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Acronyms and abbreviations

GBD	global burden of disease
GDP	gross domestic product
GMIS	Government Midwifery Incentive Scheme
GP	general practitioner
HEF	health equity fund
HRH	human resources for health
IDI	in-depth interview
LMICs	low- and middle-income countries
M&E	monitoring and evaluation
MDGs	Millennium Development Goals
MPA	minimum package of activities
MRBS	mandatory rural bonded scholarship
NCD	noncommunicable disease
NGO	nongovernmental organization
NHFPC	National Health and Family Planning Commission (of China)
ODA	Official Development Assistance
SDGs	Sustainable Development Goals
UHC	universal health coverage
WHO	World Health Organization

I. Policy Brief

What is the problem?

Sufficient and qualified human resources for health (HRH) are indispensable for achieving universal health coverage as part of the Sustainable Development Goals (SDGs). The World Health Organization (WHO) recommends a threshold of 4.45 physicians, nurses and midwives per 1000 population to meet the SDGs by 2030.

Maldistribution of health workers is a serious concern in the Asia Pacific region. The majority of health workers tend to be concentrated in urban areas, leaving a shortage of health workers in remote and rural areas. This geographical imbalance is more serious in low- and middle-income countries (LMICs). For example, in India in 2015, the doctor-patient ratio was 1:2000 in urban areas, in contrast to 1:20 000 in rural areas. Maldistribution of health workers results in poor availability of health services and negative health outcomes, particularly for vulnerable populations in rural and remote areas.

WHO has developed evidence-based recommendations to improve health worker attraction and retention in rural and remote areas. These recommendations include education, regulation, financial incentives, and personal and professional support. While there is plenty of guidance globally on possible interventions to remedy the maldistribution of the health workforce, there is remarkably little convincing evidence in the Asia Pacific region on interventions that have been effective.

The Asia Pacific Region has unique socioeconomic and health system characteristics. It covers both the most populous countries (e.g. China and India) and small Pacific Island countries (e.g. Tokelau and Niue). Many countries in the region have experienced rapid economic growth in recent decades. The health systems of these countries are undergoing significant changes in terms of health financing reform and private health sector development. Examining how these significant contextual factors affect strengthening of HRH in this region can contribute to our knowledge and provide useful lessons for the region and other countries on how to strengthen their HRH.

This study draws on case studies and a systematic literature review to analyse the key interventions used in the Asia Pacific Region to attract and retain health workers in remote and rural areas. Thirty-nine published articles, including the grey literature from the region, were systematically reviewed. These were supplemented with more detailed case studies from Cambodia, China and Viet Nam, selected on the basis of how well they represented the status of socioeconomic development. Twenty-eight key informants, including policy-makers, health managers, academic experts and rural health workers, were interviewed for the case studies. The implementation process, effectiveness and contextual factors of the interventions identified were analysed.

What do we know (and not know) about viable options to address the problem?

1. Multiple interventions to attract and retain rural health workers in the Asia Pacific region

Countries in the Asia Pacific region have made substantial efforts to attract and retain rural health professionals by implementing a wide range of interventions recommended by WHO. Different patterns of interventions were identified from the literature review and case studies. Thirty-nine interventions were identified in the literature review, among which the most frequently reported were education (16) and regulation interventions (nine). Only two studies reported financial incentives. However, in the case studies from Cambodia, China and Viet Nam, use of financial incentives was frequently reported during the key informant interviews. This difference in findings demonstrates the limitations of relying on the published literature as a source of information.

"Bundles" of linked and coordinated interventions are more likely to attract and retain health workers than single or uncoordinated interventions. Bundled interventions were identified from the literature review, especially from high-income countries. The Jichi Medical University programme in Japan serves as a good example of bundled interventions. This bundled intervention includes linked and coordinated components of education (recruitment of rural students), regulation (compulsory rural services for 9 years) and financial incentives (wavier of tuition fees) into one programme to improve effectiveness.

2. Lack of rigorous evaluation

The majority of the studies reviewed did not report any effective evaluation of the interventions. Only 14 out of 39 studies identified from the literature

assessed the effectiveness of the interventions. Even when a programme was evaluated, most of the evaluation comprised vague descriptions without any statistical data. The case studies revealed several reasons for the lack of rigorous evaluation. First, technical difficulties in evaluation were a major barrier; these included the complexity of interventions, lack of baseline data and/or control group, and multiple effectiveness dimensions with various indicators. Second was the reluctance and lack of interest among those involved in implementing the interventions. National policy-makers in China explained that the evaluation of programmes was often not thought of by the founders and executors of interventions.

3. Effectiveness of interventions

Of those interventions that were actually evaluated, the effects of the interventions seemed to be curiously in line with the expectations, although the data presented were less than robust. Thirteen studies stated that their interventions attracted more health workers to serve in rural and remote areas. Ten studies reported that signing compulsory contracts resulted in an extended length of rural services or a large proportion of health workers remaining in their rural positions. Five studies reported an increase in coverage of health services (e.g. skilled birth attendance), four even reported improved health outcomes (decrease in infant mortality rate or maternal mortality rate). Both the literature review and the case studies revealed that bundled interventions are likely to have a greater effect than single interventions on their own.

It should be noted that weaknesses in the study design of the evaluations reviewed made it difficult to always draw causal inferences. It is hard to tell what the level of attraction and retention would be without the intervention, or to distinguish the effects of different components in the bundled interventions.

4. Context matters

Various contexts, including socioeconomic factors and health system-related issues, have direct and indirect impacts on the attraction and retention of rural health workers. Countries with increasing financial resources (like China) can better afford interventions to strengthen rural HRH. Mandatory rural bonded scholarships are much more likely to influence rural retention in countries where conformity to prescribed behaviour is strong (Japan) and legal contracts are enforced (Australia).

Our case studies found that health systems were an important contextual factor for the development of HRH. Increased autonomy of public hospitals attracted more health workers from rural primary health facilities. Pro-poor health financing policies for universal health coverage (UHC) increased the demand for, and utilization of, health services, and provided financial incentives to motivate rural health workers. The abolition of the referral system in some Asia Pacific countries pushed health workers to move from primary health facilities to higher-level hospitals. The prosperous private health sector led to a brain drain of health workers at rural primary health facilities, given that the attractiveness of working in the private sector outweighed the financial and non-financial incentives offered by the government in rural primary health facilities.

Regardless of the importance of intervention design and implementation, contextual factors are often overlooked when making domestic and global policy recommendations. Although some studies and key informants in our case studies stressed the importance of contextual factors, they were seldom analysed in a systematic way during the policy formulation and implementation process. In most cases, central governments mandated uniform interventions that were then implemented by decentralized administrations. Local authorities were not fully engaged in the decision-making process, missing the opportunity of incorporating local contexts into the design and implementation of interventions to attract and retain health workers in rural and remote areas.

This policy brief highlights the fact that using interventions to strengthen HRH as an individual health system building block in isolation may not result in attracting and retaining health workers in rural and remote areas. Health systems have many interacting parts that operate within social, economic and political contexts. Expecting health workers to stay in facilities that have inadequate supplies and equipment, or where living conditions and educational facilities deter family posting is neither realistic nor practical – even if the staff concerned receive special training and financial incentives. The effectiveness of interventions is inevitably influenced by the effectiveness of governance (in the health sector and beyond) and the relationship between the public and private services. This is especially the case in those countries with limited financial resources, poor governance and limited administrative and managerial capacity, and high levels of social, geographical and gender inequity. In these circumstances, shortage of well-qualified health personnel in rural areas is inevitable if the overall health system remains weak. Single, poorly funded interventions (often supported by donors or nongovernmental organizations [NGOs]) with little political support could hardly be successful.

Recommendations

1. Given the implications and importance of context on strengthening of the rural health workforce, it is necessary to conduct a systematic context analysis when designing, implementing and evaluating interventions, including analyses of economic affordability, social and cultural acceptability, and health system-related factors.
2. The engagement of local authorities in formulating a local HRH plan is critical to ensuring consideration of the local context and priorities, including local living and working conditions, opportunities for training and professional development, and the type of incentives preferred by health professionals.
3. Interventions to attract and retain health workers in rural and remote areas should not be implemented in isolation. Rather, they should be integrated into an overall health system reform, which includes reforms that improve working conditions and governance. Similarly, when developing health system reforms in Asia Pacific countries, their potential impacts on the implementation and effectiveness of interventions to attract rural health workers should be systematically analysed. Furthermore, greater emphasis should be put on leadership development, supportive supervision, pastoral care for staff safety and welfare, and continuing investment in professional development to improve staff productivity and performance.
4. Monitoring and evaluation (M&E) need to be included in the overall study design in order to monitor progress, identify emerging challenges and assess the effectiveness of the interventions. Key performance/output indicators should be included in the M&E, including the number of health workers attracted to the rural post, length of rural services, and proportion of health workers remaining in rural service after a certain period of time. Additionally, M&E should also pay special attention to the local context and its influence on the implementation and effectiveness of the intervention.
5. A platform for mutual learning may be established to promote communication/exchange of information on rural HRH capacity-building in the Asia Pacific region. Although one country cannot replicate exactly the same strategies from another country due to differences in context, there are often many experiences and lessons that can be transferred between countries. The platform can be in various forms, e.g. a web-based knowledge exchange platform or annual/biannual meetings. Standard report templates can be developed for countries in the Asia Pacific region to share their specific policies on health worker attraction and retention, and their output and outcome measures.

