

Physical Activity and Diet in the Management of Individuals with Type 2 Diabetes Mellitus: A review of interventions and policies in Ghana, Sub-Saharan Africa and Lower-Middle Income Countries

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Physical Activity and Diet in the Management of individuals with Type 2 Diabetes Mellitus: A review of interventions and policies in Ghana, Sub-Saharan Africa and Lower-Middle Income Countries

A thesis submitted in partial fulfilment of the requirement for the degree of Master of Science in Public Health

by:

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Declaration:

Where other people's work has been used (either from a printed source, internet or any other source) this has been carefully acknowledged and referenced in accordance with departmental requirements.

The thesis '**Physical Activity and Diet in the Management of Individuals with Type 2 Diabetes Mellitus: A review of interventions and policies in Ghana, Sub-Saharan Africa and Lower Middle Income Countries**' is my own work.

Signature



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Abbreviations

BDI: Buddy Doctor Initiative
BMI: Body Mass Index
CHPS: Community-based Health Planning and Services
CHW: Community Health Workers
CPD: Continuous Professional Development
DBP: Diastolic Blood Pressure
DRC: Democratic Republic of Congo
FBS: Fasting Blood Sugar
GDP: Gross Domestic Product
GGHE: General Government Health Expenditure
GHS: Ghana Health Service
GI: Glycaemic index
GL: Glycaemic Load
HbA1c: Glycated Haemoglobin
HDL: High Density lipoprotein
HRM: Heart Rate Monitor
ICCC: Innovative Care for Chronic Conditions
KBTH: Korle Bu Teaching Hospital
LMIC: Low and Middle-Income Countries
MoFA: Ministry of Food and Agriculture
MoH: Ministry of Health
MoTI: Ministry of Trade and Industry
MoYS: Ministry of Youth and Sports
NCD: Non-Communicable Disease
NDRC: National Diabetes Research Centre
NHIA: National Health Insurance Authority
NHIS: National Health Insurance Scheme
PEN: Package for Essential NCD interventions
QoL: Quality of Life
RCT: Randomized Controlled Trial
RHNP: Regenerative Health and Nutrition Program
SBP: Systolic Blood Pressure
SMS: Short Message Service
SSA: Sub-Saharan Africa
STG: Standard Treatment Guidelines
T2DM: Type 2 Diabetes Mellitus

VU: Vrije Universiteit
WHO: World Health Organization
QoL: Quality of Life

Glossary

Diabetes mellitus: 'Diabetes (mellitus) is a chronic condition that occurs when the body cannot produce enough insulin or cannot use insulin, and is diagnosed by observing raised levels of glucose in the blood'¹. There are three main types: type 1, type 2 and gestational diabetes¹.

Healthy diet: Daily consumption of components of the different food groups of the right quality in the right quantity. It contains a reduced amount of refined sugars and fats, and increased fruits and vegetables. It varies depending on culture and lifestyle².

Diabetic diet: Individualized diet or diet plans for people with diabetes

Physical activity: 'Bodily movement produced by skeletal muscles that requires energy expenditure'³. It may also be referred to as exercise. It is sometimes classified as moderate or vigorous intensity.

Moderate intensity physical activity: 'requires a moderate amount of effort and noticeably accelerates the heart rate'⁴. Examples include walking, dancing and gardening.

Vigorous intensity physical activity: 'requires a large amount of effort and causes rapid breathing and a substantial increase in heart rate'⁴. Examples include running, fast cycling and carrying heavy load.

Sedentary/inactive lifestyle: 'Insufficient physical activity'⁵ in an individual's lifestyle.

Glycaemic control: Levels of blood glucose in an individual with diabetes⁶. It is measured by glycated haemoglobin (HbA1c), fasting blood glucose or post-prandial glucose levels. Values for these parameters for diagnosis of diabetes are:

Glycated haemoglobin⁷: $\geq 6.5\%$

Fasting Blood Sugar⁸: $\geq 126\text{mg/dl}$

Postprandial glucose levels⁸: $\geq 200\text{mg/dl}$

Body mass index (BMI) ⁹: 'a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in metres'.

