Chapter 18. Innovations in Community-Based Health Care for Cardiometabolic Diseases

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Abstract

Cardiometabolic diseases disproportionately affect low and middle income countries (LMIC) where nearly 80% of cardiometabolic disease related deaths occur. These diseases occur at a much younger age in LMIC contributing to greater loss of potential years of healthy life. With the acute shortage and mal-distribution of the health workforce in LMIC, achieving better health outcomes for the prevention and control of cardiometabolic diseases is a major challenge. This chapter reviews two innovative strategies of prevention and management of diseases, namely task-shifting (shifting some aspects of health care management to non-physicians) and self-management (enabling patients to manage symptoms, treatment and lifestyle changes associated with disease).

Our review suggests that task-shifting and self-management initiatives for cardiometabolic diseases in LMIC can be effective strategies, with some (although often poor quality) evidence of improved health outcomes such as reductions in blood pressure and blood glucose levels, increased uptake of medications and improvement in lifestyle behaviours. While there is accumulating evidence from intervention research to support both these strategies, little is known about components of those interventions that work the best, and there are large evidence gaps in how to translate the successful findings from research settings into real life. Operational research is needed to understand issues relating to the effectiveness and cost-effectiveness of these strategies and the quality of care provided, patient acceptability and importantly, given likely concerns over safety and effectiveness health outcomes.

Introduction

Cardiometabolic conditions are the leading cause of premature mortality and morbidity among adults worldwide, including many low- and middle-income countries (LMICs). The chronic nature of these conditions imposes a high burden on individuals and societies and produces substantial challenges for traditional health systems.

Prevention and early intervention are crucial. In addition to population-based approaches, key preventive strategies require the extension of health care delivery platforms to the community. This chapter reviews the evidence pertaining to two important strategies involving extension of health services into communities in LMICs for the prevention and management of cardiometabolic conditions and risk factors. The first strategy focuses on task-shifting, defined as assigning health care management and prevention tasks to nonphysicians. We reviewed the literature as it related to cardiometabolic diseases, using a systematic review of the published literature. Given its broad and diverse focus, a narrative literature review was performed for the second strategy, self-management—with or without support from family or community-based peers. These detailed reviews are accompanied by two case studies, outlining examples of initiatives employed in communities in LMICs.

Task Shifting for Cardiometabolic and Respiratory Diseases in LMICs

In many countries, first-level physicians are the first point of contact and the main providers of health care for individuals with noncommunicable diseases, including for the prevention and management of cardiometabolic diseases. In LMICs, too few doctors exist and physician workforce disparities for rural and remote regions are substantial (Kar and others 2008; Ministry of Health and Family Welfare 2010; WHO 2006).

An alternative workforce that is structured around the community and consumer needs could potentially address this need. *Task-shifting* describes the delivery of services normally performed by physicians to health professionals with a different or lower level of education and training or persons specifically trained to perform limited tasks only, without formal health education (Lekoubou and others 2010). Task-shifting may be facilitated by medical technology, such as standardized diagnostic equipment linked to electronic decision support, which standardizes the performance and interpretation of certain tasks.

Task-shifting has typically occurred in close collaboration with the medical profession (WMA 2009) and can potentially result in cost and physician time savings (Abegunde and others 2007; Buttorff and others 2012; Mdege and Shehzad 2012). A study in Uganda reporting the potential impact of task-shifting on the costs of antiretroviral therapy and physician supply found that the estimated annual mean costs of follow-up per patient were US$31.68 for physician follow-up, US$24.58 for nurse follow-up, and US$10.50 for pharmacist follow-up (Babigumira and others 2009). In addition, task-shifting is a potentially efficient way to reorganize the workforce by ensuring better specialization and quality of care, allowing physicians to focus on the jobs that cannot be delegated (Callaghan, Ford, and Schneider 2010). A study in Rwanda showed that task-shifting from a physician-centered to a nurse-centered model for antiretroviral therapy reduced the demand on physician time by 76 percent (Mdege and Shehzad 2012).

Task-shifting in health care began in the 1970s-80s, when auxiliary nurses in the Democratic Republic of Congo took on the role of providing health care due to a shortage of physicians. This shift allowed the few available physicians to use their time and expertise to manage people with more complicated diseases. Other LMICs in South Asia and Sub-Saharan Africa have used this approach for childhood conditions (Bang and others 1999; McCollum and others 2010) and infectious diseases (Fairall and others 2012). A Cochrane review that assessed the performance of nonphysician health workers (NPHWs) on maternal and child health indicated that task-shifting was beneficial in promoting immunization and breastfeeding, improving tuberculosis outcomes, and reducing childhood morbidity and mortality, compared to usual care (Lewin and others 2010). Growing evidence from countries in Sub-Saharan Africa suggests that task-shifting for antiretroviral therapy can help to curb the impact of HIV infection. A systematic review of HIV care in Sub-Saharan Africa showed that task-shifting offered cost-effective and high quality care to more patients than a physician-centered model (Callaghan, Ford, and Schneider 2010). Very few studies have examined the role of NPHWs in managing noncommunicable diseases in LMICs; most of these have focused on a single risk factor or disease (Labhardt and others 2010; Lekoubou and others 2010), rather than on integrated disease management.

A Systematic Review

We conducted a systematic search for published studies that involved task-shifting of the prevention or management of noncommunicable diseases to NPHWs in LMICs. For the purpose of this review, a *NPHW* was defined as a nurse or health care worker with no formal medical training. The term *noncommunicable diseases* defines a range of chronic noninfectious conditions, including cardiovascular disease (CVD), diabetes, hypertension, cancer, chronic obstructive pulmonary disease, neurological conditions, and mental health problems. A search strategy with the following terms was used “task-shifting,” “nonphysician health care workers,” “community health care worker,” “hypertension,” “diabetes,” “cardiovascular disease,” “chronic obstructive pulmonary disease,” “respiratory disease,” and “noncommunicable disease.”

The databases reviewed were Medline via PubMed and the Cochrane library. Table __.1 highlights the inclusion and exclusion criteria of the systematic review. The review was limited to peer-reviewed, community-based studies in LMICs and studies that involved clinical interventions. Studies focused on health education or health promotion, and hospital-based studies were excluded. Only English language reports were considered. The quality of studies was assessed on criteria such as design of the study, method of randomization, and sources of bias; no study was excluded on the basis of study quality. A meta-analysis was not done, due to high levels of heterogeneity among studies in relation to the task-shifting model under evaluation, types of patients, and outcomes evaluated.

Table __.1 Inclusion and Exclusion Criteria for the Systematic Review of Task-Shifting in NCD Prevention and Management

Inclusion criteria	Exclusion criteria
• Studies where a task usually performed by physicians is shifted to a different cadre of health care provider • Disease conditions limited to NCDs, cardiovascular disease, diabetes, hypertension, chronic obstructive pulmonary disease, respiratory diseases. • tudies conducted LMICs • Intervention studies: randomized controlled trials, before/after studies and other quasi-experimental studies • Community-based studies • Peer-reviewed articles • Articles in English language	• Studies primarily involving health education or health promotion interventions • Hospital-based studies

Source:

- *Note*: LMICs = low- and middle-income countries; NCD = noncommunicable disease.

Characteristics of Studies

The search generated 3,009 articles; eight were included in the review. Five studies were conducted in Cameroon, two in India, and one in South Africa (Table __.2). Four studies were based in rural regions, and four studies included both rural and urban regions. Studies involved task-shifting for the management of hypertension, CVD, diabetes and respiratory diseases. Tasks were predominantly shifted from physicians to nurses (Coleman and Wilkinson 1998; Kaufman and others 2012; Kengne and Sobngwi 2009; Kengne and others 2010; Kengne and others 2008; Kengne and Sobngwi 2009a; Kaufman and others 2012; Labhardt and others 2010); there was only one example of shifting to other health workers (Joshi and others 2012).

