Mid-level health workers

The state of the evidence on programmes, activities, costs and impact on health outcomes

A literature review

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Glossary

AHW	auxiliary health worker
ANM	auxiliary nurse midwife
ART	antiretroviral therapy
CBR	community-based rehabilitation
CMA	community medical assistant
CRW	community rehabilitation worker
CO	clinical officer
FWA	family welfare assistant
FWV	family welfare visitor
HA	health assistant
IMCI	integrated management of childhood illnesses
LHV	lady health visitor
MA	medical assistant
MCH	maternal and child health
MLW	mid-level worker
NPC	non-physician clinician
OCO	orthopaedic clinical officer
SBA	skilled birth attendant
SEARO	WHO Regional Office for South-East Asia
SSC	senior secondary school
TBA	traditional birth attendant
TC	*técnico de cirurgia*
WHO	World Health Organization
WPRO	WHO Regional Office for the Western Pacific

Executive summary

A severe and growing shortage of health workers has become an international emergency that in recent years has generated considerable international attention and concern. The crisis is greatest in low-income countries with high disease burdens and health systems on the brink of collapse. One strategy identified to alleviate health worker shortages and improve access to and quality of health services has been the accelerated use of mid-level workers.

Mid-level workers are health care providers who have received less training and have a more restricted scope of practice than professionals; who, in contrast to community or lay health workers, however, do have a formal certificate and accreditation through their countries' licensing bodies.

Mid-level practitioners have been used in many countries for more than 100 years. In many low-income countries, mid-level doctors (then called auxiliaries) originated in colonial times, when they were trained to render care to indigenous populations as professional health care remained the privilege of Europeans. Today they are used in high- and low-income countries either to assist professionals or to render care independently, particularly in rural health centres and district hospitals, making up for the scarcity or absence of professionals such as therapists, doctors, dentists, pharmacists or nurses.

But despite their often vital importance to health service delivery, particularly in low-income countries, mid-level cadres are often considered a stopgap measure in emergency situations. They are consequently neither properly integrated into health systems nor adequately planned for and managed. If, however, they are considered key cadres to render health care in the short to medium term, but more likely in the long term as well, integration, planning and management of these cadres within health sector planning must be improved.

This review aims to support such efforts by collating what we know about experiences with mid-level cadres in low-income countries in Africa, south-east Asia and the Pacific, regions that heavily rely on them. It interrogates the existing evidence on the evaluation of different types of mid-level workers and their impact on health outcomes and it identifies knowledge gaps. The review focuses specifically on the role of mid-level workers as independent practitioners in areas that suffer from severe shortages of professionals. The review took a narrative and iterative approach to finding literature. It focused on English-language material published between 1963 and January 2008.

Findings suggest that for more than 100 years different categories of mid-level workers have been used successfully to provide health care, particularly to underserved communities, and that the use of mid-level workers has been widening in both high- and low-income countries. Utilisation, skills, length of training and management practices vary quite substantially across cadres and countries. Particularly Asian countries have, over the years, developed a large number of local mid-level worker categories, from birth attendants to health assistants, who are not modelled on traditional health professions but respond to specific country needs. In African countries, on the other hand, most mid-level cadres appear to be developed from traditional professional cadres, such as medical doctors, pharmacists, etc. Some countries have developed a multitude of these categories, most notably Mozambique.

The review also found evidence of considerable challenges as well as vast gaps in our knowledge of how mid-level cadres are functioning and how they affect health outcomes in communities and countries where they are being used. Paramount among these is that in many countries mid-level workers continue to exist on the margins of the health sector, even though their centrality in the delivery of health care is well accepted. This ambiguity has its roots in the colonial history of mid-level worker programmes and in the predominance of the traditional health professions in determining health systems discourses and structures, and it often leads to a lack of attention to crucial management issues, such as training and support, career progression, regulatory issues and the integration of these into health staffing structures.

Another concern is the proliferation of cadres in some countries. Undue proliferation undoubtedly creates inefficiencies in the health system and makes monitoring of service delivery and staff difficult. It has been suggested that the introduction of new cadres is a natural result and an integral part of national human resource planning processes that consider which services are to be delivered at each

level of care, which skills are required to deliver these services and which staff are appropriate and available to render these services.

The lack of standardization of mid-level cadres internationally is considered both a drawback and a benefit. On the one hand, it inhibits the sharing of resources and mid-level workers and defies comparison and the development of typologies. On the other hand, however, the local nature of many cadres ensures their suitability to local needs, thus, it is hoped, providing locally appropriate health service solutions; it also facilitates retention.

Finally, and crucially, few countries now have adequate information systems to monitor and evaluate production, deployment, retention and progression of mid-level workers. While there are shortcomings in human resource information systems quite generally in most countries, mid-level workers, who are less well-established in health systems, are particularly affected by this lack of information.

The review found that the evidence regarding the impact of mid-level workers on health outcomes is not good. Most studies show that mid-level workers improve access to and coverage of health services, and argue that well-trained and motivated mid-level workers provide better and more accessible services than better-qualified but less-motivated professionals. But there are very few studies that rigorously link health outcomes or health status to these cadres. Similarly, information on the cost and cost–effectiveness of using mid-level cadres exists only in very few countries. Undoubtedly this lack of evidence contributes to the continued ambiguity regarding the legitimacy and roles of mid-level workers, even in countries where they are widely used and health service delivery actually depends on them.

Possibly the most important finding of this review is that at this stage there is a considerable amount of descriptive and experiential information but little rigorous research evidence on this topic available in the English-language literature. There is therefore an urgent need to improve what we know about mid-level workers and their role in and impact on health outcomes. A similar review of literature in French, Portuguese and possibly Spanish is also an urgent requirement.

If mid-level worker programmes are to become an even more important feature in the staffing of health systems in low- and middle-income countries, many of the challenges identified in this review, particularly with regard to legitimacy, management, governance and evidence, must be addressed. The review recommends what can be done to address management challenges and to build a better evidence base.

1. Introduction

A severe and growing shortage of health workers has become an international emergency that in recent years has generated considerable international attention and concern (Joint Learning Initiative, 2004; WHO, 2006). The crisis has several drivers: ageing populations and insufficient production of health workers in many high-income countries; migration, attrition and increased care needs in many low-income countries; and poor human resource planning in many countries throughout the world. In many African and some Asian countries the crisis is aggravated by a raging HIV/AIDS pandemic that has driven fragile health systems to the brink of collapse.

WHO estimates a shortage worldwide of about 4 million health workers. It suggests that "in absolute terms, the greatest shortage occurs in south-east Asia, dominated by the needs of Bangladesh, India and Indonesia. The largest relative need exists in sub-Saharan Africa, where an increase of almost 140% is necessary" (WHO, 2006: 12). In these areas human resource density (i.e. density of all health workers per 1000 population) lies between 2.9 in Africa and 5.8 in south-east Asia, compared to 40.3 in Europe and 14.9 in the Americas (North and South) (Speybroeck et al., 2006: 4).

In the light of this crisis, questions of how health services should be organized, who should render health care, and how to improve access, affordability and equity have become prominent in international debates again. The Primary Health Care approach, launched 30 years ago in Alma-Ata, is being seriously revisited (Haines et al., 2007; WHO, 2005), and the roles of communities and lay health workers in organizing and supporting health care are being reconsidered (Haines et al., 2007; Lehmann & Sanders, 2007; Walt & Smith, 1980; WHO, 2006).

What role mid-level cadres specifically can play in improving access to care is another question that again features prominently, most recently in a review by Mullan & Frehywot in *The Lancet* (2007).

Who are mid-level workers (MLWs)? The term is often used quite loosely and has a number of different meanings. Mid-level workers are often defined as those who have received less training than doctors but who perform aspects of doctors' tasks. This understanding is reflected in the two definitions below:

> Mid-level practitioners are front-line health workers in the community who are not doctors, but who have been trained to diagnose and treat common health problems, to manage emergencies, to refer appropriately, and to transfer the seriously ill or injured for further care (WHO/WPRO, 2001: 1).

> We defined NPCs *[non-physician clinicians]* as health workers with training beyond the secondary school level, who have fewer clinical skills than physicians but more than basic nurses. Our definition of NPCs included workers who were trained to deliver a range of personal clinical health services, but excluded those who specialised in health administration, population health activities, one clinical activity (e.g. only eye care, orthopaedic skills, or anaesthetics). We also excluded health workers who, for reasons of necessity (e.g. shortage of health workers in a community) or ambition (e.g. desire for recompense), engaged in advanced practices for which they had not been trained (Mullan & Frehywot, 2007: 2158/9).

Another definition is that devised by WHO in 1968, which identifies the mid-level doctor or medical assistant as just one of a range of mid-level workers:

> The medical assistant is part of a category of auxiliary health personnel. In contradistinction to professionally qualified personnel – who are fully responsible for the whole range of duties within their profession: medicine, nursing, dentistry, sanitation, laboratory technology, etc. – only certain functions are delegated to auxiliary personnel, and they work under the supervision and guidance of a fully qualified person (as quoted by Rosinski, 1969: 968).

This definition expands the category of mid-level worker to include all health professions and identifies mid-level workers as those health cadres often, but not always, linked to traditional health professions, who have received less training and have a more restricted scope of practice than professionals. They should not be conflated with lay or community health workers, however. While the latter as a rule receive some training, but no certification or licence, mid-level workers will have passed a formal exam and have received a certificate by an accredited training institution.

While the WHO definition expands the definition of MLWs to include different categories, it emphasizes that mid-level workers will always work under the direct supervision of health professionals. This is true in some but not all cases. Particularly in rural areas, including district hospitals, mid-level workers often practise independently, with little or no supervision from professionals.

This review therefore defines mid-level workers as health care providers who are not professionals but who render health care in communities and hospitals. They have received less training and have a more restricted scope of practice than professionals. In contrast to community or lay health workers, however, they have a formal certificate and accreditation through their countries' licensing bodies. Some may work under the direct or indirect supervision of professionals, while others work independently and indeed lead health care teams, particularly in primary and community care.

The debate about the definition and role of mid-level workers is not a new one, nor is their existence. A brief overview of the history of mid-level workers is provided in section 3. At this stage it is sufficient to mention that in many low-income countries mid-level doctors (then called auxiliaries) originated in colonial times, when mid-level cadres were produced and used to render care to indigenous populations. In many ways this origin dogs the perception of the role and acceptance of these cadres to this day, as care by MLWs continues to be suspected of being second-rate care for the poor. The discourse was, and in many ways continues to be, dominated by the perception that the doctor with industrialized-country training was the gold standard in health care – perceptions that have been successfully nurtured by the established professions (Gish, 1973: 1251).

But despite continuing suspicion regarding their role and ongoing battles to improve the acceptance of MLWs, many countries today rely heavily and increasingly on them to staff health services and improve quality and equity of care. It therefore seems timely to review the available evidence and experience with MLWs, particularly in low-income countries that rely on them most heavily.

The objectives of this review are therefore:

- to critically examine the existing evidence on the evaluation of different types of mid-level health workers and their impact on health outcomes;
- to identify gaps in knowledge and evidence on the use of mid-level health workers to deliver basic health care services;
- to provide policy recommendations on the use of mid-level health workers in response to the acute shortages of health workers, particularly in areas with significant shortages of health workers, such as sub-Saharan Africa, south-east Asia and the Pacific region.

2. Methodology

This is a narrative literature review that took an iterative approach to finding relevant literature. It focused on English-language material published between 1963 and January 2008. The author conducted several *Pubmed* and *Academic One File* searches using a range of different search terms including "mid-level workers", "medical assistants", "clinical officers", "health auxiliaries" and "auxiliary health workers". These searches were followed by a snowballing approach to the identification of further material, in particular the systematic harvesting of reference lists of identified articles. Finally, web sites of organizations known to have worked with or on mid-level cadres were also searched. About 180 articles were initially assessed and 46 eventually included in the review.

Inclusion criteria were a focus on low-income countries and publication in a peer-reviewed publication, published book or formal evaluation report. In a few cases where specific information on a particular programme was needed and could not be otherwise ascertained, use was made of reports published on web sites. Articles on high-income countries were excluded. Articles in languages other than English were largely excluded by virtue of the use of only English-language search engines to find literature.

