see and treat’ approach in screening for cervical cancer and at increasing compliance with follow-up investigations and treatment, are also worth repeating in other settings of the APR.

When aggregating findings across studies with relatively low risk of bias, there is evidence for several health systems weaknesses that constrain delivery of NCD services (irrespective of type). These comprise:
- a lack of adequately equipped facilities;
- limited financial resources and protection against health care costs;
- shortages in and inadequately trained health workers;
- high costs and unavailability of essential drugs and treatment; and
- inappropriate service delivery models.

There was very little evidence, however, on the activities required to overcome these weaknesses. The studies that looked at increasing staffing on interventions through addition of nurses were small and set in Hong Kong; thus repeat studies in other contexts will be required before firmer conclusions can be drawn. Likewise for the studies on expenditure on NCDs and insurance, an essential medicines list and simplified risk assessment and surveillance tools.

Conclusions

The literature on a health systems response to NCDs remains limited and patchy. There is little quality evidence available on how health systems in the region are delivering NCD services and the corresponding bottlenecks or the activities required to overcome them. Despite these quality issues, we found evidence that several health systems weaknesses are limiting the delivery of NCD services.

The heterogeneity across the studies suggests that research on health systems and NCDs has not been a priority area and is not on the development agenda of policy makers and program implementers in the APR. Significant gaps remain in the evidence base and require further investigation. These gaps—which imply the need for further operational research—include questions related to:
- reform of primary, secondary and tertiary care service delivery;
- how best to improve human resource development;
- best practices in NCD health service delivery;
- reasons for poor quality of care;
- development of tools and clinical guidelines for use in resource-limited settings;
- effective approaches to health financing and offering protection from health costs;
- how to strengthen supply management chains.

In addition, studies are needed in countries across the APR, particularly those in which the NCD burden is relatively high and evidence on NCD programs low. Evidence needs to be generated on approaches that integrate health promotion, disease prevention and treatment, and on approaches that can effectively address more than one NCD. Lastly, not only is research required in several areas, but the quality of research must also be enhanced.
INTRODUCTION

Non-communicable diseases are now the leading cause of global mortality, causing an estimated 36 million deaths, or 63 per cent of all deaths, in 2008. Eighty per cent of these deaths occurred in low- and middle-income countries (WHO 2011a). It is anticipated that mortality and morbidity due to NCDs will only increase during the next five to 25 years; in some regions, such as Africa, the Middle East and the Asia-Pacific region (APR), the burden of NCDs will be higher than in others. In East Asia and the Pacific, it is projected that NCDs will account for up to 80 per cent of all deaths and 40 per cent of all morbidity by 2030 (WHO 2011a). The need to address this rising burden of disease is increasingly being acknowledged internationally, as reflected by the discussions of the 2011 World Health Assembly and the convening of the UN High Level Meeting on NCDs in September 2011. Within this context, the literature on NCD control is rapidly evolving, with various approaches for LMICs being proposed.

Most NCDs are chronic and associated with lifestyle factors. This means that any response must be multifaceted, involving health promotion and prevention measures as well as delivery of treatment and care services over long periods. Population-wide and individual interventions that can control NCDs cost effectively have already been identified. The WHO Package of Essential Non-communicable (PEN) disease interventions (2011b) outlines these interventions, which range from salt reduction to tobacco taxation to treatment with aspirin for individuals at risk of cardiovascular disease. It has been recognised, however, that successful delivery and management of all these measures requires well-functioning health systems. Yet in most LMICs, health systems are undermined by weaknesses including limited financial resources, shortages of health workers, weak governance and inadequate service delivery models. Determining how these health systems can be better adapted or strengthened to cope with NCDs requires an understanding of their mutual interaction.

Non-communicable disease has emerged as a major concern in both reducing the growing disease burden and preparing health systems to respond. The significance of these questions was underlined by the September 2011 United Nations High Level Summit on NCDs. The summit declaration set out the task of combating NCDs, recognised as four key diseases: heart disease, diabetes, stroke and cancer, which account for 63 per cent of all deaths globally. The declaration called for options for strengthening and facilitating multi-sectoral actions for the prevention and control of NCDs, including in the review of the Millennium Development Goals in 2014. One concern of the declaration was the poor evidence base on prevalence, risk factors and the health systems response to NCDs.

This paper presents the results of a review of published literature on health systems issues related to the control of NCDs in the APR. The purpose of this study was to identify, categorise and describe the literature and to provide a summary of published findings. The study focused on two issues:

1. How do LMICs in the APR (including member countries of the World Health Organization’s regions of the ‘Western Pacific’ and ‘South-east Asia’) implement health services and interventions aimed at primary-to-referral treatment of NCDs as well as secondary and tertiary care and prevention?

2. What are the main health system issues and bottlenecks encountered in the delivery of interventions aimed at prevention, treatment and care of NCDs in LMICs in the APR?

This review looks at four specific NCDs: cancer, CVD, chronic respiratory disease and diabetes. While NCDs encompass a range of health conditions, these four diseases account for the majority of NCD deaths and also share common risk factors (WHO 2011a). Our choice to narrow the review is in line with the WHO’s report, which also focuses on these four NCDs.

Here, we have compiled, mapped, synthesised and assessed the available evidence on how health systems are addressing NCDs in the APR based on literature published between 1990 and 2010. The focus was particularly on the bottlenecks experienced in implementing NCD control strategies. Previous anecdotal evidence indicates that such issues include shortcomings in the continuum of care, inadequate financial protection (particularly for outpatient care) and differing models of service delivery. While the wide discourse around cost-effectiveness of prevention and treatment for NCDs is acknowledged (Abegunde
et al 2007; Asaria et al 2007; Gaziano et al 2007; Lim et al 2007; Beaglehole et al 2011a; Beaglehole et al 2011b; WHO 2011a), assessing evidence on the cost-effectiveness and/or the clinical effectiveness of particular NCD interventions was beyond the scope of this review.

**METHODS**

**Search of the Published Literature**

A systematic search of published literature was carried out using four electronic databases: PubMed, Embase, Medline and Web of Science. The search of titles published from 1990 to the end of 2010 used NCD and health system-related keywords and medical subject heading (MeSH) terms. The words and terms used in search strings are provided in Table 1.

The search of titles was limited to studies addressing NCDs and health systems in LMICs in the APR. The search terms and MeSH terms used included: low-income, middle-income or developing country-related terms together with nominated countries. The country-related key words included Bangladesh, Bhutan, Brunei, Cambodia, China, Cook Islands, Brunei Darussalam, Fiji, French Polynesia, Guam, Hong Kong, India, Indonesia, Kiribati, Laos, Macao, Malaysia, Maldives, Marshall Islands, Micronesia, Mongolia, Myanmar, Nauru, Nepal, New Caledonia, Niue, Pacific, Papua New Guinea, Philippines, Pitcairn Islands, Samoa, Solomon Islands, Sri Lanka, Thailand, Timor-Leste, Tokelau, Tonga, Tuvalu, Vanuatu and Viet Nam.

A summary of the results from the literature search is provided in Table 2. Published literature was searched as follows:

1. A first search of the PubMed database produced 1765 articles. This figure was obtained from cross-referencing 992,108 articles related to NCDs, 536,881 articles related to health systems and 78,660 articles focusing on at least one LMIC in the APR. The search strings used are outlined in Appendix 1.

2. A second search using the Embase+Medline databases yielded an additional 416 articles. The search strings used were the same as those used for PubMed.

3. A last search of the Web of Science database produced 476 titles. Search strings had to be modified here in order to meet the database’s maximum limit (50) of combined words that could be used in searches.

4. Combining the search results from the three databases gave a total of 2657 potential articles. These were exported to Endnote X4 to identify duplicates; 559 articles were identified as duplicates and excluded from the list, giving a total of 2098 articles.

5. Results from the online databases were compared with a WHO Western Pacific Regional Office Endnote database on NCDs comprising 850 articles. Following exclusion of duplicates within the database and articles that had already been

**TABLE 1. KEYWORDS AND MESH TERMS USED IN SEARCH STRINGS**

<table>
<thead>
<tr>
<th>Area</th>
<th>Keywords and MeSH terms used</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCDs</td>
<td>Non-communicable diseases, chronic illness, chronic diseases, cardiovascular diseases, heart diseases, stroke, diabetes mellitus, cancer, chronic respiratory diseases, lung diseases, obstructive, occupational lung diseases, pulmonary disease, chronic obstructive, asthma, pulmonary, hypertension. Also included MeSH terms for risk factors related to NCDs, including ‘diet’, ‘tobacco’ and ‘exercise’.</td>
</tr>
<tr>
<td>Health systems</td>
<td>Health systems, health system strengthening, health system bottlenecks, health reform, health system performance, organization and administration, responsiveness, efficiency, quality, service delivery, health care provision, health services, health services delivery, health workforce, human resources, health staff, information, information systems, medical product, essential medicines, drug, health care financing, financing, insurance, risk protection, resource allocation, budget allocation, out-of-pocket, health expenditure, resources allocation, organization, management, monitoring and evaluation, service delivery, health services, health care service, leadership, stewardship, governance, access, accessibility, coverage, health promotion, patient expectation, patient expectations, patient satisfaction, patient safety, patient education, patient opinion, patient communication, patient survey, patient support, patient experience, patient experiences, patient engagement, patient information, patient compliance.</td>
</tr>
</tbody>
</table>
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Articles were included in the review if they:

1. presented results of programs addressing NCDs or of surveys of facilities offering NCD care;
2. described patient experiences of receiving NCD-related care; or
3. reported on interventions to strengthen health systems in ways that have the potential for a positive impact on NCD care. Articles were included if they focused on any of the health systems or service delivery features identified in the search criteria—including NCD organisation and service delivery, workforce, health information systems, health financing, essential medicines, prevention (including in a health facility), screening, early treatment, late treatment and palliative care.

Articles that reported on chronic infectious diseases, such as AIDS, but reported results relevant to NCDs were also included. Articles were also included even if they looked at chronic diseases generally or did not specify the type of NCD, as it was felt that the results might be relevant to the four specific NCDs examined in this review.