Table __.2: Summary Data from Published Studies Describing Task-shifting for Prevention and Management of Cardiometabolic and Respiratory Diseases

Author, year	Country	Disease addressed	Study type	Intervention	Outcome	Challenges	Cost effectiveness analysis
Coleman R, 1998(Coleman R 1998)	South Africa (rural and urban)	Hypertension and diabetes (also epilepsy and asthma)	Before-after	Protocol developed based on WHO guidelines. Patients initially screened by a doctor, and followed up by NPHWs Comparator: Usual care before intervention	BP controlled in 68% of patients, blood glucose controlled in 82% of patients with type 2 diabetes. ** Better adherence measured by self-report improved from 79% at the first visit to 87% at the most recent clinic visit.	High attrition of patients	No
Kar SS, 2008(Kar SS, Thakur JS et al. 2008)	India (rural, urban, and slum)	Cardiovascular disease	Before-after	NPHWs trained in WHO protocol for CVD risk assessment Comparator: Usual care before intervention	Increase in knowledge of NPHWs regarding CVD risk factors and symptoms. Increase in referral of individuals with raised BP. Decrease in systolic BP (154.5mmHg to 145.6mmHg), increase in intention to quit tobacco (25.5 to 60.3 percent) and reported regular use of antihypertensive medication (34.8% to 58.3%).	None reported	No
Kengne AP, 2008(Kengne AP, Sobngwi E et al. 2008)	Cameroon (rural)	Asthma	Before-after	Training of NPHWs for diagnosis and management of asthma. Monthly visit by physician. Patients identified and managed by nurses Comparator: Usual care before intervention	Increase in number of days without asthma attack.**	41 percent lost to follow-up	No

Kengne AP, 2009(Kengne AP, Sobngwi E et al. 2009)	Cameroon (rural and urban)	Hypertension and diabetes	Before-after	Training of NPHWs. Clinical management algorithm. Comparator: Usual care before intervention	BP decreased by 5.9/3.3mmHg. Fasting glucose decreased by 1.6mmol/l.	High attrition of patients.	No
Kengne AP, 2009(Kengne AP, Awah PK et al. 2009)	Cameroon (rural and urban)	Hypertension	Before-after	Training of NPHWs Comparator: Usual care before intervention	BP decreased by 11.7/7.8mmHg.	High attrition of patients.	No
Labhardt ND, 2010(Labhardt ND, Balo J et al. 2010)	Cameroon (rural)	Hypertension and diabetes	Before-after	Training of NPHWs Provision of equipment (sphygmomanometer, stethoscopes, blood glucose meters) Drugs Comparator: Usual care before intervention	100% retained equipment; 70% had functional blood glucose meter; 96% antihypertensives, 72% oral blood glucose lowering drugs.** Knowledge of NPHWs significantly improved. BP decreased by 22.8/12.4mmHg and blood glucose by 3.4mmol/l.	Changes in staff, Low case detection, High attrition of patients	No
Labhardt ND, 2011 (Labhardt ND, Balo JR et al. 2011)	Cameroon (rural)	Hypertension and diabetes	RCT	NPHW led care. Group 1. Treatment contract between patient and nurse + free medication for a month for every four months of consecutively attended follow up visits, Group 2. Treatment contract + letters reminding patients for a visit Comparator: Usual care	Retention rates in the intervention groups 60 percent and 65 percent in groups 1 and 2, 29 percent in control group.	50 percent lost to follow up across the three arms	No
Joshi R, 2012(Joshi R, Chow C et al. 2012)	India (rural)	CVD (Coronary heart disease and Stroke)	Cluster RCT	NPHWs trained to opportunistically screen individuals at high risk of developing CVD. Algorithm based care. Comparator: Usual care.	The proportion of high risk individuals identified was 12% greater in intervention villages (63.4 vs 51.4%). Agreement between the recommendations made by the trained NPHW and physicians was 88.5%.	None reported.	No

Note: BP = blood pressure; CVD = cardiovascular disease; NPHW = nonphysician health worker; RCT = randomized control trial; WHO = World Health Organization;
** Pre-intervention data unavailable

Quality of Studies
Only two of the eight studies were randomized controlled trials. The remaining studies evaluated the effects of the intervention by comparing outcomes before and after implementation; these studies provide low quality evidence of effectiveness. Three of the eight studies did not discuss sources of bias or limitations of the study findings; one did not report the details of statistical analysis used. Some studies reported more than 40 percent of the patients lost to follow-up, which further limits the reliability of the evaluation findings (Kenghe and others 2008; Labhardt and others 2010).

Does Task-Shifting Improve Health Care Effectiveness?
Process of care outcomes. The reviewed studies suggested that trained NPHWs may be able to successfully identify individuals in the community with noncommunicable diseases, including asthma (Coleman and Wilkinson 1998), CVD (Joshi and others 2012; Kar and others 2008), hypertension (Coleman and Wilkinson 1998; Kengne and Awah 2009; Labhardt and others 2010; Labhardt and others 2011), and diabetes (Coleman and Wilkinson 1998; Kengne and Sobngwi 2009; Labhardt and others 2010; Labhardt and others 2011. Findings from studies in which NPHWs were permitted to prescribe medications suggest that trained NPHWs may be able to effectively treat patients according to study protocols for conditions such as asthma (Coleman and Wilkinson 1998; Kenghe and others 2008), hypertension (Coleman and Wilkinson 1998; Kengne and Awah 2009; Labhardt and others 2010; Labhardt 2011), and diabetes (Coleman and Wilkinson 1998; Kenghe and others 2009; Labhardt and others 2010; Labhardt and others 2011). Several studies reported improved access to health care at the community level, although the metric to evaluate access was usually not described (Coleman and Wilkinson 1998; Kengne and Sobngwi 2009; Labhardt and others 2010).

Disease control outcomes. Only one study reported disease control outcomes. A before-and-after study from rural South Africa showed that trained NPHWs, with the help of treatment protocols and without the input of physicians, could achieve control in 68 percent of patients with hypertension, 82 percent with diabetes, and 84 percent with asthma, although pre-intervention rates for comparison were not provided (Coleman and Wilkinson 1998).

Treatment concordance. One study specifically examined concordance between physicians and NPHWs for the diagnosis and management of CVD risk, showing a high level of agreement between NPHWs and physicians (Joshi and others 2012). The study reported that recommendations for drug therapy made by NPHWs guided by algorithms were the same as those made by physicians in more than 87 percent of patients with prior stroke or myocardial infarction (Joshi and others 2012).

Is Task-Shifting Cost-Effective?
None of the studies reported cost-effectiveness outcomes.

What Are the Enablers of and Barriers to the Effectiveness of Task-Shifting Initiatives?

Potential enablers of task-shifting. Health system factors, such as training NPHWs; providing algorithms (Joshi and others 2012); disseminating protocols and guidelines for screening, treatment, and drug titration; and making medications available (Coleman and Wilkinson 1998) aided the success of task-shifting interventions. Several studies had a training component specifically designed for NPHWs that involved the development of algorithms and protocols, with training for screening, diagnosis, management, and follow-up for several diseases (Joshi and others 2012; Kengne and Sobngwi 2009a, Kengne and Awah 2009b; Labhardt and others 2010). Two studies reported significant changes in the knowledge level of NPHWs as a result of training and supervision (Kar and others 2008; Labhardt and others 2010). A study from Cameroon showed that the knowledge regarding the choice of correct antihypertensive drugs improved substantially after training, from 17 to 94 percent, and remained high two years after the intervention (95 percent) (Labhardt and others 2010). A study from India indicated that the knowledge levels of NPHWs for CVD increased from 47 to 93 percent after a four-day training program (Kar and others 2008).

The provision of diagnostic and management protocols with treatment algorithms was another key element that appeared to facilitate task-shifting models (Joshi and others 2012; Kengne, Sobngwi and others 2009b). Two studies from South Africa and Cameroon developed detailed protocols for hypertension, diabetes, and asthma management based on the WHO and other international guidelines (Coleman and Wilkinson 1998; Kengne, Sobngwi and others 2009b); similar protocols were developed for CVD screening and management in India (Joshi and others 2012; Kar and others 2008). Several studies had a task-sharing model where physicians were available for consultation in complicated cases (Kengne and others 2010), for confirmation of the diagnosis, and for initiation of CVD treatment (Joshi and others 2012). A cluster RCT in rural Cameroon showed that nurse-led facilitators could retain patients at the end of one year with free medications and reminder letters. The retention rates in the two intervention arms were 60 percent and 65 percent, respectively, compared with 29 percent in the control group (Labhardt and others 2011).

Potential barriers to task-shifting. Potential barriers to successful task-shifting in these studies included conditions associated with poor staff retention, irregular medication supply, and unavailability of equipment. A study in Cameroon reported only 48 percent of the trained NPHWs were retained at the end of the two-year study period; this low rate was primarily due to the transfer of staff to other public health facilities (Labhardt and others 2010). Some primary health centers did not have equipment to measure blood pressure or blood glucose and did not have protocols or guidelines for the management of noncommunicable diseases (Coleman and Wilkinson 1998; Joshi and others 2012; Labhardt and others 2010).

The availability of medications was identified as another challenge. Two studies had to directly provide the agents for patients, as the first-level health care center did not store sufficient quantities for noncommunicable diseases (Coleman and Wilkinson 1998; Labhardt and others 2010). A cluster randomized controlled study in rural India that showed NPHWs could identify individuals at high risk of CVD with the help of an algorithm but failed to demonstrate effects on outcomes, such as the number of medications prescribed or blood pressure and cholesterol levels. To obtain treatment, patients had to visit physicians located some distance away, because NPHWs did not have authority to prescribe medications (Joshi and others 2012).