Given the long interest in mid-level workers, it is not surprising that over the years a number of researchers have summarized the evidence on various subtopics, in particular the role and use of mid-level doctors (Dovlo, 2004; Fendall, 1968a, 1968b, 1972; Mullan & Frehywot, 2007). These texts were heavily drawn on where appropriate to address the overarching theme of this review, "Mid-level health workers: the state of the evidence on programmes, activities, costs and impact on health outcomes".

The evidence presented is of necessity guided by the available literature. Early publications, such as those by Fendall, tend to be programmatic rather than research-based, arguing the need for or the pros and cons of MLWs rather than reporting systematic and rigorous research. Many other papers, even those published in academic journals, are purely descriptive in character. Rigorous evaluations of programmes, including training programmes, support structures, performances, etc., are rarely reported in the early literature. As will be seen in this review, only very recently and in very few countries have systematic research studies investigated aspects of MLW programmes. Possibly the most important finding of this review is that at this stage there exists a considerable amount of descriptive and experiential information but little rigorous research evidence on this topic available in the English-language literature. A similar review of the literature in French, Portuguese and possibly Spanish is an urgent requirement.

3. The history of mid-level worker programmes

The history of mid-level workers and their role in health care delivery stretches over more than 100 years. Three fairly discrete periods can be distinguished: an early colonial period, a period of building health systems in newly independent countries and a period of renewed interest, starting in the early 2000s.

The colonial period

In India, health auxiliaries were used since the late 19th century to work in disease control and eradication.

> Smallpox vaccinators were among the first types of health auxiliaries. Since the 1920s health auxiliaries have been used for combating diseases such as yaws, yellow fever, sleeping sickness, leprosy, tuberculosis, venereal diseases and, more recently, for malaria eradication (Jagdish, 1981: 44).

In Papua New Guinea, medical assistants were introduced in about 1910. Fanning reports that these health workers received a short course of training and were then sent to rural areas to "impart basic knowledge of hygiene and treat minor ailments" (Fanning, 1981: 39). After World War II "aid post orderlies" were trained in Papua to replace medical assistants (Watters & Theile, 2000).

In African countries, mid-level workers first emerged in the early part of the 20th century, during the colonial period, when "proper doctoring (…) was basically confined to Europeans" (Gish, 1973: 1251) and many colonized countries saw the establishment of rudimentary health systems (Fendall, 1968b). Several countries set up schools for the production of medical assistants, such as the African Native Medical Corps, which was formed in 1918 (Mullan & Frehywot, 2007). Examples of schools can be found in Nigeria, Senegal and Sudan. The initial aim of these schools was to produce "native" auxiliaries who were:

> trained to perform specific tasks, taught a minimal (not maximal) core of theory, and limited and selected vocational skills. He[1] is trained to carry out certain functions, in relation to common diseases, which through experience have become largely routine. His is the role of diagnosis, but not differential diagnosis, of treatment, but not selective treatment (Fendall, 1968b: 86).

As a rule these schools trained males with between four and eight years of schooling for a period of between 18 months and two years.

In many African countries, schools to train medical assistants were transformed into medical schools from about the 1940s, as countries moved towards independence, training fully licensed and registered medical practitioners.

Post-independence

The 1950s and 60s saw newly independent states in Africa and Asia build their health systems. As a rule, they inherited patchy and highly uneven health care systems, which they sought to restructure in different ways. While most tried to build health services that would better service underserved areas, "most government and international funding continued to go to curative, urban services" (Werner & Sanders, 1997, quoted in Sanders et al., 2003). Gish reflects on this period, saying that the medical profession "succeeded in (re)creating European systems of medical care in the newly independent nations of Asia and Africa that were totally inappropriate to countries with conditions vastly different from those in the industrialised world" (Gish, 1973: 1251).

While western models of care and staffing were maintained, a significant post-colonial development was the expansion of rural health centres staffed by auxiliaries such as medical and health assistants, which improved health service coverage. These developments created substantial international debate. In 1968 a WHO expert committee was asked to assess the role and training of "medical assistants and other auxiliary personnel" as "a partial answer to the health manpower crisis" (Rosinski, 1969: 967). The conclusions emanating from the committee (as reported by Rosinski, 1969) recommended that "simple functions" could be delegated to medical assistants, that medical assistant programmes should suit the needs of the country, that initial and continuing training should be planned and encouraged. The committee and much of the literature of the time however took pains to emphasise the distinction between licensed doctors and medical assistants and stressed that "automatic upgrading of medical assistants to the level of fully qualified physicians should not be allowed" (recommendation 11, as reported by Rosinski, 1969: 970).

The commission's views reflect the strong industrialized-country medical dominance, aimed at protecting the medical profession and, despite acknowledging a need, deeply suspicious of any alternative health care models. These tensions are reflected throughout the discussions about the "health auxiliary" that featured prominently in public health journals throughout the 1960s. One of the most prominent and vocal proponents of health auxiliaries, NRE Fendall, for example, argued in numerous publications that while physicians undoubtedly rendered superior health care, health auxiliaries were adequate for the needs of most communities, given the demand and the comparatively simple nature of most health problems. In numerous publications he argued the case for health auxiliaries as a bridge between traditional and modern society, who would be happy to serve in rural areas and should not be considered "second rate physicians" (Fendall, 1963, 1964, 1967, 1968a, 1968b, 1969, 1970, 1972).

> To describe the medical assistant as a near doctor, incomplete doctor or sub-professional, is to misunderstand completely the purpose, role, function and responsibility if this person. Whether he acts as assistant or substitute he is not replacement of the physician but a complement to him. (…). There is a large and clear gap between what the medical assistant can do and what a physician can accomplish" (Fendall, 1968a: 619).

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1 The 1960s literature talks exclusively of male MAs and most of it is quite explicit about the "need" for MAs to be males.

The medical assistant's field, Fendall argued, was:

> the practice of simple empirical medicine in a limited range of diseases with restricted medicaments, to act as a sorting station, and to render emergency care (Fendall, 1968a: 619).

While in academic medical circles the debate about the legitimacy and efficacy of auxiliary personnel raged, in many newly independent countries production of auxiliaries was either continued or introduced to address the need to build health services. In some countries war and conflict situations aggravates the shortages: Mozambique, for example, was left with 80 doctors for a population of 14 million after independence (Pereira et al., 2007).

Emerging programmes differed from country to country. In Papua New Guinea "aid post orderlies" became the primary health care workers who, after one year of training and one year of supervised practical work, were assigned to defined rural populations.

> Here they are provided with a limited selection of curative medicines, especially for life-threatening diseases such as malaria and pneumonia. They are equipped to treat common ills such as scabies and ideally take an active part in community hygiene and sanitation work, health education, and immunisation programmes (Fanning, 1981: 40).

"Health extension officers" received three years of training in clinical medicine, administration and public health, as well as one year of residency training, after which they were posted to rural health centres.

> Here he has the comprehensive task of looking after patients who are referred to the centre by peripheral workers, running an out-patient service, and supervising the aid post orderlies and nurses in his area. He is also actively involved in health education, environmental improvement, and disease control programmes while administering the health centre and preparing the monthly reports and epidemiological surveys (Fanning, 1981: 41).

In India different health auxiliaries had been used since the late 19th century and continued to play a crucial role in primary care delivery throughout the 20th century (Jagdish, 1981).

In Ghana the Rural Health Service was formed to train health centre superintendents, later called medical assistants. "Much of rural health care in northern Ghana is now provided by these medical assistants" (Mullan & Frehywot, 2007: 2158)

In Kenya health auxiliaries (clinical officers) were used in outpatient care in hospitals, as auxiliary anaesthetists and in rural health centres, in the latter ostensibly under the supervision of doctors, but more often working independently and as team leaders (Branicki, 1981; Coghlan & Towey, 1979; Malone, 1981).

Tanzania had been ambivalent about the continued production of medical auxiliaries in the immediate post-independence period. However, after the Arusha Declaration of 1967 a decision was made to substantially extend rural health centres and dispensaries and to staff them with a range of health auxiliaries, from medical assistants as team leaders to medical aides, maternal and child aides, rural sanitarians, lab and pharmaceutical auxiliaries and nurse assistants (Gish, 1973).

In many countries, however, efforts to rebuild and restructure health systems came to a halt from the mid-1970s as a result of the world oil crisis and the subsequent worldwide economic recession. Many African countries were hit particularly hard, as world prices for many agricultural products plummeted and debt escalated, creating a dramatic shortage of resources to invest in health care, education, and social services (Sanders et al., 2003).

The crisis was followed in the 1980s and 90s by the structural adjustment policies of the World Bank and the International Monetary Fund that resulted in further cuts in health and social development spending. In this context, efforts to expand health services and ensure adequate staffing took a back seat. While health auxiliaries continued to be used in many countries, for example in Mozambique, funding for programmes often became patchy and unreliable.

The HIV/AIDS crisis

However, recent years have seen a resurgence in the interest in mid-level worker programmes. This renewed interest is prompted partly by a worsening human resource crisis in many low-income countries, which particularly in sub-Saharan Africa is accompanied by sharply increasing care needs as well as attrition of health workers resulting from the HIV/AIDS pandemic. But it is also driven by a growing concern about poor performance of health systems, a critical re-examination of global health policies in recent decades and a consequent re-examination of the Primary Health Care approach.

Collapsing health systems in many low-income countries and severe health worker shortages in many industrialized countries have created powerful push and pull factors that draw ever-increasing numbers of professionals to more lucrative posts in high-income countries. Few if any low-income countries have sufficient numbers of professionals to staff their public health services. In many countries, such as South Africa, the situation is aggravated by a concentration of human resources in urban centres and/or the private sector. It is not surprising, then, that health planners, managers, and academics are again considering the merits and opportunities of using mid-level and lay health workers to counter the spiralling human resource crisis and to rebuild health systems, particularly in underserved areas.

The rest of this review will discuss the available evidence regarding the roles, training, management and effectiveness of mid-level workers.

4. Different cadres of mid-level workers and their roles

Mid-level cadres have evolved over more than 100 years, initially constrained and controlled by industrialized-country models of health care, but increasingly in response to unmet needs or emergencies, particularly in low-income countries. Because of their diverse and contested history, a multitude of mid-level health worker categories can be found throughout the world. Many countries have a proliferation of auxiliaries, assistants and technicians in their different professions. Their training, levels, functions, regulation, career paths and integration into the formal health system vary from country to country, making comparisons or typologies virtually impossible.

Mid-level workers have been given many different titles, e.g. physician assistant, medex, medical assistant, health assistant, health officer, nurse practitioner, nursing assistant, dental auxiliary, physiotherapy assistant, dental technician, etc. These titles do not always reflect the entry requirements, levels of training, or levels of practice. Some mid-level practitioners with equivalent training, for example, are given different titles in different countries.

> For example, the role and training of nurse aides in the Solomon Islands and of community health workers in Papua New Guinea are similar.
>
> At the same time, some mid-level practitioners with different educational backgrounds may have similar titles. A medical assistant in Kiribati is a nurse who has received advanced training. A medical assistant in Fiji does not have a nursing background.
>
> Even mid-level practitioners with similar educational backgrounds and training have different titles in different countries. For example, medical assistants in Fiji, health officers in Tonga and health extension officers in Papua New Guinea are basically equivalent in their role, training and function (WHO/WPRO, 2001: 3).

As a rule, the early MLWs were usually called “auxiliaries”, while today terms such as “assistant” or “technician” are more common, as in “pharmacist’s assistant” or “pharmacist technician”. A term recently used to capture the breadth of mid-level cadres is “modern health associate professional” (Dal Poz et al., 2006).

Like their different titles, the roles mid-level workers play in health care differ widely. In low-income countries they have played a particularly important role in staffing rural health centres and district hospitals, making up for the scarcity or absence of professionals such as doctors, dentists, pharmacists or nurses. However, particularly medical and nursing assistants also play a role in large hospitals where they assist medical doctors and nurses in their tasks.

In the past the role of mid-level cadres was often discussed as "substitution" of professionals (Dovlo, 2004). This in some instances flagged their intended temporary existence. In other cases it signals the quite informal delegation of tasks to less-qualified staff because of unmet needs in rural and remote areas. In the Pacific, for example,

> many nurses in rural areas of the Pacific function as nurse practitioners, diagnosing and treating conditions as best they can. However, most have not been specifically trained for this function in their basic education programmes, although many basic nursing education programmes in the Pacific try to include some content on the assessment and management of common primary health care problems (WHO/WPRO, 2001: 7).