Articles were excluded from the review if:

1. there was no clear source that indicated the use of an evidence base or research method;
2. they dealt with issues unrelated to health systems (broadly defined);
3. they were purely prospective (program design) or simply promoting ‘achievements’ without providing any evidence;
4. they were studies focused on measuring the prevalence of NCDs or their risk factors;
5. they failed to identify appropriate lessons.

Selection Process

Figure 1 summarises the literature selection process. Four reviewers each read the complete list of 2509 abstracts. Abstracts retained for the next round of screening were those that were judged as meeting the inclusion criteria by at least one reviewer. This first round resulted in the removal of 2023 abstracts. The remaining 486 were read again by all four reviewers. In this round, only those abstracts deemed to meet the inclusion criteria by at least three of the four reviewers were retained; the final figure was 78 remaining abstracts.

To ensure that potentially eligible literature had not been missed, one reviewer re-read those abstracts excluded in the second round that had been judged as meeting the inclusion criteria by two reviewers. Of the 111 abstracts in this category, seven met the inclusion criteria. Adding these to the abstracts retained from the second round gave a total of 85 abstracts eligible for full-text screening. In the final round of the selection, two reviewers read 85 full-text articles. Of these, 36 were excluded, giving a remaining total of 49 articles.

Appendix 2 lists the literature that was excluded along with the reasons for exclusion. The majority of the papers dealt with issues unrelated to health systems or did not clearly indicate of use of an evidence base or research method.
Records identified through online database searches (n = 2657)

Records after removal of duplicates (n = 2098)

Records within the WPRO database (n = 850)

Records after exclusion of duplications and application of search limits (n = 411)

Total abstracts screened (n = 2509)

Abstracts excluded (n = 2023)

Abstracts excluded (n = 408)

Abstracts included (n = 7)

Full text articles excluded (n = 36)

Abstracts that 2 out of 4 reviewers agreed on for inclusion re-screened (n = 111)

Articles included in the review (n = 49)
Categorisation and Analysis of Full Texts

Data from each of the 49 articles included in this review were analysed and abstracted into the following categories:

1. first two authors and year;
2. type of article; research articles were classified according to study type;
3. aims or scope of the article/study;
4. countries of focus;
5. type of NCD;
6. health system component(s) of focus; and
7. lessons or recommendations.

Health systems components were classified in line with the six building blocks of health systems as outlined by the WHO: service delivery, health information systems, medicines and essential drugs, health financing, human resources and governance and leadership (though there were no relevant studies for this last category) (WHO 2007). Under each main category, studies were further classified in sub-categories (see Table 3).

The above information from each paper was recorded by one reviewer and cross-checked by another reviewer for any inconsistencies. Findings were then analysed for quality of evidence regarding effective NCD services or interventions in countries of the APR and the bottlenecks encountered. The quality of evidence was assessed using an appraisal tool developed by the research team, based on critical appraisal checklists of the Critical Appraisal Skills Programme UK (http://www.casp-uk.net/).

RESULTS

Table 4 summarises the content and main characteristics of the articles included in this review as per the categories outlined in the previous section.

Typology of the Included Articles

Type of article/study design

The different types among the 49 articles are illustrated in Figure 2. The most common type was research articles (n = 36), namely surveys and intervention studies. There were also several discussion papers (n = 7) and review papers (n = 6).

Countries studied

Fifteen articles focused on multiple countries, of which nine looked at issues within the general context of LMICs or developing countries. Three were set specifically within the APR, while three looked at a specific group of countries of which a few were from the APR. One study was set in China and Nigeria. Of the 33 single-country studies, the most common setting was India, followed by Hong Kong (considered here separately to mainland China), Sri Lanka and Thailand (n = 5 for all). Figure 3 provides an overview of the settings.

FIGURE 2. TYPES OF ARTICLES*

*Research articles are presented according to study type (survey, intervention study, qualitative study, case study and evaluation)
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Health systems components studied
The majority of the published literature looked at health service delivery (n = 26), focusing particularly on activities related to screening, early detection and disease prevention (n = 12). The number of articles grouped into each of the health systems components is summarised in Table 3.

NCDs studied
The number of articles focusing on each type of NCD is provided in Figure 4. Most articles addressed issues related to cancer and CVD, followed by diabetes and CRD—though at significantly lower numbers. Four articles looked at more than one NCD, and three did not specify the NCD(s) of focus.

*Some countries solely or also figured in multi-country studies.
USAPI = United States Associated Pacific Islands.
TABLE 3. HEALTH SYSTEMS COMPONENTS ADDRESSED

<table>
<thead>
<tr>
<th>Health Systems Components</th>
<th>No of articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health service delivery:</td>
<td>26</td>
</tr>
<tr>
<td>Clinical management</td>
<td>6</td>
</tr>
<tr>
<td>Primary care</td>
<td>2</td>
</tr>
<tr>
<td>Quality of care</td>
<td>2</td>
</tr>
<tr>
<td>Organisation and management</td>
<td>1</td>
</tr>
<tr>
<td>Patient experiences with NCD services</td>
<td>2</td>
</tr>
<tr>
<td>Screening, early detection and disease prevention</td>
<td>12</td>
</tr>
<tr>
<td>Integrated service delivery</td>
<td>1</td>
</tr>
<tr>
<td>Health information systems for NCD control</td>
<td>7</td>
</tr>
<tr>
<td>Health financing</td>
<td>7</td>
</tr>
<tr>
<td>Financial burden of health payments</td>
<td>3</td>
</tr>
<tr>
<td>Access to services and patient support</td>
<td>4</td>
</tr>
<tr>
<td>Medicines and essential drugs</td>
<td>6</td>
</tr>
<tr>
<td>Human resources</td>
<td>2</td>
</tr>
<tr>
<td>Multiple components (addressing more than one component)</td>
<td>1</td>
</tr>
</tbody>
</table>

FINDINGS

Results from the studies included in this review are presented below according to the health systems components outlined previously. Under each of the categories, studies are discussed in terms of findings related to: (1) delivery of health services and interventions for prevention, treatment or care of NCDs, and (2) health system issues and bottlenecks encountered in the delivery of these services.

One study provided an overview of the health systems constraints in delivering services for chronic diseases in LMICs and thus is not classified under one of the categories. Based on a comprehensive literature review that draws on evidence from different LMICs, Samb, Desai et al (2010) found these weaknesses:

- shortages in adequately trained health workers and lack of investment in training on chronic diseases;
- weak health information systems that lack integrated and coordinated collection of data on chronic diseases; and
- weak supply management chains and procurement systems that result in undersupply, shortages or high costs of drugs and medical products.

It is important to note, however, that the article focused on chronic diseases, not all of which are NCDs.

Health service delivery

Clinical management: In this review, six articles focused on clinical management, five of which related to CVD (Mendis 2003; Mendis 2005; Brainin, Teuschl et al 2007; Mendis, Lindholm et al 2007; Mendis, Johnston et al 2010;) and one to CRD (asthma) (Ghosh, Ravindran et al 1998). The articles were of different types (research, review and discussion articles) and mainly focused on the contexts of LMICs in general.

Two studies identified health systems weaknesses as limiting effective management of NCDs. A review of literature found that long-term management of stroke in developing countries was constrained by poor awareness of stroke among patients, a lack of monitoring facilities and equipment (though variations existed between countries), limited access to and availability of adequate rehabilitation facilities and poor compliance with treatment (Brainin, Teuschl et al 2007). Likewise, inadequate funds and facilities, human resource shortages, poor awareness of CVD, high drug costs, inadequate continuing medical education and a lack of access to basic health care were identified as challenges to effective management of hypertension (Mendis 2003). This study, however, provided little evidence to support the identification of these barriers.

Four articles examined interventions that could enhance clinical management in resource-limited settings. Three looked at the use of risk assessment tools for CVD; the results suggest that the effectiveness of the tools is yet to be demonstrated. Two discussion papers stated that the use of prediction tools to assess absolute risk of CVD in LMICs could help to manage CVD by targeting limited resources at high-risk individuals (Mendis 2005; Mendis, Lindholm et al 2007). However, neither paper provided sufficient evidence to support the argument, referring only to
a few sources and providing no data from countries. A randomised control trial (RCT) undertaken in select primary health care centres across China and Nigeria found mixed results regarding the effectiveness of a WHO CVD risk management package\(^1\) in reducing blood pressure and improving adherence to lifestyle-change interventions (Deerasamee, Srivatanakul et al 2007). At 12-month follow up, mean blood pressure decreased more and rates of hypertension control were higher among intervention patients (frequenting centres where the package was implemented) than in control patients (p < 0.001). At the same time, though, half of the intervention patients still had uncontrolled hypertension, and improvements in other behavioural risk factors were not seen at either site. The last study looked at a different intervention: self-management training for chronic asthma patients. In a RCT at a tertiary care centre in Kerala (India), self-management training for asthma improved breathing ability by 14.5 per cent, reduced productive days lost by 48.5 per cent, reduced likelihood of hospitalisation and emergency visits and decreased average health costs by 22 per cent—findings which were all statistically significant (p < 0.05) (Ghosh, Ravindran et al 1998).

**Primary care:** With the growing burden of NCDs in LMICs, the role of PHC systems in the management and prevention of the diseases is becoming increasingly important. Only two studies explored delivery of primary care NCD services. No consistent results were found due to variable quality of evidence, and because the studies focused on different issues. One study found that delivery of RF/RHD control measures in PHC systems of 16 developing countries led to greater awareness of RF/RHD among patients and increased coverage for secondary prophylaxis and medical care (WHO 1992). These findings, however, were not substantiated with relevant in-country evidence, thus making interpretation difficult. In addition, the study noted issues related to data quality and availability in countries, suggesting that program results may be biased. The other study, set in one province of Thailand, noted that an important barrier to delivery of CVD services at PHC centres was the lack of knowledge and skills to manage CVD and its risk factors among health care providers (Aekplakorn, Suriyawongpaisal et al 2005).