Blood pressure¹⁰: Pressure of blood circulating within an individual's arteries. Normal values are

Systolic Blood pressure: $\leq 120\text{mmHg}$

Diastolic Blood pressure: $\leq 90\text{mmHg}$

Lipid Profile: A medical investigation to determine quality and quantity of lipids in an individual's blood. It provides the following measures¹¹:

Total cholesterol

Low-density lipoprotein (bad cholesterol)

High-density lipoprotein (good cholesterol)

Triglycerides

Intervention: 'An act performed for, with or on behalf of a person or population whose purpose is to assess, improve, maintain, promote or modify health, functioning or health conditions'¹². Interventions in this study include experimental studies and intervention studies on self-management and education, which focus on physical activity and diet in people with type 2 diabetes mellitus.

Policy: 'A set of ideas or a plan of what to do in particular situations that has been agreed to officially by a group of people, a business organization, a government or a political party'¹³. A policy in this study refers to any government policy document, strategy, guideline, action plan, legislation or regulation.

Adwoa F. Agyemang-Benneh. Ghana

Thesis Abstract

Background:

Type 2 Diabetes Mellitus (T2DM) is increasing in prevalence, contributing to 6% of total mortality in Africa. Lifestyle changes can help improve health outcomes, yet physical activity and diet in the management of T2DM patients in Ghana appears to be underutilized.

Objective:

The study examined physical activity and dietary interventions and policies in the management of people with T2DM in Ghana, and in Sub-Saharan Africa (SSA) and lower-middle income countries, in order to make recommendations for improving health outcomes in Ghanaian patients.

Methodology:

An extensive review of literature was done systematically to identify policies and interventions in Ghana, as well as in SSA and lower middle-income countries, which emphasize physical activity and diet in the management of T2DM. An adapted innovative care for chronic conditions (ICCC) framework was used to analyse findings under the micro, meso and macro levels.

Results:

Interventions in Ghana are few, but there is focus on development of human resource in health. There is less focus on implementation of policy recommendations, or provision of context-specific guidelines for physical activity and diet. In SSA and lower middle-income countries, education interventions, community-based and culturally appropriate interventions appear to improve health outcomes. Policies exist in most countries but many policies appear to lack implementation, and few provide financing options, legislation and inter-sectorial partnerships.

Conclusion and Recommendations:

Effective interventions and policies can be applied to the Ghanaian context. The Ministry of Health (MoH) must initiate context specific diet and exercise interventions and adopt culturally appropriate policies with enforced implementation.

Keywords: physical activity, diet, management, type 2 diabetes mellitus, Ghana

Word Count: 13, 121

Introduction

Type 2 Diabetes Mellitus (T2DM) is a non-communicable disease whose prevalence is rapidly increasing particularly in developing countries, such as are in Sub-Saharan Africa (SSA). It is expected that by 2040, there would be a 143% increase in T2DM prevalence in Africa as compared to the 53% global increase¹⁴. As such, effective measures must be put in place to prevent complications and improve quality of life of people with T2DM.

The political declaration of the 2011 United Nations General Assembly on NCD prevention and control¹⁵ and Global Action Plan for NCD prevention and control¹⁶ both show the extent of global reaction to the problem of NCDs, including T2DM¹⁷.

The management of people with T2DM is complex and good outcomes involve patients, health care providers, the community and the nation as a whole.

As a practicing dentist, I came across people with T2DM who claimed adherence to medication, but complained of difficulty with adhering to diet and physical activity recommendations. As a clinical auditor, I also noticed that clinicians rarely documented non-pharmacological prescriptions. Noticing the gap, I decided to explore how effective physical activity and dietary interventions and policies can be used in Ghana for improved health outcomes among people with T2DM.

This study is an extensive literature review of physical activity and dietary interventions and policies in the management of people with T2DM in Ghana, as well as in SSA and lower middle-income countries. It is presented under five chapters:

- Chapter 1 gives a brief overview of the Ghanaian background, health system and burden of disease, as well as diabetes and its characteristics in the country.
- Chapter 2 presents the problem statement, justification and objectives, methodology, analytical framework and limitations.
- Chapter 3 presents the analysis of findings of the study, using the analytical framework.
- Chapter 4 discusses findings of the study and its relation to the Ghanaian context.
- Chapter 5 concludes the study, bringing out the salient evidence gathered, and will suggest recommendations for Ghana.

Chapter 1: Background, Burden of Disease and Diabetes

1.1 Background

1.1.1 General Information

Ghana is an Anglophone country in West Africa. It has a population of approximately 27 million people, a population growth rate of 2.3%, total fertility rate of 4.03 children born/woman, and a sex ratio of 95.2 males to 100 females^{18, 19}. Although 54% of the population fall below the age of 25 years, 5% of the population are above 65 years, and this proportion is one of the highest for SSA countries^{19, 20}.