II. Working Paper

1. Introduction

Impact of shortage and maldistribution of HRH

Sufficient and qualified human resources for health (HRH) are indispensable for achieving universal health coverage as part of the Sustainable Development Goals (SDGs). The World Health Organization (WHO) recommends a threshold of 4.45 physicians, nurses and midwives per 1000 population to meet the SDGs by 2030. According to this threshold, there will be a projected shortage of 18 million health workers in low- and middle-income countries (LMICs)(WHO, 2016a; WHO, 2016b). The greatest shortage is in South-East Asia in absolute terms and in sub-Saharan Africa in terms of relative need.

Evidence has shown a close association between HRH and population health at the global level. Approximately 90% of maternal deaths and 80% of stillbirths occurred in 58 countries with a critical shortage of trained midwives. The availability of health workers could have helped to avoid millions of unnecessary deaths (WHO, 2013). Studies have found that regions with more health workers were likely to have a lower global burden of disease (GBD) (Anyangwe & Mtonga, 2007; WHO, 2016a; WHO, 2016b). With about 37% of global health workforce, the Americas bore about 10% of the GBD. Africa bore about 25% of the GBD and has about 3% of the global health workforce. One of these studies also pointed out that the Asia Pacific region bore about half of the GBD with only one third of the global health workforce (Anyangwe & Mtonga, 2007). Buchan and colleagues (2013) found that the unavailability of health workers in rural areas could result in high mortality, especially maternal and infant mortality (Buchan et al. 2013).

An improved supply of HRH has been demonstrated to improve health systems performance. Immunization is one example. If more health workers were available, the coverage of three vaccines (measles-containing vaccine, third dose of diphtheria–tetanus–pertussis vaccine, and third dose of polio

vaccine) could be remarkably improved (Anand & Bärnighausen, 2004). Similarly, another study found that 80% coverage of measles immunization and skilled attendance at birth could be achieved when health personnel density was over 2.5 workers per 1000 population (Chen et al. 2004). A cross-country economic study discovered that increasing investment in HRH promoted achievement of the Millennium Development Goals (MDGs), increasing income, reducing poverty and expanding female education (WHO Regional Office for the Western Pacific, 2009).

HRH in the Asia Pacific region

The Asia Pacific region has unique characteristics in terms of socioeconomic and health system context. It covers both the most populous countries (i.e. China, India) and small Pacific Island countries (i.e. Tokelau, Niue). Many countries in the region have experienced rapid economic growth in recent decades. The health systems in these countries are undergoing significant changes in terms of health financing reform and private health sector development.

Shortage of HRH is a critical concerns in the Asia Pacific region (*see* Annex 1 for the list of countries in the Asia Pacific region). Several Asian countries lack of adequate HRH, such as Cambodia, Indonesia, Lao People's Democratic Republic, Myanmar and Viet Nam. A similar situation occurred among the Pacific Island countries, such as Papua New Guinea and the Solomon Islands (Kanchanachitra et al. 2011). HRH shortage is not unique to LMICs (Lehmann et al. 2008). It is also a concern in some high-income countries due to their specific demographic characteristics. According to a report from the Ministry of Health, Labour and Welfare, because of the ageing problem, Japan will have a shortage of 380 000 nursing care workers in 2025 (The Japan Times, 2015).

Maldistribution of health workers is also a serious concern in the Asia Pacific region. The health worker concentration in urban areas has caused geographical disparity (Dolea et al. 2010). For example, in Australia, one general practitioner (GP) serves 998 residents in urban areas, while one GP serves 1551 people in rural and remote areas (RHWA, 2015). The maldistribution was more serious in LMICs. In India, the doctor:patient ratio was 1:2000 in urban areas, in contrast to a ratio of 1:20 000 in rural areas (Chawla, 2015).

Demographic and epidemiological transition, and health system reforms occurring in the Asia Pacific region require more qualified HRH. An ageing population presents challenges in both high-income countries, such as Japan, and some upper-middle-income countries, such as China. These

changing demographics have a significant impact on the pattern of health-care demand. More health workers, especially nurses, are needed to care for the elderly (Rao et al. 2006). In addition, a large number of LMICs, like Thailand and Viet Nam, are undergoing epidemiological transition from communicable/infectious diseases to noncommunicable diseases (NCDs). Some countries experience a double burden of both infectious diseases and NCDs, and may face the threat of new and emerging diseases in the future. Many Asia Pacific countries are undergoing health system reforms to achieve the health-related SDGs, particularly universal health coverage (UHC). Without a sufficient number of qualified health workers, it would be difficult to achieve the health-related SDG targets. Thus, health challenges and health system reforms have urged policy-makers to strengthen HRH as a priority in the Asia Pacific region (WHO Regional Office for the Western Pacific, 2009).

Interventions for attracting and retaining rural health workers

Various recommendations have been proposed to address the global challenges in HRH shortage and maldistribution (Dieleman et al. 2009; Källander et al. 2013; Lehmann et al. 2008; Wilkinson et al. 2001). In 2010, WHO published evidence-based recommendations to increase access to health workers in remote and rural areas through improved retention. The recommended interventions were divided into four categories: education, regulation, financial incentives, and personal and professional support, although there may be some overlap between the categories (Buchan et al. 2013). Many Asia Pacific countries have implemented these interventions to some extent in order to attract and retain health workers at rural health facilities (Matsumoto et al. 2010). While there is plenty of guidance available globally from WHO and others about interventions that might remedy maldistribution of the health workforce, there is remarkably little convincing evidence of effective interventions in the Asia Pacific region.

This working paper aims to investigate the key interventions for attracting and retaining health workers in rural and remote areas in the Asia Pacific region, evaluate their implementation process and effectiveness, and analyse the different contexts that influence their level of success. The working paper will provide evidence-based recommendations to improve and rebalance HRH in countries of the Asia Pacific region and the world.

2. Methodology

This study applied mixed methods, using systematic literature review and country case studies to explore the interventions on attraction and retention of rural health workers in the Asia Pacific region.[1] The Asia Pacific region covers a large population, has a variety of social, economic and political systems, as well as rapidly changing health systems. It also suffers the greatest shortage of HRH in the world. A list of countries in this region is provided in Annex 1.

Systematic review

A systematic literature review was conducted on the topic of attraction and retention of rural health workers in the Asia Pacific region. The systematic review gathered all the available evidence using predesigned search strategies (Cochrane Library, 2011. *See* Annex 2). Evidence from three databases (PubMed, Embase and Cochrane) and five websites (WHO, Global Health Workforce Alliance, World Bank, Global Health Centers for HRH, and Asia Pacific Action Alliance on Human Resources for Health) were included for screening.

The inclusion criteria for literature selection were as follows. (1) Any topic related to interventions on attraction and retention of health workers was eligible, including education, regulation, financial incentives, personal and professional support, and bundled interventions. (2) Any health worker was eligible, including general physicians, specialists, nurses, midwives, pharmacists and traditional health workers. (3) The study settings were limited to rural and remote areas, and contexts were limited to countries and regions in the Asia Pacific. (4) Studies using diverse methodologies

1 The study covers both "attraction" and "retention". In many studies, these two terms are used without clear distinction. The WHO (2010) report's title is about "retention", but the scope of the report includes attraction and retention.

were eligible, including randomized controlled trials, studies with a quasi-experimental design, cohort studies, case-control studies, cross-sectional studies, qualitative studies, reviews and commentaries. (5) Included publications were those published between 1 January 2000 and 31 December 2017. (6) Publications were included only if they were in English.

The exclusion criteria were as follows. (1) There was no intervention or detailed description of the intervention. (2) The topic was about international migration of the health workforce. (3) The participants were not health professionals. (4) The study settings were not in rural or remote areas. (5) The contexts were outside the Asia Pacific region. (6) The abstracts or articles were not available in the included databases. (7) The article was not in English.

Country case studies

We selected Cambodia, China and Viet Nam for conducting case studies to supplement findings from the systematic literature review. Two factors were taken into account in selecting these three countries: (1) they are at different stages of socioeconomic development; and (2) relationships had already been established between the research team and partners from the three countries. In-depth interviews (IDIs) and the grey literature were the main sources of data collection in these case studies. IDIs were conducted with 28 key informants, including four policy-makers, 10 local health managers, five academic experts and rural health workers in Cambodia (9), China (10) and Viet Nam (9). In each country, key informants with extensive experience in HRH were recruited to participate. With assistance from local collaborators, IDIs were conducted to identify which key interventions attract and retain rural health workers. Interviews were conducting using a predesigned interview guide (*see* Annex 3).

Data analysis

1. Systematic review

Narrative synthesis was used to review and synthesize the extracted data from the systematic review. The categorization of interventions on attraction and retention was based on the WHO-recommended framework (WHO, 2010). The indicators for effectiveness covered three dimensions: attraction; retention; and improved health workforce performance (Dolea et al. 2010). Categorization of contexts designed by Liu and colleagues was applied and revised to fit the emerging contexts of the included studies (Liu et al. 2015).