**Quality of care:** Two studies that looked at the quality of care for diabetes in specific South Asian settings found that quality was poor. A study undertaken in three different clinics—private, public and non-governmental organisation (NGO)—in Karachi found that overall diabetes care was sub-optimal (Azam, Khuwaja et al 2010). It was best in the private clinic, where a greater proportion of patients were informed of diabetic complications (92 per cent versus 58 per cent in NGO and 52 per cent in public clinics, p = < 0.001), monitored for blood pressure (100 per cent versus 79 per cent in NGO and 57 per cent in public clinics, p = < 0.001) and examined for foot complications (98 per cent versus 52 per cent in NGO and 8 per cent in public clinics, p = < 0.001). A survey at a diabetic clinic based in a large hospital in Sri Lanka found that the average consultation time was four minutes, follow-up systems were lacking, blood glucose and proteinuria testing was not standardised or conducted at frequencies prescribed by local clinical guidelines and 47.5 per cent of 200 patients had never undergone screening to detect eye complications arising from diabetes (Mulgirigama and Illangasekera 2000). However, details on selection of the study site, exclusion and inclusion criteria for recruitment of patients, and administration of the survey questionnaire were not provided, suggesting that risk of bias may be high. Reasons for substandard care were not explored in either study.

**Organisation and management:** Only one article looked at how NCD services are organised or managed in the APR. A case study on the establishment of the National Cancer Center Singapore highlighted important management challenges: difficulties in attracting staff and shortages in adequately trained staff, problems in engaging staff in research activities and ensuring compliance with research protocols, addressing cultural differences in perceptions of cancer and a lack of financial resources (Soo 2008). Management of human resources was deemed most important in advancing a cancer care and control program.

**Patient experiences:** Two qualitative studies set in Hong Kong found that patients’ concerns with cancer care were related to health system weaknesses. In the larger study, which had a sample of 41 patients, obstacles to good follow-up cancer care were identified as insufficient care and attention from doctors in treatment, lack of systems to ensure follow-up consultations, unstructured information provision

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\(^1\) This package was specifically developed for LMIC settings and is to be used to help clinicians assess and manage cardiovascular risk. It is based on three scenarios commonly encountered in LMICs and is built on algorithms (see Mendis, Johnston et al 2010 for further details).
Screening, early detection and prevention: Twelve articles looked at screening, early detection and disease prevention, the overwhelming majority of which focused on cancer (n = 11), especially cervical cancer (n = 8). One article looked at RF/RHD. Ten studies investigated cancer screening, eight for cervical cancer and two for oral cancer. No consistent results were found across the studies because different programs or issues were assessed or, when programs were similar, results were conflicting. There is, however, some evidence to suggest that inadequate infrastructure and service delivery models and poor knowledge of screening are barriers to effective screening programs.

A review of cytology screening programs in LMICs, including in South and South-east Asia, concluded that screening is still inadequate, inefficient and of poor quality, with minimal impact on incidence and mortality (Sankaranarayanan, Budukh et al 2001). The study provided little evidence to suggest why, with only a few references made to inadequate infrastructure, limited financial resources and poor public knowledge. Another review on types of cervical cancer screening methods noted that, in India and similar settings, visual inspection of the cervix with acetic acid (VIA) and visual inspection after application of Lugol’s iodine may be more feasibly and easily integrated into the primary healthcare system (Juneja, Sehgal et al 2007). However, insufficient evidence from resource-limited settings was provided to support the recommendations. In fact, findings from an evaluation and a review of a VIA and cryotherapy-based cervical screening program in Bangladesh suggest otherwise, the program being found to have minimal uptake and coverage (less than 0.5 per cent), as well as poor compliance with treatment (less than 50 per cent) (Ahmed, Ashrafunnessa et al 2008; Basu, Nessa et al 2010). These issues are largely attributed to weaknesses in the health system: non-systematic data collection, weak follow-up and referral systems, inadequate equipment to perform screening, shortages in trained staff and poor quality control. The methodology of the review was not clear, however, and bias was evident in the evaluation, as only four out of 44 districts were reviewed, with reasons for non-random selection not provided.

The two studies focusing on prevention of oral cancer explored different issues. A review of the evidence on the practicality and efficacy of using community health workers and other health auxiliaries in the early detection of oral cancer and precancerous lesions (through mouth examinations of high-risk individuals), from studies undertaken in India and Sri Lanka, found that such an approach was feasible (Sankaranarayanan 1997). However, the review found mixed results in sensitivity and specificity of mouth examinations by health workers, and no evidence of reduction of oral cancer incidence or mortality was available. A study in Sri Lanka reported poor knowledge about oral cancer screening among 35 per cent of the public sector dentists surveyed as a potential barrier to successful screening (Ariyawardana and Ekanayake 2008). A major limitation of the study was the low response rate of 38 per cent among dentists.

There is evidence to suggest that programs can be adapted to overcome some of the challenges in delivering screening for cancer. In one province of Thailand, a “screen and treat” single approach, whereby women are first screened for cervical cancer and then immediately offered treatment if found to be positive, was deemed feasible, safe and acceptable—90 per cent of women who participated reporting being highly satisfied (Royal Thai College of Obstetricians and Gynaecologists 2003). Logistical regression analyses of findings from a RCT undertaken in India showed that follow-up home visits and an emphasis on counselling and explanation helped to ensure high compliance rates for further diagnostic investigations (over 70 per cent) and treatment (over 80 per cent) for breast and cervical cancer (Dinshaw, Mishra et al 2008). However, the study did not provide comparisons with compliance rates achieved without the interventions. Based on a survey and modelling studies, Adab, McGhee et al (2004) conclude that three-yearly and five-yearly organised screening programs with 80 per cent coverage would be more effective and efficient than an opportunistic cervical screening program. In Thailand, an organised cytology-based cervical screening program in one province is
said to have reduced the incidence of and mortality from cervical cancer (Deerasamee, Srivatanakul et al 2007). Robust evidence to support these conclusions was not provided, however, thus making it difficult to assess the actual impact of the program.

Two articles looked at the contribution of registries to primary prevention and early detection, both reporting the potential for positive impacts. A discussion paper suggested that national RHD registers, along with prevention and screening, can allow more effective delivery of prophylaxis and early detection (Colquhoun, Carapetis et al 2009). The other article reported on a survey of the impact of the first population-based rural cancer registry in India, which not only undertook case findings but also implemented cancer awareness activities and early detection clinics within villages. The study found that awareness of cancer among populations served by the registry was significantly higher (by at least 30 per cent, p < 0.01) compared to non-served populations, and that incidence of early stage cervical cancer cases increased from 4.2 to 7.1 per 100,000 over a 16-year period (Jayant, Nene et al 2010). The findings may be biased, because the study did not control for confounders.

Integrated service delivery: One study reported that the integration of care for diabetes and hypertension with that for HIV/AIDS in chronic disease clinics at referral hospitals of two provincial capitals in Cambodia was feasible and acceptable to patients (Janssens, Van Damme et al 2007). After 24 months of care, 87.7 per cent of all HIV/AIDS patients, 71 per cent of diabetic patients and 68 per cent of hypertensive patients attending the clinics were alive and in active follow-up. However, the study provides no comparisons with clinics where care is not integrated. Furthermore, there is likely to be bias in sampling because the clinics were set up in hospitals of provincial capitals, where infrastructure and referral capacities would be better than in hospitals in smaller cities or towns.

Health information systems for NCD control

Seven studies addressed health information system-related issues. Of these, three looked at implementation of telemedicine, two at implementation of the WHO STEPS stroke instrument, one at the implementation of a surveillance system to assess community disease risk factors using the routine health care system and one at quality control indicators in cancer registries. The results related to implementation of telemedicine are largely unclear. In Hong Kong, delivery of a tele-rehabilitation program for stroke patients at one community centre improved the patients’ physical abilities, self-esteem, overall quality of life and knowledge of stroke (Lai, Woo et al 2004). However, participants in the study were recruited through convenience sampling, with no information provided on characteristics of patients who chose not to participate, suggesting findings may have overestimated the positive impact. Two studies, one set in the United States Associated Pacific Islands and another in two rural Cambodian communities, assessed telemedicine in managing and treating rheumatic heart disease patients (Abbas and Person 2008) and in delivering health services for chronic disease patients (Kvedar, Heinzelmann et al 2006). Sufficient relevant evidence was not provided in either case to support conclusions on the beneficial impact of telemedicine on service delivery and health outcomes.

The WHO STEPS stroke instrument, based on a three-step approach involving data collection on incidence and fatality in hospitals and communities, is designed to guide programmers in establishing stroke surveillance. Studies in two cities of India, Bangalore (Nagaraja, Gururaj et al 2009) and Mumbai (Dalal, Bhattacharjee et al 2008), found that the instrument can be implemented feasibly to guide development of stroke surveillance. The Bangalore study, however, did not implement step three of the instrument. In another study in India, undertaken in rural Haryana, surveillance of communicable and non-communicable disease risk factors was implemented through the routine community health care system by using health workers in the collection of data (Nongkynrih, Anand et al 2010). Comparison of the surveillance results of this system with those from a NCD risk factor survey based on the WHO STEPS showed no difference (p values > 0.1), suggesting that behavioural surveillance can be undertaken by health workers within the routine health care system. It is important to note, however, that the study involved simple measurements—for example, measurement of mean waist circumference rather than body-mass index. This means that the conclusions on feasibility of the system may be limited to collection of data requiring minimal equipment or infrastructure.

2 Risk factors were measured by tobacco use, blood sugar level, consumption of fruits and mean waist circumference.
The last study, which surveyed quality control indicators from 225 population-based cancer registries in 63 LMICs, found that across all registries there were issues of data accuracy and completeness (Curado, Voti et al. 2009). Registered cases in most LMICs (namely in Asia and Latin America), were largely diagnosed based only on clinical and imaging methods rather than being microscopically verified, while inadequate official mortality data meant that mortality to incidence ratios for fatal cancers could not be calculated. These findings, the authors conclude, reflect deficiencies in health systems, although these are not identified in the study.

Health financing

Financial burden of health payments: Three research articles looked at the burden of expenditure on NCD/chronic disease health care costs for households and individuals. Aggregation of results from these studies is not straightforward because one study looked at chronic diseases (Sun, Liu et al. 2009), and the definition of ‘catastrophic spending’ varied. Furthermore, the aims and outcomes measured differed between the study set in Vietnam (Thuan, Lofgren et al. 2006) and the two studies set in China (Heeley, Anderson et al. 2009; Sun, Liu et al. 2009).