Population density in Ghana was 103 persons/squared kilometres in 2010²⁰ and rapid urbanization is taking place with an annual rate of urbanization of 3.4%¹⁹. Thus, about 54% of the population resides in urban areas and this number is expected to increase to 63% by 2025^{19, 21}.

Literacy rate of Ghanaians above 14 years is 76.6% but only 44.56% of adults 65 years and above are literate²².

Life expectancy from birth has increased from 38/43 years (male/female) in 1979 to 60/63 years (male/female) in 2013 and was estimated to increase to 66.6 years for the total population by 2016^{19, 20, 23}.

1.1.2 Socio-economic situation

Ghana attained lower middle-income status per World Bank classifications in 2011^{18, 24} and by 2014, gross domestic product (GDP) per capita was \$1,432²⁵. The service sector made the largest contribution to the GDP in 2014²⁶. People engaged in professional, clerical, sales and service jobs have increased from 23.4% in males and 46.6% in females in 2003 to 29% in males and 59.5% in females in 2014^{20, 27}.

Seventy-one percent of urban dwellers in the country belong to the first two wealthiest quintiles²⁰. Yet, 24% of the total population fall below the poverty line and majority reside in rural areas²⁸.

1.1.3 Diet and Physical Activity Culture.

Ghanaians prefer to eat at home with family, sharing meals with starchy staples such as cassava²⁹. They also consume vegetables and fruits an average of only 3-4 days in a week in 2014²⁰. Recent changes have resulted in increased indulgence in 'fast foods' including salty and canned foods, and processed snacks outside the home^{20, 30}.

A new emerging culture is one of increased physical activity through gyms and social clubs. These are usually found in the upper and middle-income population and among young men³¹. Physical activity is low in urban poor areas and lack of places to exercise has been cited as a contributing factor³⁰.

1.1.4 Health System

The Health system in Ghana is governed by the Ministry of Health (MoH), which makes policies as well as generates and allocates resources²³. Health agencies, such as the Ghana Health Service (GHS) and the National Health Insurance Authority, are under the supervision of MoH.

The three-tier system in the GHS provides a gatekeeping strategy intended for early treatment at the primary level and prompt referral to higher levels where required²³. Thus, at the primary level, Community-based Health Planning and Services (CHPS) compounds and health centres provide primary care in the community; the secondary level is represented by district hospitals; and teaching and specialist hospitals form the tertiary level²³.

Community Health Workers (CHW) and nurses are the main clinical staff at the primary level²³. Private standalone pharmacies and licenced chemist shops also provide healthcare services to Ghanaians³².

The health system in Ghana has an active private sector. It is estimated that private health care providers offer 55% of health care services³³ and in 2008 private not-for-profit providers constituted 20% of all private facilities³⁴. Private-for-profit providers also form 40% of facilities accredited to the NHIS³⁵.

The Ghanaian health system has seen overall improvements over the years, including a 26% increase of the public health sector workforce (from 42,193 in 2007 to 57,038 in 2015)³⁶. There has also been an increase in the number of health facilities (hospitals, clinics and health centres) from 3,110 in 2008 to 5,865 in 2015^{34, 37}.

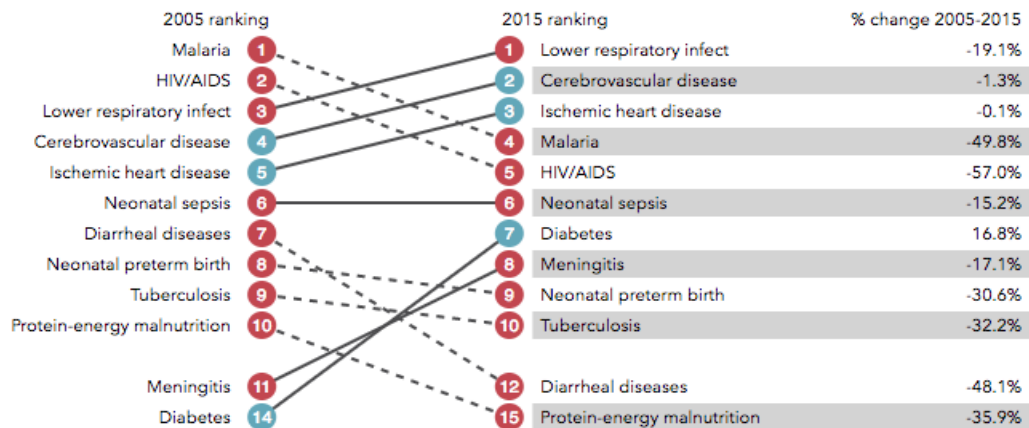
General government health expenditure (GGHE) forms 7% of general government expenditure (GGE)³⁸ but this is below the 15% agreed upon by African country heads in the Abuja Declaration³⁹.