2. Qualitative analysis

To analyse the data from the IDIs, interviews were transcribed verbatim, and thematic analysis was then applied to analyse the qualitative data using Nvivo

11 (QSR International Pty Ltd, Melbourne, Australia). Draft coding nodes were developed for the transcripts (Mullei et al. 2010). The transcripts were then coded to test, validate and refine the nodes. New nodes were created when new themes and subthemes emerged. The nodes were consistent among transcripts (Keane et al. 2012). After coding, the information under each node was summarized to generate a clear picture of the issues that had arisen (Mullei et al. 2010). Quotations from the interviewees were cited to comprehend the underlying mechanisms.

3. Results

Interventions for attracting and retaining rural health workers

This section first presents the interventions identified from the systematic literature review, followed by interventions identified from the three case studies in Cambodia, China and Viet Nam. It ends with a brief summary and comparison analysis of information from the two data sources.

Interventions identified in the systematic review

Table 1 describes the 39 interventions identified by the review for attracting and retaining rural health professionals in the Asia Pacific region. Among the included interventions, 14 were from high-income countries; 13 from Australia and one from Japan. The majority of interventions focused on physicians (N=19). The interventions were divided into four categories, according to the WHO-recommended framework (WHO, 2010).

1. Educational and training interventions

There were nine educational interventions, which involved the components of rural placement, rural education/training and rural recruitment. The length, contents, participants and methodologies of education varied among different studies. A systematic review on strengthening the rural health workforce found that health workers with rural backgrounds were more likely to serve at rural health facilities than those without rural backgrounds (Dolea et al. 2010). An intervention from the Philippines emphasized a rural background in their requirements for recruitment (Cristobal & Worley, 2012). Additionally, rural placement and rurally oriented education were reported to positively influence the future health services in rural and remote areas (Dolea et al. 2010). Three interventions in Australia introduced rural medical education to improve the capacity of various health professionals at rural health facilities. The remaining three programmes (two in Australia and

one in the Marshall Islands of Micronesia) implemented standard medical education for rural health workers.

Task-shifting training was also implemented to create more rural health professionals. Four LMICs (Bangladesh, Bhutan, India and Nepal) conducted task-shifting training among medical officers and nurse anaesthetists to increase the provision of anaesthesia services. Additionally, Bangladesh and India focused on training community female health workers to increase accessible health services related to maternal and infant health, and family planning (Mavalankar & Sriram, 2009).

2. Regulatory interventions

Eight regulatory interventions were reported, including mandatory rural bonded scholarships (MRBS) and compulsory rural services (WHO, 2010). Six MRBS programmes were identified (two in Australia, one in Japan, two in Nepal and one in Thailand) to send and keep physicians in rural and remote areas. Free medical education in return for years of rural services was the basic principle of MRBS. The duration of rural services ranged from two years in Nepal to nine years in Japan (Shankar et al. 2010; Matsumoto et al. 2008).

Two studies from China and Thailand introduced compulsory rural services. Since 1968, the Thai Government has been implementing a policy of compulsory rural service for all new medical graduates from public universities. The length of rural services was three years for physicians and dentists, and two years for nurses (Wiwanitkit, 2011). Similarly, in Beijing, China, 13 urban hospitals sent their physicians to support 11 recipient rural hospitals. The urban physicians were required to serve at least one month every year at the rural hospitals (Jian et al. 2012).

3. Interventions providing financial incentives

The literature review found published evidence on the use of financial incentives to attract and retain rural health professionals from only two countries, the Philippines and Vanuatu. In the Philippines, physicians were recruited as municipal health officers with attractive salaries for two years to work in rural areas (Leonardia et al. 2012). Vanuatu, located in the South Pacific Ocean, gave a monthly financial allowance to rural health professionals (Buchan et al. 2011).

4. Interventions providing personal and professional support

Five interventions for promoting personal and professional support were implemented to strengthen the rural health workforce in Australia. The benefit packages were diverse. The interventions for international nurses and psychiatrists provided better living conditions and family support, while the

intervention introduced by Pond and his colleagues focused on professional development among physicians (Francis et al. 2008; Greenwood & Williams, 2008; Pond et al. 2009). Two other interventions provided support for professional development and the family, such as spouse employment assistance (Morell et al. 2014; Wilkinson et al. 2001).

In addition to the four intervention categories, six studies described the application of bundled interventions, which combined various components of the above four intervention categories (Table 1). Two interventions among various health professionals from Bangladesh and India involved the components of MRBS, financial incentives, and personal and professional support. Interventions from India and Samoa combined financial incentives with personal and professional support. In Australia, psychiatrists and allied health professionals received training and professional network support. In Nepal, family practice doctors, who benefited from professional training and logistical support, had to serve at rural health facilities in return.

Key interventions included from the country case studies

The country case studies examined key interventions for attracting and retaining rural health professionals in Cambodia, China and Viet Nam, based on key informant interviews. The socioeconomic status among and within the three countries meant that each country varied in its current HRH status and heath service needs. As a result of these variations, the interventions on rural health worker attraction and retention had different context-specific influences.

1. Key interventions in Cambodia

Medical education and personal and professional support were the key interventions reported in Cambodia. Findings from key informant interviews showed that because of its weak health workforce and high maternal mortality rate, the Cambodian Government emphasized medical education of mid-level health workers (midwives and nurses). There was a one-year medical education programme for primary nurses and midwives, and a three-year programme for secondary nurses and midwives. Students with 12 years of primary education were eligible to receive free medical education at the regional training centres in four provinces, including Stung Treng, Kampot, Kampong Cham and Tbong Khmum.

Apart from a basic salary, there were several extra sources of financial incentives and allowances in Cambodia. First, the Government issued a midwife incentive scheme to motivate primary and secondary midwives to conduct safe deliveries. Midwives received US$ 15 at health centres

and US$ 10 in hospitals for each safe birth. Second, health facilities were allowed to allocate 60% of the user fees as financial incentives to rural health professionals. Third, in 2000, the Government, with support from several donors, established the health equity fund (HEF) to subsidize the health services for officially registered poor persons. Part of this fund was also allocated to rural health workers as extra incentives. Fourth, village health workers financially benefited from disease prevention and health promotion programmes led by international organizations. Health workers received incentives by assisting with programmes such as dissemination of educational information, case identification and reporting, and expansion of immunization.

In terms of personal and professional support, the Cambodian Government announced in 2016 that all health workers would become civil servants.

2. Key interventions in China

The key informants reported that China implemented a comprehensive package of interventions, including medical education, financial incentives, and personal and professional support.

Special medical education programmes were introduced and implemented in China to equip rural primary health facilities with better qualified health workers. Key informant interviews and policy documents showed that the Central Government issued a medical rural bonded scholarship in 2010. This programme aimed to produce physicians with bachelor degrees for rural township health centres in all the central and western provinces. Eligible candidates received five years of free medical education and a monthly stipend in return for six years of compulsory rural services. This programme recruited 5000 medical students for all the central and western provinces every year since 2010 (Central Government of China, 2010). A cohort study showed that among the first batch of 305 graduates from four universities, 90.7% of them complied with the terms of the contract and worked in rural township health centres after graduation, in contrast to only 2.8% of medical graduates who received standard medical training (Hu et al. 2016).

Additionally, in 2010, the Ministry of Education initiated a new education programme on rural medicine to train more assistant physicians for village clinics. The graduates received an associate degree after three years of education, and were limited to work at rural health facilities (MOE, 2010). The scale of this programme was unclear due to the limited amount of information available. China also used financial incentives as a key intervention to attract and retain rural health workers. In 2008, the Central

Government founded a financial incentive programme that subsidized the annual income of physicians with 20 000 RMB (about US$ 2914) in eight pilot provinces. Later, this programme was scaled up to 23 central and western provinces. According to one key informant who was responsible for evaluating the programme, it successfully recruited 1080 general physicians for 828 township health centres in 218 counties.

Since 2010, the Government has improved personal and professional support to health workers in order to strengthen the capacity of primary health facilities. After ending the policy that allowed health facilities and physicians to make profits from the sale of drugs, the Government was responsible for financing primary health facilities, including infrastructure construction, procurement of equipment and health personnel. These measures largely improved rural working conditions (WHO Regional Office for the Western Pacific, 2015b). Additionally, between 2009 and 2013, the Government allocated special funds to subsidize various in-service training programmes for rural health workers (WHO Regional Office for the Western Pacific, 2015a). Furthermore, a twinning partnership was developed, which paired urban and rural health facilities. The former provided long-term technical assistance to the latter, which helped mitigate professional isolation in rural areas (WHO Regional Office for the Western Pacific, 2015b).

3. Key interventions in Viet Nam

Key informants stated that the Vietnamese Government utilized in-service training, financial incentives, and personal and professional support to build a strong rural health workforce.

Although it could not directly expand the pool of rural health workers, key informants stated that in-service training was widely used to strengthen the capacity of rural health workers. For example, in 2012, 1816 training projects were conducted, mostly in rural areas. Some of the projects included long-term training such as upgrading the qualifications of assistant physicians.

Key informants reported that the Vietnamese Government issued a series of financial incentive policies to improve income among rural health workers. From 2009 to 2014, the Central Government issued Decrees No. 64, No. 73, No. 75, No. 116 and Circulation No. 10, all of which included financial incentives/subsidies. For instance, under Decree No. 64, rural health workers were eligible for an additional 70% of the basic salary as allowance for their first five years of rural service. The amount of the financial incentives varied. Most were available for only a few years. In addition, some local governments with good fiscal status also provided higher income and housing subsidies to attract rural health workers.