The study set in Vietnam looked at the burden of out-of-pocket health care payments for communicable and non-communicable diseases on households in the district of Bavi (Thuan, Lofgren et al. 2006). It found that communicable diseases accounted for a greater percentage, 50-66 per cent, of household health care expenditure across all income quintiles. In households with catastrophic health care expenditure (more than 40 per cent of the household’s capacity to pay), as much as 85 per cent of this expenditure was on communicable diseases. Only in households where health care expenditure ranged between 30 and 40 per cent of households’ capacity to pay did expenditure on NCDs, at 59 per cent, exceed that on communicable diseases. Even this finding may not accurately reflect the reality, as the result was skewed by one household in the group having a very high expenditure on NCDs.

Results from the Chinese studies suggest that NCD/chronic disease patients in rural (Sun, Liu et al. 2009) and urban (Heeley, Anderson et al. 2009) China incur significant expenditure on health care, and that insurance affords protection from these costs, though the extent varies. In an analysis of health expenditure data from a household survey in three counties of Shandong and Ningxia provinces in China, Sun, Liu et al. (2009) found that 14-15 per cent of families faced catastrophic health care costs (over 40 per cent of non-food expenditure) due to health care costs for chronic disease. Among individuals who were members of the New Co-operative Medical Insurance Scheme, non-food expenditure on health care costs was an average of 27 per cent in Shandong and 35 per cent in Ningxia. A survey by Heeley, Anderson et al. (2009) found that of 4739 three-month survivors of stroke, an estimated 71 per cent experienced catastrophic health care costs (defined as ≥ 30 per cent of total household annual income). Workers without health insurance were seven times more likely to experience catastrophic payments than workers with insurance (odds ratio [OR]: 6.9, confidence interval [CI]: 4.6-10.3), as were patients who were either retired or not working and without insurance (OR: 4.7, CI: 3.1-7.2; OR: 1.82, CI: 1.3-2.6, respectively). At the same time, coverage by health insurance did not necessarily guarantee financial protection, 14 per cent of insured workers still facing catastrophic health payments.

Accessibility of services and support: Four studies explored barriers to services and support, all of which were set in countries of the APR. Common barriers identified across the studies consisted of high costs of health services, geographical barriers to reaching health services and inadequately equipped facilities.

A mixed qualitative and quantitative study undertaken in the Philippines found that access to diabetes care and treatment was mainly impeded by the high costs of services, medicines and transport to medical facilities, and by lack of coverage of outpatient services by national insurance schemes (Higuchi 2010). Other barriers included the poor availability of insulin and medicines at public hospitals and the lack of adequate equipment, medication and referral systems to treat and care for patients at PHC centres. Similarly, a qualitative study in Sri Lanka found that lack of appropriately equipped facilities, geographical inaccessibility of hospitals and financial burdens were obstacles to care for diabetes patients (Perera, Gunatilleke et al. 2007). The last was particularly important, with daily direct and indirect costs of inpatient care for diabetes at public hospitals amounting to an average of 211 per cent of daily income for low-income households, 131 per cent for middle-income and 57 per cent for high-income households. In Malaysia, barriers to self-management of breast cancer
consisted of unavailability of information, shortages in health personnel, poor health personnel expertise in diagnosing and treating cancer, weak patient-provider relationships and lack of insurance coverage and financial subsidies for drugs (Loh, Packer et al 2007). The study, however, did not discuss the potential influence on findings of confounders, such as income status of participants. A survey in east Nepal found that patients presented late for acute coronary syndrome at a tertiary care hospital because of a lack of ambulance services and delays in primary diagnosis largely due to inadequate equipment and facilities (Acharya, Adhikari et al 2009). This study did not provide enough detail on how data was collected or substantial evidence to support conclusions on reasons for delay.

Medicines and essential drugs

Six studies looked at availability and affordability of essential medicines for NCDs. Two studies reported overall poor availability of NCD drugs in countries of the APR, particularly in the public sector, and high cost of drugs in the private sector. A comprehensive WHO study undertaken in Bangladesh, Brazil, Malawi, Nepal, Pakistan and Sri Lanka found that of 32 medicines surveyed, for CVD, diabetes, chronic respiratory disease and glaucoma, ≤ 7.5 per cent were available in the public sector of all countries, except in Sri Lanka and Brazil (Mendis, Fukino et al 2007). In the private sector, availability was substantially higher but prices also more expensive: in Nepal, for example, private sector prices were 66.3 per cent higher than in the public sector. Similarly, a study in four states and one major city of India found that essential inhalation medicines for asthma were not available in public sector facilities, except in one state (Kotwani 2009). For generic and innovator drugs that were available in the private sector, prices ranged from 0.82 to 1.49 times the international retail price, making the drugs unaffordable to around 80 per cent of India’s population.

A review of secondary literature identified this high cost of essential asthma medication as a significant barrier to accessing treatment in developing countries (Ait-Khaled, Enarson et al 2007).

Only one study specifically examined barriers to accessing NCD drugs. Beran and Yudkin (2010) found that access to insulin in five LMICs (including Vietnam) was related to policies governing purchase, distribution and tendering, as well as the level of the health system at which insulin was available. Access to insulin was part of the larger issue of access to treatment, which was in turn dependent on the availability of adequate facilities and trained health care workers. Two studies looked at how to overcome costing and distribution challenges, specifically through the use of an essential medicines list. In the small island states of the South Pacific, an essential drugs list for hypertension helped to reduce costs of drugs and improve distribution (Bailey, Azam et al 2001). Similarly, a study in Thailand concluded that a national list of essential medicines was beneficial in controlling prices and patterns of use of cardiovascular drugs (Burapadaja, Kawasaki et al 2007). The rigour of these conclusions is questionable, however, as the findings were poorly explained and it is not clear how they affirm the value of the list.

Human resources

With shortages in health workers in LMICs, there has been a growing discourse on task shifting and training personnel of other cadres, such as nurses, to deliver services that might normally be delivered by physicians. Two studies that looked at the impact of equipping nurses with additional skills or tools to support delivery of NCD services showed that health outcomes were improved. A matched, randomised intervention study involving 45 nursing homes in Hong Kong found that use of a care protocol by community nurses to support nursing home staff in caring for elderly patients with chronic obstructive pulmonary disease (COPD) improved the psychological well-being of patients (Lee, Lee et al 2002). Well-being scores,3 improved from 24.44 ± 26.70 to 18.38 ± 4.38 (p < 0.001) for patients who had been followed up by community nurses using the protocol. In contrast, there was hardly any change in well-being of patients within the control group. Likewise, Sindhu, Pholpet et al (2010) found that a nurse-led community care program helped to lower the severity of illness three and eight weeks after hospital discharge (statistically significant using ANCOVA analysis, F = 4.30, p < 0.05) among patients with COPD, coronary heart disease and chronic heart failure compared to patients who were not receiving care under that model. Participants in the experimental group also expressed significantly higher scores on satisfaction with community care than those in the control group (t = 3.93, p < 0.001).

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3 As computed from the General Health Questionnaire, which measures somatic symptoms, anxiety, insomnia, social dysfunction and depression. Lower scores indicate better well-being.
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<td>Ghosh, C.S., P.</td>
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<td>India</td>
<td>CRD (asthma)</td>
<td>Clinical management</td>
<td>The intervention group had significantly better health status (measured by breathing ability), fewer productive days lost and lower resource use (hospitalisations and emergency room visits) than the control group. Incorporation of asthma self-management training as part of clinical management of asthma can result in improvements in health status and reductions in hospital use.</td>
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<td>Clinical management</td>
<td>The success of a CVD risk-management package will also depend on the capacity of primary health care systems to deliver these interventions and serve the long-term needs of high-risk CVD patients.</td>
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<tr>
<td>Mendis, S., L.H.</td>
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<td>Risk prediction charts for use in LMICs</td>
<td>LMICs</td>
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<td>Risk prediction tools that easily and accurately predict an individual’s absolute risk of CVD are key to targeting limited resources at high-risk individuals who are likely to benefit the most.</td>
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<td>Lindholm et al.</td>
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<td>Developing countries</td>
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<td>Assessment of the effectiveness of the WHO CVD risk management package in reducing blood pressure in primary care settings and improving adherence to lifestyle change interventions</td>
<td>China</td>
<td>CVD (hypertension)</td>
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<td>Brainin, M.Y. Teuschl et al (2007)</td>
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<td>Acute treatment and long-term management of stroke in developing countries</td>
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<td>CVD (stroke)</td>
<td>Clinical management</td>
<td>The quality and quantity of stroke care are patchy in developing countries, areas of excellence being mixed with areas of severe need. A population-based approach to improving acute care and rehabilitation for stroke is needed, which is evidence-based and maximises the effectiveness of such care.</td>
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<td>Aekplakorn, W., P. Suriyawongpaisal et al (2005)</td>
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<td>Knowledge and perceptions about cardiovascular disease and its risk factors among community members and health care providers in one province of Thailand</td>
<td>Thailand</td>
<td>CVD</td>
<td>Primary care</td>
<td>Capacity building for primary CVD prevention and control is necessary. The existing training and education systems have to be revised with an orientation towards health promotion and disease prevention. Publicity of CVD burden and preventive measures, and local programs, should be implemented with community participation.</td>
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<tr>
<td>WHO CVD Unit and principal investigators (1992)</td>
<td>Intervention study</td>
<td>A study of service-oriented primary health care intervention to prevent rheumatic fever/rheumatic heart disease in 16 developing countries</td>
<td>Pakistan; India; Sri Lanka; Thailand; China; the Philippines; Tonga and non-APR countries</td>
<td>CVD (rheumatic fever/rheumatic heart disease)</td>
<td>Primary care</td>
<td>Implementation of the program in selected areas of the participating countries led to greater awareness of rheumatic fever/rheumatic heart disease among patients, and increased coverage for secondary prophylaxis and medical care. Participating countries should proceed to the next phase, and other countries where the illnesses are a problem are recommended to implement the program.</td>
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<tr>
<td>Azam, I.S., A.K. Khuwaja et al. (2010)</td>
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<td>Quality of care</td>
<td>Many patients with type 2 diabetes do not receive optimal care. Overall improvement in the quality of diabetes care is required, and further research is needed to evaluate the reasons for poor diabetes care and to identify the most cost-effective means to address these.</td>
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<td>Mulgirigama, A. and U. Illangasekera (2000)</td>
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<td>Diabetes</td>
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<td>The quality of care of diabetic patients did not meet expected standards. Two of the principal problems were lack of good organisation and poor planning of resource use.</td>
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<td>Soo, K.C. (2008)</td>
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<td>Experiences and lessons from developing a comprehensive cancer centre.</td>
<td>Singapore</td>
<td>Cancer</td>
<td>Organisation and management</td>
<td>The management of human resources is key to advancing a cancer control and care program. Cancer research is also essential for the success of a comprehensive cancer centre.</td>
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<td>Patient experiences with NCD services</td>
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<td>Patient experiences with NCD services</td>
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<td>Sankaranarayanan, R., A.M. Budukh et al. (2007)</td>
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An understanding of the scope and goals of follow-up care is not only crucial for patient care but also for the health care system. Patients are calling for more explicit goals and clinical practice guidelines to serve as frameworks for both patients and doctors.