Discussion and Conclusions

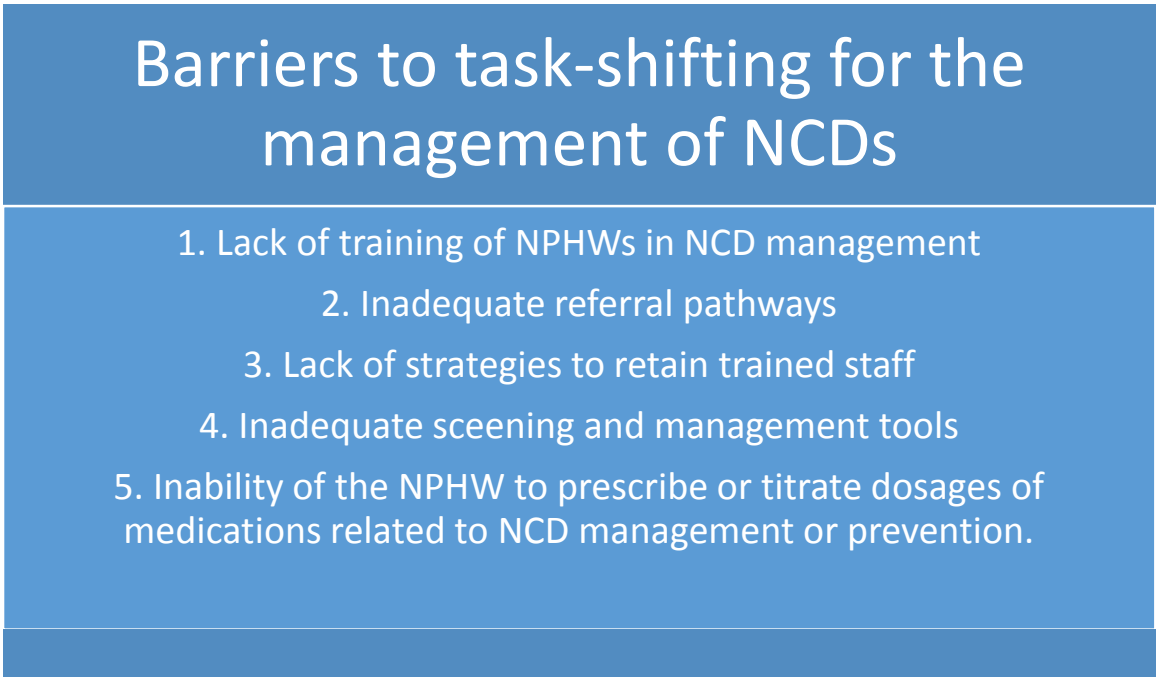
The acute shortage and maldistribution of the health workforce in LMICs is a major obstacle to improving outcomes for the prevention and control of noncommunicable diseases. Historically, reorganizing the workforce for the delivery of maternal and child health significantly improved outcomes (Haines and others 2007). More recently, task-shifting has proved to be a viable and cost-effective option for the management of HIV-AIDS in Sub-Saharan Africa (Callaghan, Ford, and Schneider 2010). High-income countries (HICs), such as Australia, the United Kingdom, and the United States, have reengineered their workforce for improved efficiency. For example, tasks such as taking blood samples, have been shifted to NPHWs like phlebotomists, who specialize in taking blood samples, freeing up physicians to provide other important services. Nurse practitioners in HICS are increasingly adopting many aspects of health care delivery that were traditionally the domain of physicians.

The translation and dissemination of prevention and treatment programs to community settings in the United States has relied heavily on NPHWs, with positive results. A review of translational research projects based on the Diabetes Prevention Program (Ruggiero L and others) concluded that using trained community health workers for patient management and peer education can be as effective as using health professionals. This review suggests that key barriers exist to effective task-shifting for NCD prevention and management in LMICs. Reengineering of the health workforce needs to be implemented, in conjunction with changes in the health system that include the following:

- Integrating NPHWs into health systems
- Developing referral pathways between physicians and NPHWs
- Training NPHWs in new skills
- Developing strategies to retain NPHWs in the workforce

- Providing NPHWs with appropriate screening and management tools
- Allowing NPHWs to prescribe a restricted number of medications in consultation with physicians or with other appropriate decision support.

Box _.1



Source: Authors

The WHO, in consultation with experts from a wide range of fields, has formulated a set of 22 recommendations that provide guidance on task-shifting (WHO 2008). These guidelines, developed in the context of the HIV epidemic in Sub-Saharan Africa, have implications for other conditions, including noncommunicable diseases. The concept of task-shifting is not readily accepted by all health care professionals (Zachariah and others 2009). Some view task-shifting as providing a competitive environment where physicians would compete with NPHWs for patients (Grumbach and Coffman 1998); others view it as unsafe for patients when care is provided in the absence of close physician supervision (Mullan and Frehywot 2007). The 60th General Assembly of the World Medical Association (WMA) in 2009 adopted a resolution on task-shifting that stated it is a short-term solution to physician shortages in LMICs and should occur in close consultation with physicians, with patient safety as the central goal. The WMA recommends further research on models of care with a physician-coordinated task-sharing approach, rather than a task-shifting model of care CMAAO 2009, CMAAO 2011).

This review clearly indicates that more rigorous research is needed to elucidate the issues relating to quality of care, patient satisfaction, and health outcomes. As randomized controlled trials are often costly and challenging in these settings, implementation studies utilizing mixed methods approaches may provide some of this much-needed evidence. Given that NPHWs are a potentially low-cost and sustainable option for the management of noncommunicable diseases in resource-constrained settings, future studies should routinely incorporate cost and cost-effectiveness analyses.

Limitations of Review

None of the studies in this systematic review reported process evaluation data, a critically important component for understanding contextual factors associated with uptake of the intervention that may influence potential for scale-up. Furthermore, the studies did not discuss the role of incentives and remuneration, and research is needed on optimal workforce conditions for task-shifting. A factor likely to

significantly influence the feasibility of these initiatives is their acceptability to patients and communities. In expanding the role of health workers in managing chronic illness, there is a need to better understand, for example, how patients might balance potential concerns over safety and efficacy with lower costs and improved access to care. Qualitative research is needed to address these questions.

This review was restricted to peer-reviewed articles published in the English language; we may have missed studies published in the gray literature and in languages other than English. We did not identify any study reporting negative results, suggesting the possibility of significant publication bias. The low number of studies identified may also reflect the inability to publish due to poor quality. The majority of study designs reviewed was of relatively poor quality in terms of level of evidence provided; future research on task-shifting should include much more robust evaluations of such strategies.

Self-Management: Engaging Patients and Caregivers

The prevention and management of cardiometabolic diseases are characterized by the need for behavioral changes (Newman, Steed, and Mulligan 2004). These include implementing healthy lifestyle changes; taking medications on an indefinite basis; and undertaking other preventive actions, including primary prevention of the condition for those at risk and secondary prevention of complications for individuals with the condition. To make these changes successfully, individuals and their caregivers must make decisions on a daily basis. The term *self-management* means different things to different people, and occasionally, different things at different times to the same person (McGowan 2005). With reference to chronic diseases in general, self-management has been defined as the ability of the individual to manage the symptoms, treatment, physical and psychosocial consequences and lifestyle changes characteristic to chronic conditions (p. 178). (Barlow and others 2002). The proponents of this definition stress that effective self-management involves the ability to monitor one's condition and to effect the cognitive, behavioral, and emotional responses required to maintain a satisfactory quality of life (Barlow and others 2002). A review of this topic (Clark and others 1991, Grady and Gough, 2014) suggests that authors in general interpret self-care as a preventive strategy and self-management as those tasks undertaken by individuals with disease to limit or reduce its impact (Clark and others 1991). We do not make such a differentiation here, given the absence of a clear-cut distinction between risk and disease states for many cardiometabolic conditions and the commonality of strategies for addressing prevention across the continuum of risk exposure.

Self-management strategies for chronic diseases have developed in recognition of the need to shift health care from traditional models of care that placed patients in the role of passive recipients, to models that recognize the pivotal role of patient-provider partnerships in achieving successful prevention and management (Bodenheimer and others 2002). The partnership paradigm (Bodenheimer and others 2002) embraces two conceptually similar but clinically separable principles: collaborative care and self-management education.

In collaborative care (also known *as patient empowerment*), providers and patients make health care decisions together, acknowledging the patients' responsibility to manage their conditions; the providers encourage patients to solve their own problems with information. Internal motivation, as opposed to external motivation, is the determinant of change. Table __.3 compares traditional and collaborative care in chronic diseases.