In terms of personal and professional support, key informants reported that the Central Government announced Decree No. 117 in 2014, which promoted health workers with more than three years of rural service to the position of civil servant. Being a civil servant is regarded as a stable and promising job in many Asia Pacific countries, and therefore a strong incentive.

Summary of the section

Diverse categories of interventions, including education/training, regulation, financial incentives, personal and professional support, and bundled interventions, were used in Asia Pacific countries to attract and retain rural health professionals. The systematic review found that education and regulation interventions were the most frequently reported interventions in the Asia Pacific region, and findings from the case studies showed that financial incentives were frequently used in Cambodia, China and Viet Nam. Regulatory and financial incentives were the most frequently reported strategies used to attract and retain rural health professionals globally. For example, more than 70 countries in the world implemented regulatory interventions, such as MRBS, compulsory rural service before promotion, and mandatory rural service without any incentive (Frehywot et al. 2010). They were widely applied to deploy and retain health workers in areas with difficult access to primary health care (Frehywot et al. 2010). In addition, as low salary was one of the main reasons for job dissatisfaction in rural and remote areas, financial incentives were important sources of income for rural health professionals in Asia Pacific countries such as Bangladesh, Cambodia, Fiji and Thailand (Henderson & Tulloch, 2008; Rahman et al. 2010). However, financial incentives were rarely reported in the systematic review. Evidence demonstrated that the effectiveness and success of a single financial incentive was limited in its ability to attract and retain rural health workers (Humphreys et al. 2009; Wilkinson et al. 2001). The lack of positive results might in part explain the underreporting of financial incentives in the literature. This highlights the limitations of relying on the published literature as the only source of information.

Implementation of interventions

In most cases, central governments were responsible for developing key interventions while regional health institutions took the responsibility for their implementation under national guidance. Various categories of interventions followed this model, including the medical education and training, and financial incentive programmes in Cambodia, China and Viet Nam, the MRBS programmes in Japan and Thailand, and the bundled interventions in India.

Differences in implementation were observed when local governments implemented the interventions. The MRBS programme in China was a typical example. There was a difference in the recruitment of medical students in the different provinces. In Guangxi and Jiangxi Provinces, each county recruited local students based on scores from the national entrance examination within the quota. However, in Qinghai Province, students with higher scores had greater autonomy in choosing their preferred counties for future rural services. High-scoring students tended to choose developed counties while lower-scoring students had to serve in remote counties. This difference resulted in 100% of the medical students signing the contract with their hometowns in Guangxi Province, but this percentage was only 20% in Qinghai Province (Hu et al. 2016). In Cambodia, public health facilities were allowed to use 60% of user fees as incentives for health professionals. The specific allocation varied and was decided by local health committees.

Apart from implementing centrally designed interventions, some regional governments also initiated their own programmes to strengthen the local health workforce. Implementation varied greatly, depending on the design of the programmes. In Viet Nam, provinces with strong fiscal capacity and desire for strengthening rural HRH offered higher financial incentives and provided better living conditions to attract rural health professionals. For instance, Quang Ngai Province provided 30 million VND (about US$ 1329) per year to attract health professionals to rural services. Additionally, in the compulsory rural service programme in China, the Municipal Health Bureau of Beijing designed a special policy for health professionals from urban hospitals to support their sister hospitals in rural areas as one of requirements for their rank promotion (Jian et al. 2012).

Case studies showed that international organizations provided assistance to LMICs and post-conflict countries to strengthen their rural health workforce through different means, such as offering technical assistance, providing funding support, and implementing disease prevention and health promotion programmes. For example, Cambodia received financial loans from the Asian Development Bank for technical assistance, among others, in identifying appropriate knowledge and skills for training programmes among midwives and nurses.

In collaboration with central or regional governments, universities were another significant stakeholder in capacity-building of the rural health workforce through medical education and training. They were responsible for medical education in the educational programmes in India, an MRBS programme in Nepal at the national level, and technical assistance in the training programmes for community health workers at rural health facilities.

Effectiveness of interventions in attracting and retaining rural health workers

This section starts with an introduction on the evaluation of interventions. The effectiveness of the intervention is then presented according to its sources (first from the systematic review, and then from the case studies). The indicators for intervention effectiveness are grouped into two categories: attraction and retention; and health system performance. The limitations of the evidence are discussed at the end of the section.

Lack of adequate evaluation of effectiveness

The majority of publications identified in the review did not report any effective evaluation of interventions. In the systematic review, 14 out of the 39 studies reported on the effectiveness of the intervention. Most of the studies used one or two effectiveness indicators, and no study reported comprehensive indicators. In the country case studies, one policy-maker in China explained that evaluation of programmes was likely to be neglected by the founders and executors due to lack of interest. Even when a programme was evaluated, most often the evaluation lacked a rigorous study design and reported only vague descriptions without presenting robust statistical data. For instance, one evaluation report of a GP programme from the National Health and Family Planning Commission (NHFPC) in China claimed to have improved the health workforce in one county. However, detailed evidence such as an increased number of physicians, duration of service and attrition rate, was not available (key informant interview with researcher from China).

The literature reported several challenges in the evaluation of interventions. First, evaluation itself was difficult. A rigorous evaluation should cover multiple dimensions with various indicators (Huicho et al. 2010). In the case of bundled interventions, it was hard to isolate the effectiveness of one specific component of the intervention from the other components (Kanchanachitra et al. 2011). Furthermore, most programmes did not have baseline data, which made it difficult to compare changes before and after the interventions. Other factors also led to a lack of evaluation, including limited research resources, poor capacity for M&E, and lack of proper control groups (Huicho et al. 2010). Although the evaluation of interventions was often neglected, the value of evaluation was emphasized in a number of studies. An assessment of HRH programmes stated that evaluation benefited HRH programmes and policies by monitoring trends, identifying emerging challenges and empowering the network for future cooperation (Dal Poz et al. 2015).

Effectiveness of interventions from the systematic review

Table 2 displays the effectiveness of interventions from the systematic review in terms of attraction and retention of rural health workers, and improved health system performance. As can be seen, half of the evaluated studies were from high-income countries.

1. Effectiveness in attracting and retaining rural health workers

The number of health professionals attracted, length of rural services and retention rates (proportion of health workers remaining in rural areas after the programme) were often used as key indicators to evaluate the effectiveness of the intervention.

Thirteen studies claimed that their interventions attracted various health professionals to serve in rural and remote areas. The number of health professionals attracted varied from 11 psychiatrists in an Australian study with personal and professional support to 93 000 educated lady health workers (most working in rural areas) in Pakistan (Wilks et al. 2008). The huge range of rural health professionals attracted to rural areas between the various interventions was due to differences in programme design and scale of programme implementation.

Among the four MRBS programmes (two in Australia, one in Japan and one in Thailand) in the category of regulation, the effect of the intervention on attraction varied. Graduates from Jichi Medical University had a very high compliance rate with the compulsory rural service requirement in return for free medical education (Matsumoto et al. 2008). In addition, positive feedback on attraction was also reported in Ateneo de Zamboanga University among medical students with rural backgrounds in the Philippines (Cristobal & Worley, 2012), in the rural practice programme in Australia (Greenhill et al. 2015), compulsory rural service programme among urban physicians in China (Jian et al. 2012), and in the bundled interventions combining financial incentives, and personal and professional support in India (Bhushan & Bhardwaj, 2015).

The effectiveness of interventions on retention of rural health professionals was described in ten interventions. There were nine studies reporting on length of rural services. Due to differences in programme design, the average duration of rural services differed greatly, ranging from 1.4 working months per health professional in the compulsory rural services programme in China to 8.7 working years in the MRBS programme in Japan (Jian et al. 2012; Matsumoto et al. 2008). Only five studies showed the retention rate after the interventions, including two personal and professional support programmes in Australia, and three MRBS programmes in Australia, Japan and Thailand

(Dunbabin et al. 2006; Matsumoto et al. 2008; Pagaiya et al. 2015). The retention rates of personal and professional support programmes and the MRBS programme in Australia were higher than in the MRBS programmes in Japan and Thailand.

2. Effectiveness in improving health system performance

Six studies reported an improvement in health system performance after the interventions in terms of expanding health service coverage and improving health outcomes. Five studies reported expanded health service coverage as a result of the interventions. The medical education programme in the Philippines reported an 11% increase in health service coverage while the bundled intervention in India resulted in only 1.3% increase in the number of accessible health facilities (Cristobal & Worley, 2012; Bhushan & Bhardwaj, 2015).

In terms of improved health outcomes, four studies reported positive feedback. A 90% decrease in the infant mortality rate was found in the medical educational programme in the Philippines (Cristobal & Worley, 2012). Compulsory rural services among urban physicians in China presented unconvincing results for mortality reduction in most rural hospitals as it lacked accurate supporting statistics (Jian et al. 2012). Both the interviewees in the case studies and the literature found that bundled interventions were more effective than single interventions (Kanchanachitra et al. 2011). For example, several studies suggested that the combination of financial incentives and other components, such as rural recruitment and task-shifting, were likely to be more effective (Buykx et al. 2010; WHO, 2010). Frehywot and colleagues (2010) also stated that if the compulsory service programmes were linked with other incentives, such as free medical education and professional promotion, they could greatly enhance the deployment and retention of rural health workers.