An opportunistic screening system achieves better coverage, but over-screens a small group of women and is less effective and efficient than an organised screening program.

The cervical screening program now needs to move from opportunistic screening to population-based, systematic screening.

Efforts to organise an effective screening program in developing countries will have to find adequate financial resources, establish the infrastructure, train the personnel and elaborate surveillance mechanisms for screening, investigating, treatment and follow-up of the targeted women.

For the program to be cost effective, coverage of the target population and compliance with treatment must be increased. Quality control parameters need to be introduced and regular training provided to health professionals.
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<th>Study aims/scope</th>
<th>Recommendation/lessons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deerasamee, S. P. Skulratanakul et al. (2007)</td>
<td>Evaluation study</td>
<td>Thailand</td>
<td>Cancer (cervical cancer)</td>
<td>Evaluation of the cervical screening program in Nakhon Phanom</td>
<td>Screening, early detection and prevention</td>
<td>Screening with the Papricoume smear plus adequate follow-up diagnosis and therapy can achieve major reductions in both incidence and mortality rates. A model for nationwide implementation.</td>
</tr>
<tr>
<td>Royal Thai College of Obstetricians and Gynaecologists and the JHPIEGO Corporation Cervical Cancer Prevention Group (2003)</td>
<td>Intervention study</td>
<td>Thailand</td>
<td>Cancer (cervical cancer)</td>
<td>Assessment of the value of a single-visit approach combining VIA with cryotherapy to screen for cervical cancer</td>
<td>Screening, early detection and prevention</td>
<td>A single-visit approach with VIA and cryotherapy seems to be safe, acceptable and feasible in rural Thailand, and is a potentially efficient method of cervical-cancer prevention in such settings.</td>
</tr>
<tr>
<td>Juneja, A., A. Sehgal, et al (2007)</td>
<td>Review</td>
<td>India</td>
<td>Cancer (cervical cancer)</td>
<td>Evaluation of different screening strategies for cervical cancer under different resource conditions, with particular focus on India</td>
<td>Screening, early detection and prevention</td>
<td>Screening with the Papanicolaou smear plus adequate follow-up diagnosis and therapy can achieve major reductions in both incidence and mortality rates. A model for nationwide implementation.</td>
</tr>
<tr>
<td>Dinshaw, K., G. Mishra et al (2008)</td>
<td>Intervention study (randomised controlled trial)</td>
<td>India</td>
<td>Cancer (cervical &amp; breast cancer)</td>
<td>Identifying the determinants of compliance with diagnostic investigations for screening positive women for cervical and breast cancer</td>
<td>Screening, early detection and prevention</td>
<td>High rates of compliance of screened positive women for diagnostic tests were found, following an intensive effort to assist compliance such as through provision of mobile cancer-care near homes for non-attendees to the referral hospital. Lower rates of compliance were found for treatment of cancer cases, particularly for cervical cancer—possibly due to the long duration of radiation therapy required.</td>
</tr>
<tr>
<td>Jayant, K., B.M. Nene et al (2010)</td>
<td>Survey</td>
<td>India</td>
<td>Cancer (cervical cancer)</td>
<td>Assessment of the impact of the first population-based rural cancer registry in India, specifically in terms of cervical cancer</td>
<td>Screening, early detection and prevention</td>
<td>The innovative methodology adopted by the registry has facilitated cancer registration in rural areas. The registry has helped to raise awareness on cancer, improved access to diagnosis, treatment and follow-up care and had a positive impact on stage of presentation and survival of cancer patients.</td>
</tr>
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### Non-communicable diseases and health systems in the Asia-Pacific region: A review of the literature

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<tr>
<th>Author(s) (publication year)</th>
<th>Study design</th>
<th>Study aims/scope</th>
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<th>Type of NCD</th>
<th>Health system component</th>
<th>Recommendation/lessons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sankaranarayanan, R. (1997)</td>
<td>Review paper</td>
<td>Reviewing and discussing the available evidence on the practicality and efficacy of the use of community health workers and other health auxiliaries of the primary health care system to provide mouth examinations</td>
<td>Multiple countries, including LMICs such as India and Sri Lanka</td>
<td>Cancer (oral cancer)</td>
<td>Screening, early detection and prevention</td>
<td>Studies in India and Sri Lanka indicate that it is feasible to train community health workers and other health auxiliaries in primary prevention and early detection of oral cancer and precancerous lesions. However, no evidence of the efficacy of such an approach in reducing incidence and mortality of oral cancer is yet available.</td>
</tr>
<tr>
<td>Ariyawardana, A. and L. Ekanayake (2008)</td>
<td>Survey</td>
<td>Determining health provider knowledge and opinions on screening for oral cancer</td>
<td>Sri Lanka</td>
<td>Cancer (oral cancer)</td>
<td>Screening, early detection and prevention</td>
<td>Thirty-five per cent of health providers had poor knowledge about oral cancer screening, and thus there is a need for continuing education programs to update knowledge.</td>
</tr>
<tr>
<td>Colquhoun, S. M., J.R. Carapetis et al. (2009)</td>
<td>Discussion paper</td>
<td>Developing effective coordinated prevention programs for rheumatic fever/rheumatic heart disease</td>
<td>Pacific island countries</td>
<td>CVD (rheumatic fever/rheumatic heart disease)</td>
<td>Screening, early detection and prevention</td>
<td>There are a number of barriers to effective coordinated prevention programs for rheumatic fever/rheumatic heart disease in the Pacific islands, including limited funding and competing health priorities. National rheumatic heart disease registers, along with primary prevention and screening for the disease, will allow more effective delivery of prophylaxis and early detection.</td>
</tr>
<tr>
<td>Janssens, B., W. Van Damme et al (2007)</td>
<td>Intervention study</td>
<td>Offering integrated care for HIV/AIDS, diabetes and hypertension within the local setting of chronic disease clinics</td>
<td>Cambodia</td>
<td>CVD (hypertension) diabetes</td>
<td>Integrated care</td>
<td>It is feasible to integrate care for HIV/AIDS with non-communicable diseases in Cambodia. Adherence support strategies proved to be complementary, and services were well accepted by patients.</td>
</tr>
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### Health information systems for NCD control

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<tr>
<th>Author(s)</th>
<th>Study design</th>
<th>Study aims/scope</th>
<th>Focus country</th>
<th>Type of NCD</th>
<th>Health information systems</th>
<th>Recommendation/lessons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbas, M.I. and D.A. Person (2008)</td>
<td>Survey</td>
<td>To review experience with management of rheumatic heart disease patients referred using a telemedicine system</td>
<td>United States-associated Pacific Islands</td>
<td>CVD (rheumatic fever/rheumatic heart disease)</td>
<td>Health information systems</td>
<td>Patients referred by the telemedicine system have been successfully treated and sent back home. Patient selection, choice of intervention and early return of the patient home are critical to the success of a telemedicine system.</td>
</tr>
<tr>
<td>Curado, M.P., L. Voti et al (2009)</td>
<td>Survey</td>
<td>A study of the value of cancer incidence data for low- and middle-income countries</td>
<td>LMICs</td>
<td>Cancer</td>
<td>Health information systems</td>
<td>Cancer registration should continue being supported and expanded geographically in LMIC. It is also necessary to make available national official death certificates, where the cause of death is assigned by specialised personnel, to achieve the optimal use of death certificates in cancer control efforts.</td>
</tr>
<tr>
<td>Author(s) (publication year)</td>
<td>Study design</td>
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<tr>
<td>Dalal, P.M., M. Bhattacharjee, et al (2008)</td>
<td>Survey</td>
<td>Establishing stroke surveillance using the WHO STEPS instrument</td>
<td>India</td>
<td>CVD (stroke)</td>
<td>Health information systems</td>
<td>WHO STEPs stroke surveillance instrument is simple to use and practical for community surveys. The data are useful for planning stroke prevention campaigns on public awareness and education with regard to diet, exercise, blood pressure control and early symptoms of minor strokes.</td>
</tr>
<tr>
<td>Kvedar, J., P.J. Heinzelmann et al (2006)</td>
<td>Intervention study</td>
<td>Experience from piloting telemedicine for cancer patients in Cambodia</td>
<td>Cambodia</td>
<td>Cancer</td>
<td>Health information systems</td>
<td>Use simple communications technology to improve care, even to some of the most impoverished communities. Infrastructure must be improved in Cambodia to enable patients, in particular cancer patients, to receive acute care that can only be provided in distant Phnom Penh.</td>
</tr>
<tr>
<td>Lai, J.C., J. Woo et al (2004)</td>
<td>Intervention study</td>
<td>Evaluating the feasibility, efficacy and acceptability of a community-based stroke rehabilitation program conducted via video-conferencing</td>
<td>Hong Kong</td>
<td>CVD (stroke)</td>
<td>Health information systems</td>
<td>All the subjects accepted the use of video-conferencing for delivery of the intervention. Telemedicine demonstrated the feasibility, efficacy and high level of acceptance of tele-rehabilitation for community-dwelling stroke clients.</td>
</tr>
<tr>
<td>Nagaraja, D., G. Gururaj et al (2009)</td>
<td>Survey</td>
<td>Developing a strategy for establishment of a population-based stroke surveillance system</td>
<td>India</td>
<td>CVD (stroke)</td>
<td>Health information systems</td>
<td>Stroke surveillance is possible and feasible. Institution-based (hospitals and vital registry data) stroke surveillance supplemented with periodical population-based information can provide comprehensive information on vital aspects of stroke like mortality, risk factors, disability and outcome. There is a need to develop stroke surveillance in a phased manner along with mechanisms to apply data for prevention and control programs.</td>
</tr>
<tr>
<td>Nongkynrh, B., K. Anand et al (2010)</td>
<td>Intervention study</td>
<td>Developing a surveillance system to assess community risk factors using the routine health care system</td>
<td>India</td>
<td>NCDs (type not specified)</td>
<td>Health information systems</td>
<td>It is feasible for health workers to do behavioural surveillance for communicable and non-communicable diseases using the routine health care system.</td>
</tr>
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</table>