The National Health Insurance Scheme (NHIS) was set up to provide financial security for Ghanaians with regards to health care. About 70% of funds for the NHIS is from tax sources⁴⁰. NHIS covers diagnosis and clinical treatment for over 90% of both communicable and non-communicable diseases prevalent in the country^{35, 41}. But out of pocket payment still forms about 27% of total health expenditure³⁸.

1.2. Burden of disease

Lower respiratory infections, cerebrovascular diseases, ischaemic heart disease and malaria constitute the top causes of mortality in the Ghanaian population⁴² (see figure 1), but there has been improvement in other health parameters. Diarrheal diseases have decreased by 48% between 2005 and 2015⁴² and vaccination coverage for measles 2 has increased from 52% in 2002 to 75% in 2014⁴³. Although still high, slight reductions have occurred in maternal mortality ratio (from 467 deaths/100,000 live births in 2000 to 319 deaths/100,000 live births in 2015)^{19, 44} and infant mortality rate (from 64.9 deaths/1000 live births to 42.8 deaths/1000 live births for both sexes in the same period)^{18, 19}.

Figure 1: Graph of Top 10 Causes of Mortality in Ghana with Percentage change between 2005 and 2015⁴²



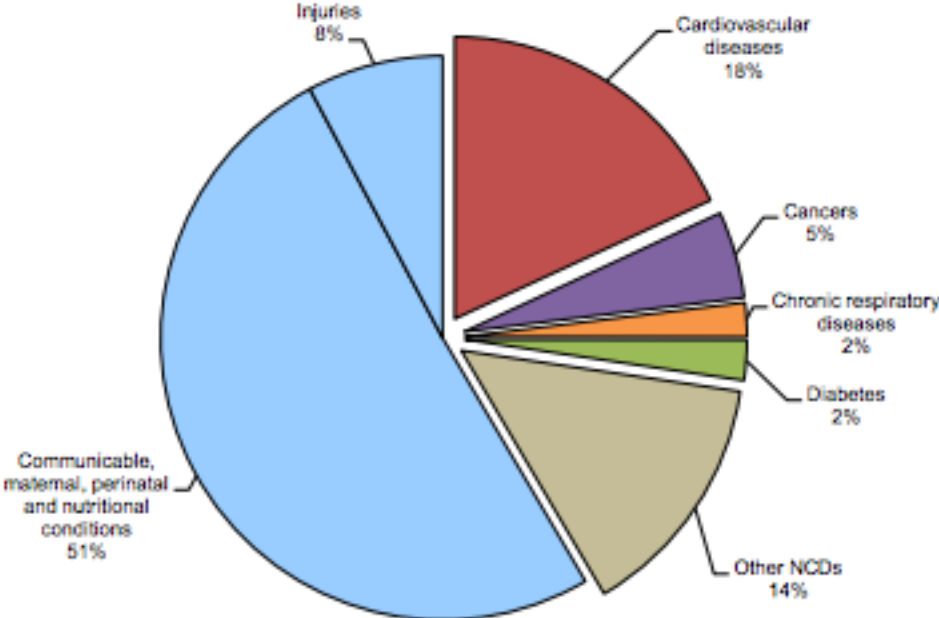
Top 10 causes of death by rate in 2015 and percent change, 2005-2015

Source Institute for Health Metrics and Evaluation, 2015

Rapid urbanization, changes in work environment and migration into more urban communities has resulted in changes in lifestyle, diet and physical

activity levels of the population⁴⁵. The on-going epidemiologic transition⁴⁶, lifestyle changes and the aging Ghanaian population, contribute to an increase in the risk for and the occurrence of non-communicable diseases (NCDs). Crude prevalence of hypertension in one study was 28.4%⁴⁷ and overweight and obese women in the country have increased from 30% in 2008 to 40% in 2014²⁰. Increased risk factors have resulted in an increase in NCDs in the country (figure 1). Stroke, hypertension, diabetes and cancer collectively result in more admissions and deaths in adults in the country compared to any communicable disease³¹.