While we do not have good data on the numbers of different cadres of mid-levels workers, WHO figures provide an indication of the widely varying numbers in different countries (Table 1).

Bangladesh, for example, has large numbers of non-medical mid-level cadres. While it has many doctors and comparatively few medical assistants, it evidently relies largely on laboratory and pharmaceutical assistants as well as unspecified "other" health workers to render services. Mozambique and Zambia, on the other hand, have large numbers of medical assistants compared to numbers of doctors. Several cadres of mid-level workers may also be subsumed under the categories of community and other health workers, most specifically in Bangladesh, India, Nepal, Nigeria and Uganda. Figures for MLWs in most Pacific countries were unfortunately not available. It should be noted that these figures do not reflect distribution within countries, as often MLWs provide services in remote areas, where health professionals are scarce.

What cadres of mid-level workers were used, and how they were used, for example as generalists or specialists, has varied and continues to vary from country to country and also over time. Generally, early MLW programmes focused on medical assistants, but as countries began to take initiative and develop cadres in response to local needs, there emerged a multitude of mid-level cadres.

India, for example, opted in the early 1970s to use different types of auxiliaries to fulfil specific tasks in the community. Jagdish found nine auxiliary staff categories in Indian primary health centres in 1973. However, following complaints from communities about unnecessary and confusing proliferation, and investigation by a government committee, programmes were collapsed and male and female multi-purpose workers introduced. While women focused on ante-, intra- and postnatal care, infant care, family planning, nutrition and health education, men were trained to take responsibility for communicable disease programmes, family planning, health education and nutrition (Jagdish, 1981).

Dovlo found a number of different levels of "doctor substitutes" in his analysis of substitution in African countries, as reflected in Table 2.

Table 2. Different levels of "doctor substitutes" in African countries

Stages	Ghana	Kenya	Malawi	Mozambique	Tanzania
Basic level	Registered nurse (nursing is required for medical assistants in Ghana)	Clinical officer	Medical assistant	Basic health agent (general medicine, pharmacy, dental)	Clinical officer (medical assistants are a step lower than clinical officers)
Post-basic level	Medical assistant	Clinical officer (partly specialized)	Clinical officer	Medium-level technicians (general medicine, pharmacy, dental, preventive medicine)	Assistant medical officer
Specialized	n/a		Clinical officer: orthopaedic, clinical medicine, dental, etc.	Medical and surgical technicians (specialized)	Assistant medical officer – specialist: orthopaedic, radiology, surgery, dermatology, anaesthesia, etc.

Source: Dovlo, 2004: 5

Table 1. 2004 workforce numbers in selected countries with substantial mid-level cadres

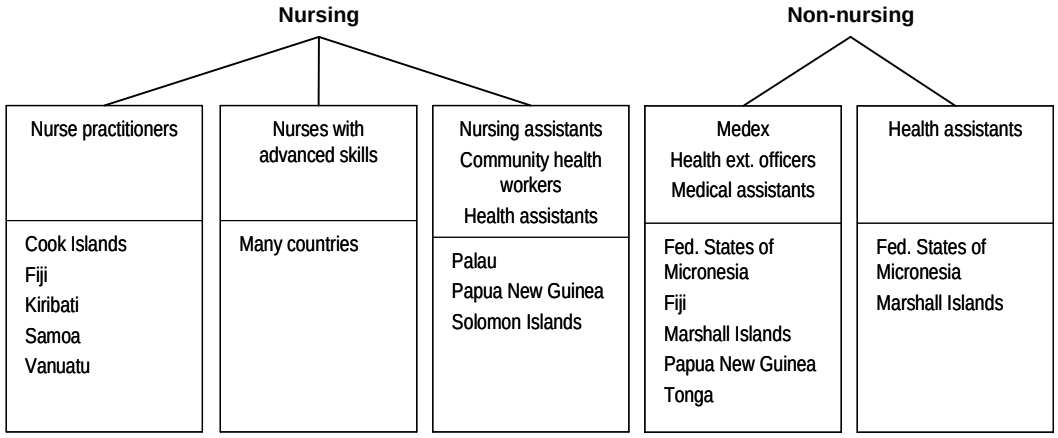
	Nursing personnel	Midwifery personnel	Physicians	Medical assistants	Pharmacists	Pharmaceutical technicians/ assistants	Dentists	Dental technicians /assistants	Laboratory scientists	Laboratory technicians/ assistants	Community health workers	Other health workers
Bangladesh	20 334	26 460	38 485	5 598	n/a	9 411	1 948	589	n/a	2 581	21 202	7 859+
Burkina Faso	4 268	2 289	708	941	227	116	58	n/a	21	315	1 201	814
Burundi	1 337	11	200	942	73	3	14	n/a	142	n/a	548	244
Central African Republic	908	705	331	347	17	0	6	7	3	36	99	114
Chad	2 146	353	345	145	31	6	7	8	111	195	154	n/a
Côte d'Ivoire	7 773	2 407	2 081	25	788	227	339	n/a	473	460	n/a	147
Ghana	15 797	3 910	3 240	787	n/a	1 388	104	289	n/a	881	n/a	6 345
India	865 135	506 924	645 825	n/a	n/a	n/a	55 058	n/a	n/a	n/a	50 393	1 035 985*
Malawi	7 264	n/a	266	707	n/a	n/a	n/a	n/a	n/a	16	n/a	n/a
Mali	5 986	2 352	1 053	343	351	n/a	44	40	25	207	68	34
Mozambique	3 947	2 236	514	1 182	14	604	16	143	45	727	n/a	477
Nepal	5 664	6 161	5 384	n/a	266	92	245	114	n/a	3 104	16 206	1 892
Nigeria	127 580*	82 726*	34 923*	n/a	6 344	n/a	2 482*	n/a	n/a	n/a	115 761	1
Rwanda	3 570	77	432	75	112	166	9	12	5	21	12 000	415
Senegal	2 606	681	594	259	63	22	70	27	32	19	n/a	445
Sri Lanka	23 030	10 401	10 479	1 339	990	n/a	771	474	1	913	n/a	207
Togo	1 667	270	225	204	49	85	18	1	171	310	n/a	402
Uganda	14 805	4 164	2 209	2 472	215	473	117	246	n/a	1 538	n/a	1 656
Zambia	16 990	5 020	1 264	2 122	707	332	269	222	n/a	1 163	n/a	1 208
Zimbabwe	9 357	n/a	2 086	n/a	605	278	276	34	481	61	n/a	743

* = 2003 data
+ = 2005 data

Source: WHO, not dated. *Global atlas of the health workforce.*

In the Pacific region, two models of mid-level practitioner programmes are distinguished: programmes associated with nursing and those that are not. Nurse clinicians in this system are considered mid-level practitioners, as are various categories of nursing assistants and health extension officers. Figure 1 reflects these different models and their subcategories.

Figure 1. Models of mid-level practitioners in the Pacific



Source: WHO/WPRO, 2001:7

Significantly, both nurse practitioners – i.e. nurses with advanced clinical skills – as well as nursing assistants are considered mid-level workers in this model, together with a range of medical assistant categories. This mirrors some African scenarios in which medical assistants, clinical officers and assistant medical officers, although operating at very different levels of skills, are all considered mid-level workers.

While the nurse-driven MLW model appears to have been popular in many countries of the Pacific region, the WHO study acknowledges that it is not always feasible:

> Despite the many advantages of the nursing model, it is not a good choice for every country. Which model is the best model depends on the country situation. Mid-level practitioner programmes in the Pacific have developed to meet specific country needs. How these programmes developed depended on the resources available at the time.
>
> The Micronesian countries, for example, have had a long-standing nursing shortage, so they have not had a large pool of nursing candidates for mid-level practitioner training. However, they have had the benefit of the Pacific Basin Medical Officer Training Programme which was based in Pohnpei for 10 years and which produced a cadre of Pacific island medical officers and health assistants. So the non-nursing model was right for the time.
>
> The Marshall Islands is an example of a Pacific island country with a nursing shortage which has used mid-level practitioners since the 1940s. It also provides a good example of how a cadre of mid-level health workers has evolved over time, because of changing financial and human resources in the health sector.
>
> In the mid-1940s military corpsmen in the Marshall Islands were trained on the job for one year to fill the post-war shortage of health care providers. Then in the 1970s these corpsmen were trained to be mid-level practitioners, and a new classification of health worker was born—the health assistant. The corpsmen training ended and over the next 30 years, around 80 health assistants were trained.
>
> In the late 1970s, in cooperation with the University of Hawaii, an 18- month Medex mid-level practitioner programme was established to expand and upgrade the skills of nurses and health assistants in the North Pacific, particularly in Micronesia and the Republic of the Marshall Islands. The Marshallese health workers who graduated from this programme have played a key role in health care delivery.

> Today, one of the Marshallese graduates of the Medex programme supervises the health assistants who continue to provide basic primary health care services on the outer islands. At the present time, the remaining graduates of the earlier Medex programmes are now working in central out-patient clinics. (WHO/WPRO, 2001: 11/12).

In Bangladesh, a particular effort has been made in recent years to reduce the maternal and child mortality and morbidity through increasing access to health care services, with special emphasis on human resource development. To this end, the country makes use of a range of mid-level health workers at the community level: family welfare assistants (FWAs) and health assistants (HAs) provide maternal and child health care (MCH) services. At the next level of care, family welfare visitors (FWV) and sub-assistant community medical officers, or medical assistants, are responsible for providing maternal and child health (MCH) services, together with graduate medical officers. FWV trainees, who are secondary-school graduates, undergo an 18- month training course in one of 12 FWV training institutes. On completion of the training they receive midwifery registration from the Bangladesh Nursing Council. In addition, Bangladesh makes use of "skilled birth attendants" after abandoning the training of traditional birth attendants (WHO/SEARO, 2005).

> Ninety basic health workers (FWA and Female HAs) were trained at district level in selected essential midwifery skills and abilities (WHO, 2004). The training aimed to enable them to provide antenatal care, conduct normal home births, postnatal care and newborn care, and also to identify early and refer obstetric complications. FWA and FHAs having minimum SSC with > two years experience in basic or family welfare health services and residing in the place of posting were selected for the training. The trainees were evaluated through examinations and certified and registered by Bangladesh Nursing Council as SBA (community auxiliary midwife). The evaluation of the pilot programme showed that the SBAs are making a significant contribution to increasing the proportion of births by a trained health provider. On average, each SBA performs 3-4 births per month; it is believed that this could easily be raised to 5 or 6 with further strengthening of the field programme. MOHFW had decided to scale up this training programme, and also importantly, to simultaneously establish a supervisory mechanism and accreditation system for the training programme. Consideration is being given to increasing their capacities to be able to offer obstetric first-aid so that they can comply with the international definition of SBA" (WHO/SEARO, 2005: 11/12).

In Nepal, health centres and health posts are also staffed by a variety of different levels of trained health workers who are referred to by an array of acronyms (see case study below). In addition to the mid-level cadres, Nepal has a wide array of community health workers who have received between one week and three months of training and who play different roles in community health care.

As can be expected, the roles and activities of mid-level workers are as diverse and varied as their different categories and contexts. A comprehensive exploration of their roles is therefore not feasible. However, Table 3 provides an overview of different categories and their scope of activities that could be found in the literature, most notably in Mullan & Frehywot (2007) and the WHO study on mid-level practitioners in the Pacific region (WHO/WPRO, 2001).