Health financing
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<tr>
<th>Author(s) (publication year)</th>
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<tbody>
<tr>
<td>Heeley, E., C.S. Anderson et al (2009)</td>
<td>Survey</td>
<td>Economic impact of stroke on households and influence of health insurance coverage on health care costs faced by families</td>
<td>China</td>
<td>CVD (stroke)</td>
<td>Financial burden of health payments</td>
<td>Health insurance protects families against catastrophic health care payments, highlighting the need to accelerate building a comprehensive health care system in both urban and rural settings in China.</td>
</tr>
<tr>
<td>Sun, Q., X.Y. Liu et al. (2009)</td>
<td>Survey</td>
<td>Investigating the extent to which patients suffering from chronic disease in rural China face catastrophic expenditure on health care, and how far insurance offers financial protection</td>
<td>China</td>
<td>Chronic diseases (NCDs not specified)</td>
<td>Financial burden of health payments</td>
<td>A significant proportion of patients with chronic diseases face catastrophic health care costs, and these are especially heavy for the poor. There is an urgent need for a clear policy on financial protection to those with chronic disease.</td>
</tr>
<tr>
<td>Thuan, N.B.T., C. Lofgren et al (2006)</td>
<td>Survey</td>
<td>Investigating the relative effect of different illnesses on the total economic burden of health care for households in general and for households that have catastrophic health care spending in a rural district of Vietnam</td>
<td>Vietnam</td>
<td>All four</td>
<td>Financial burden of health payments</td>
<td>Communicable diseases are the reason for most household health care expenditure. However, communicable illnesses are more common in the poor population than in the rich population.</td>
</tr>
<tr>
<td>Loh, S.Y., T. Packer et al (2007)</td>
<td>Qualitative study</td>
<td>An exploration of the perceived barriers to self-management of women diagnosed with breast cancer</td>
<td>Malaysia</td>
<td>Cancer</td>
<td>Access to services and support</td>
<td>The main barriers to self-management were unavailability of information, inability to access services and support and socio-economic-cultural issues.</td>
</tr>
<tr>
<td>Perera, M., G. Gunatilleke et al (2007)</td>
<td>Discussion paper</td>
<td>An exploration of the accessibility and affordability of diabetes care for patients from different types of households</td>
<td>Sri Lanka</td>
<td>Diabetes</td>
<td>Access to services and support</td>
<td>Diabetes patients experience important barriers in accessing and affording care, and these can have a negative effect on the entire household.</td>
</tr>
<tr>
<td>Higuchi, M. (2010)</td>
<td>Survey</td>
<td>Access to diabetes care and medicines</td>
<td>Philippines</td>
<td>Diabetes</td>
<td>Access to services and support</td>
<td>Patients took intermittent medication based on their own judgment or select pieces of medical advice, subjectively weighing symptoms against household budget. The current public health insurance and decentralised health systems do not promote access to diabetes care.</td>
</tr>
<tr>
<td>Author(s) (publication year)</td>
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<tr>
<td>Acharya, P, R.R., Adhikari et al (2009)</td>
<td>Survey</td>
<td>Reasons for late presentation of acute coronary syndrome at a tertiary care centre in Nepal</td>
<td>Nepal</td>
<td>CVD (acute coronary syndrome)</td>
<td>Access to services and support</td>
<td>Transportation was the leading cause for delay, and the hospital does not presently operate any ambulance services. Delays in referrals at primary health care centres were another reason for late presentation.</td>
</tr>
<tr>
<td>Alt-Khaled, N., D.A. Enarson et al (2007)</td>
<td>Review</td>
<td>Improving the quality of care for asthma in developing countries</td>
<td>Developing countries</td>
<td>CRD (asthma)</td>
<td>Medicines and essential drugs</td>
<td>The increased affordability of drugs provided by the asthma drug facility should bring rapid and significant health and cost benefits for patients, their communities and governments. This should improve the credibility of the public health sector and other services that can provide quality asthma care, thus strengthening health systems in general.</td>
</tr>
<tr>
<td>Bailey, M.C., A.A. Azam et al (2001)</td>
<td>Case study</td>
<td>To illustrate the advantages of using an essential drugs list and bulk purchasing of NCD drugs (hypertension) within the context of small island states</td>
<td>Cook Islands, Kiribati, Marshall Islands, Nauru, Niue, Tuvalu</td>
<td>CVD (hypertension)</td>
<td>Medicines and essential drugs</td>
<td>An essential drug list and centralised bulk purchasing can reduce drug costs and therefore increase access to essential medicines for hypertension in small island states.</td>
</tr>
<tr>
<td>Beran, D. and J.S. Yudkin (2010)</td>
<td>Discussion paper</td>
<td>Understanding how medicines get to the individuals needing them and how affordability and accessibility impact overall access.</td>
<td>Developing countries</td>
<td>Diabetes</td>
<td>Medicines and essential drugs</td>
<td>The barriers to access to insulin were linked more to distribution, tendering and government policies than to accessibility and affordability. Access to medicines alone cannot improve levels of health; access to the full range of treatment is needed. A vital factor is the role of health care workers in the initial diagnosis.</td>
</tr>
<tr>
<td>Burapadaja, S., N. Kawasaki et al (2007)</td>
<td>Survey</td>
<td>Examining the effects of using the national list of essential medicines to control patterns of use and the prices of cardiovascular drugs available on the market in Thailand</td>
<td>Thailand</td>
<td>CVD</td>
<td>Medicines and essential drugs</td>
<td>Essential medicines have effects on the patterns and the values of cardiovascular products available for the market.</td>
</tr>
<tr>
<td>Kotwani, A. (2009)</td>
<td>Survey</td>
<td>Assessing the availability, price and affordability of beclomethasone and salbutamol inhalers in five Indian states using a standardised methodology</td>
<td>India</td>
<td>CRD (asthma)</td>
<td>Medicines and essential drugs</td>
<td>The high cost of essential asthma inhalation medicines, coupled with their non-availability in the public sector, increases the likelihood of asthma exacerbation and mortality in India. The burden of asthma can be reduced by increasing access to affordable essential asthma medicines in the public and private sectors.</td>
</tr>
<tr>
<td>Author(s) (publication year)</td>
<td>Study design</td>
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<tr>
<td>Mendis, S., K. Fukino et al (2007)</td>
<td>Survey</td>
<td>Assessing the availability and affordability of medicines used to treat CVD, diabetes, chronic respiratory disease and glaucoma and to provide palliative cancer care in six LMICs</td>
<td>Bangladesh, Brazil, Malawi, Nepal, Pakistan and Sri Lanka</td>
<td>CVD, diabetes, CRD</td>
<td>Medicines and essential drugs</td>
<td>A significant proportion of chronic disease morbidity and mortality can be prevented if medications are made accessible and affordable. A commitment by governments to meet the needs of their citizens who suffer from chronic diseases is urgently required. A range of policy options and technical options exists to enable governments to ensure that medicines for chronic diseases are consistently available and affordable, particularly in the public sector.</td>
</tr>
<tr>
<td>Lee, D.T., I.F. Lee et al (2002)</td>
<td>Intervention study</td>
<td>Evaluation of the effects of a care protocol on the care of nursing home patients with chronic obstructive pulmonary disease</td>
<td>Hong Kong</td>
<td>CRD (chronic obstructive pulmonary disease)</td>
<td>Human resources</td>
<td>Supporting nursing home staff in the care of COPD patients through community nursing visits can enhance older residents’ psychological well-being.</td>
</tr>
<tr>
<td>Sindhu, S., C. Pholpet et al (2010)</td>
<td>Intervention study</td>
<td>Effect of nurse-led community care model on perceived health status, length of stay, cost, satisfaction and re-admission rates</td>
<td>Thailand</td>
<td>CVD, CRD</td>
<td>Human resources</td>
<td>A nurse-led, collaboratively developed program has potential to improve satisfaction and decrease symptom development in people with chronic illnesses.</td>
</tr>
<tr>
<td>Samb, B., N. Desai et al (2010)</td>
<td>Discussion paper</td>
<td>Assessment of the challenges to delivery of chronic disease care in LMICs; the contribution of chronic disease interventions to health systems and the current global agenda on health systems strengthening</td>
<td>LMICs</td>
<td>Chronic diseases (NCDs not specified)</td>
<td>Multiple components</td>
<td>Every effort must now be made to embed the discourse on chronic diseases firmly within the health-systems strengthening, and to promote the needs of health systems to chronic disease advocates.</td>
</tr>
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</table>
DISCUSSION

In this review, we sought to understand how health services and interventions for the prevention, treatment and care of NCDs are being implemented in countries of the APR, and to identify the bottlenecks encountered in the delivery of these health services or interventions. Following a systematic search and selection of published literature, 49 articles were deemed eligible for inclusion in the review. Classification and analyses of findings from these articles have identified the evidence available in the two areas of focus mentioned.

Quality and Applicability of Evidence

The published literature on NCD service and interventions in the APR shows considerable heterogeneity. There was little consistency in methods or outcomes across studies under each of the health systems components analysed, which often made aggregation of individual study results difficult. The quality of evidence was also variable. A considerable number of the included articles were discussion or review papers (n = 13), and many of these did not provide enough evidence to support the arguments or conclusions. Where evidence was given, selection criteria were not outlined in a few studies. In other papers, we also found that findings were not clear or that conclusions were not substantiated by findings. This suggests that some studies had outcome bias, with all measured outcomes not being presented. Furthermore, some outcomes were based on incomplete data. The evaluation of the cervical screening program in Bangladesh, for example, reported problems with unavailable, incomplete or poor quality data at the health centres that were assessed.