Effectiveness of interventions: evidence from the country case studies

In the country case studies, various indicators were used to evaluate the effectiveness of interventions in attracting and retaining rural health professionals. The respondents reported positively on the financial incentives in Cambodia, the MRBS programme in China and the qualification upgrading programme in Viet Nam.

The financial incentives programme in Cambodia showed positive results both in attracting and retaining rural health professionals, and in improving population health. The Government Midwifery Incentive Scheme (GMIS),

which increased midwife income levels, was successful in retaining midwives at rural health facilities, and improving maternal and child health.

The MRBS programme in China demonstrated effectiveness in mitigating physician shortages in township health centres in China through its compulsory rural service requirement. The socioeconomic differences between urban and rural areas in China made it difficult to retain health professionals in rural health facilities. The compulsory requirement for rural service kept health workers in rural areas for a certain period of time (key informant interview with an academic expert in China).

The Viet Nam programme that upgraded qualifications for assistant physicians produced a large number of physicians to serve at rural health facilities in the past decade. Before 1995 some community health stations did not have health workers; after the implementation of this programme, almost 100% of them have physicians in place.

"The MRBS programme recruits 5000 medical students every year at the national level. Even though 20% of the students (1000) do not work in rural areas after graduation, the remaining 4000 students will still work in rural areas for five years, which is still good. I think the effectiveness of the programme depends on its effects on attracting primary health workers in rural areas, instead of the programme itself. It is not appropriate to conclude that the MRBS programme is not effective because 20% of the participants refuse to work in rural areas. It is the 80% of the participants that we pay attention to." (National policy-maker from China)

"Among the trained assistant physicians, 90% of them came back to provide health services. Most participants are working in the DHs and are satisfied with their work... I think this is very effective. Before 1995, some community health stations did not even have health workers. Now almost 100% of CHSs have medical doctors." (Provincial health manager from Viet Nam)

Summary of the effectiveness of implemented interventions

The effectiveness of the interventions varied according to the intervention and country. In the systematic review, most of the evaluated interventions were found to be effective in attracting and retaining rural health workers. Regulatory interventions were more effective in attracting and retaining health professionals than other types of interventions. In the country case studies, the effectiveness varied among different interventions. The MRBS programme was reported to be effective in mitigating the shortage of licensed physicians at primary health-care facilities.

It should be noted that there might be publication bias, as probably only positive results have been reported. Interventions that did not show the intended results or showed negative effects were neglected in the literature and interviews. In addition, weakness in the study design of the evaluations was another factor that made it difficult to draw any causal inference from the evaluation exercise. For example, it is not easy to conclude whether the observed differences between participants and non-participants are due to selection effects or the intervention (Bärnighausen & Bloom, 2009).

Effects of contexts on attracting and retaining rural health workers

Different contexts would often affect the implementation and effectiveness of interventions (Lehmann et al. 2008; Mays et al. 2005). Moore and colleagues (2015) pointed out that implementation of interventions was often localized and diversified due to existing contexts, which in turn led to variations in effectiveness (Moore et al. 2015). Understanding how the interventions work in different contexts can also facilitate evaluation and transferability of findings to other settings (Rycroft-Malone et al. 2013). Regardless of the importance of context analysis, there was little evidence of the implications of contexts on the design, implementation and effectiveness of interventions for strengthening the rural health workforce. A study on health system contexts (Collins et al. 1999) stated that the implications of contexts are often neglected, resulting in negative consequences of interventions, such as low cost–effectiveness, poor health service performance and poor health status among the population. Liu and his colleagues (2015) summarized the impact of political, economic and social factors, and health system- and implementation process-related contexts on compulsory and incentive-based strategies (Liu et al. 2015). Analysis of contexts on other interventions in specific countries are often lacking.

Table 3 presents the list of contexts that are discussed in 19 published articles and reports, including political, economic and social issues, health systems and others.

Political, economic and social issues

1. Political context

HRH in rural areas are affected by political and socioeconomic factors at the macro level. Political insecurity could negatively influence the sustainability of interventions to improve HRH. The existence of corruption could lead to heavy wastage of resources from international donors. Corruption also

resulted in lower effectiveness of the incentive programme in Asia Pacific countries (Henderson & Tulloch, 2008).

2. Economic development

The pool and distribution of health workers was largely determined by economic development status. There was a positive relationship between gross domestic product (GDP) per capita and density of health workers. In 2015, the GDP per capita was US$ 14 100 in China, which was much higher than in Viet Nam (US$ 6000) and Cambodia (US$ 3500) (CIA, 2016a; CIA, 2016b; CIA, 2016c). Meanwhile, the number of health workers per 1000 population in China (4.9 in 2012) was larger than in Viet Nam (2.6) and Cambodia (1.4) (National Health and Family Planning Commission, 2016; WHO, 2012; WHO Regional Office for the Western Pacific, 2015a). In addition, regional economic disparities within countries led to the maldistribution of health workers. For instance, the density of health workers in China was 5.3, 4.6 and 4.7 per 1000 population in the eastern, central and western areas, respectively (WHO Regional Office for the Western Pacific, 2015b). A similar situation was reported in Cambodia, where about 40% of general physicians and 74% of specialist physicians were concentrated in the capital city of Phnom Penh (WHO Regional Office for the Western Pacific, 2015a).

Without a strong, sustainable economy, it is hard to achieve universal health coverage. A slow-growing or declining national economy undermines the sustainability of capacity-building of HRH and destabilizes the health workforce (Cameron Health Strategies Group, 2013). Fiscal capacity determines the amount of funding available for public health services and recruitment of health professionals. Variations in fiscal capacity among local governments in India led to the regionally imbalanced distribution of HRH. Because most local governments had limited fiscal capacity, the majority of HRH flowed to the central health facilities. Centrally concentrated HRH make health personnel shortages inevitable in rural and remote areas (Satpathy & Venkatesh, 2006).

Economic disparities among different countries were also reflected in the design of interventions. China had strong economic capacity to scale up financial incentives and compulsory rural services, with incentives for general physicians. With its constrained economy, Cambodia emphasized primary and associate medical education for midwives and nurses.

3. Social and cultural factors

The distinctive culture of the Asia Pacific region has played an essential role in the mobility and production of rural health professionals, as reported in eight studies. For example, the management culture in Asia Pacific countries

influences HRH. An ingrained practice is the granting of professional promotion on the basis of seniority; it is the primary criterion in the management systems of many Asia Pacific countries. In this context, however, the effects of performance-based incentives on health professionals are limited, especially for younger professionals (Henderson & Tulloch, 2008). Additionally, social accountability could promote the production of rural health professionals. In Zamboanga province in the Philippines, the public health sector prioritized local population health by promoting medical education and health service activities. They established Ateneo de Zamboanga University to specifically develop rural health professionals (Cristobal & Worley, 2012). Social accountability also motivated the graduates to work for local health facilities (Cristobal & Worley, 2012).

Other social factors have also influenced the design of interventions. For example, Cambodia has a long history of colonialism and domestic conflict (WHO Regional Office for the Western Pacific, 2015a) and, as a result, its rural education and infrastructure were poor. Most students dropped out of school in the eighth or ninth grade. This raised a big challenge for the recruitment of candidates to midwifery and nursing education programmes, which required that the candidates should have at least 12 years of primary education. In order to recruit enough candidates, the government had to reduce the educational requirement to seventh grade.

"We lack people with enough educational background, like students with a high school diploma…The civil servant standard requires the students to have 12 years of primary education plus another 1 year of medical education to become primary midwives and nurses, and 12 plus 3 years to become associate (midwives and nurses). Most students in the communities have only 7 years of schooling… That's why we don't have many health workers." (National policy-maker from Cambodia, IDI)

Health system-related factors

As a key component of health systems, HRH is considerably affected by other health system building blocks, such as governance, health financing, physical resources, the private sector and service delivery.

1. Governance

Seven studies reported that governance was a significant context influencing rural HRH. As defined by WHO, governance in the health sector is dominated by the government, which adopts the role of steering and decision-making in order to achieve UHC (WHO, 2017). Governance is a complex process, and includes directing policy development and implementation, monitoring

changing trends, integrating health into national development, regulating stakeholders and setting up accountability mechanisms. These processes require good collaboration between the public and private sectors, and civil society (WHO, 2017). Governance directly affects capacity-building of rural HRH. A systematic review of effective retention incentives for rural health workers in Australia concluded that good governance was more likely to produce a sustainable rural health workforce (Buykx et al. 2010). A multicountry case study found that centralized governance hampered community involvement during the implementation of training programmes for community health workers in the LMICs (Gopinathan et al. 2014).

"…Local governance and management are very important…Implementing a programme usually needs much communication with various stakeholders. If the officers have strong responsibility, they will try their best to achieve the goals…." (National policy-maker from China)

2. Health financing

The significance of health financing was reported in three studies. The study on incentive-based programmes in the Asia Pacific region states that sustainable health financing was indispensable for maintaining a strong health workforce (Henderson & Tulloch, 2008). A study in Thailand used discrete choice experiments to illustrate that better health insurance coverage could have the greatest impact on an increase in the uptake of nurses in rural posts (Blaauw et al. 2010).