Table 3. Mid-level workers and their roles in Africa and Asia

Country	Title	Entrance requirements	Pre-service education	Scope of practice
Africa				
Angola	Clinical officer	secondary school	3	medicine, minor surgery, obstetrics (no CS)
Burkina Faso	Clinical officer	secondary school	3	medicine, minor surgery
Botswana	Nurse clinician	RN with experience	1	medicine, obstetrics (no CS)
Cape Verde	Health officer	secondary school	3	medicine

Country	Title	Entrance requirements	Pre-service education	Scope of practice
Ethiopia	Health officer	BSc or RN	3	medicine, minor surgery, obstetrics
	Health officer	secondary school	3	medicine, minor surgery, obstetrics
Gabon	Clinical officer	secondary school	3	medicine
Ghana	Medical assistant	RN with 3-5 yrs experience	1	medicine, obstetrics (no CS)
	Medical assistant	secondary school	3	medicine, minor surgery, obstetrics
Guinea-Bissau	Clinical officer	secondary school	3	medicine
Kenya	Clinical officer	secondary school	3	medicine, minor surgery, orthopaedics, dermatology, anaesthesia,
Lesotho	Nurse officer	RN with 5 years' experience	1	medicine, obstetrics (no CS), public health
Liberia	Physician assistant	secondary school	3	medicine, obstetrics (no CS)
Malawi	Clinical officer	secondary school	3	medicine, minor surgery, obstetrics, orthopaedics, dermatology, ophthalmology
Mauritius	Community health care officer	secondary school	3	medicine, obstetrics (no CS)
Mozambique	Clinical officer	secondary school	2.5	medicine, minor surgery, obstetrics, dermatology, public health
Rwanda	Nurse clinician	RN with experience	1	medicine, obstetrics (no CS)
Senegal	Health officer	NA	NA	medicine only, but can take additional courses to train in minor surgery, obstetrics and others
Seychelles	Nurse clinician	RN	1	medicine
Sierra Leone	Community health officer	secondary school	2	medicine, obstetrics (no CS)
South Africa	Physician assistant	secondary school	3	medicine
Sudan	Clinical officer	secondary school	3	medicine only, but can take additional courses to train in minor surgery, obstetrics and others
Tanzania	Assistant medical officer	3 years' experience	2	medicine, minor surgery, obstetrics, dermatology, anaesthesia
	Clinical officer	secondary school	3	medicine, obstetrics (no CS)
Togo	Medical assistant	RN	2	medicine, minor surgery, obstetrics (no CS), ophthalmology
Uganda	Clinical officer	secondary school	3	medicine, hospice care
Zambia	Clinical officer	secondary school	3	medicine, obstetrics (no CS), anaesthesia, orthopaedics
	Nurse	secondary school	na	medicine, minor obstetrics (no CS)
Zimbabwe	Health officer	secondary school	2-3	medicine, obstetrics (no CS)
	Rehabilitation technician	secondary school	2	community rehabilitation
Asia				
Bangladesh	Skilled birth attendant	health assistants with experience	na	ante- and postnatal care, deliveries, obstetric referrals
	Family welfare assistant Female health assistant	secondary school	na	maternal and child health

Country	Title	Entrance requirements	Pre-service education	Scope of practice
	Family welfare visitor	secondary school	1.5	midwifery
Cook Islands	Nurse practitioner	na	1	
Fiji	Nurse practitioner, Medical assistant	na	1	
India	[Multi-purpose workers]	na	na	ante-, intra-, postnatal care, infant care, family planning nutrition, health education
Kiribati	Medical assistant	na	1.5	
Marshall Islands	Health assistant	na	1.5	
Micronesia	Health assistant	na	1	
Nepal	Health assistant	secondary school	3	diagnose and treat common ailments
	Auxiliary health worker, Community medical assistant	na	1.5	diagnose and treat common ailments
	Auxiliary nurse midwife	na	1.25	antenatal care, deliveries, immunisation, growth monitoring
Papua New Guinea	Aid post orderly	na	1	limited curative medicine, health promotion
Samoa	Clinical nurse consultant	na	1	
Tonga	Health assistant	na	3	
Vanuatu	Nurse practitioner	na	10 months	

Sources: Mullan & Frehywot, 2007: 2160; WHO/WPRO, 2001: 4 and other articles used in the review

It is noteworthy that as a rule Asian countries appear to be making much wider use of nurse practitioners, while in African countries the role of medical assistant is most common and established. Of course this table does not list the myriad of other mid-level workers that may exist in countries but for whom no information could be found in the literature. An example of the full scope of mid-level cadres used in one country can be found in Table 4 below, which lists the different levels and health worker cadres found in Mozambique.

A relatively recent and increasingly important addition to the activities of MLWs is HIV/AIDS care and particularly treatment. Mullan & Frehywot found that

> Malawi, Ethiopia, Tanzania, Zambia, and Uganda were building their antiretroviral treatment strategies around NPCs [non-physician clinicians]. Many informants reported that NPCs had a useful and well accepted role in antiretroviral treatment, and were leaders in HIV/AIDS treatment campaigns (Mullan & Frehywot, 2007: 2161).

In Malawi clinical officers, medical assistants and nurses were trained to manage and deliver antiretroviral therapy (ART). Between 2004 and 2005, 1138 health care workers (118 doctors, 384 COs, 23 MAs and 613 nurses) were trained and certified in ART management. By the end of 2005 the number of patients on treatment had risen from 4000 to 37 840 (Libamba et al., 2007).

Table 4. Health worker categories in Mozambique

Auxiliary technicians	Assistant technicians (or specialized assistants)	Health technicians	Specialized technicians	Higher level technicians N2 (BA)	Higher level technicians N1 (BA Honours)	Physicians and health specialists
Pharmacy auxiliary	Pharmacy assistant	Pharmacy technician	Pharmacy technician	Pharmacy technician	Pharmacist	1. Public health doctors consultant principal assistant 2. Hospital doctors consultant principal assistant 3. Generalist doctors consultant principal assistant 1st class intern. 2nd class intern.
Rehabilitation auxiliary	Agent of physical and rehabilitation medicine	Technician of physical and rehabilitation medicine	Technician of physical and rehabilitation medicine	Technician of physical and rehabilitation medicine	Physiotherapist	
Electro medicine technical assistant	Electro medicine agent	Electro medicine technician				
Odonto/oral technical assistant	Odonto/oral agent	Odonto/oral technician[2]	Odonto/oral technician[2]	Odonto/oral technician[2]	Dentist	
Elementary nurse	Nurse[2]	General nurse		Nurse[2]	Nurse[2]	
Microscopist	Laboratory agent	Laboratory technician[2]	Laboratory technician[2]		Laboratory technician[2]	
Autopsy assistant	Mortuary agent					
	Hospital administration agent	Hospital administration technician[2]	Hospital administration technician[2]	Hospital administration technician[2]	Hospital administration technician[2]	
	Entomology agent	Health statistician				
	Medicine agent	Medicine technician[2]	Medicine technician[2]	Medicine technician[2]		
	Preventive medicine agent	Preventive medicine technician	Preventive medicine technician	Preventive medicine technician		
	Nutrition agent	Nutrition technician[2]		Nutrition technician[2]	Nutritionist	
	MCH agent	MCH nurse[2]	MCH nurse[2]	MCH nurse[2]		
	Electrocardiography operator					
		Midwife				
		Anaesthesiology technician[2]	Anaesthesiology technician[2]	Anaesthesiology technician[2]		
		Instrumental technician[2]	Instrumental technician[2]	Instrumental technician[2]		
		Ophthalmology technician[2]	Ophthalmology technician[2]	Ophthalmology technician[2]		
		Prosthesis technicians[2]		Prosthesis technicians[2]		
		Psychiatry and mental health technician[2]	Psychiatry and mental health technician[2]	Psychiatry and mental health technician[2]		
					Clinical psychologist	
		Radiology technician[2]		Radiology technician[2]		
		Radiotherapy technician[2]		Radiotherapy technician[2]		
			Surgery technician			

Source: Ferrinho & Omar, p. 28.: Table 6: Legislated special health careers

[2] At different levels of skill and specialization

The situation with nurses is more complex. For registered nurses, roles and scopes of practice in many countries have changed significantly over the years, as they stepped into the gap left by doctors or medical assistants. In some countries this has led to a formal change in the scope of practice. In Zambia, for example, "nurses and midwives can now do detailed physical examinations, insertions and removal of intrauterine devices, resuscitation including intubations, vacuum delivery/extractions and performing manual vacuum aspiration on post-abortion patients" (Dovlo, 2004: 5/6). In other countries, however, the extension of scopes of practice by nurses still only exists de facto, not de jure, a situation that has led to much unhappiness and demotivation among nurses.

Scopes of practice have been a matter of much contention in the discussions of mid-level workers. Coming from traditions of distinct and clearly circumscribed scopes of practice, professionals have always argued for tight and restricted scopes of practice for MLWs. However, as Dovlo points out, insisting on a limited the scope of practice for MLWs has implications for their usefulness, particularly in areas where quick referrals are not easily possible (Dovlo, 2004: 7). In such areas it is imperative that health workers (whether MLWs or nurses or any other category) be able to respond to the priority health needs of the population. Failure to do so renders them not much more than referral services and severely undermines their legitimacy in the populations they serve and among fellow health workers. Practice in many countries therefore increasingly suggests a move away from restrictive delineations in favour of overlapping and competence-based scopes of practice.

Medical assistants/clinical officers

Medical auxiliaries, today usually called clinical officers or medical assistants, have been and continue to be used with great success in many African and Asian countries. Section 3 detailed some of the historical developments.

In Mozambique the large-scale establishment of medical-assistant programmes was motivated by a dramatic scarcity of health professionals after independence. Among the most successful categories of medical assistants in this country are the so-called *técnicos de cirurgia* – advanced mid-level medical practitioners able to perform emergency surgery, obstetrics and traumatology under difficult conditions in district hospitals.

> The TC in Mozambique does not have a medical degree; candidates are recruited mainly among the best mid-level medical practitioners and nurses, with substantial experience in rural areas. They undergo an intensive training programme, learning under the tight supervision of senior surgeons, comprising two years of training at Maputo Central Hospital and a one-year internship in a provincial hospital. (Cumbi et al., 2007: 2).

Despite considerable initial resistance from medical professionals, TCs are now widely accepted in the Mozambican health system (Cumbi et al., 2007). As a rule they provide the only surgical services in rural hospitals. Evaluations of their performance and cost–effectiveness, which are among the few rigorous evaluations that exist to date, showed no significant differences in patient outcomes when compared with results obtained by trained medical specialists and at a cost 10 times cheaper than training medical specialists (Ferrinho & Omar, 2004; Pereira et al., 1996; Vaz et al., 1999) (see also sections on performance and cost–effectiveness below).

Tanzania has medical assistants as well as two more advanced categories: assistant medical officers (AMOs) and assistant medical officer specialists.

> AMOs were first trained in a three-year course to be Medical Assistants. After working at that level for five or more years, mostly in rural health centres or district hospitals, they are eligible for two more years of training in one of the referral hospitals. Upon graduation, they obtain the title of "Doctor" and are licensed to practice medicine like MDs. They have more experience than an intern who has just graduated from university, but are a little short in theoretical knowledge (Diefenthal, 2008).

AMO specialists are trained in ophthalmology, radiology, anaesthesiology and dermatology and are intended to work in the more remote regional hospitals that need people with specialized knowledge. AMO specialists will have received an additional two years of training in their speciality (Diefenthal, 2008). Unfortunately, evaluations of their performance and impact could not be found in the literature.

Malawi has made use of clinical officers (COs) since 1980. This cadre undergoes four years of training that includes anatomy, physiology, pharmacology, paediatrics, medicine, surgery, obstetrics and gynaecology. They

are largely responsible for providing clinical care at district hospital level and play a very important role in the larger central hospitals. At larger hospitals they are often supported by doctors, but in smaller hospitals they function well without medical officer support. Clinical officers' duties include outpatient care, emergency care, ward management of hospitalized patients and surgical care. Surgical procedures include, among others, caesarean sections, hernia repairs, management of ectopic pregnancies and fracture management.

Comprising a separate cadre are medical assistants who receive two years of training and focus on medicine, but are allowed to upgrade to the clinical officer level after some years of practice.

Many clinical officers in Malawi have moved beyond the clinical care sector to lead district health management teams (as district health officers) and to support many of the important programmes in Malawi such as TB control, malaria control, integrated management of childhood illnesses (IMCI) and others. Here they are active as programme managers and as researchers (Thetard, 2004).

A specialized category of clinical officers are orthopaedic clinical officers (OCOs), who are deployed in government district and mission hospitals where they often provide the sole orthopaedic care for the population (Tindall et al., 2005: 627). OCOs were trained for 18 months at USD 14 000 per student. By 2005, 70 OCOs operated in Malawi.