Figure 2: Ghana Country Profile on Non-Communicable Diseases, 2014⁴⁸



Source, WHO Non-Communicable Disease Country Profiles, 2014

1.3 Diabetes

Currently, one out of every 11 adults in the world has diabetes and in 2015, the disease was culpable for 5 million deaths in adults, globally¹. In Africa, diabetes was responsible for an estimated 6% of total deaths in 2010, including premature mortality in adults^{1, 49}. Mortality from diabetes may

however be an underestimation, as its complications, such as renal failure, are usually the documented causes of death⁵⁰.

It is estimated that the number of Ghanaians with diabetes will increase from 517,000 in 2011 to 1,036,000 in 2030⁵¹. This figure will represent roughly 4.5% of the adult population in 2030^{51, 52}, but the true figure may be higher due to the growing and aging population, and possible improvements in detection of cases. In Ghana, mortality from diabetes has also increased by almost 17% between 2005 and 2015⁴² (see figure 1)

Diabetic complications are also present in the country. Over a 31-year period, hospital admissions for diabetic complications increased by 633% in one tertiary hospital in the country⁵³. In one study, individuals with diabetes in rural Ghana suffered from complications such as hypertension or depression⁵⁴.

Complications from diabetes arise when the disease is poorly managed. These complications include increased susceptibility to infections, including malaria and tuberculosis, increased risk of renal and cardiovascular diseases and nerve damage^{1, 55, 56}. Depression, one of the major contributors to global burden of disease, is another complication of diabetes⁵⁷⁻⁵⁹. Diabetes may result in miscarriages, stillbirths and infertility, which have severe cultural implications on an individual⁶⁰. The disease is also associated with stigma, for instance, where poor glycaemic control results in loss of weight⁵⁴.

However, the risk of complications is significantly reduced when clinical parameters such as blood pressure and glucose levels are well regulated⁶¹⁻⁶³.

Type 2 diabetes mellitus (T2DM) represents about 90% of diabetes cases¹. It occurs in both males and females and commonly in people between 40 and 59 years¹. Although majority of people with T2DM in Africa are undiagnosed, urban dwellers are usually more affected by T2DM, and this has been linked with increased sedentary lifestyle and unhealthy diets^{1, 64}. A recent study showed that prevalence of T2DM in rural Ghana was 3.6% for men and 5.5% for women, whereas urban men and women had prevalence of 10.3% and 9.2% respectively⁶⁵. Urban population with diabetes increases with lower level of education, while diabetes in rural

areas is associated with increasing education levels⁶⁶. T2DM is also known to occur in people who are obese and of low socioeconomic status in Ghana⁶⁷.

Chapter 2: Problem Statement, Justification, Objectives, Methodology, Conceptual Framework and Limitations

2.1 Problem Statement

There has been some response to prevention of diabetes and other NCDs in Ghana. The Regenerative Health and Nutrition Program (RHNP) was carried out between 2006 and 2007 to promote healthy lifestyle among Ghanaians⁶⁸. This blanket approach for primary prevention of NCDs contributed to increased sensitization of the public on healthy lifestyle and diet through television and radio stations in Ghana⁶⁹. The RHNP also trained about 1,000 change agents to educate their families and communities on healthy diet, increased physical activity and increased consumption of water^{68, 69}. But management of people with diabetes in the country appears to be inadequate in some aspects⁷⁰.

Increases in the occurrence of diabetic complications and mortality have been attributed to inadequate management of patients with diabetes in Ghana⁷⁰. Ineffective management and self-care practices have been attributed to 'problematic assumptions' made on diabetes treatment and interventions by individuals, health care providers, and policy makers and implementers⁷⁰.

Medication plays an important role in management of many patients with T2DM^{1, 71}. In Ghana, biomedicine is often the prioritized area for care⁷². Access to medication has also increased through the NHIS, which spends 10.3% of its total cost of medication on diabetes treatment alone⁷³. The NHIS also covers outpatient services including laboratory investigations and in-patient admissions for diabetic complications in insured patients⁷⁴. Still, other aspects of management of T2DM are left unattended to.