Table __.3: Comparison of Traditional and Collaborative Care in Cardiometabolic Diseases

Issue	Traditional care	Collaborative care
What is the relationship between patient and health professionals?	Professionals tell patients what to do; patients are passive	Expertise is shared with active patients; professionals are the experts about the disease, and patients are the experts about their lives

Who is the principal caregiver and problem solver? Who is responsible for outcomes?	The professionals	The patient and professional are the principal caregivers; they share responsibility for solving problems and for outcomes
What is the goal?	Compliance with instructions; noncompliance is a personal deficit	Patient sets goals, and the professionals help patients to make informed choices; lack of goal achievement is a problem to be solved by modifying strategies
How is the behavior changed?	External motivation	Internal motivation; patients gain understanding and confidence to accomplish new behaviors
How are problems identified?	By the professionals	By patients, for example, pain or inability to function; and by professionals
How are problems solved?	Professionals solve problems for patients	Professionals teach problem-solving skills and help patients in solving problems

Source: Adapted from Bodenheimer and others 2002.

Self-management education occurs in the sphere of patient education and includes a plan to provide patients with problem-solving skills (table __.4) (Bodenheimer and others 2002; Von Korff and others 1997). A patient with diabetes, for instance, will gain knowledge about diet, physical activity, and drugs that control blood glucose and will acquire technical skills on how to monitor blood glucose through traditional patient education.

Table __.4 Comparison of Traditional Education and Self-Management Education

Issue	Traditional patient education	Self-management education
What is taught?	Information and technical skills about the disease	Skills on how to act on problems
How are problems formulated?	Problems reflect inadequate control of the disease	Patient identify problems they experience that may be related to the disease
What is the relation of education to the disease?	Education is disease-specific and teaches relevant information and technical skills	Education provides problem-solving skills that are relevant to the consequences of chronic conditions
What is the theory underlying the education?	Disease-specific knowledge creates behavioral change, which improves clinical outcomes	Greater patient confidence in the capacity to make life-improving changes (self-efficacy) improves clinical outcomes
What is the goal?	Compliance with the behavioral changes taught to improve clinical outcomes	Increased self-efficacy to improve clinical outcomes
Who is the educator?	Health professionals	Health professionals, peer leaders, and other patients, often in group settings

Source: Adapted from Bodenheimer and others 2002.

Self-management interventions seek to address the challenges that individuals face in achieving optimal health goals related to management of their noncommunicable diseases (Newman, Steed, and Mulligan 2004). These interventions vary in terms of the population targeted, delivery location, self-management tutors used, mode and format of delivery, and content of the intervention (Barlow and others 2002). Self-management interventions have been implemented as part of multifaceted approaches to chronic care (Arauz and others 2001; Barcelo and others 2010; Faria and others 2013; Galante and others 2012; Thakur and others 2009); identifying the impact of each component on improving self-management or patient health status is a challenge.

Cardiometabolic Conditions Targeted in Intervention Studies

An overview of selected self-management interventions conducted in LMICs is presented in Online Table __.1. Diabetes appears to be the most often targeted condition. This is a global trend, likely reflecting the fact that diabetes is one of the conditions for which the evidence-base for self-management interventions is more developed (Newman, Steed, and mulligan 2004). The aims of these interventions tend to be diverse, addressing issues ranging from lifestyle modification to improving glycemic control though medications and coping with the symptoms. Interventions in LMICs have also targeted hypertension; obesity; and rehabilitation of patients with existing disease, such as coronary heart disease or stroke, and managing overall CVD risk (Fornari and others 2013; Mujica and others 2010).

Online Table __.1 Examples of Self-Management Interventions for Cardiometabolic Conditions in LMICs and the Evaluation of Their Effects **Reference/ country**	**Population**	**Design**	**Intervention**							**Duration of follow-up**	**Primary outcome**	**Effect size**	**Cost effectiveness**
			Setting	**Content**	**Format**	**Mode**	**Tutors**	**Group/ individual**	**Theories**				
Thankappan (Thankappan KR, Mini GK et al. 2013), India	224 adults with type 2 diabetes	Parallel group RCT	Referral diabetes clinic	Smoking cessation	Counselling (3 sessions), Printed support materials	Face-to-face	Doctors, Diabetes educators	Individual	5'A's & 5 'R's	6 months	Quit rate (7-day smoking abstinence)	Nearly nine times higher quitting rate	Not reported
											Harm reduction (reduction of the number of cigarettes smoked per day >50% of baseline use)	Non-significant effect	Not reported
Mash (Mash B, Levitt N et al. 2012), South Africa	34 public health diabetes clinics	Pragmatic cluster RCT	Primary care	Understanding diabetes, lifestyle, medication, complications	Guiding style education (4 sessions)	Face-to-face	Health promotion officers	Group	Motivational interviewing	12 months	diabetes self-care activities, 5% weight loss, 1% reduction in HbA1c	No effect on diabetes self-care activities, body weight and HbA1c;, Significant reduction of systolic (and diastolic) BP by	Not reported

												4.6 (3.3) mm Hg	
Cespedes (Cespedes J, Briceno G et al. 2013), Columbia	1216 preschool children, 928 parents, 120 teachers	Parallel group RCT	Preschool	Health eating and active lifestyles	Classroom educational and play activities, workshops, written materials	Face-to-face	Not specified	Both	Social cognitive theory and the transtheoretical model of health promotion	18 months	Mean change in knowledge, attitudes and habits related to healthy eating and living, and active lifestyle	Significant increase of the weighted score of knowledge, attitude and habits among children (3.9 units), parents (4.1) and teachers (5.4) after 5 months	Not reported
Fornari (Fornari LS, Giuliano I et al. 2013) Brazil	197 school age children, 323 parents	Parallel group RCT	School	CVD prevention education	Classroom educational and play activities	Face-to-face	Team of nurses, physical education teachers, nutritionists, physiotherapists, psychologists and teachers	Group	Not specified	10 months	CVD risk profile of children, CVD risk profile of parents	Significant 0.8% reduction of the mean Framingham CVD risk score; and 91% reduction of the number of parents with high Framingham risk score (>10%) in the intervention group	Not reported
Ribeiro (Ribeiro AG, Ribeiro SM et al. 2011), Brazil	28 women with hypertension	Parallel group RCT	Primary care, homes	Hypertension and dietary treatment measures	Monthly health education workshops (5), with or without Family orientation home visits	Face-to-face	Not specified	Group	Not specified	6 months	Adherence to nutritional guidelines; Knowledge on control and risk of hypertension	Significant reduction in the consumption of risk foods, oil, sugar and decreased body mass index, waist circumference, systolic blood pressure and glycemia	Not reported
Faria (Faria HT, Veras VS et al. 2013), Brazil	51 patients with type 2 diabetes	Before-after	Primary care	Pathophysiology, treatment, Lifestyle, foot care, self-monitoring, hypoglycemia, chronic complications, special	Classroom interactive lectures (20 sessions), Individualised meeting, Printed hand-outs	Face-to-face,	Team of nurses, nutritionists, psychologists, physical educator, undergraduate	Both	None	5 months	Self-perception of health Health related quality of life	Improvement of the mean perceived general health score from 64.0 to 70.6 (on a scale of 0 to 100) following the intervention	Not reported

				situations, family support									
Tan (Tan MY, Magarey JM et al. 2011), Malaysia	182 diabetic patients	Parallel group RCT	Hospital	structured education programme based on self-efficacy to enhance self-care practices.	Structured individual education (monthly), telephone follow-up, printed material	Face-to-face	Not specified	Individual	Social cognitive theory	3 months	Self-care practice, HbA1c, diabetes knowledge	Increased weekly sessions of self monitoring of blood glucose by four times, increased adherence to medication (7%), improved diabetes knowledge score by 2.6 points, better glycaemic control	Not reported
Alhalaiqa (Alhalaiqa F, Deane KH et al. 2012), Jordan	136 non-compliant hypertensive patients	Parallel group RCT	Hospital & homes	Adherence therapy	20 min sessions (7)	Face-to-face	Nurses	Individual	Not specified	11 weeks	Change in systolic blood pressure	Significant drop in systolic (23 mm Hg) and diastolic (15 mm Hg) blood pressure	Not reported
Jafar (Jafar TH, Islam M et al. 2010; Jafar TH, Islam M et al. 2011), Pakistan	4023 children and young adults	Parallel group cluster RCT	Home	Reduction in blood pressure using non-drug interentions	90 min heath education session (every 3 month)	Face-to-face	Trained community health workers	Group (household)	Not specified	2 years	Change in blood pressure of children and young adults	Systolic BP remained unchanged in the intervention group, but increased by 1.5 mm Hg in the control group while diastolic BP increased by 0.6 (intervention) and 2.1 mm Hg (control group)	Not reported
Barcelo (Barcelo A, Cafiero E et al. 2010; Barcelo, Cafiero et al. 2010)(Barcelo A, Cafiero E et al. 2010; Barcelo, Cafiero et al. 2010)(Barcelo A, Cafiero E et al. 2010; Barcelo, Cafiero et al. 2010)[19,20]{Barcelo, 2010 #631;Barcelo A, 2010 #600}[19,20]{Barcelo, 2010 #631;Barcelo A, 2010 #600}[41, 55][41, 55][42, 56][42, 56][43, 57], Mexico	297 diabetes clinics	Parallel group cluster RCT	Public health facilities	Structured patients education program, foot care, Providers training	3 learning sessions using breakthrough series	Face-to-face	Physicians, nurses, nutritionists, psychologists	Group	Chronic care model	18 months	Quality of diabetes care	The proportion of patients achieving three or more quality improvement goals improved from 16.6% to 69.7% with the intervention	Not reported