> They know 60% of the techniques used by orthopaedic surgeons and can treat injuries, congenital and acquired deformities (…), and acute and chronic bone infections. Their knowledge covers 95% of cases seen in district hospitals (Blair, 1994: 409).

Another cadre of specialized clinical officer is used in Kenya, where auxiliary anaesthetists have existed since the mid-1950s. They are clinical officers who have received one year of additional training. They are employed in district and provincial hospitals, albeit in small numbers. While they have been very successful and often are the only anaesthetist available, Coghlan & Towey in their 1979 assessment identified considerable challenges: at that time auxiliary anaesthetists earned considerably less then secretaries or craftsmen in Kenya, and they lacked supervision and continuing training, leading to substantial attrition of this staff category (Coghlan & Towey, 1979). No subsequent literature on auxiliary anaesthetists in Kenya could be found.

Medical assistants or clinical officers are the earliest and most widely used category of mid-level workers, particularly in Africa but also in Asia. Many countries have relied on them for many years to ensure the availability of medical, surgical (particularly obstetric) and public health services in community facilities and district hospitals, and many have introduced specialist medical assistants. While their performance and impact has not been systematically tracked and evaluated over the decades, there are examples in the recent literature of rigorous assessments of their performance and comparable cost, most notably in Malawi and Mozambique (see also section 7 below).

Nurse auxiliaries

There is very little literature available on the role of mid-level nurses as a special cadre. To begin with, it is not clear who mid-level nurses actually are. While in most countries they would be the non-registered, assistant category of nurses, we learnt earlier that particularly in the Pacific region advanced nurse practitioners are also considered a mid-level cadre.

The role of assistant nurses is not well documented. We know that in many African countries the production of certain types of non-registered nurses, particularly enrolled nurses, was either discontinued or considered to be discontinued. This was in an effort by nursing regulatory bodies to further professionalize the profession (Dovlo, 2004). However, in most cases where this was attempted, training for these categories was reintroduced a few years later, when it became clear that their absence left a large gap in staffing hospital and community services.

In many low-income countries, nurses have functioned as nurse clinicians for many years, albeit informally, in the absence of medical personnel. In several countries, advanced training to become a nurse practitioner has been available for several years (WHO/WPRO, 2001). Much of this work has gone unacknowledged and unrewarded.

But it has been more recently, with the introduction of antiretroviral therapy for AIDS, that the role of nurses has begun to be redefined. In many countries, certainly in sub-Saharan Africa, professional nurses now play a crucial role in ensuring access to AIDS treatment by initiating and managing treatment at first levels of care, including in

communities (Amolo Okero et al., 2003; Ferradini et al., 2006; Kelly et al., 2001; Marchal, De Brouwere & Kegels, 2005; Médecins sans Frontières, 2006; Palmer, 2006). Much work still needs to be done to acknowledge these changes in legislative and policy frameworks, such as licensing, scopes of practices, adjustments of remuneration scales, etc.

Dental auxiliaries

In South Africa dental therapists have been trained since 1975, with the aim of increasing dental care in rural areas. However, because there were not enough posts in the public service, the Medical and Dental Council allowed dental therapists to work in private practice, creating competition with dentists. A study in 2003 found that close to 80% of dental therapists lived in urban areas (Hugo, 2005).

Community rehabilitation workers

Community rehabilitation workers (CRWs) did and still do exist in several countries (e.g. India, Uganda), but very little information is available about this cadre.

> The major objective of CBR [community-based rehabilitation] is to ensure that people with disabilities (PWD) are able to maximize their physical and mental abilities, have access to regular services and opportunities, and achieve full social integration within their communities. CBR is a comprehensive approach, which encompasses disability prevention and rehabilitation in primary health care activities and integration of disabled children in ordinary school and provision of opportunities for the gainful economic activities for disabled adults (Sharma & Vashist, 2007: 139).

One of the most successful programmes that uses mid-level rehabilitation workers has existed in Zimbabwe since the early 1980s (the following is based on (Finkenflügel, 2004) and on personal communication from Rati Mpofu, first principal of the School for Community Rehabilitation). The programme was initiated by the Ministry of Health in response to an exceptionally high need for rehabilitation services in the country and started in 1981 (a national disability survey, carried out in 1981, indicated that there were some 276 300 people with disabilities in Zimbabwe, equivalent to 3.6% of the population (Finkenflügel, 2004)). By 1990, 175 rehabilitation technicians had been trained and were working in 65 rehabilitation departments in central, provincial and district hospitals.

In the 1990s rehabilitation assistants were renamed “rehabilitation technicians”, following an acknowledgement that most functioned largely independently due to a lack of professionals in district and provincial hospitals. Rehabilitation technicians today work primarily in district hospitals and communities, where they provide the only rehabilitation as well as health promotion and prevention services to people with disabilities.

Rehabilitation assistants were initially trained for six months, but today rehabilitation technicians are trained for two years. At the start of the programme, general assistants with some experience in rehabilitation as well as good writing and English skills were admitted. Today O-levels with five passes are required.

Finkenflügel reports that

> the training is broadly based as they are expected to provide services to people with a wide range of disabilities resulting from physical, mental, affective, speech, hearing, and visual disorders. The training focuses on basic rehabilitation skills and includes aspects of occupational therapy, physiotherapy, speech therapy, and social work. Function, rather than underlying impairment, is stressed. The basic assumption is that most people with a disability can benefit significantly from interventions that address problems faced in daily life, such as those of moving, dressing and eating. (…) The Rehabilitation Technicians worked on the wards and outpatient clinics in addition to participating in outreach programs. In each district, the Rehabilitation Technicians received an intermittent type of supervision by the therapists who were based in provincial hospitals and a few larger, district hospitals (Finkenflügel, 2004: 116).

While the programme has been very successful and has trained personnel from other African countries, it also has encountered a number of difficulties. Among these have been issues of teaching personnel as well as career preparation. So far, only professional therapists who often do not have sufficient experience in community-based

rehabilitation are qualified to train rehabilitation assistants – a situation that has led to the call for a postgraduate programme for rehabilitation assistants to qualify them to teach. Proposals to provide a laddered career path option between rehabilitation and the professional therapies have so far been unsuccessful due to resistance from professional bodies. Nevertheless, the Zimbabwean community rehabilitation programme is one of the oldest and most successful, and much could be learnt from a thorough study of its history and experiences.

Other auxiliaries

Apart from medical, nursing, and dental assistants, a large number of different mid-level cadres exist. While many mirror the traditional health professions (such as pharmacists' assistants, physiotherapy assistants, laboratory technicians and auxiliary midwives), others are conceptualized independently of these professions, in response to specific environments and needs. Some of these auxiliaries and their use will be briefly introduced below.

In Pakistan, lady health visitors (LHVs) are mid-level health providers who form the backbone of community health care delivery to mothers and children. They are high-school graduates with two years of training, regulated by the Pakistan Nursing Council. LHVs deliver pre- and postnatal care and attend normal deliveries and provide care in preventive and health-promotive management of infectious diseases, growth and development of under-fives, nutrition, childhood diseases and illnesses related to women's health (Majumdar, Amarsi & Carpio, 1997: 33).

As in Nepal and Pakistan, in Myanmar

> Among basic health workers, lady health visitors and midwives provide the backbone of maternal health care service delivery, with the assistance of auxiliary midwives (AMWs). Each township has approximately five rural health centres, staffed by a health assistant, lady health visitor and a midwife. As well as providing services, rural health centre staff oversees the services provided from four or five sub-rural health centres, which are staffed by a midwife. In addition, voluntary health worker, auxiliary midwives, and community health workers, provide services at the village level (WHO/SEARO, 2005: 58).

India, like many other South-East Asia countries, makes use of mid-level ophthalmic personnel, particularly in dealing with cataract surgeries.

> With an output of 3.7 million cataract surgeries in a year, India has a CSR [cataract surgical rate, i.e. number of cataract operations per million population in a year] of 3 600, one of the highest in the world. This is achieved by approximately 12 000 ophthalmic surgeons. Currently, there are a variety of paramedical personnel in eye care. Some common categories include: paramedical ophthalmic assistants, opticians, ophthalmic nurses, refractionists, orthoptists and ophthalmic technicians. The estimated number of personnel in these categories is about 15 000. However, another 15 000-20 000 persons are working in eye care facilities without acquiring any formal training or qualification. Approximately 80 institutions are currently training the MLOPs in India, with a combined admission capacity of approximately 1 300 each year. In spite of such large numbers, there are no statutory councils or governmental bodies such as those existing for education of doctors and nurses" (WHO/SEARO, 2002: 4).

This brief introduction of different cadres of MLWs in no way does justice to the whole scope. However, in most cases the literature may mention but not elaborate upon the roles, organization and structure of these cadres. In order to develop a comprehensive typology of mid-level cadres, much research in countries is needed. Such research would need to detail these cadres' recruitment, entry requirements, training, roles and activities, organization and structure within the health system, and supervision and support.

So far the focus of the review has been on the roles and utilisation of different cadres. To provide a more in-depth illustration of how different cadres might be located within national health systems, below are included two country case studies, one from Malawi and one from Nepal.

Country case study 1. Clinical officers in Malawi

Malawi had 123 doctors serving a population in excess of 10 million in 2002-2003 (doctor: population ratio of 1: 89,962)1. Four out of 26 health districts had no doctors whilst a further 6 had only one doctor. Malawi has responded to this problem by training and relying on the clinical officer cadre since 1980, when the first group of clinical officers commenced service delivery.

Clinical officers are largely responsible for the provision of clinical care at district hospital level and play a very important role in the larger central hospitals. Often clinical officers will be supported by doctors but they have shown themselves able to function well without medical officer support.

Their duties include OPD care, emergency care, ward management of hospitalized patients and surgical care. Clinical officers carry out a range of surgical procedures including, amongst others, caesarean sections, hernia repairs, management of ectopic pregnancies and fracture management.

With the advent of the provision of anti-retroviral agents (ARVs) to public sector patients it is clear that the clinical officers will be leading the teams responsible for delivery of ARVs in many health districts.

Clinical officers undergo a four year training which includes anatomy, physiology, pharmacology, paediatrics, medicine, surgery, obstetrics and gynaecology. A separate cadre, medical assistants (two years of training), are allowed to upgrade to the clinical officer level after some years of practice – they are then trained specifically as anaesthetists and orthopaedic officers.

Many clinical officers have moved beyond the clinical care sector to lead district health management teams (as district health officers) and to support many of the important programmes in Malawi such as TB Control, Malaria Control, IMCI and others. Here they are active as programme managers and as researchers.

It is clear that clinical care at hospital level in Malawi will be severely hampered, if not impossible, without the clinical officer cadre.

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Country case study 2. Midlevel primary health care workers in Nepal

Nepal is one of the poorest and least developed nations in South Asia. Its dramatic geography, stretching from the highest mountains in the world, to the tropical low lying plains in the south presents a great obstacle to improving the health of its 23.4 million people.

The Nepal Health Care system is based on the district health system. The country is divided into 75 districts, each district being further divided into village development committees (VDC), which in turn comprise of 9 to 11 wards. Most, but not all, districts have a district hospital. The District Public Health Officer is responsible for all primary health care services in the district.

Each district usually has one or two health centres, and several health posts and sub health posts. These are staffed by a variety of different levels of trained health workers that are referred to by a bewildering yet widely used array of acronyms. Health posts are staffed by Health Assistants (HA) who have undergone 3 years clinical training. Sub Health Posts are staffed by Auxiliary Health Workers (AHW), also known as Community Medical Assistants (CMA), who have had 18 months clinical training. These categories of staff are able to diagnose and treat the common illnesses in their area. Many of the more experienced ones have extensive clinical knowledge, sometimes more than the doctors to whom they refer. However, they also have several widely held poor practices that I have observed across the country. Overprescribing and polypharmacy are very common.