Healthy diet, physical activity and weight management have been described as essential for management of type 2 diabetes^{1, 75}, and are some of the evidence-based recommendations made by the World Health Organization (WHO) for management of diabetes⁷⁶. Non-pharmacological aspects of management can aid in achieving positive outcomes by maintaining glycaemic control, blood pressure and improving quality of life⁷⁷. Conflicting evidence in recent studies however, indicate otherwise, arguing that the effects of diet and exercise in reduction of morbidity and/or mortality in

people with T2DM are inconclusive⁷⁸. Unfortunately, literature on effectiveness of physical activity and dietary interventions in Ghana is low.

An individual's knowledge, beliefs and attitudes towards a disease influence health outcomes⁷⁹. Cultural norms also play a role in lifestyle choices, such as dietary preferences and physical activity, and may positively or otherwise influence management of T2DM⁷⁹. Individuals with T2DM in Ghana may not be informed about the potential severity of the disease, and some patients have inadequate glycaemic control despite knowing their disease status^{30, 80}. Patients in Ghana cite difficulty in giving up favourite foods, unaffordability of recommended foods and lack of exercising areas as some barriers to self-care practices^{54, 81}.

The community provides a support structure within which patients, families and health facilities interact. But misconceptions about diabetes and its complications may lead to stigmatization in Ghana⁷⁰ and affect the community's contribution to help individuals.

Health care organisation can also influence outcomes in management of people with T2DM. A multidisciplinary health team, which offers education, and support to patients, may result in good outcomes⁸². Little is known of use of health care teams to care for patients with T2DM in Ghana. However, one study indicated that more than 90% of nurses assessed in the country were not aware of dietary recommendations for people with diabetes⁸³.

On a national level, policies, strategies, plans and legislation, which help for adoption of healthy lifestyles also contribute to improved management of diabetes⁸⁴. A preliminary search could not identify national-level programs in Ghana, which promoted healthy diet and physical activity in people with T2DM.

Together, patients, community partners and health teams, the community and health care organization, and the policy environment constitute the micro, meso and macro levels of the health care system within which care for chronic conditions, including diabetes, may be tackled^{84, 85}.

2.2 Justification

There is a gap in evidence of interventions, policies and programmatic responses to the management of T2DM patients in Ghana, where physical activity and dietary recommendations are concerned.

Many studies suggest that diet modifications and physical activity improve glycaemic control, reduce BMI and also improve quality of life of people with diabetes⁸⁶⁻⁸⁸. However, most of these studies were done in high or upper-middle income countries, and there is paucity on data for Ghana and Sub-Saharan Africa.

Given the rise in T2DM, the amplified interest of the population of Ghana in increased physical activity, and the fact that there may be little intervention or policy response⁶⁹, it is an opportune time to identify evidence applicable to Ghana. Evidence gained will help provide recommendations on lifestyle interventions and policies, which employ diet and physical activity in the management of Ghanaians with T2DM.

2.3 General Objective

To examine interventions and policies related to physical activity and diet in the management of people with T2DM in Ghana, as well as in SSA and lower-middle income countries, in order to make recommendations to policy makers, implementers and stakeholders on how the disease can be effectively managed in Ghanaian patients.

2.4 Specific Objectives:

1. To analyse physical activity and dietary interventions and policy recommendations in Ghana in the management of T2DM patients.
2. To evaluate interventions and policies in the management of T2DM patients in SSA and in lower-middle income countries, with regards to physical activity and dietary recommendations.
3. To make context-specific recommendations to policy makers, implementers and stakeholders on effective lifestyle interventions for management of T2DM in affected Ghanaians.

2.5 Methodology

In order to achieve the objectives of the study, an extensive review of literature and policies was conducted systematically between March and July 2017.

2.5.1 Objective 1

In order to analyse physical activity and dietary interventions and policy recommendations in Ghana in the management of T2DM patients, websites of different government agencies in Ghana i.e., Ministry of Health and its sub-agencies e.g. GHS, Ministry of Youth and Sports (MoYS), Ministry of Food and Agriculture (MoFA) and Ministry of Trade and Industry (MoTI) were searched for policies, strategic plans and population or community level interventions for their recommendations concerning physical activity and diet in the management of type 2 diabetes. A few experts on the topic were also contacted via email for Ghanaian policies. PubMed, Embase and the Vrije Universiteit (VU) library were also searched for interventions in Ghana where physical activity or diet was used on a patient-, community- or population-based level as an intervention for management of the disease in patients. Boolean operators (AND, OR or NOT) were used in combination with key words 'Ghana', 'intervention', 'policy', 'strategy', 'program', 'study', 'exercise', 'physical activity', 'diet', 'nutrition', 'diabetes', and 'T2DM' and their synonyms in the search (Table 1).