Health financing policies in all the three countries where the case studies were carried out brought opportunities for rural health facilities to attract and retain health workers. Both the Chinese and Vietnamese governments increased financial investment to expand health insurance coverage. In China, the New Rural Cooperative Medical Scheme established in 2003 covered a majority of the rural population. Together with two other basic health insurance schemes for urban employees and urban residents, about 96% of the whole population had been enrolled in health insurance schemes by 2014 (WHO Regional Office for the Western Pacific, 2015b). In Viet Nam, under the Revised Health Insurance Law, compulsory health insurance was implemented in 2015. It had covered about 81% of the population by 2016. Improved health coverage greatly increased the demand for health services, especially in rural areas (WHO Regional Office for the Western Pacific, 2015b). The increase in utilization of rural health services led to an increase in demand for qualified health workers, which in turn promoted the need to scale up interventions for attracting and retaining HRH.

In Cambodia, key informants explained that health financing policies provided extra financial incentives for rural health workers. First, a health equity fund was established in 2000 to subsidize the poor so that they could have access to free health services, and was also used to provide financial incentives for rural health workers. The Ministry of Health has been scaling up health equity funds throughout the whole country and including other vulnerable groups (USAID, 2016). The expanding coverage of health equity funds was expected to give rural health workers extra income. Second, Official Development Assistance (ODA) was another main financing source that provided extra income for rural health workers. ODA contributed 20% of total health expenditure in 2012 (WHO Regional Office for the Western Pacific, 2015a). It economically benefited rural health workers through funding disease prevention and health promotion programmes. Village health workers received financial support from the ODA programmes through implementing activities such as data collection and patient referrals.

"The health equity fund would be quite significant because it can be used by health staff. They provide a substantial supplement to the income in particular poor areas…Global Fund and JICA are still paying incentives. They have directed more funding to the staff working in rural facilities…village malaria workers receive regular payment because they do quite a lot of important work in terms of quick tests for malaria and data collection. They do community identification of malaria patients and refer them to health centres." (Academic expert from Cambodia, IDI)

3. Physical resources

Within the health system, the availability of physical resources could push or pull rural health professionals. Seven studies found that limited physical resources, such as limited hospital equipment or medical supplies, were common in low-income countries. Physical resources were vital for rural health professionals, as they provided basic support for health service operations. For example, due to the lack of equipment, health centres in Cambodia could not diagnose tuberculosis. After collecting samples from suspected tuberculosis patients, rural health professionals needed to transfer these to hospitals, which increased their workload (Chhea et al. 2010). The barriers caused by limited physical resources need to be overcome in order to successfully attract more health professionals to rural and remote areas (Snadden et al. 2011).

4. Private sector

In many Asia Pacific countries, an expanding private health sector is increasingly competing with the public health sector in attracting able health professionals. Four studies in our systematic review reported that the

private sector attracted health professionals from the public sector. The Thai Government set high tuition fees at public medical universities while offering medical students tuition waivers as long as they fulfilled a 3-year rural service commitment after graduation. However, the private sector put this programme at risk because private hospitals in urban areas attracted public health professionals by offering higher incomes, better working environments and professional development.

Based on interviews with the key informants, dual practice in the public and private health sectors was popular in both Cambodia and Viet Nam. In Viet Nam, the private health sector provided 60–75% of ambulatory health services, 40% of outpatient services and 4% of inpatient services (WHO, 2012). Over half of the public health workers were also in private practice. A similar situation was reported in Cambodia where about one quarter of all health workers were also private health-care providers (CIA, 2016a). About 56% of public health workers had a dual practice in the private health sector (MOH, 2014). Dual practice made a significant contribution to health workers' income. In the public health sector, the monthly income ranged from US$ 169 for primary nurses and midwives to US$ 320 for physicians. Under dual practice, the monthly income ranged from US$ 400 for nurses and midwives to US$ 1500 for specialist physicians (MOH, 2014).

The growing private health sector in Cambodia and Viet Nam was a threat to the implementation of financial incentives to attract and retain rural health workers. Most private hospitals were in urban areas, and they offered higher salaries to recruit staff.

"If there is no opportunity for staff to practise in the rural areas outside their public roles, it is very hard to retain them…The population is small and the opportunity for doing private practice is very limited. So the specialist staff don't stay there and they go to provinces with a large population." (Academic expert from Cambodia, IDI)

"The doctors serving in hospitals are also allowed to practise in the public and private sectors. They have public income as well as private income while the doctors at the primary level only have public income. This is not consistent." (Academic expert from the WHO Country Office in Viet Nam)

In the past decade, the private health sector has dramatically increased in China, from 10% of all hospitals in 2002 to 53% in 2015 (National Health and Family Planning Commission, 2016). However, the size of private hospitals was usually small, reflected by the fact that they only contributed to 15% of all hospital beds and 12% of outpatient services in 2015 (National Health and Family Planning Commission, 2016). Key informants reported

that public hospitals still played a dominant role in China and could provide better career development opportunities. Private hospitals were reported to have difficulty in recruiting qualified physicians although they often offered higher compensation. In China, few physicians from public hospitals had dual practice in the private health sector.

5. Primary service delivery system

Reforms in the primary service delivery system indirectly influenced the planning and structure of HRH in Cambodia, China and Viet Nam. The Vietnamese Government abolished its referral system in January 2016. Key informants reported that this reform drove more patients to visit district hospitals and significantly decreased the patient volume in health centres. Reduced outpatient services decreased service revenue and available financial incentives for rural health workers, pushing them away from rural primary health facilities. The same situation occurred in China in the 1980s when the gate-keeping system was abolished and patients had the freedom to choose public hospitals as their first point of contact (Liu et al. 2006).

"In the past, every insured patient had to go to the health centres first while now they can directly go to the district hospitals or other health centres if they like… Patients have a tendency to go to the district hospitals because there are more health services they can use there. The patients think that health workers at district hospitals have higher qualifications and are better equipped. The list of essential medicines is also more diverse in the district hospitals. " (Rural health workers from Viet Nam, IDIs)

In Cambodia, the Government issued a minimum package of activities (MPA) in 1996 to serve as operational guidelines for health centres. Updated every five years, the MPA provided detailed requirements on service provision, health workforce management and development of health facilities. As defined by the MPA, primary and secondary midwives and nurses were qualified and responsible for health services at health centres. If advanced health services were needed, patients could go to the physicians at district or higher-level hospitals. Key informants argued that under the current MPA, only nurses and midwives, rather than physicians, were needed at health centres to provide relevant services. The MPA helped ensure that the existing health workforce was efficiently utilized.

"It relates to our minimum package of activities and comprehensive package of activities. Health centres provide only health education, obstetric activities and immunization. When health services are not available in the health centre, patients are referred to the hospitals where there are doctors. In the future, if the minimum package of activities and comprehensive package of activities

changed, we would also change in accordance…If the population size increases, they would have to upgrade their services. The health centres would become hospitals, which means that they would need doctors. If the services aren't needed, we don't want to underuse our staff." (National policy-maker from Cambodia, IDI)

Other contextual factors

Other contexts such as geography, language and technology also contributed to the effectiveness of interventions, as depicted by three studies. The geography of the Pacific Island countries is often fragmented and isolated, with small populations. With recent urbanization, the outer islands may be neglected in terms of economic growth and health service delivery. Another context contributing to the effectiveness of an intervention was language. Difficulties in understanding the language could hamper medical education and training of health workers. Gopinathan and his colleagues (2014) discovered that health professionals from several states in India were uncomfortable with the medium of instruction, which undermined the effectiveness of their training. Finally, the effect of technology has been described in the literature. Technology has been widely applied to the delivery of training and promotion of distance communication. Distance education allowed rural health professionals to be trained without having to travel long distances, and mitigated professional isolation at rural health facilities (Snadden et al. 2011).

4. Policy implications and recommendations

1. Given the implications of contexts on strengthening the rural health workforce, it is necessary to conduct systematic context analysis when designing, implementing and evaluating interventions, including analysis of economic affordability, social and cultural acceptability, and health system-related factors.
2. The engagement of local authorities in formulating a local HRH plan is critical to ensure consideration of the local context and priorities, including local utilization of services, availability of an appropriate skill mix and productivity of health staff. In formulating local solutions, the local authorities should review impediments to and opportunities for staff recruitment based on analysis of specific requirements, such as improvement in living and working conditions, opportunities for training and professional development, and the type of incentives preferred by health professionals and relevant staff.
3. Interventions to attract and retain health workers in rural and remote areas should not be implemented in isolation. Rather, they should be integrated into an overall health system reform, which includes reforms that improve working conditions and governance. Similarly, when developing health system reforms in Asia Pacific countries, their potential impact on the implementation and effectiveness of interventions to attract rural health workers should be systematically analysed and relevant measures taken when necessary. For example, when evidence becomes available that a pro-poor health financing policy has increased the demand for health services and financial resources for primary health-care facilities, it may open a policy window for implementing relevant interventions to attract health workers. Furthermore, greater emphasis should be put on leadership development, supportive supervision, pastoral care for staff safety and welfare, and continuing investment in professional development to improve staff productivity and satisfaction.