Many CMAs also have their own private medical shops in their homes or the nearby bazaar. I have observed that in some cases this business takes priority over the working hours of the health post, which should be open from 10 am to 2 pm. This co-existing private system, together with the fact that the government only delivers drug supplies twice a year, which are thus often inadequate, gives very little incentive to the midlevel workers to maintain a good supply of medicines in the health post. On more than one occasion I have heard complaints that these supplies make it on to the shelves of the CMAs' private medicine shops before they see the storage cupboard of the health post. The lack of medicines is frequently cited by the community as a reason why they do not attend the health post. However, of the many health posts I have visited across the country, I have yet to find one with so little stock that it was not able to function. There was always one choice of antibiotic available and many other useful medicines. I have also met many skilled and dedicated CMAs, from whom I have also learnt a lot. It is hard to generalize. I have been as disappointed in some places as I have been impressed in others.

There are several other community based workers that are under the authority of each health post or sub health post. Each health post has an auxiliary nurse midwife (ANM). This person is responsible for antenatal care, deliveries in the health posts or at home, and immunization and growth monitoring of children. She is also responsible for implementing vertical programmes such as polio immunization days or vitamin A distribution campaigns. These workers have undergone 15 months clinical training, including practical training around conducting deliveries. They are often in short supply at a health post level. Those who work at the district hospital level are usually very well experienced. A study on traditional birth attendants (TBAs) in Nepal found that one third of the sanctioned ANM posts in health posts were not manned.

Sub health posts do not employ an ANM and instead make use of the services of a Maternal and Child Health Worker (MCHW). These women have had 3 months of training followed by a 6 week refresher course. They are responsible for immunization and antenatal care at a sub health post level.

Both health posts and sub health posts also employ a village health worker (VHW). This worker has also had 3 months training, and is responsible for house to house visits, follow up of TB cases, assistance with immunization programs, treatment of pneumonia, giving worm medicine and contraceptives.

A final category of worker is the female community health volunteer (FCHV). These are women chosen by women's groups in the community. They have 14 days of initial training and then a refresher course of a few days twice a year. For the training days they are paid. Otherwise their work is voluntary and their main task is education about maternal health issues. They also distribute condoms, vitamin A tablets and oral rehydration solution.

Traditional birth attendants (TBA) are also used and found all over the district. Many of these women have been trained either by mission hospitals or by the government. However the training of TBAs has fallen out of favour internationally and this programme no longer receives funding.

Although this system sounds impressive and well organized, in many situations it functions poorly. Staff positions may not be filled, or if filled, staff may not present for duty. The services are open for only a few hours daily. There seems to be more emphasis on collecting statistics for reports than on providing quality care. The system is often corrupt. These issues provide important lessons for South Africa.

In an attempt to try and improve management and service delivery, the government has recently handed over control of the health posts in certain districts to the village development committees. This happened last week in the district in which I am working. The results remain to be seen.

In spite of problems the government of Nepal has managed to distribute health posts and sub health posts through out the country and has done well in making health systems accessible to all its people. While visiting many villages and sometimes walking for several days I have never found myself in a village more than 2 hours walk from the nearest health post. Midlevel workers make this possible. For this Nepal is to be commended. While the system functions poorly at times, it at least provides a structure on which to build.

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5. Preparing for practice

Recruitment

There is hardly any information available about recruitment procedures for MLWs. We know that most of them will either be secondary school graduates or have extensive experience in health care, either as nurses or in other cadres.

Mullan & Frehywot found that in African countries "many NPCs were drawn from rural and poor areas, and trained closer to their geographical origin and eventual place of service than did other health workers" (Mullan & Frehywot, 2007: 2159).

In Micronesia the government recruited young high school graduates to be trained as health assistants. Candidates had to be nominated by the mayor or health council of their area and had to successfully complete a written test (Keni, 2006).

In general it appears that MLWs are often recruited among school leavers from disadvantaged geographical locations who cannot afford to study medicine or one of the other health professions or do not have the necessary grades.

Training

In most Asian and some African countries training programmes for non-physician clinicians distinguished between those that recruited registered and experienced nurses and those that recruited graduates from secondary school directly. The former as a rule receive one year of additional classroom teaching and six months of practical training, often in the form of an internship. Secondary-school graduates typically received three years of training, with an additional year of internship.

> All NPCs were trained in basic diagnosis and medical treatment and had prescriptive authority. Some received subspecialty and surgical training in fields such as caesarean sections, orthopaedics, ophthalmology, and hospice care. NPC training programmes relied less on hospitals and advanced technology than did training programmes for physicians. The training was practical and focused on local health challenges and treatment of indigenous disorders. Educational programmes were developed and operated by ministries of both health and education; these arrangements varied between countries. Non-governmental programmes did exist, including a clinical officer training programme in southern Sudan that was run by the African Medical Research and Education Foundation (AMREF) and a clinical officer training programme in Uganda that was offered by a private university (Mullan & Frehywot, 2007: 2159).

In the Pacific, mid-level nurse practitioners would receive a short course of clinical training, while non-nurse practitioners would receive more extended training:

> Most non-nurse mid-level practitioner training models do not require a health background for entrance; nor is a nursing background required. Graduation from high school is the most common entry requirement for these programmes. Thus, these programmes are typically longer than mid-level nurse practitioners' training programmes. Three years of study would not be unusual (WHO/WPRO, 2001: 9).

To better prepare nurses for clinical roles at primary levels of care, in the Pacific

> many nursing education institutions have tried to include some basic medically-focused content in their curricula (such as the signs and symptoms and treatment of common diseases), and some forward-thinking health departments have produced standard treatment guidelines. While these help, they are not a substitute for supervised clinical training in the process of clinical decision-making, such as how to take a proper patient history; how to conduct a good physical examination; how to assess the findings of the examination and how to make a differential diagnosis (WHO/WPRO, 2001: 8).

Table 5 provides an overview of the training of different cadres of health assistants, compiled from available information. It shows that most training programmes focus on curative skills and combine classroom teaching with different amounts of practical training. Teaching styles were discussed in only one article, and where examination methods are detailed, they usually consist of paper-based tests with a certain amount of oral/practical evaluation. From the evidence, it appears that mid-level training programmes generally follow standard health professions programmes, although they are usually taught at dedicated training institutions. Unfortunately the question of who trains mid-level workers is not answered in the literature, and should be another research priority.

> One of the main weaknesses of the mid-level practitioner programmes internationally is that the teachers themselves do not have up-to-date skills in clinical curative primary care. This is because the teachers never acquired these skills, as is the case with nurses teaching in newly established nurse practitioner training programmes, or because they have been out of practice for many years. In mid-level practitioner programmes in some industrialized countries, teaching staff are required to work as clinicians providing direct patient care at least 20% of the time, and often for 50% of the time (WHO/WPRO, 2001: 14/15).

Table 5. Training of health assistants

Country	Category of MLW	Entry requirements	Length of training	Subjects covered	Practical training	Teaching styles	Evaluation methods	Post-training direct supervision	Cont. education	Source
Bangladesh	Medical assistants		4 years	Basic health care, EPI, antenatal, postnatal and intranatal care, childhood illness, and general health services.	n/a	n/a	n/a	n/a	n/a	(WHO/SEARO, 2005)
	Senior staff nurses		4 years	choice of specialities in one year						(WHO/SEARO, 2005)
	Skilled birth attendant/auxiliary midwife	Female welfare and health assistants (SSC graduate plus 2 years experience)		Ante-natal care, conduct normal home births, postnatal care and newborn care, and also to identify early and refer obstetric complications.				Examinations		(WHO/SEARO, 2005)
Ethiopia	Different categories (junior clinical nurse, junior public health nurse, junior lab technician, junior midwife, junior pharmacy technician	High school graduate, entrance exam	12 months	3 months theory, six months integrated theory and practice	3 months field training under supervision of teachers in area of qualification		continuous evaluation and final exam			(Getahun, Yirga & Argaw, 2002)
Malawi	Orthopaedic clinical office	Medical assistants	18 months	4 months anatomy, pathology, biochemistry, physiology of trauma	6-months internship		Tests, examinations Oral-practical evaluation			(Blair, 1994)
	Clinical officer		4 years	Anatomy, physiology, pharmacology, paediatrics, medicine, surgery obstetrics, gynaecology						(Thetard, 2004)
Micronesia	health assistant	high school graduate	18 months	5 months of theory: Medical terms Mathematics basic anatomy &	Hospital assignments (rotations) during training	teamwork, group discussions, practical demonstrations	closed book exams	1-2 week teaching visit by physicians every 6 months	n/a	(Keni, 2006)

Country	Category of MLW	Entry requirements	Length of training	Subjects covered	Practical training	Teaching styles	Evaluation methods	Post-training direct supervision	Cont. education	Source
				physiology Basic pharmacology, pathology, ophthalmology, ENT, surgery, medicine Community medicine Obstetrics Communication & health promotion						
Pakistan	Lady health visitor	High school graduates	2 years	pre-natal care, normal deliveries, post-natal care, new-born and neo-natal care; management of infectious diseases, nutrition programmes, childhood diseases, women's health			Licensing examination			(Majumdar, Amarsi & Carpio, 1997)
Papua New Guinea	Aid post orderlies		1 year plus 1 year internship		1 year supervised practice at a health centre					(Fanning, 1981)
	Health extension officer	Male nurse	3 years	Clinical medicine, administration, public health	1 year supervised residence (6 months clinical experience and 6 months community health)				No	(Fanning, 1981)

The 2001 WHO study on mid-level and nurse practitioners in the Pacific makes the following recommendations regarding training programmes:

- Training programmes should be at least 12 months in length for nurse practitioners to provide comprehensive training in primary care. For those with less background, more time would be needed.
- Training should focus on essential core content and related clinical competences, emphasizing critical thinking and problem-solving. Core content areas would likely include: health assessment and clinical decision-making; pathophysiology, assessment, management and prevention of common chronic, acute health problems; reproductive, child and adolescent care; basic epidemiology, and advanced primary health and community care; preventive health education, teaching and counselling; and administration of health centres, monitoring and evaluation and improvement of health services.
- Practical clinical experience should be introduced early on, and should make use of experienced clinical mentors and well-qualified clinical teaching staff.
- Adequate clinical teaching and supervision needs to be ensured, so that students get appropriate feedback on their practical clinical activities.
- "Evaluation should focus on clinical performance and evaluation of required competencies (…) and students should be clinically evaluated on site".
- Teaching staff should maintain relevant clinical skills.
- Furthermore, continuing education is vital for keeping up MLWs' motivation and for ensuring competent practice:

> A number of strategies have been found to be successful. One strategy is to make sure that every visit by a clinician or physician to rural health facilities becomes a teaching visit.
>
> Another strategy is to rotate mid-level practitioners periodically to a referral hospital where they can care for patients under the supervision of medical specialists. For such rotations to be meaningful, attention must be given to scheduling that is consistent with the specific clinical learning needs of the midlevel practitioner and that reinforce diagnostic reasoning and safe, evidence-based clinical decision-making. The most effective way to organize this is for the clinical experience to be structured and under the overall supervision of one particular doctor.
>
> Rural health workers often say that they feel left alone and forgotten. Inviting them to national and international workshops and meetings is another way of updating their knowledge and boosting their morale. Workshops, meetings and lectures should be a supplement, and not a substitute, for hands-on clinically focused continuing education (WHO/WPRO, 2001: 17/18).

Licensing

In most African countries, non-physician clinicians are registered or licensed to practice by a national professional body (usually the medical council), in conjunction with the respective ministry of health (Mullan & Frehywot, 2007). Kenya is one of very few countries that have a specific professional body for clinical officers. This board regulates both their training and practice under an act of parliament. In Ghana medical assistants are certified by the Ministry of Health (Dovlo, 2004), while in Bangladesh, skilled birth attendants are licensed by the Bangladesh Nursing Council.

6. Management issues

The management of mid-level cadres is generally not well described in the literature. Hardly any information is available regarding management issues such as supervision, career paths, regulation or governance. If lessons are to be learnt from existing programmes and if programmes internationally are to become integral parts of health service staffing, this is a knowledge gap that urgently needs to be filled.