2.5.2. Objective 2

In order to evaluate interventions and policies in the management of T2DM patients in SSA and in lower-middle income countries, with regards to physical activity and dietary recommendations, searches were conducted in PubMed, Embase and VU library. Google scholar and Google were searched to identify non-peer reviewed or unpublished documents. Websites of the various health ministries in SSA and lower-middle income countries were also searched for policies, strategic plans and interventions or programs. Again, websites of WHO main and regional offices were searched for country policies related to the study.

Search terms title word [tw] and title/abstract, [ta], indexing terms (MeSH/Emtree) and Boolean operators (AND, OR or NOT) were used in combination with keywords 'exercise', 'physical activity', 'diet therapy', 'intervention', 'observational study', 'policy', 'strategy', 'diabetes mellitus', 'Sub-Saharan Africa' 'lower-middle income country' and 'developing country' (Table 1).

Table 1: Key Words for Search Strategy

Physical Activit*	A N D	Diet	A N D	Interventio ns/Policies	A n d	Type II Diabetes	A N D	Sub Saharan Africa	OR	LMIC NOT Sub Saharan Africa
Aerobic exercise Acute Exercise Isometric exercise Fitness Energy expenditur e Physical endurance Motor activity Leisure activities Training Walking Running Bicycling Sports NOT Work related	/ O R	Healthy diet Nutrition Dietary Intake Food Feeding Consumpti on Energy Intake Carbohydra te- restricted diet Diet Therapy Diet Modificatio n		Study Trial Policy Program Initiative Strategy Plan Report Guidelines		Diabetes Diabetes Mellitus, Non-Insulin- Dependent Diabetes Mellitus, Stable Diabetes Mellitus, Type II Type 2 Diabetes Mellitus Maturity-Onset Diabetes Mellitus Slow-Onset Diabetes Mellitus Adult-Onset Diabetes		Benin, Botswana, Burkina Faso, Cameroun, Congo (Brazzaville), Congo (DRC), Ethiopia, Guinea, Ivory Coast, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Swaziland, Tanzania, Togo, Uganda, Zambia		Afghanistan, Armenia, Bangladesh, Bhutan, Bolivia, Cambodia, Comoros, Egypt, El Salvador, Eritrea, Guatemala, Honduras, India, Indonesia, Kiribati, Kosovo, Kyrgyz Republic, Lao PDR, Mauritania, Micronesia Fed. Sts, Moldova, Mongolia, Morocco, Myanmar, Nepal, Nicaragua, Pakistan, Papua New Guinea, Philippines, Samoa, Sao Tome and Principe, Solomon Islands, Sri Lanka, Syrian Arab Republic, Tajikistan, Timor-Leste, Tonga, Tunisia, Ukraine, Uzbekistan, Vanuatu, Vietnam, West Bank and Gaza, Yemen Republic

2.5.3 Inclusion and Exclusion Criteria

The search focused on interventions and policies in Ghana, then in SSA and lower middle-income countries. SSA and lower-middle income countries were classified using the World Bank database on country classifications^{89, 90}. Results obtained initially were thin and limited to randomized controlled trials for interventions. The search was then broadened to include 'self management' and 'education' interventions, as long as there was a focus on diet and physical activity.

Literature included in this study were observational or experimental studies, interventions, guidelines, programs, and policies from Ghana, SSA and lower-middle income countries where exercise and diet were used or recommended in the management of T2DM patients. For intervention studies, no specification was given as to outcome measures used in the study. Only articles and documents in English and published within the last 10 years (2007 to 2017) were included. This study included policies for Ghana and policies from countries within which intervention studies were found. The researcher intended to identify countries where policy had been translated into practice to some extent, and not just countries that have policies.

Studies were excluded if they used mathematical models or if they were conducted outside SSA, lower-middle income countries or on foreign immigrants. Studies on medication, pregnant women, children, type 1 diabetes, religious studies e.g., studies in Ramadan, studies solely on risk factors, genetic studies and studies on herbal preparations were also excluded.