Mujica (Mujica V, Urzua A et al. 2010), Chile	51 adults with metabolic syndrome	Parallel groups RCT	Hospital	Structured physical activity and nutrition counselling	Lectures (4 monthly), practicals, printed material	Face-to-face	Physician, nutritionists, physical therapists, psychologists	Group	Not specified	18 months	Cardiometabolic profile	Decreased waist circumference, weight, body mass index, diastolic blood pressure and triglycerides with intervention; but similar proportion of participants achieved a reversion of metabolic syndrome in the two groups	Not reported
Kisioglu (Kisioglu AN, Aslan B et al. 2004), Turkey	400 adults women	Parallel groups RCT	Hospital	Structured education program by experts on physical activity and weight control	Group based education sessions	Face-to-face	Not specified	Group	Not specified	6 months	Change in blood pressure and body weight	Significant reduction of body weight (but not blood pressure) in the intervention group, with more participants moving from the upper (high risk) categories to the lower ones with the intervention	Not reported

Source: the Authors

Note: 5 'A's (Ask, Advise, Assess, Assist, and Arrange), 5 'R's (Relevance, Risks, Rewards, Roadblocks, and Repetition); BP = blood pressure; CVD = cardiovascular disease; RCT = randomized controlled trial.

Theories of Self-Management Interventions

Historically, self-management interventions were based on an educational approach, providing information in a traditional didactic format. The expectation was that the more knowledge people receive, the more likely they will be to engage the behavioral changes required to better manage their condition (Lorig and Holman 2003). This approach is still reported in published models implemented and evaluated in LMICs. However, with the growing understanding that knowledge alone is not sufficient to promote behavioral change, self-management interventions have increasingly been based on more complex theory (Lorig and Holman 2003; Newman, Steed, and Mulligan 2004). Theoretical models that have commonly been applied for cardiometabolic diseases in LMICs include the social cognitive theory, the stress coping model, and the readiness to change construct of the transtheoretical model (Newman, Steed, and Mulligan 2004). The evidence base does not support the use of any one theoretical framework; the appropriateness of each may be highly contextual. Strategies for self-management interventions in chronic diseases have been based on cognitive behavioral therapy.

Target Populations in Self-Management Interventions

Existing self-management interventions on cardiometabolic diseases in LMICs have targeted individuals with existing diseases, people with risk factors for disease, family members, or companions of those with or at risk for disease, as well as providers assisting in the delivery of self-management interventions. The intended beneficiaries have often been the direct targets of self-management interventions; however, the complexity of managing multiple risk factors for preventing cardiometabolic diseases suggests that targeting the direct beneficiary alone is insufficient. Alternative approaches have been developed, such as the use of peer-supporters that has been less tested in LMICs, and targeting family members or others. An example of an increasingly adopted innovation is educating children to influence their parents. In Brazil, Fornari and coworkers intervened with school children to help lower the cardiovascular risk of their parents (Fornari and others 2013).

Some evidence indicates that family interventions can improve the outcomes for individuals with or at risk of chronic diseases (Fisher and Weihs (2000). However, the few available studies in this area have been largely conducted in HICs. In a systematic review of family intervention studies in people with diabetes, Armour and others (2005) found family interventions were associated with improved diabetes-related knowledge in five studies and a significant improvement in blood glucose control in eight studies?. In a more recent trial in Chile (Garcia-Huidobro and others 2011] that involved 243 patients with type 2 diabetes from three first-level clinics in Santiago, a family-based intervention significantly improved blood glucose control during the first six months of intervention but not during extended follow-up (Garcia-Huidobro and others 2011). The family-based intervention consisted of two family meetings or visits at home, one individual counseling session, one counseling session with relatives, and one multifamily education session (Garcia-Huidobro and others 2011).

The involvement of health care providers in self-management interventions has often occurred in the context of multidisciplinary teams. Members of these teams include physicians, nurses, dieticians, physical therapists, pharmacists, psychologists, and lay health workers. The use of lay workers in LMICs is appealing, considering the shortage of the trained health workforce in these settings. In addition to delivering interventions within health care facilities, NPHWs have been used for community-based interventions,

particularly those occurring within households. In the Control of Blood Pressure and Risk Attenuation (COBRA) trial in Pakistan, trained lay health workers delivered a household self-management intervention for controlling blood pressure to several thousand individuals (Jafar and others 2010; Jaraf and others 2011).

Pharmacists are another health professional group through which the delivery of self-management interventions is increasingly reported. A review to examine the effects of pharmacist-provided, non-dispensing services on patient outcomes, health service utilization, and costs in LMICs identified 12 relevant studies. The review suggested that services that target self-management can lead to improvements in glucose levels, as well as blood pressure and cholesterol levels, and may improve the quality of life of patients with diabetes or hypertension. Furthermore, use of pharmacy services appeared to be associated with reduced utilization of other health care services (Pande and others 2013).

Education in Self-Management

Education is a key element of self-management support and should be targeted to individuals' circumstances (Novak and others 2013). The WHO Working Group on therapeutic patient education has emphasized the importance of patient-centered education for the effective management of chronic diseases (WHO Working Group 1998). Education interventions for cardiometabolic diseases have been delivered using paper-based or electronic support, face-to-face or remote interaction, and individual or group meetings. Multidimensional approaches with both written information and opportunities for in-person education and discussion have been proposed as particularly effective strategies; group settings offer a potential additional benefit of peer support (Novak and others 2013).

A quasi-experimental before-and-after evaluation study in Brazil explored the effect of educational intervention on the outcomes of 51 adults with type 2 diabetes (mean age 57.6 years). The content of the program was informed by the difficulties that providers encountered during patient care. The topics covered were concepts, pathophysiology and treatment of diabetes mellitus, physical activity, nutrition, care and examination of feet, self-monitoring, hypoglycaemia, chronic complications, special situations, and family support. It was delivered via group interactive lectures (20 sessions per group) and completed by individual consultations for those with additional needs identified during the group work and aimed to reinforce the strategies proposed during group meetings. These consultations were conducted with approximately 15 participants who had difficulties to maintain their metabolic control, or in fitting in the group activities. The program was delivered over a five-month period by a multidisciplinary team including nurses, nutritionists, psychologists, a physical educator, and undergraduate students in nursing and psychology. Participation in the program was associated with improvement in the perceptions of patients regarding their general health status (Faria and others 2013).

In contrast to this high-intensity intervention, a structured public health group-based education program that was administered in two steps to young women (mean age 34 years) in Turkey was associated with significant six-month improvement in the dietary habits and reductions in body weight, blood pressure, and prevalence of obesity. However, an economic evaluation to determine cost-effectiveness was not performed (Kisioglu and others 2004). The intervention included educating the women about healthy cooking and physical exercise to reduce high blood pressure and weight.

Technology in Self-Management Interventions

Mobile technology applications, such as short message service (SMS) and multimedia message service (MMS), have been suggested as potentially convenient, cost-effective ways of supporting self-management. SMS and MMS programs could overcome barriers to patient education and self-management in LMICs because they are relatively inexpensive, and accessible (mobile phone ownership is high and increasing in many LMICs). However, evidence to support their effectiveness remains very limited at the global level. A Cochrane review identified only four relevant studies, all conducted in HICS (de Jongh and others 2012). The review found moderate quality evidence in support of the improvement in individual's self-management capacity for diabetes, as well as improvement in the adherence to medications for diabetes or hypertension. The review further identified significant evidence gaps regarding the long-term effects, acceptability, costs, and unintended effects of such interventions. A RCT among Indian men with impaired glucose tolerance randomised to receiving lifestyle related SMS demonstrated that the incidence of type 2 diabetes was lower in the intervention group compared to control (18% participants in the intervention group developed type 2 diabetes compared with 27% in the control group, hazard ratio 0·64, 95% CI 0·45–0·92; p=0·015) (Ramachandran A and others 2013).

In a short-term randomized trial involving 200 patients with hypertension recruited across clinics in Honduras and Mexico, an intervention comprising automated telephone care management plus home blood pressure monitoring was effective in improving the perception of general health and patients' satisfaction with care. Intervention patients had lower depression scores and fewer medication related problems. In the subgroup with high information needs at baseline, the intervention was associated with significant lowering of blood pressure (Piette and others 2012).