4. M&E need to be included in the overall study design in order to monitor the progress, identify emerging challenges, and assess the effectiveness of the interventions. Key performance/output indicators should be included in the M&E, including the number of health workers attracted to the rural post, length of rural services, and proportion of health workers remaining in rural service after a certain period of time. M&E should also pay special attention to the local context and its influence on the implementation and effectiveness of the intervention.
5. A platform for mutual learning may be established to promote communication/exchange of information on rural HRH capacity-building in the Asia Pacific region. Although one country cannot replicate exactly the same strategies as other countries due to different contexts, there are often many experiences and lessons that can be transferred between countries. The platform can be in various forms, e.g. a web-based knowledge exchange or annual/biannual meetings. Standard report templates can be developed for countries in the Asia Pacific region to share their specific policies on health worker attraction and retention, and their output and outcome measures.

Table 1: Overview of the included interventions from the systematic review

Interventions	Study	Country	Period	Professional Cadres	Components
Education	(Latham et al. 2007)	Australia	2003–2004	25 Enrolled nurses	Part-time 4-year distance rural education
	(Gupta et al. 2014)	Australia	2005–2011	536 Physicians	Rural medical education and rural internship
	(Koczwara et al. 2010)	Australia	2007–2008	769 Cancer health-care workers	7.5-hour online education on palliative oncology
	(Williams et al. 2014)	Australia	2011	2 Physiotherapists	6-month physical health education
	(Chang et al. 2002)	Australia	N/A	303 Registered nurses	12-month rural education on mental health
	(Nixon et al. 2017)	New Zealand	2002–	Rural general physicians	4-year rural vocational training
	(Cristobal & Worley, 2012)	Philippines	1994–2011	164 Physicians	Rural recruitment; 1-year rural practice
	(Raha et al. 2010)	India	2003–2005	2200 Physicians	3-year rural education
	(Keni, 2006)	Marshall Islands of Micronesia	2004–2005	16 Male health assistants	5-month education and practice

Table 1: Overview of the included interventions from the systematic review (cont.)

Interventions	Study	Country	Period	Professional Cadres	Components
Education	(Mavalankar & Sriram, 2009)	Nepal	1996–	Anaesthesia assistants (3-month training: n=50; 6-month training: n=74)	Initially 3-month; currently 6-month task-shifting training
	(Mavalankar & Sriram, 2009)	Bangladesh	1993–1998; 2000–	Medical officers	1-year training; 17-week task-shifting training
	(Ahmed & Jakaria, 2009)	Bangladesh	2004–2008	4000 Family planning workers	6-month training
	(Mavalankar & Sriram, 2009)	Bhutan	2002–	Nurse anaesthetists (2–4 per year)	1-year task-shifting training
	(Mavalankar & Sriram, 2009)	India	2003–	500 Medical officers	18-week task-shifting training
	(Sundaraman et al. 2012)	India	2005–	846 809 Female community health workers	Rural training
	(Bhushan & Bhardwaj, 2015)	India	2006–2013	1500 Physicians	16-week comprehensive training on emergency obstetric care

Table 1: Overview of the included interventions from the systematic review (cont.)

Interventions	Study	Country	Period	Professional Cadres	Components
Regulation	(Wiwanitkit, 2011)	Thailand	1968–2010	Public health workers	3-year rural service for physicians and dentists and 2 years for nurses
	(Pagaiya et al. 2015)	Thailand	2000–2011	1093 Physicians	Rural recruitment; 3-year free rural education; 3-year rural practice; 3-year rural services
	(Jian et al. 2012)	China	2008–2010	1200 Urban physicians	1 month/year rural services; training to rural physicians
	(Matsumoto et al. 2008)	Japan	1978–2006	2988 Physicians	6-year free medical education; 3-year postgraduate training; 6-year rural services
	(Turner & Scott, 2007)	Australia	1995–	Physicians	Free medical education in return for rural services; personal and professional support
	(Devine et al. 2013)	Australia	2000–2010	146 Physicians	Free medical education; 2-year rural services
	(Woolley et al. 2016)	Australia	2000–	Physicians	Rural recruitment, rural placement, scholarships worth over $25 000, 6-year rural services
	(Solez et al. 2012)	Nepal	2010–2012	Physicians	Free medical education in return for rural services
	(Shankar et al. 2010)	Nepal	N/A	Physicians	Free medical education; 2-year rural services

Table 1: Overview of the included interventions from the systematic review (cont.)

Interventions	Study	Country	Period	Professional Cadres	Components
Financial incentives	(Cristobal & Worley, 2012)	Philippines	1993–2011	452 Physicians	2-year rural services
	(Buchan et al. 2011)	Vanuatu	N/A	Health workers	Monthly financial allowance
Personal and professional support	(Wilks et al. 2008)	Australia	1994–2006	11 International psychiatrists	Better living conditions and educational opportunities for their children
	(Wilkinson et al. 2001)	Australia	1995–1999	17 Physicians	Academic, technology and accommodation support
	(Pond et al. 2009)	Australia	2002–2009	Medical specialists	Educational upskilling or rural-specific clinical practice, and peer support
	(Morell et al. 2014)	Australia	2012–2013	349 Health workers	Case-managed recruitment and retention support, including psychosocial and professional development support, and spousal employment assistance.
	(Francis et al. 2008)	Australia	N/A	18 International nurses	Better living conditions

Table 1: Overview of the included interventions from the systematic review (cont.)

Interventions	Study	Country	Period	Professional Cadres	Components
Bundled interventions	(Rawal et al. 2015)	Bangladesh	1971–2013	Various health-care workers	Rural education and internship; 2-year rural services; monthly hardship allowance; better living and working conditions, and professional support
	(Greenwood & Williams, 2008b)	Australia	2006–2007	106 Psychiatrists and allied health professionals	6-month training; professional network-building
	(Woolley et al. 2016)	Australia	1988–2014	Physicians	2-year financial support during undergraduate study in return for 2-year rural services with relocation allowance and professional support
	(Zimmerma-net al. 2016)	Nepal	2011–2015	20 Family practice doctors	3-year rural services; in-services training; comfortable quarters and available Internet
	(Sundarara et al. 2011)	India	2005–2009	82 343 Skilled health workers	Free education in return for 7-year rural services; monthly financial incentives; better living and working environment
	(Lisam et al. 2015)	India	2010–2011	1319 Health workers	Monthly financial incentives; health insurance; extra marks for postgraduate admission
	(Buchan et al. 2011)	Samoa	N/A	Health workers	Outreach services from urban health facilities; financial incentives for rural health workers

Table 2: Overview of effectiveness of interventions from the systematic review

Intervention	Study	Country	Professional cadres	Attraction Number of newly recruited health workers in rural area	Retention 1. Average service duration 2. Retention rate	Improved health system performance 1. Health service coverage 2. Health status
Education	(Greenhill et al. 2015)	Australia	Physicians	1224	1. 1 working year 2. N/A	1. N/A 2. N/A
	(Cristobal & Worley, 2012)	Philippines	Physicians	128	1. N/A 2. N/A	1.Increased by 11% 2. Infant mortality rate decreased by 90%
Regulation	(Jian et al. 2012)	China	Urban physicians	1200	1. 1.4 working months 2. N/A	1. N/A 2. Vague results of reductions in mortality rate in most rural hospitals
	(Bhushan & Bhardwaj, 2015)	India	General physicians	1500	1. N/A 2. N/A	1. Increased by 131% for hypertension, 171% for haemorrhage, 111% for abortion, 106% for sepsis and 102% for other complications, and 58% for antenatal care 2. N/A

Table 2: Overview of effectiveness of interventions from the systematic review (cont.)

Intervention	Study	Country	Professional cadres	Attraction Number of newly recruited health workers in rural area	Retention 1. Average service duration 2. Retention rate	Improved health system performance 1. Health service coverage 2. Health status
Regulation	(Dunbabin et al. 2006)	Australia	Physicians	82	1. 2 working years 2. 43%	1. N/A 2. N/A
	(Devine et al. 2013)	Australia	Physicians	126	1. 2.2 working years 2. N/A	1. N/A 2. N/A
	(Matsumoto et al. 2008)	Japan	Physicians	2882	1. 8.7 working years 2.10.7%	1. N/A 2. N/A
	(Pagaiya et al. 2015)	Thailand	Physicians	1093	1. 3.9 working years 2. 28.9%	1. N/A 2. N/A
	(Zimmerman et al. 2016)	Nepal	Physicians	20	1. 3 working years 2. 75%	1. 203% increase in delivery; provision of comprehensive emergency obstetric care 2. N/A

Table 2: Overview of effectiveness of interventions from the systematic review (cont.)