The majority of research papers were deemed to have selection bias, implying that findings may not have produced an accurate reflection of the issue in question. The studies looking at implementation of the WHO STEPS instrument, for example, were undertaken in urban settings of India, where data are more easily obtained and of better quality. Likewise, the study on a tele-rehabilitation program for stroke recruited participants through convenience sampling, with no discussion of the characteristics of stroke patients who chose not to participate and the corresponding implications. Findings from the survey on knowledge of screening for oral cancer in Sri Lanka were undermined by the low response rate of 38 per cent. Another limitation we found in study design was the lack of control groups in studies that reported on services or interventions, which made it difficult to judge impact. With regard to data analysis, one quantitative study did not adjust for confounding factors. Even in qualitative studies or evaluations, there was little discussion of how variation in factors within the studied sample may have influenced findings. The study on barriers to self-management of breast cancer in Malaysia, for instance, did not consider how the low income of the majority of participants might have influenced findings. Lastly, most of the published evidence comes from studies undertaken in specific settings with small sample sizes. This limits generalisation of findings to a wider population or to other settings in the APR.

Despite the wide variability in the nature and quality of research that underpinned the studies in this review, the accumulation of evidence in certain areas provides insights on health systems weaknesses limiting effective delivery of NCD services and interventions.

Summary of Results

We were unable to find any consistent evidence regarding effective interventions and services for prevention, treatment and care of NCDs in the APR. Relevant studies in this review showed considerable heterogeneity of services or interventions of focus, outcomes, communities involved and quality of evidence. For example, while many studies looked at cervical screening programs in LMICs and the APR, these focused on different types of programs and produced evidence of variable quality.

There is, however, preliminary evidence available from single countries in the APR to suggest that programs combining screening and treatment in a single approach can be feasibly implemented in resource-limited settings, and that emphasising patient compliance through follow-up visits and counselling can improve compliance with treatment. Similarly, experience from Cambodia shows that care for diabetes and hypertension may be feasibly integrated with care for HIV/AIDS in referral hospitals. These studies are worth exploring in other settings of the APR to determine whether such programs can use the minimum resources available to maximal efficiency in reducing cervical cancer incidence and mortality, as
well as in offering care for NCDs. In terms of human resources, evidence from two studies suggests that equipping nurses with additional skills or tools to support delivery of NCD services can improve health outcomes for NCD patients. Both studies were small and set in Hong Kong, though, and thus repeat studies in other contexts will be required before firmer conclusions can be made.

There is also some evidence from India and Pacific Island countries that suggests that registries for cancer and RF/RHD (CVD) can contribute to early detection of disease when implemented alongside prevention and screening activities. As the studies looked at different diseases (cancer and RF/RHD) and populations (rural and urban), it is possible that the benefits of this intervention may be applicable to the spectrum of NCDs and in different settings. Still, it is worth repeating similar studies in other contexts as well as for different NCDs. Surveillance of NCD risk factors, as shown in rural Haryana, may also be undertaken through the routine health care system by using health workers to collect data. Similar studies, using different measurements and indicators, could be also repeated in different contexts in the APR. Lastly, as the quality of evidence to support the benefits of using simplified risk assessment and surveillance tools and national medicine lists varied, these are interventions that should also be considered for further study.

Due to the few studies undertaken under each specific health systems component analysed in this review and the variable quality of research, there is a lack of evidence on specific health systems weaknesses by type of component or disease. However, when aggregating findings from across studies with relatively low risk of bias, we were able to find accumulating evidence for several health systems weaknesses that constrain delivery of NCD (irrespective of type) services. These comprised:

- a lack of adequately equipped health facilities;
- limited financial resources and protection against health care costs;
- shortages in and inadequate knowledge and skills of human resources;
- high costs and unavailability of essential drugs and treatment; and
- inappropriate service delivery models, namely weak referral and follow-up systems.

As can be seen, poor financial protection against health care costs and a lack of financial resources within the health system were the most recurring weaknesses identified across the studies. Given that the evidence on the extent of financial protection offered by insurance varied between the two relevant studies in this review, it is essential that further studies be undertaken to understand how medical insurance for NCDs can be provided effectively.

**Limitations**

This review is biased to published literature, which may be an important limitation given that the literature around NCDs has been evolving rapidly over the past year. There may be studies relevant to this review that were missed because they were not submitted for publication or not yet accepted. Another limitation is the exclusion of studies published in a language other than English or searchable only in non-English databases.

**CONCLUSIONS**

This review has shown that the literature on health systems and NCDs in the APR remains limited and patchy. There is little good quality evidence available on how health systems in the region are delivering NCD services and the corresponding bottlenecks experienced and the activities required to overcome them. Despite these quality issues, we found accumulating evidence that several health systems weaknesses are limiting the delivery and implementation of NCD services. These consisted of poorly equipped health facilities, a lack of financial and human resources including adequately trained workers, shortages in and high costs of essential drugs and medicines, unsuitable service delivery models and weak health information systems. Our findings thus concur with existing evidence from literature that health systems in LMICs are poorly equipped to address the rising burden of NCDs. Some of these weaknesses, such as weak health information systems or human resource shortages, are related to the generic low capacity of health systems in the APR. Others, however, such as inadequate service delivery models and skilled health workers, seem to be specific to the characteristics of NCDs (such as their chronic nature) and the corresponding responses required. The evidence on how to strengthen health systems accordingly, or on
effective NCD services or interventions currently being implemented, is less substantive.

The heterogeneity across the studies reviewed suggests that research on health systems and NCDs is not a priority area and is not on the development agenda of policy makers and program implementers in the APR. The many small-scale studies focusing on different issues further indicate that there is no coordinated plan for NCD research in countries of the APR that aims to provide evidence to inform policy, prevention and implementation. The lack of strategic direction in research may partially be due to the lack of data generated within health information systems. The Global Status Report on NCDs and recent articles published in the Lancet, for example, highlight that surveillance of NCDs and risk factors for NCDs needs to be improved in LMICs (Farzadfar, Finucane et al 2011; Danaei, Finucane et al 2011; Danaei, Finucane et al 2011; Finucane, Stevens et al 2011). A vicious circle might thus be in place, whereby weaknesses in the health system are undermining plans and research to better understand these very weaknesses.

There a number of significant gaps in the evidence base which require further investigation in order to define an adequate and appropriate response to NCDs in the APR. Many of the gaps are context specific, requiring a range of country-based studies to determine burden of disease, responses launched to date through national health systems, unmet needs and the resources that can be mobilised to deal with the problem. Still, some specific areas that we have identified as requiring further research include:

- how primary, secondary and tertiary levels of the health system can be rearranged and reformed to deliver health promotion and prevention activities along with treatment and care;
- effective approaches to human resource development;
- reasons for and underlying causes of poor quality of care for NCDs, including palliative care;
- identification of best practices in NCD health service delivery;
- development of tools and clinical guidelines that can be easily and feasibly implemented in resource-limited settings;
- approaches to health financing and how populations can be protected from the impact of significant NCD-related health costs; and
- approaches to strengthening supply management chains for drugs and technologies.

Furthermore, this review also shows that current research is persisting with disciplinary or service divisions, given that there were no studies exploring approaches to integrate prevention, promotion and treatment. Such approaches must be trialled and explored to help inform development of effective responses to NCDs.

While the literature included in this review related to many countries, there is a significant lack of evidence from high-burden countries. It was surprising, for instance, to see few studies set in the Pacific islands even though NCD morbidity and mortality are very high in these states. Thus, to gain a better regional understanding of the interactions between NCDs and health systems, research activities should be prioritised in those countries for which there is currently little evidence available and where burden is relatively high. Similarly, evidence needs to be generated across the spectrum of NCDs and not just for particular cancers or cardiovascular diseases. Moreover, research needs to be undertaken on approaches that can address more than one disease. Identifying synergies across the four major preventable NCDs may provide opportunities for reducing the costs of service delivery in both treatment and prevention.

Not only should further research be undertaken, but the quality of research must also be enhanced. Studies need to be rigorously designed and analysed, ensuring that samples are as representative as possible and include hard-to-reach populations. When new health systems-strengthening activities are being tested, these should be implemented with a control/comparison group—with ‘exposure’ to the intervention randomised, if possible, and adequate time allocated in follow-up. Importantly, as well, research needs to be carried out in countries across the APR, preferably in a manner that supports cross-country comparisons.

The emerging burden of NCDs in developing countries, including in the APR, requires an efficient and effective response that can be developed only through a sound evidence base that provides guidance not only on treatment responses required but also on broader issues of service delivery, access to services and
equity of outcomes. This implies a need for operational research that addresses the areas where gaps in knowledge are evident. Moving this research agenda ahead will require strong leadership and strategic direction at both the national and regional levels. Coordination of national research programs in the development of common methodologies or protocols in the APR, for example, will allow for comparisons to be made within and between countries in terms of disease burden, epidemiological trends, service delivery models or impact of interventions (WHO 2010). Ultimately, what is needed is a coherent and comprehensive health systems response in addressing NCDs. With the increasing prominence of NCDs on the global health agenda, now is the ideal time to garner the support of policy makers, donors and researchers.
REFERENCES