The effect of telephone-based self-management support on diabetes control was assessed in two primary care facilities in Chile (Lange and others 2010). The intervention consisted of six telecare self-management support encounters during a 15-month period. Telecare included providing support to the participants and motivating them to continue their medications. Information was updated on their electronic health records, which could be accessed by the providers during the next patient visit. Compared with usual care, participants in the intervention group maintained their blood glucose levels during follow-up, while a deterioration in glucose management was observed in the control group. In the intervention group, perceptions of self-efficacy were higher, compliance to clinic visits was greater, and visits for emergency care were fewer (Lange and others 2010).

Cost-Effectiveness of Self-Management Interventions

Only two studies have assessed the cost-effectiveness of self-management interventions in LMICs. The cost-effectiveness of community-based strategies to control blood pressure was evaluated in the Control of Blood Pressure and Risk Attenuation (COBRA) trial in Pakistan (Jafar and others 2011). The COBRA project randomized 1,341 individuals with hypertension in 12 randomly selected centers in Karachi to usual care or one of three intervention programs: (1) combined home health education (HHE) by lay health workers plus trained general practitioner; (2) HHE only; and (3) trained general practitioners only (Jafar and others 2009; Jafar and others 2010). The annual cost per participant was US$3.99 for the combined HHE and trained general practitioners, US$3.34 for HHE alone, and US$0.65 for trained general practitioners alone. The combined HHE and trained general practitioners was the most cost-effective intervention, with an incremental cost-effectiveness

ratio of US$25 (95% CI 6-99) per mmHg reduction in systolic blood pressure (Jafar and others 2011).

The cost-effectiveness of home rehabilitation for ischemic stroke was evaluated in Thailand (Sritipsukho and others 2010). The study randomized 58 patients with ischemic stroke to home rehabilitation programs versus conventional hospital care. The Barthel Index and Modified Rankin Scale were used to evaluate the outcome measures, and success defined as an improvement by at least one level of the outcome scale. The cost and number of successful cases were greater in the intervention than the usual care group. For patients with mild or no disability based on the Barthel Index, the incremental cost-effectiveness ratios were 14,212 THB and 24,364 THB, respectively (Sritipsukho and others 2010). This finding was assessed to be cost-effective by the authors when compared with the gross domestic product.

Discussion and Conclusions

Self-management initiatives for cardiometabolic diseases in LMICs and at regional and global levels are in their infancy. Evidence is accumulating from intervention research to support self-management, but little is known about which components of those interventions work best in LMICs; we know virtually nothing about how to scale-up models found to be effective in research settings.

Extensive reviews of self-management intervention studies around the world have identified general components that have been found to work well in diverse settings (de Silva 2011; Novak and others 2013). These components can assist the development and implementation of strategies for promoting the uptake of self-management for chronic diseases in LMICs (box __.1). However, for these to be effective, it is important to understand the barriers and facilitators of the implementation, many of which are context specific.

Box __.2 Elements that Support Self-Management

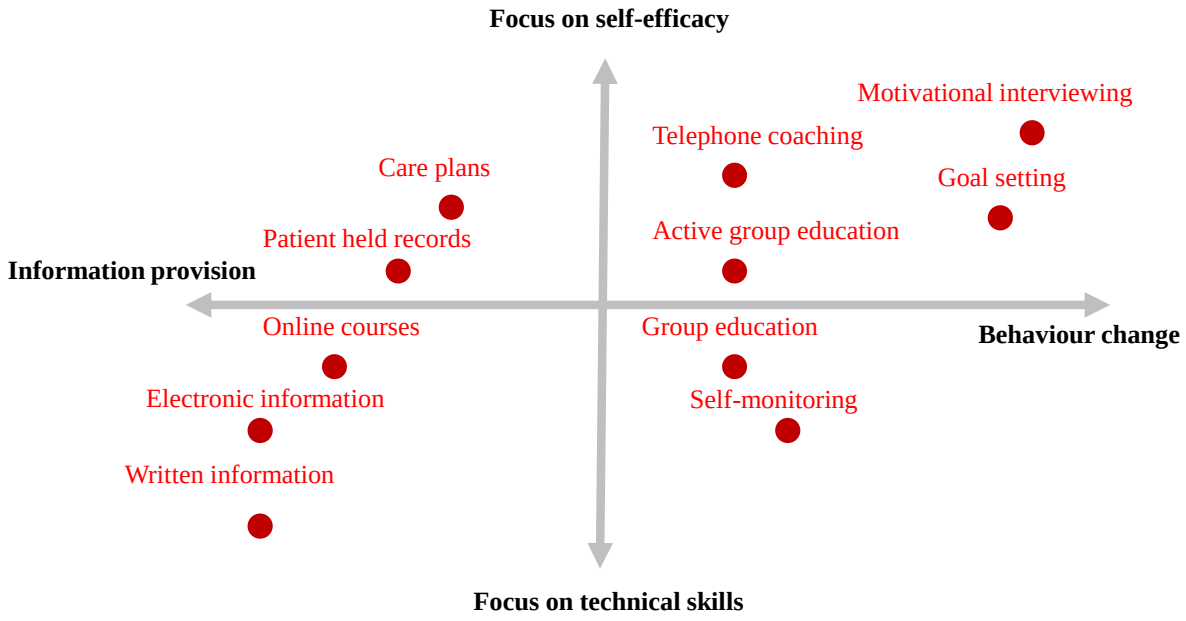
Elements that support self-management for chronic diseases include the following:

- Involving people in decision making
- Emphasizing problem solving
- Developing care plans as a partnership between service users and professionals
- Setting goals and following up on the extent to which these are achieved over time
- Promoting healthy lifestyles and educating people about their conditions and how to self-manage
- Motivating people to self-manage using targeted approaches and structured information and support
- Helping people to monitor their symptoms and know when to take appropriate action
- Helping people to manage the social, emotional and physical impact of their conditions
- Using proactive follow-up
- Providing opportunities to share and learn from other service users.

Source: Adapted from de Silva 2011.

Furthermore, different strategies will likely have to be combined for the same condition within any given setting and at different times for the same individual to achieve the desired effect (figure ___.1). It is important to note that in available studies from LMICs, self-management has been implemented as a component of much broader interventions targeting chronic disease prevention and control. Most of these studies did not develop an evaluation framework to tease out the contribution of the self-management component from the overall effect of the intervention.

Figure __.1 Continuum of Strategies To Support Self-Management



Source: Adapted from de Silva 2011.

Conclusions

Innovative approaches to extending the care of people with cardiometabolic conditions into the community are likely to be crucial components of any suite of strategies to reduce the burden in LMICs. Effective task-shifting to more affordable and community-based health care workers and effective consumer self-management are two important examples. For both, the current evidence base has critical gaps in terms of effectiveness, cost-effectiveness, and key understandings for scale-up, particularly in LMICs. Ongoing and new research is crucial. This chapter provides some insight into approaches that have the potential to be effective and scalable, as well as factors that might impede or facilitate their utility.

Case Study 1. Investigating **a** Cardiovascular Disease Risk Management Model Led **b**y Non**p**hysician Health **C**are Workers

Technology-Aided Task-Shifting to Prevent and Manage Cardiovascular Disease Risk in Rural India

Devarsetty Praveen, Anushka Patel, Arvind Raghu, Gari D Clifford, Pallab K Maulik, Ameer Abdul Mohammad, Kishor Mogulluru, Lionel Tarrasenko, Stephen MacMahon, David Peiris

Background

Cardiovascular diseases are the major cause of premature death and disability in India, yet few people at risk are able to access best practice health care (WHO 2004). In India, CVD risk factors levels are high, even in rural populations, which constitute 70 percent of the total population. CVD is the leading cause of adult deaths in many rural Indian communities (Joshi and others 2006; Kinra and others 2010). Despite the availability of evidence-based guidelines for the prevention of CVD, the use of simple, affordable preventive treatments (such as smoking cessation strategies, aspirin, low-cost statins, **ACE-inhibitors, and beta-blockers**) is very low in these communities (Joshi and others 2009). Multiple barriers exist at different levels of the health systems, including lack of facilities, limited access to providers, and high out-of-pocket costs for consumers (Rao and others 2011). Mobile Health (mHealth) is a promising strategy to address some of these barriers, but very few mHealth interventions have been subject to robust evaluation.

This case study describes an innovative strategy, Systematic Medical Appraisal Referral and Treatment in India (SMARTHealth India), that consists of the following:

- Use of a mobile device-based clinical decision support system (CDSS) for CVD risk management
- Task-shifting traditional physician roles to NPHWs
- Integration of the overall system within the government primary health care infrastructure in rural India.