Supervision

Although numerous articles mention the need for supervision, there is little detailed discussion of supervision in the literature. Articles that report on existing programmes do not examine supervision at all, most likely reflecting a lack of focus on supervision in programme evaluations or research. A number of programmatic articles, however, emphasize the importance of supervision in ensuring quality of care and continued performance by mid-level cadres. WHO's study of the Pacific region is one such example:

> Mid-level practitioners need to be supervised by doctors. But when the mid-level practitioners are in remote areas, day-to-day medical supervision is impossible, so countries need to use other strategies. Some countries assign a doctor full time to travel from one remote health facility to another, to provide supportive supervision and on-the-job continuing education to the mid-level practitioner and to follow up patients with serious and/or complex health problems.
>
> Another strategy is to have district medical officers and/or hospital-based doctors visit rural health facilities on a regular basis. At the very least, mid-level practitioners should have detailed feedback on the cases they refer to hospital (WHO/WPRO, 2001: 17).

Supervision is an aspect of human resource management that is widely agreed in the international literature of the past 30 years to be of crucial importance, yet in practice it has seen little large-scale intervention, innovation and improvement. Like other areas of human resource management, the supervision of mid-level cadres is an important area where policy and management action is required, accompanied by monitoring, evaluation and research into good practices and lessons learnt.

Remuneration

As in previous research, very little detailed information was found in this review regarding levels of remuneration of mid-level workers. Indications are that mid-level cadres are generally poorly paid, which in some cases was linked to poor retention (WHO/WPRO, 2001).

Career progression

Career progression is another topic rarely addressed in the literature. A study conducted in Mozambique found that health service staff generally:

> judged the TCs' career perspectives as inadequate. They think that TCs should not be considered mid-level cadres, since they have more years of training, far heavier responsibilities, unique skills at district level and higher workloads than most mid-level staff (Cumbi et al., 2007).

Similarly in the Pacific, non-nurse MLWs found career prospects limited.

> For non-nurse mid-level practitioners like medical assistants and health extension officers, career advancement is more difficult. The assessment found that many of them feel that their career is at a "dead end". One was quoted as saying, "We feel like we are just out there floating. We are not doctors or nurses, and there is little chance for us to go forward in our jobs."(WHO/WPRO, 2001: 18)

Tanzania, on the other hand, has addressed the career paths of medical assistants by allowing progression from medical assistant to assistant medical officer to assistant medical officer specialist, the latter two of which are allowed to carry the "doctor" title.

Nevertheless, Dovlo found that suggestions

> that assistant medical officers did not attract recognition and respect from doctors and health administrators in Tanzania, despite doing work similar to a doctor's (Dovlo, 2004: 7/8).

Several countries in the Pacific have made it possible for mid-level cadres to progress to medical school and become doctors or promote them to become administrators and programme managers (WHO/WPRO, 2001: 18).

In most countries, however, career paths and progression and the integration of MLWs into the staffing structures of the formal health system have not been addressed satisfactorily, a fact that contributes to their continued lack of legitimacy and acceptance within health services.

7. Performance

Performance of mid-level worker programmes is made up of different but closely interlinked elements: individual health worker performance, use of services, impact effectiveness and financial performance or cost–effectiveness. The literature provides some insights into individual health worker performance as well as costs and cost–effectiveness of programmes. No evidence was found, however, on changes in utilization rates and the impact of MLW programmes on health outcomes and the health status of populations.

Health worker performance

The evidence regarding the performance of mid-level cadres, either measured by quality benchmarks or in comparison to their professional equivalents, comes exclusively from a few African countries.

In Kenya the performance of clinical officers at the first level of outpatient care in a district hospital was assessed by means of an audit in the mid-1970s. COs in the outpatient department saw between 150 and 190 patients a day. It was found that while there were some difficulties, approximately three-fourths of the care dispensed was of acceptable quality. Patients with less serious illnesses as a rule received better care than patients with more serious illnesses. The study also found that a number of systems issues, such as a referral system and lack of a suitable record system, had a substantial impact on the quality of services (Malone, 1981).

Clinical officers have been particularly successful at providing emergency obstetric and gynaecological care. In Malawi, for example, clinical officers conducted 93% of major obstetric operations in government hospitals, but referred other surgical cases (Steinlechner et al., 2006). No significant differences have been found between their postoperative outcomes and those of medical officers in terms of general postoperative well-being (COs: 94.1%; MOs: 94.9%), stillbirths (COs: 8.5%; MOs: 11.3%) or neonatal mortality (CO: 2.2%; MOs: 1.6%). These results mirror similar findings in Mozambique where *técnicos de cirurgia* (TCs) perform most obstetric operations (Chilopora et al., 2007; Pereira et al., 2007). In 2002, for example,

> 47 specialist physicians and 53 técnicos de cirurgia performed a total of 5264 and 6914 major obstetric surgeries (caesarean sections, obstetric hysterectomies, and laparotomies for ectopic pregnancy), respectively (unpublished). On average, each técnico performed 117 caesarean sections, 7 obstetric hysterectomies, and 7 laparotomies for ectopic pregnancy, annually. Comparable numbers for specialists were 102, 4, and 6 (Kruk et al., 2007: 1256/7).

Increasingly particularly nurses, but also mid-level doctors are being used to render HIV care in primary care facilities. Although evidence is very limited at this stage,

> early experience suggests that good clinical outcomes can be obtained treating children with ART at primary care facilities in Zambia using predominantly non-physician clinicians. (…). Decentralised services can play an important role complementary to that of the speciality centre and in Lusaka have achieved clinical and immunologic outcomes comparable to those seen in the more industrialised world (Bolton-Moore et al., 2007: 1897/8).

Problems with performance were found in several studies, often linked to lack of training and/or support and supervision, as well as lack of guidelines. In western Uganda, for example, medical assistants were found to be making wrong decisions in the identification of 13% of IMCI cases, suggesting that diagnostic algorithms should be made more user-friendly (Kolstad et al., 1998). In Tanzania, "problems with quality of training are translated into quality of practice problems for medical assistants" (Dovlo, 2004: 8).

Overall, however, the existing evidence suggests that where mid-level cadres received appropriate and adequate training and continue to be supported, their performance is close to or even better than that of their professional counterparts (Haines et al., 2007).

Cost–effectiveness

Cost–effectiveness studies are few and have been conducted only for non-physician clinicians. The cost–effectiveness of other mid-level cadres has not been discussed in the literature at all.

In their study on non-physician clinicians, Mullan & Frehywot found that where information regarding cost and cost–effectiveness was available, it indicated that cost for training NPC amounted to about USD 1000 to USD 2000 per year and was less costly than training physicians (see Table 6 below).

Table 6. Reported training cost per year for NPCs in selected sub-Saharan African countries

	Cost per year, USD (tuition plus room and board)	Length of training (years)
Ethiopia	1200 – 1500	3
Ghana	4000	1
Malawi	2000	3
Tanzania	1300 – 2000	3
Zambia	1000 – 1500	3

Source: Mullan & Frehywot, 2007:2161

Kruk et al. recently conducted an economic evaluation of surgically trained medical officers in Mozambique. They compared the training, deployment costs and surgical productivity of TCs and specialist physicians. They derived the cost of training and deployment of both cadres from reviewing budgets, annual expenditure reports and accounting statements from training institutions and interviews with directors and administrators. The study found that

> the total cost of producing a "técnico de cirurgia", including first-level training was $19,465 per student. The comparable cost for producing one specialist physician was $74,130. The annual cost for deploying técnicos de cirurgia and specialist physicians were $3859 and $10,367 respectively. The majority of the deployment costs were salaries; the cost of additional supervision and referrals for técnicos de cirurgia were $199 per person per year or 5.1% of total.
>
> […]
>
> The 30-year discounted costs of training and deployment, not including start-up, are $71,914.8 and $167,057.7 for técnicos de cirurgia and physicians, respectively. Técnicos de

> cirurgia perform 1850 surgeries, while physicians perform 1159 surgeries (discounted) in the same timeframe largely because of their longer period of training. The resulting cost per surgery for Técnicos de cirurgia is $38.87 versus $144.1 for physicians, as shown in Figure 2. Today técnicos de cirurgia earn less than operating room scrub nurses in Mozambique (Mozambique Ministry of Health, unpublished). If their salaries were to double, their cost per major surgery would still be less than half that of physicians (…). Técnicos de cirurgia retain a substantial cost advantage in all of the scenarios. (Kruk et al., 2007: 1256/7)

Dovlo (2004) includes some interesting observations regarding cost–effectiveness, not only for the health system but also for patients in his review. It was found that in Kenya a basic clinical officer consultation was less than half as expensive to the client as a physician consultation. Furthermore clinical officers were expected to order fewer tests, which reduced costs to clients. In Ghana it was estimated that the cost of antenatal care received from a doctor was 38% more than that received from a nurse or medical assistant. Lastly, travel costs to be seen by a mid-level worker were likely to be considerably less than travel costs to a doctor.

8. Retention

Mid-level workers are often considered attractive because it is assumed that at a time of accelerating attrition of health professionals they are more easily retained. However, little systematic evidence has been collected to track length of stay, reasons for leaving or destinations when leaving. Only one article was found that compared retention rates of mid-level doctors and professionals.

Pereira et al. compared retention of medical officers versus clinical officers in Mozambique 20 years after the initiation of *técnicos de cirurgia* in Mozambique. They found that of all TCs graduated in 1987, 1988 and 1996, 88% were still working in district hospitals. By comparison only 7% of medical officers who were originally assigned to district hospitals after graduation were still working there. Seven years after graduation not a single MO initially employed at district level was still working there (Pereira et al., 2007). Pereira et al. conclude that

> Sending recent medical graduates for rural service is not an efficient solution to the problem of staff shortages in district hospitals. They do not stay there and they do not have enough training to carry out important functions (Pereira et al., 2007: 1533).

TCs, by comparison, show excellent retention and will have had at least three years of surgical training and experience.

There is no reason to doubt the widely held assumption, which is supported by anecdotal evidence, that MLWs are not only much more easily attracted to areas with health worker shortages but also retained there. However, evidence is lacking and tracking of MLWs is an urgent requirement.

9. Key challenges

The information collated in this review indicates that mid-level workers have been and are being successfully used in very different contexts and constellations in many African and Asian countries. Many African countries are in fact increasingly relying on NPCs, even in their future human resource plans.

> The Zambian government planned to increase the number of NPCs from 1000 to 2600. Ethiopia has been using a flooding and retention strategy to increase the numbers of health officers and health extension workers in the country, and has started an accelerated training programme that will produce 5000 health officers by 2010. AMREF planned to increase the number of its graduates in southern Sudan from 30–40 to 100 per year. Lesotho wanted to raise the annual graduation rate of nurse officers by 42%, and South Africa was opening programmes at its medical colleges to produce 100 physician assistants every year from 2007. Ghana, which has had a tradition of NPCs but a small training capacity, has committed to double its output of medical assistants in the next 2 years. Sierra Leone planned to

augment the number of its community health-care officers from 167 to 500 (Mullan & Frehywot, 2007: 2159/60).

If MLW programmes are to become an even more important feature in the staffing of health systems in low- and middle-income countries, many of the challenges identified in this review, particularly with regard to legitimacy, management and governance, as well as the evidence base, need to be addressed.

Policy and management challenges

Integration into the health system

In many countries MLWs continue to exist on the margins of the health sector, even though their centrality in the delivery of health care is well accepted. This ambiguity has its roots in the colonial history of MLW programmes and in the predominance of the traditional health professions in determining health systems discourses and structure. Some professionals may fear financial and professional competition, while others are concerned that "insufficient expertise" of MLWs may negatively affect the profession (Mullan & Frehywot, 2007).

The uncertainty about the position of MLWs in health systems frequently leads to a continued lack of attention to crucial MLW management issues, such as training and support, career progression, regulatory issues and the integration of these cadres into health staffing structures. This results in a vicious cycle in which MLWs are not well accepted because they are insufficiently trained, supported and integrated, and they are insufficiently trained, supported, and integrated because they are not well accepted.

These concerns need discussion and resolution in countries and internationally, based on evidence rather than prejudice or partial information. Experiences and evidence from countries that have well-developed and well-integrated MLW programmes, such as, for example, Bangladesh and Mozambique, should inform such discussions and the search for solutions.

Appropriate training

Insufficient teaching staff and training sites have been identified as another impediment to the scaling up and sustainability of MLW programmes (Mullan & Frehywot, 2007). But it is not only a lack of numbers, but also the appropriateness and relevance of curricula, teaching methodologies and personnel that must be addressed. At present the literature is silent on these topics, but the fragments of information available indicate that not all curricula and teaching methods may be tailored to the needs and future practice of MLW: instead they are defined primarily by the content and structure of professional curricula. This holds the danger of producing watered-down professionals rather than well-trained mid-level cadres with appropriate qualifications.