Intervention	Study	Country	Professional cadres	Attraction Number of newly recruited health workers in rural area	Retention 1. Average service duration 2. Retention rate	Improved health system performance 1. Health service coverage 2. Health status
Financial incentives		N/A	N/A	N/A	N/A	N/A
Personal and professional support	(Gardiner et al. 2006)	Australia	General physicians	N/A	1. N/A 2. 5% reduction in desire to leave	1. N/A 2. N/A
	(Wilks et al. 2008)	Australia	International psychiatrists	11	1. Increased from 18 months in 1994 to 4 years in 2006 on average 2. N/A	1. N/A 2. N/A
	(Wilkinson et al. 2001)	Australia	Physicians	17	1. 1.2 working years 2. 47.06%	1. N/A 2. N/A
Bundled interventions	(Lisam et al. 2015)	India	Physicians	1319	1. 2 working years 2. N/A	1. Health facilities; became more accessible in remote areas 2. N/A

Table 3: Categorization of contexts from the systematic review

Category	Study	Contexts	Number of studies reporting contexts
Socioeconomic factors	(Gopinathan et al. 2014); (Henderson & Tulloch, 2008); (Snadden et al. 2011); (Strasser & Neusy, 2010)	Fiscal capacity	4
	(Cristobal & Worley, 2012); (Gruen et al. 2002); (Keni, 2006); (Henderson & Tulloch, 2008); (Strasser & Neusy, 2010); (Snadden et al. 2011); (Wilks et al. 2008)	Culture	7
Health system-related factors	(Buykx et al. 2010); (Gopinathan et al. 2014); (Henderson & Tulloch, 2008); (Huang et al. 2013); (Lisam et al. 2015); (Raha et al. 2010); (Snadden et al. 2011)	Governance	7
	(Gopinathan et al. 2014); (Snadden et al. 2011); (Williams et al. 2014)	Health financing	3
	(Chhea et al. 2010); (Gopinathan et al. 2014); (Gruen et al. 2002); (Henderson & Tulloch, 2008); (Snadden et al. 2011); (Strasser & Neusy, 2010); (Williams et al. 2014)	Physical resources	7
	(Chhea et al. 2010); (Gopinathan et al. 2014) ; (Gruen et al. 2002)	Shortage and maldistribution of HRH	3
	(Chhea et al. 2010); (Henderson & Tulloch, 2008); (Huang et al. 2013); (Wiwanitkit, 2011)	Private sector	4
	(Chhea et al. 2010); (Gruen et al. 2002)	Service delivery	2
Other factors	(Henderson & Tulloch, 2008)	Geography	1
	(Gopinathan et al. 2014)	Language	1
	(Snadden et al. 2011)	Technology	1

ANNEX 1. Countries and areas of the Asia Pacific Region

WHO Western Pacific Region

American Samoa, Australia, Brunei Darussalam, Cambodia, China, Cook Islands, Fiji, French Polynesia, Guam, Hong Kong (Special Administrative Region [SAR] of China), Japan, Kiribati, Lao People's Democratic Republic, Macao (SAR China), Malaysia, Marshall Islands, Federated States of Micronesia, Mongolia, Nauru, New Caledonia, New Zealand, Niue, Commonwealth of the Northern Mariana Islands, Palau, Papua New Guinea, Philippines, Pitcairn Islands, Republic of Korea, Samoa, Singapore, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu, Viet Nam and Wallis and Futuna.

WHO South-East Asia Region

Bangladesh, Bhutan, Democratic People's Republic of Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand and Timor-Leste.

ANNEX 2. Search strategies

#1: Search terms regarding participants

MESH: Health Personnel OR Health Manpower OR Community Health Aides

OR Free terms (Title/Abstract): "health personnel " OR "health human resource" OR "health human resources" OR "health workforce" OR "medical staff" OR "health care provider" OR "health care providers" OR "healthcare provider" OR "healthcare providers" OR "health care worker" OR "health care workers" OR "healthcare worker" OR "healthcare workers" OR "health professional" OR "health professionals" OR "health care professional" OR "health care professionals" OR "health worker" OR "health workers" OR practitioner OR practitioners OR physician OR physicians OR "community health aide" OR "community health aides" OR "community worker" OR "community workers" OR "family planning personnel" OR "family planning worker" OR "family planning workers" OR "doctor" OR "doctors" OR nurse OR nurses OR "nursing staff" OR "nursing workforce" OR pharmacist OR pharmacists OR "traditional health worker" OR "traditional health workers" OR midwives

#2: Search terms regarding interventions

MESH: Motivation OR Reimbursement Mechanisms OR Salaries and Fringe Benefits OR Staff Development OR In-service Training OR Training Support OR Physician Incentive Plans OR Employee Incentive Plans OR Mandatory Programs OR Personnel Management OR Health Resources

OR Free terms(Title/Abstract): incentive OR incentives OR motivation OR motivations OR motivating OR salary OR salaries OR income OR wage OR wages OR "financial reward" OR "financial rewards" OR "fringe benefit" OR "fringe benefits" OR "compulsory service" OR "compulsory services" OR train OR training OR trainings OR scholarship OR scholarships OR education OR "outreach service" OR "outreach services" OR "continuing medical education" OR educational OR "professional development" OR "professional support"

OR “career development” OR “development opportunity” OR “development opportunities” OR “resource availability” OR “resources availability” OR “human resource management” OR “human resources management” OR “personnel management”

#3: Search terms regarding study settings

MESH: Rural Population OR Medically Underserved Area OR Poverty Areas OR Developing Countries OR Rural Health Services OR Primary Health Care

OR Free terms(Title/Abstract): “physician shortage area” OR “physician shortage areas” OR “poverty area” OR “poverty areas” OR “poor area” OR “poor areas” OR “rural area” OR “rural areas” OR “remote area” OR “remote areas” OR “underserved area” OR “underserved areas” OR “under-served area” OR “under-served areas” OR “developing area” OR “developing areas” OR “developing countries” OR “under-developed area” OR “under-developed areas” OR “underdeveloped area” OR “underdeveloped areas” OR “less-developed country” OR “less-developed countries” OR “primary care setting” OR “primary health care setting” OR “primary healthcare setting” OR “community setting” OR “primary care practice” OR “primary health care practice” OR “primary healthcare practice” OR “community practice” OR “primary care practices” OR “primary health care practices” OR “primary healthcare practices” OR “community practices” OR “community health center” OR “community health centers” OR “community health centre” OR “community health centres”

#4: Region

MESH: Asia OR Pacific Islands

OR Free terms(Title/Abstract): “Asian Pacific countries” OR “Asian Pacific region” OR Brunei OR Cambodia OR “Timor-Leste” OR Indonesia OR Laos OR Malaysia OR Myanmar OR Philippines OR Singapore OR Thailand OR Vietnam OR China OR Japan OR Mongolia OR “North Korea” OR “South Korea” OR “American Samoa” OR “French Polynesia” OR “Pitcairn Islands” OR Samoa OR Tonga OR Tuvalu OR Wallis OR Futuna OR Australia OR “New Zealand” OR Fiji OR “New Caledonia” OR “Papua New Guinea” OR “Solomon Island” OR Vanuatu OR “Federated Stated of Micronesia” OR Guam OR Kiribati OR “Marshall Islands” OR Nauru OR “Northern Mariana Islands” OR Palau OR Bangladesh OR Bhutan OR India OR Maldives OR Nepal OR Pakistan OR “Sri Lanka” OR “Cook Islands” OR Niue OR Tokelau

ANNEX 3. Interview topic guides

Interview guide for national policy-makers

1. Could you please list the interventions in your country to attract and retain primary health workers in rural and remote areas?
2. What are the main problems you aim to solve through the interventions mentioned above?
3. How are the interventions implemented? (The departments involved in intervention implementation and their main responsibilities)
4. How are regional differences adjusted during implementation?
5. What is the effectiveness of the interventions? (The indicators that should be used, include the number of participants, length of services, turnover rate and other achievements)
6. What are the challenges you face during implementation of interventions?
7. How do contextual factors influence the implementation of these interventions? (Contextual factors, such as political factors, fiscal capacity, governance, economic development, traditional culture and ethics, health system, new technology, legislation, funding, engagement of stakeholders, and monitoring and evaluation can be provided as hints to facilitate the discussion.)
8. What reforms have been conducted to overcome the challenges mentioned above?
9. What are the key lessons learned from implementing these interventions?

Interview guide for different levels of health managers

1. Could you please briefly introduce the general situation of primary health workers in rural and remote areas in your province/district/community?

(General situation: such as the total number, shortage, maldistribution and mobility of primary health workers should be included.)

2. What interventions have been implemented/are being implemented to attract and retain rural primary health workers in your province/district/health facilities?
3. How are the interventions implemented? (The departments involved in intervention implementation and their main responsibilities)
4. What is the effectiveness of the interventions? (The indicators that should be used include the number of the participants, length of services, turnover rate and other achievements.)
5. What are the challenges you face during implementation of interventions?
6. How do contextual factors influence the implementation of these interventions? (Contextual factors, such as fiscal capacity, governance, economic development, traditional culture and ethics, health system, new technology, legislation, funding, engagement of stakeholders, and monitoring and evaluation can be provided as hints to facilitate the discussion.)
7. What are the key lessons learned from implementing these interventions?

Interview guide for academic researchers/HRH experts

1. What interventions/policies do you know of to attract and retain health workers in rural areas in your country?
2. What is the effectiveness of these interventions? (Indicators such as the number of participants, length of service, turnover rate and other achievements should be used.)
3. What are the challenges you face during implementation of interventions?
4. How do contextual factors influence the implementation of interventions? (Contextual factors, such as political factors, fiscal capacity, governance, economic development, traditional culture and ethics, health system, new technology, legislation, funding, engagement of stakeholders, and monitoring and evaluation can be provided as hints to facilitate the discussion.)
5. Could you please provide any suggestion to improve the effectiveness of the interventions?

Interview guide for health workers at rural health facilities

1. Could you please share with me how you become a primary health-care worker in the rural area?
2. As a primary health-care worker, what is your responsibility?
3. What are the main challenges you face while working at health facilities?
4. Will you go on working in a rural area in the future?
    1. If yes, what kind of factors attract you to staying here?
    2. If no, what kind of factors push you away?
5. Could you please list several suggestions for the government to improve attraction and retention of health workers in rural areas?

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