# APPENDIX 1

## Keywords and MeSH Terms Used in the Search of the Published Literature

<table>
<thead>
<tr>
<th>Search</th>
<th>Most Recent Queries</th>
</tr>
</thead>
<tbody>
<tr>
<td>#4</td>
<td>Search #1 AND #2 AND #3 Limits: only items with abstracts, Humans, English, Publication Date from 1990/01/01 to 2010/12/31 Field: Title</td>
</tr>
<tr>
<td>#3</td>
<td>Search “health systems” OR “Health system strengthening” OR “health system bottlenecks” OR “health reform” OR “health system performance” OR “Organization and Administration” OR “Organization and Administration” [MeSH] OR Responsiveness OR Efficiency OR Quality OR Service delivery OR “health care provision” OR “health services” OR “health services delivery” OR “Health workforce” OR “human resources” OR health staff OR Information OR “information systems” OR Medical product OR “essential medicines” OR drug OR “health care financing” OR Financing OR insurance OR “risk protection” OR “resource allocation” OR “budget allocation” OR “out-of-pocket” OR “health expenditure” OR “resources allocation” OR Organization OR management OR “monitoring and evaluation” OR Service delivery OR “health services” OR “health care service” OR Leadership OR stewardship OR governance OR Access OR accessibility OR Coverage OR “Health promotion” OR “patient expectation” OR “patient expectations” OR “patient satisfaction” OR “patient safety” OR “patient education” OR “patient opinion” OR “patient opinion” OR “patient communication” OR “patient survey” OR “patient support” OR “patient experiences” OR “patient experience” OR “patient engagement” OR “patient information” OR “patient compliance” Limits: only items with abstracts, Humans, English, Publication Date from 1990/01/01 to 2010/12/31 Field: Title</td>
</tr>
<tr>
<td>#2</td>
<td>Search Middle-income country OR Middle-income countries OR “Developing Countries”[MeSH] OR New Caledonia OR Brunei Darussalam OR Cambodia OR China OR Fiji OR Papua New Guinea OR Philippines OR Hong Kong OR Samoa OR Kiribati OR Solomon Islands OR Lao OR Tonga OR Tuvalu OR Malaysia OR Vanuatu OR Viet Nam OR Mongolia OR Bangladesh OR Bhutan OR India OR Indonesia OR Maldives OR Myanmar OR Nepal OR Sri Lanka OR Thailand OR Timor-Leste OR pacific OR Samoa OR Nauru OR New Caledonia OR Niue OR Cook Islands OR Fiji OR French Polynesia OR Guam OR Pitcairn Islands OR Kiribati OR Tokelau OR Lao OR Tonga OR Macao OR Tuvalu OR Vanuatu OR Marshall Islands OR Micronesia OR Mongolia OR Bhutan OR Maldives Limits: only items with abstracts, Humans, English, Publication Date from 1990/01/01 to 2010/12/31 Field: Title or Abstract</td>
</tr>
</tbody>
</table>
### APPENDIX 2

**List of Excluded Studies and Reasons**

In this review, studies were excluded if:

1. there was no clear source that indicated the use of an evidence base or research method;
2. they dealt with issues unrelated to health systems (broadly defined);
3. they were purely prospective (program design) or simply promoting ‘achievements’;
4. they were epidemiological studies or focused solely on risk factors; or
5. they failed to identify appropriate lessons.

<table>
<thead>
<tr>
<th>Author(s) (Publication year)</th>
<th>Title</th>
<th>Reasons for exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balagopal, P., N. Kamalamma et al (2008)</td>
<td>A Community-Based Diabetes Prevention and Management Education Program in a Rural Village in India</td>
<td>Exclusion criterion 2 Study relates to a community-based education program, which does not describe how NCD services are currently being delivered within the health system or health facilities. Not in line with review aims.</td>
</tr>
<tr>
<td>Yip, C.H., R.A. Smith et al (2008)</td>
<td>Guideline Implementation for Breast Healthcare in Low- and Middle-Income Countries</td>
<td>Exclusion criteria 1 and 2 Paper is suggesting what should be done, and does not present in detail the evidence that was used to inform the recommendations. The focus on health systems, or how the research informs overcoming health system bottlenecks, is not apparent.</td>
</tr>
<tr>
<td>Azarisman, S.M., H.M. Hadzri et al (2008)</td>
<td>Compliance to national guidelines on the management of chronic obstructive pulmonary disease in Malaysia: a single centre experience</td>
<td>Exclusion criterion 2 The study’s aim is mainly related to assessing the severity of COPD cases. Compliance with national guidelines, which is meant to be the second aim of the study, is considered only in the discussion. The health systems link is weak.</td>
</tr>
<tr>
<td>Dey, S. and A.S. Soliman (2010)</td>
<td>Cancer in the Global Health Era: Opportunities for the Middle East and Asia</td>
<td>Exclusion criteria 1 and 2 Paper largely focuses on prevalence and risk factors of cancer, without much discussion of how services are being delivered—with very little focus specifically on the APR. Argues for what should be done. Little evidence is presented to substantiate arguments.</td>
</tr>
<tr>
<td>Trapido, E.J., J.M. Borras et al (2009)</td>
<td>Critical factors influencing the establishment, maintenance and sustainability of population-based cancer control programs</td>
<td>Exclusion criterion 1 Paper is meant to provide examples from different countries and organisations implementing strategies to overcome obstacles and maintain and advance cancer control programs. The evidence base for statements made is weak, and there is no indication of methods used to collect data. Some examples do not seem to provide any implications for cancer control.</td>
</tr>
<tr>
<td>Author(s) (Publication year)</td>
<td>Title</td>
<td>Reasons for exclusion</td>
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<tr>
<td>Wang, L., L. Kong et al (2005)</td>
<td>Preventing chronic diseases in China</td>
<td>Exclusion criteria 1 and 2. Paper provides an overview of chronic disease burden, risk factors and what is being done in China. However, there is not enough discussion or evidence to support how NCD services are being delivered and the lessons or implications for health systems. The paper does not seem relevant (is too broad) to the questions of the review.</td>
</tr>
<tr>
<td>Beaglehole, R., J. Epping-Jordan et al (2008)</td>
<td>Improving the prevention and management of chronic disease in low-income and middle-income countries: a priority for primary health care</td>
<td>Exclusion criteria 1 and 2. Paper argues for what should be done rather than reviewing what is currently being done and how to address health systems bottlenecks. Also, the paper largely draws upon evidence from high-income countries, and the evidence cannot necessarily be applied to LMICs.</td>
</tr>
<tr>
<td>Joshi, R., S. Jan et al (2008)</td>
<td>Global inequalities in Access to Cardiovascular Health Care</td>
<td>Exclusion criterion 1. An opinion piece without clear methodology or justification for the opinion; generalisations which do not consider the specific circumstances of different LMICs (for example, use of private sector).</td>
</tr>
<tr>
<td>Mendis, S. (2010)</td>
<td>The policy agenda for prevention and control of non-communicable diseases</td>
<td>Exclusion criterion 1. Poor description of methodology; very broad review including both LMICs and HICs; broad generalisations in relation to LMICs.</td>
</tr>
<tr>
<td>Reddy, K.S., B. Shah et al (2005)</td>
<td>Responding to the threat of chronic diseases in India</td>
<td>Exclusion criterion 2. Review paper which provides an overview of chronic disease prevalence and what is being done in India. However, it does not discuss how services are being delivered and the lessons or implications for health systems. The paper does not seem relevant (is too broad) to the questions of the review.</td>
</tr>
<tr>
<td>Yang, G., L. Kong et al (2008)</td>
<td>Emergence of chronic non-communicable diseases in China</td>
<td>Exclusion criteria 1 and 2. Paper provides an overview of chronic disease burden, risk factors and what is being done in China. However, there is not enough discussion or evidence presented to support how NCD services are being delivered and the lessons or implications for health systems. The paper does not seem relevant (is too broad) to the questions of the review.</td>
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<tr>
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<tr>
<td>Otter, R., Y.L. Qiao et al (2009)</td>
<td>Organization of population-based cancer control programs: Europe and the World</td>
<td>Exclusion criteria 1 and 2. Lack of an evidence base and research method, broadly defined and not of much relevance to health systems. Paper also focuses largely on HICs, and not enough information is provided to suggest that lessons might be applicable to LMICs.</td>
</tr>
<tr>
<td>Harford, J.B., B.K. Edwards et al (2009)</td>
<td>Cancer control—planning and monitoring population-based systems</td>
<td>Exclusion criteria 1 and 2. Lack of an evidence base and research method, broadly defined and not of much relevance to health systems. Paper also focuses largely on HICs, and not enough information is provided to suggest that lessons might be applicable to LMICs.</td>
</tr>
<tr>
<td>Magnusson, R.S. (2010)</td>
<td>Global Health Governance and the Challenge of Chronic, Non-Communicable Disease</td>
<td>Exclusion criteria 1 and 2. Lack of an evidence base and research method, broadly defined and not of much relevance to health systems. Paper also focuses largely on HICs, and not enough information is provided to suggest that lessons might be applicable to LMICs.</td>
</tr>
<tr>
<td>Bovet, P., J.P. Gervasoni et al (2003)</td>
<td>A two-week workshop to promote cardiovascular disease prevention programs in countries with limited resources</td>
<td>Excluded based on criterion number 2. Excluded because article reports on a workshop.</td>
</tr>
<tr>
<td>Nayak, S., J.P.B. Pradhan et al (2005)</td>
<td>Cancer patients’ perception of the quality of communication before and after the implementation of a communication strategy in a regional cancer center in India</td>
<td>Excluded based on criterion number 2. Excluded because article relates to hospital patient care practices.</td>
</tr>
<tr>
<td>Markson, L.E., W.M. Vollmer et al (2001)</td>
<td>Insight into patient dissatisfaction with asthma treatment</td>
<td>Excluded based on criterion number 2. The paper discusses patient dissatisfaction with asthma treatment and is more related to disease management issues than interactions with the health system.</td>
</tr>
<tr>
<td>Cockram, C.S., T. Van Binh et al (2006)</td>
<td>Diabetes prevention and control in Viet Nam: a demonstration project in two provinces</td>
<td>Excluded based on criterion number 1. There is no clear evidence base or methodology described when results of the project are presented or health systems barriers have been identified.</td>
</tr>
<tr>
<td>Author(s) (Publication year)</td>
<td>Title</td>
<td>Reasons for exclusion</td>
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<tr>
<td>Ha, D.A. and D. Chisholm (2010)</td>
<td>Cost-effectiveness analysis of interventions to prevent cardiovascular disease in Vietnam</td>
<td>Excluded based on criterion number 2. While cost-effectiveness of interventions is not unrelated to health systems, the findings of the report are not relevant to the questions of the review.</td>
</tr>
<tr>
<td>Maher, D., A.D. Harries et al (2009)</td>
<td>A global framework for action to improve the primary care response to chronic non-communicable disease: a solution to a neglected problem</td>
<td>Excluded based on criterion number 3. Article proposes a framework that could be used, does not present results or experiences from NCD interventions that have been implemented nor present an evidence base when identifying health systems bottlenecks. Also not specific to APR.</td>
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</tbody>
</table>