The objectives were twofold: (1) to develop a valid CVD risk assessment and management algorithm based on best practice national and international recommendations, with a focus on blood pressure management; and (2) to assess utility, preliminary effectiveness, and acceptability of the system among community members, NPHWs, and physicians.

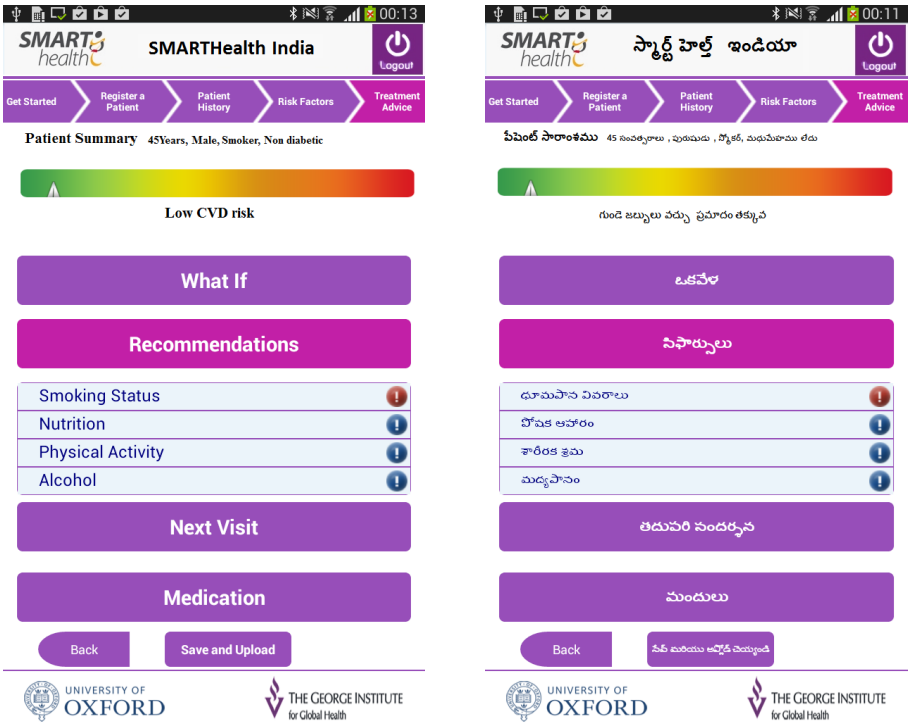
Methods

A mobile application software (app) was developed to deliver the CDSS, which was based on plain language clinical rules developed from standard guidelines that were subsequently programmed and translated. A formal training course was developed for the NPHWs and physicians that focused on both the conditions targeted and delivery of the interventions. The algorithm was validated and field tested in 11 villages in Andhra Pradesh, involving 11 NPHWs and three first-level health care physicians.

The mobile app takes users through a four-step process (patient registration, past medical history and medications, risk factor measurements, and treatment advice). For blood pressure measurement, the NPHWs/physicians use a Bluetooth^{TM}-enabled automatic monitor to wirelessly upload readings into the app. Blood glucose, cholesterol (if available), height, and

weight are manually entered. The treatment advice page provides the 10-year CVD risk of each participant, lifestyle, referral, and follow-up recommendations for NPHWs, and medication recommendations for physicians.

Figure __.2 Treatment Advice Screen of the Application [Note to authors: For reasons of print quality, it probably will not be feasible to have the screen shot; **and we will probably need permission; use** to be determined]



Source: Praveen D et al, 2014

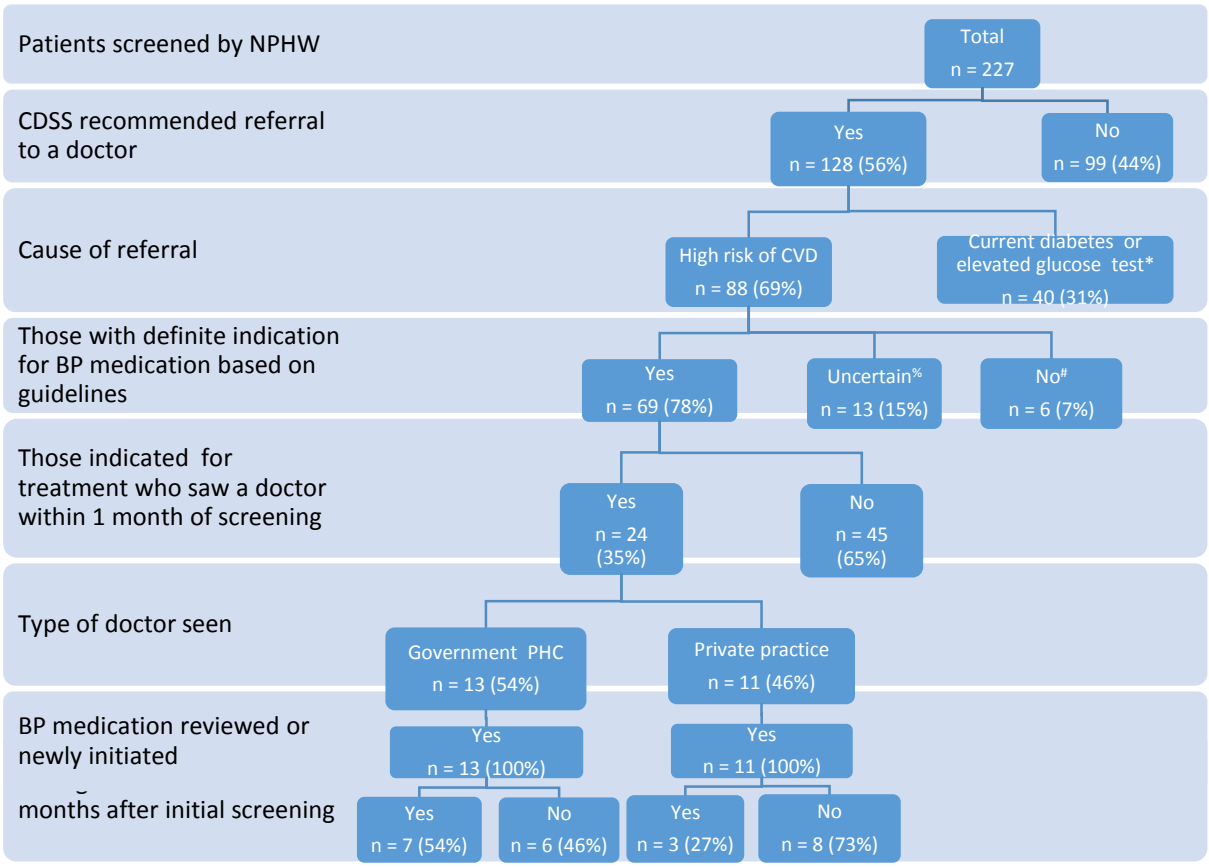
A mixed method evaluation was conducted that consisted of clinical and survey data, and in-depth patient and staff interviews, to understand barriers and enablers to the use of the system. At the end of the study, all physicians and NPHWs participated in an in-depth interview, and selected community members participated in four village-based focus group discussions in separate groups by gender. Interviews were semi-structured and conducted by a researcher experienced in these field settings who was proficient in English and Telugu. Interviews covered the following domains: (1) staff roles and responsibilities; (2) patient, NPHW, and doctor satisfaction with using the tablet; (3) staff knowledge and skills; and (4) impact of CDSS on usual work routines.

Findings

Quantitative evaluation: During the pilot study, NPHWs and physicians used the CDSS to screen 227 and 65 adults, respectively. The NPHWs identified 39 percent (88/227) of patients for referral; 78 percent (69/88) of these referred patients had a definite indication for blood pressure-lowering medication. Only 35 percent (24/69), however, saw a doctor within one month of referral; 42 percent (10/24) of these reported continuing medications at a three-month follow-up visit. Physicians identified and recommended 42 percent (10/24) of patients for blood pressure-lowering medications. Overall, therefore, after three months, only 10/69

(15 percent) of patients with an indication for blood pressure medications were actually taking such treatment. This pilot demonstrated the importance of concurrent health system strengthening for task-shifting strategies to be successful.