Continuing education and supportive supervision have been identified as challenges in several articles. While it is acknowledged that both are vital to enable continued performance of MLWs in all categories, it is also recognized that in most programmes neither are available in sufficient quantity or quality, often due to remoteness or unavailability of supervisory personnel.

Proliferation of cadres

Another concern raised has been the proliferation of cadres in some countries (Dovlo, 2004). Undue proliferation undoubtedly creates inefficiencies in the health system and makes monitoring of service delivery and staff difficult. The introduction of new cadres therefore must be the result and an integral part of national human resource planning processes that consider which services are to be delivered at each level of care, which skills are required to deliver these services and which staff are appropriate and available to render these services.

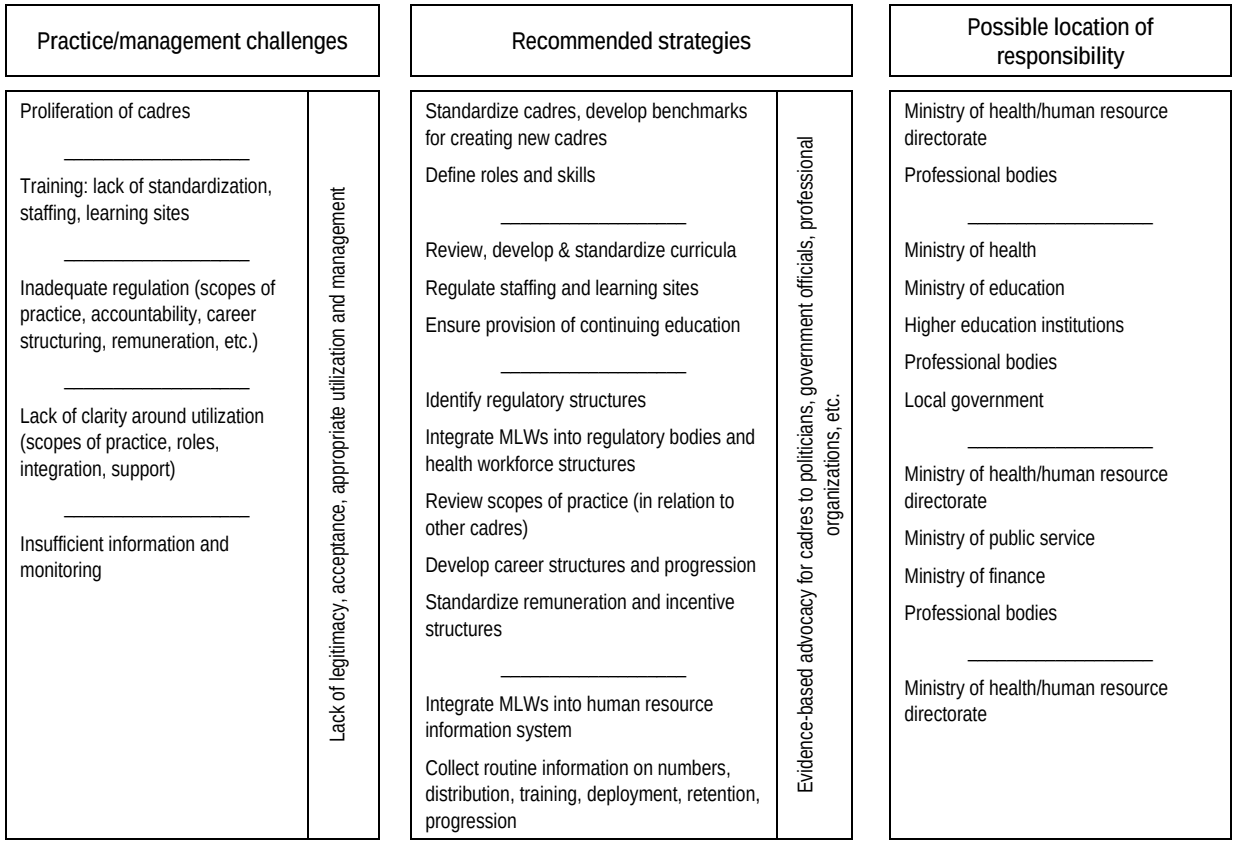
The lack of standardization of mid-level cadres internationally is considered both a drawback and a benefit (Mullan & Frehywot, 2007). On the one hand, it inhibits the sharing of resources and mid-level workers and defies comparison and the development of typologies. On the other hand, however, the local nature of many cadres ensures their suitability to local needs, thus providing locally appropriate health service solutions.

Lack of information

Lastly, and crucially, few countries have adequate information systems to monitor and evaluate production, deployment, retention and progression of mid-level workers. While there are shortcomings in human resource information systems quite generally in most countries, mid-level workers, who are less well established in health systems, are particularly affected by this lack of information.

Figure 2 summarizes key practice and management challenges and makes suggestions for possible strategies to address these as well the possible location of responsibility for such strategies.

Figure 2. Towards better management of MLW programmes



Evidence and research gaps

The evidence regarding the impact of MLWs on health outcomes is not good. Most studies show that MLWs improve access to and coverage of health services, and argue that well-trained and motivated mid-level workers provide better quality and more accessible services than better-qualified but less-motivated professionals. But there are very few studies that rigorously link health outcomes or health status to these cadres. Similarly, information on the cost and cost–effectiveness of using mid-level cadres exists in only very few countries. Undoubtedly this lack of evidence contributes to the continued ambiguity regarding the legitimacy and roles of MLWs, even in countries where they are widely used and health service delivery actually depends on them. As Dovlo comments: "The paucity of hard evidence on substitutes limits the value of the experience so far gained" (Dovlo, 2004: 11). Mozambique is among the few countries that have begun to systematically investigate and evaluate aspects of its MLW programme.

Other countries will need similarly detailed research to ascertain present practices but also possible future usages with regard to training, utilisation, management and governance.

Not only is there a need for systematic academic research, as shown by the emerging evidence from Malawi and Mozambique, for example. There also is a need for situational assessments within and across countries to provide baseline information and a need to set up regular monitoring systems.

Table 7 provides a list of possible assessment questions that could contribute to filling existing evidence gaps. It does not claim to be complete, nor would all topics apply to all countries. It rather wants to suggest key themes, as they emerge from the existing evidence base. The topics as listed here may require both systematic assessments as well as ongoing monitoring by means of a range of methods.

Table 7. Developing an assessment and monitoring agenda

Assessment questions	Possible indicators or data sources
Which cadres now exist? How are they produced and in what numbers?	• Absolute numbers of different cadres • % of health workforce; in relation to other cadres • Geographical distribution Other characteristics: gender, etc., of cadre
What are their roles and responsibilities within health teams at different levels of health care (i.e. what are their roles in relation to other health workers)?	• Mapping of team members' roles • Compare job description and roles of different cadres within teams • Observations and interviews with different health service providers
Which skills do they require to perform their roles effectively? And how are these acquired (e.g. formal training, informal training, experiential)?	• Skills profiles for different cadres • Observations and interviews with managers and health service providers
How are MLWs recruited and selected?	• Review recruitment and selection criteria • Survey of recruitment practices
Are training programmes adequate and appropriate to prepare MLWs for their roles?	• Define training needs where necessary • Review training curricula • Assess/observe new graduates in practice • Interview managers, service providers, training providers, graduates
Are continuing education and supervision available to support MLWs in their roles?	• Survey and interviews on frequency and content of continuing education programmes, supervisory visits, etc.
Are MLWs deployed and used according to identified needs?	• Survey of where MLWs are deployed • Interviews with managers • Comparison with job descriptions and human resource plans
Are MLWs performing the roles allocated to them? Are they performing assigned (formal) and/or assumed (informal) roles?	• Survey/ observations of roles being performed • Interviews with managers and MLWs • Comparisons with scopes of practice, job descriptions, human resource plans
How are MLWs functioning and accepted in health teams?	• Interviews with managers and health care providers (different cadres)
How long do MLWs stay in post? Where do they go when they leave?	• Review staff records and registers • Interviews with managers • Surveys/interviews with existing and former MLWs

Assessment questions	Possible indicators or data sources
How does health care change in areas served by MLWs in terms of access, coverage, affordability, equity and health outcomes?	• Assess changes in utilization rates and geographical, socioeconomic distribution of utilization • Assess health outcomes for key indicators • Assess changes in affordability for clients (fees, transport, etc.) through surveys and/or interviews
Are MLWs cost–effective in relation to health gains and in comparison to other cadres?	• Cost training, deployment, utilization • Cost–effectiveness analysis

10. Conclusions and recommendations

This review aimed to examine the existing evidence regarding different types of mid-level health workers and their impact on health outcomes, and to identify gaps in knowledge and evidence on the use of mid-level health workers to deliver basic health care services.

The evidence suggests that for over 100 years different categories of mid-level workers have been used successfully to provide health care, particularly to underserved communities, and that the use of MLWs has been widening in both high- and low-income countries. Utilisation, skills, length of training and management practices vary quite substantially across countries. Particularly Asian countries have, over the years, developed many local MLW categories, from birth attendants to health assistants, who are not modelled on traditional health professions but respond to specific country needs. In African countries, on the other hand, most mid-level cadres appear to be developed from traditional professional cadres, such as doctors, pharmacists, etc. Some countries have developed a multitude of these categories, most notably Mozambique.

Recommendations emanating from the review suggest that, most importantly, there is an urgent need to improve what we know about mid-level workers and their role and impact on health outcomes. Gathering such evidence has two aspects: first, information on mid-level workers must be routinely collected within human resource information systems. Where such systems do not exist or are not sufficiently developed, such developments must be a policy priority. Second, detailed and systematic research on different aspects of mid-level worker programmes and their impact on health care delivery and outcomes is needed in most countries. Recent years have seen the beginnings of such research in selected countries and on selected cadres, most notably clinical officers. Similar studies are needed in other countries and on other cadres. Only then will policy-makers, managers and academics be able to assess and judge the present impact and future potential of mid-level cadres and set the agenda for future investments and improvements.

Recommendations regarding the standardization of categories and their training are ambiguous. While standardization would allow the sharing of often scarce resources, the rationale for MLWs is often their context-specific, local designation and training. A suggestion made by the East, Central and Southern African Health Community (ECSA) to look into regional collaboration warrants exploration, as it may retain much of the local specificities of MLWs while allowing for the sharing of facilities.

Crucial to the successful utilization and integration of MLWs is a health team approach. If MLWs are to function effectively, their roles must be discussed in relation to the roles of other team members, such as professionals, community health workers, clerical staff, etc. The aim must be to provide an appropriate skills mix in the health team to render appropriate, equitable and high-quality care. Task-shifting as advocated by WHO must be discussed in this context.

Other recommendations concern particularly the management of mid-level cadres. There is general agreement that common areas in need of strengthening include training, legislation and regulations, and the health system and human resource policies relevant to career structure and professional development, clinical supervision, continuing education, adequate housing and adequately equipped and maintained health facilities.

Mid-level cadres furthermore need legal regulation like other cadres, including agreements on scopes of practice, accountability and autonomy of practice, as well as career structuring. The last is particularly important in relation to health professions. Career laddering that allows access to appropriate health professions based on education and experience should be seriously considered.

Training curricula, sites and staff must be formalized and reliably resourced, and tailored to the practice requirements of specific mid-level categories. Training programmes should be regularly reviewed and evaluated to ensure their continued relevance and appropriateness. Continuing education and supportive supervision should be reliably available to all staff and should be provided by staff with appropriate experience in the MLWs' field of practice.

Although we know little about incentives and remuneration, it would appear that salary and incentive structures must be urgently considered to ensure retention, motivation and job satisfaction of mid-level cadres.

Finally, there is the question of numbers. The available evidence indicates that in a conducive environment, mid-level workers can make a vital contribution to improving access to and quality of health care. However, they cannot be the only response to overwhelming and growing health worker shortages. Increased community participation must be another response. And there continues to be a great need for accelerated production of health professionals in countries with shortages. This very importantly includes production in high-income countries that presently fill their supply gaps by further depleting health worker numbers in those countries that can least afford this.

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