Figure __.3 Assessment and Management Pathway for Patients Screened by NPHWs



Note: *Either patients with a past history of diabetes who were not at elevated CVD risk (n= 9) or patients whose random capillary glucose tests were elevated (n=31). Further information on management practices for this group is beyond the scope of this chapter.
% Patients diagnosed with peripheral vascular disease but lacking any other data to suggest high CVD risk (excluded from further analyses).
# Patients with absolute risk 20 to 30 percent and BP < 140/90 or risk 30-40 percent and BP < 130/80 are not indicated for medications.
BP = blood pressure: CDSS = Clinical Decision Support System

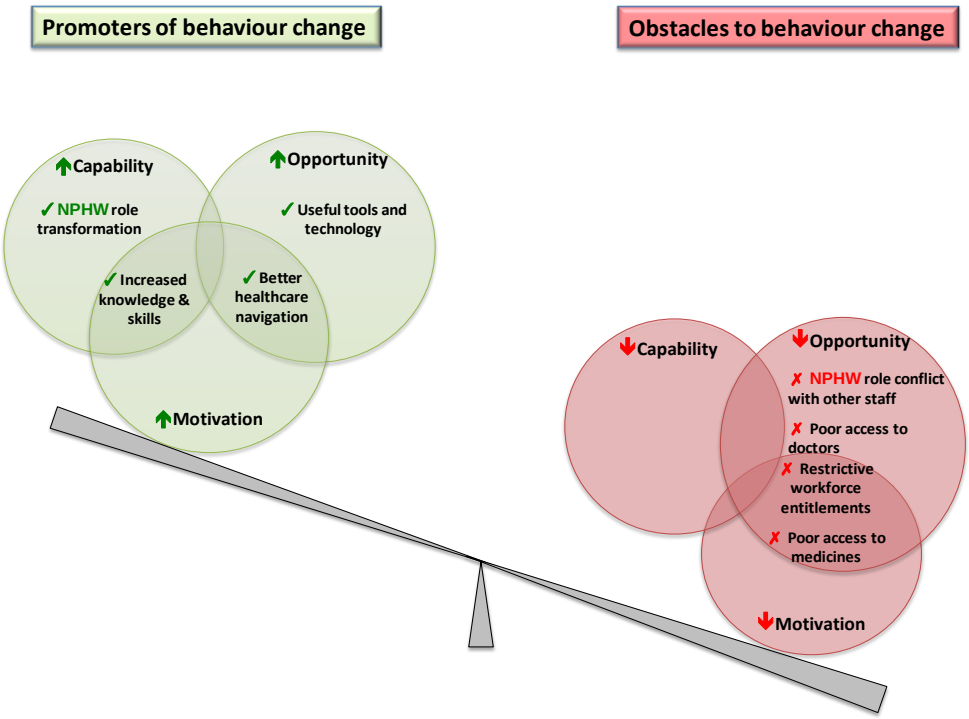
Source: Praveen D et al, 2014.

Qualitative evaluation: All physicians and NPHWs participated in interviews, and four community focus groups were conducted. Three interrelated interview themes emerged:

- The intervention strategy had potential to transform prevailing health care models.
- Task-shifting of CVD screening to NPHWs was the central driver of change.

- Despite high acceptability, actual transformation is substantially limited by system-level barriers, such as access to physicians and medicines. These themes are summarized in figure __.4.

Figure __.4 Illustration of the interview themes in context of the COM-B model.



Source: Praveen D et al, 2014

Conclusions

This feasibility study provides initial insights into the acceptability and preliminary effectiveness of a smartphone CDSS to improve CVD detection, prevention, and management in a first-level health care facility in India. It incorporates a technological solution with innovative workforce strategies to address the growing CVD epidemic. Appreciation of the broader systems issues, such as the inability of NPHWs to prescribe and dispense essential medications, and integration of mHealth strategies within this broader context are essential factors in maximizing the impact of such approaches.

The intervention strategy has been substantially modified to include a focus on health systems strengthening (government support through policy directives, ensuring essential medication availability, incorporation of recall and reminder systems, modified provider remuneration incentives, and incorporation of a consumer support program for long-term drug adherence). It is being rigorously evaluated for clinical and cost-effectiveness in a large cluster randomized trial. If found to be successful, the findings are likely to advance knowledge on scalable strategies to improve access to effective health care for underserved populations in LMICs.

Case Study 2. Investigating a Community-Based Diabetes Care Model

The Mopotsyo Model in Cambodia

Claudia Harner-Jay, Ashley Morganstern, Bernhard Weigl, Jennifer Drake, Mary Beth Weber, and Helen C. McGuire

Mopotsyo Model of Care

More than 325,000 Cambodians have diabetes (*IDF Diabetes Atlas*) and require access to chronic care. They face four main barriers when they seek services: financial, geographical, informational, and household.

MoPoTsyo is a nonprofit organization started in 2005 with the goal of empowering people living with **diabetes** and hypertension to manage their diseases and eliminate the barriers to quality care. Since 2007, MoPoTsyo has screened more than 460,000 adults for **diabetes**. In 2011, PATH selected the *MoPoTsyo Patient Information Center* in Cambodia as an innovative care model for noncommunicable diseases in low-resource settings. This case study is based on information gathered during PATH's onsite investigation to identify the success factors of MoPoTsyo and its potential for replication.

Currently, 135 peer educators serving 16 districts help to facilitate services for 14,000 people living with **diabetes** and hypertension. The program includes three components, all managed by the core staff at the head office: a network of peer educators, a revolving drug fund (RDF), and contracted physicians.

MoPoTsyo peer educators must be diagnosed with diabetes, complete an intensive six-week course delivered by MoPoTsyo, shadow an experienced peer educator and pass an examination. Once trained, peer educators lead group screening and information sessions in their home, which include monitoring blood glucose, blood pressure, heart rate, and weight; providing self-management education; answering member questions; and fostering peer support. Peer educators are organized under a diabetes program manager appointed jointly by MoPoTsyo and the local health authority in each operational district. Robust monitoring of peer educator performance and assuring consistent quality standards is a priority for MoPoTsyo.

MoPoTsyo procures medicines at international market prices and distributes them to 20 subcontracted community pharmacies, which in turn sell them to MoPoTsyo members at fixed prices below the market retail prices. Pharmacies with large sales volumes yield a 5 to 15 percent profit, and members benefit from a consistent supply of affordable medications.

Outcomes Achieved

A recent evaluation of 150 randomly selected MoPoTsyo patient records found significant reductions in **fasting plasma glucose** and out-of pocket expenses.(VanPelt M and other, 2013; Eggermont, N. 2011). The sensitivity and specificity of MoPoTsyo's screening approach; the relative health status of patients screened compared to alternative screening

methods; and the operational and logistical implications of diagnosing people earlier in their disease process are being assessed.

Key Success Factors

An interdisciplinary, patient-centred, team-based model of care (WHO: Innovative Care for Chronic Conditions 2002, Barr VJ and others, 2003).

The MoPoTsyo model places the patient at the center, supported by a cross-disciplinary team of a peer educator, physician, and pharmacist. Clearly defined roles, strong relationships, and good communication strategies among team members optimize care. The peer educator coordinates the team and facilitates health system navigation for the patients.

All team members record symptoms, progress, medical status, and medications in the members' patient care booklets. Peer educators monitor this information, including physicians' orders and patients' adherence to treatment. The booklets serve as identification when members purchase prescribed drugs. This simple information management and coordination system ensures that all team members are informed of the person's health status and care.

2. Reduced cost community-level services

For most Cambodians, diabetes care is difficult; for example, patients often travel long distances for care, and no hospitals offer free diabetes care. MoPoTsyo reduces direct and indirect costs by providing services close to home, using the RDF, and managing relationships with contracted physicians and pharmacies. Patients pay US$5 for consultation, testing, and transportation, compared to US$30 or more in the private sector. Average monthly medication costs for MoPoTsyo members are US$5.50. Patients report that services and medications are convenient and helpful.

3. Use of peer educators to enhance trust and model good disease management

MoPoTsyo peer educators are viewed as trusted community leaders committed to self-managing their disease. A MoPoTsyo physician reported that many patients have more trust in peer educators than health care professionals, because peer educators set a good example in their lifestyle choices and how they manage their **diabetes**. Peer educators are not allowed to prescribe or sell medications and do not have a financial stake in medications or services, so patients see them as unbiased. Although peer educators receive a small amount of money as reimbursement for their costs, many reported that they are motivated by the desire to manage their disease and the prestige they enjoy educating others to do the same, rather than by the money provided. Many hold jobs in their communities, often in leadership positions. The reputation of the peer educators as respected community members with an elevated social status enhances the reputation of MoPoTsyo as a credible organization. Patient trust and respect for MoPoTsyo grows as their health improves.

4. A dynamic, well-connected leader

MoPoTsyo's CEO and founder, Maurits van Pelt, has created a strong organization with staff members who are committed to enabling fellow Cambodians to self-manage diabetes and hypertension. MoPoTsyo staff report that van Pelt nurtures a team approach with on-the-job professional development and mentoring. The team has won the win support of donors and buy-in from key stakeholders to incorporate the model into the government system.

Conclusion and Implications

The MoPoTsyo model of care offers a promising and affordable approach to the care and management of noncommunicable diseases in low-resource settings and offsets constraints that impede access to care. Increasing the availability of services by centering them in communities, providing medications through contracted pharmacies, and launching a peer education program are specific approaches that MoPoTsyo has applied to provide comprehensive team-based care closer to home at a reduced cost.

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