2.5.4 Study Selection

After duplicates were eliminated for intervention studies from PubMed, VU library and Embase, the researcher conducted a title and abstract screening. Title and abstract screening was done by reading through all titles and abstracts and applying the inclusion and exclusion criteria to the information available to select relevant articles. Articles from Google Scholar and Google were also screened and added to results of title and abstract screening. Full articles were obtained from these results and further screened for inclusion or exclusion (see figure 3). Articles whose full

text could not be obtained were excluded. Study location, sample size, retention rate and level of intervention in the studies were further extracted, together with characteristics of patients and outcome measures of study (see annex 2, 3 and 4).

Documents from websites of government and international agencies were screened independently before selection and addition to the final list. These documents were selected based on their relevance to the study topic, and adherence to inclusion criteria indicated above (see figure 4).

Figure 3: Flowchart of Selection Criteria for Physical Activity and Dietary Interventions for Management of Type 2 Diabetes in Ghana, Sub-Saharan Africa and other lower-middle income countries

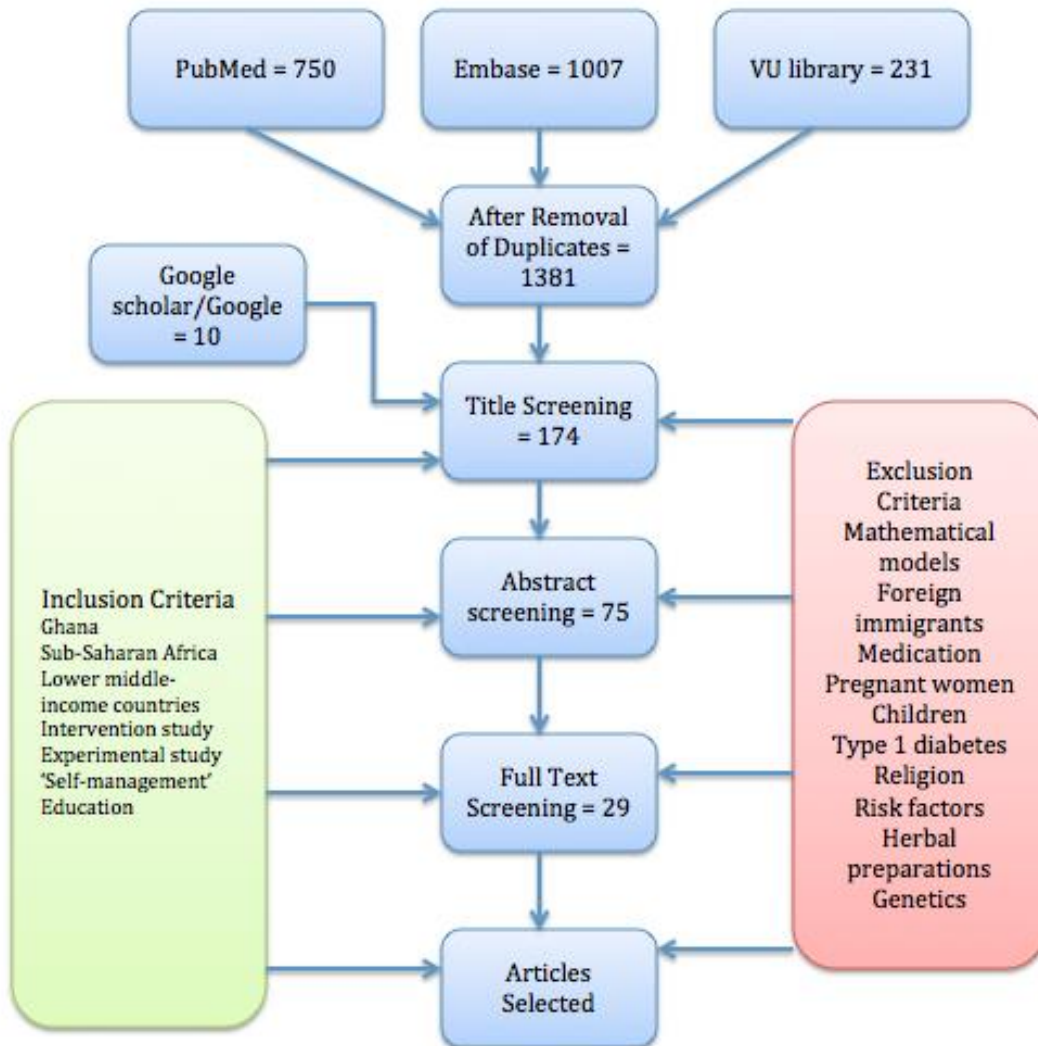
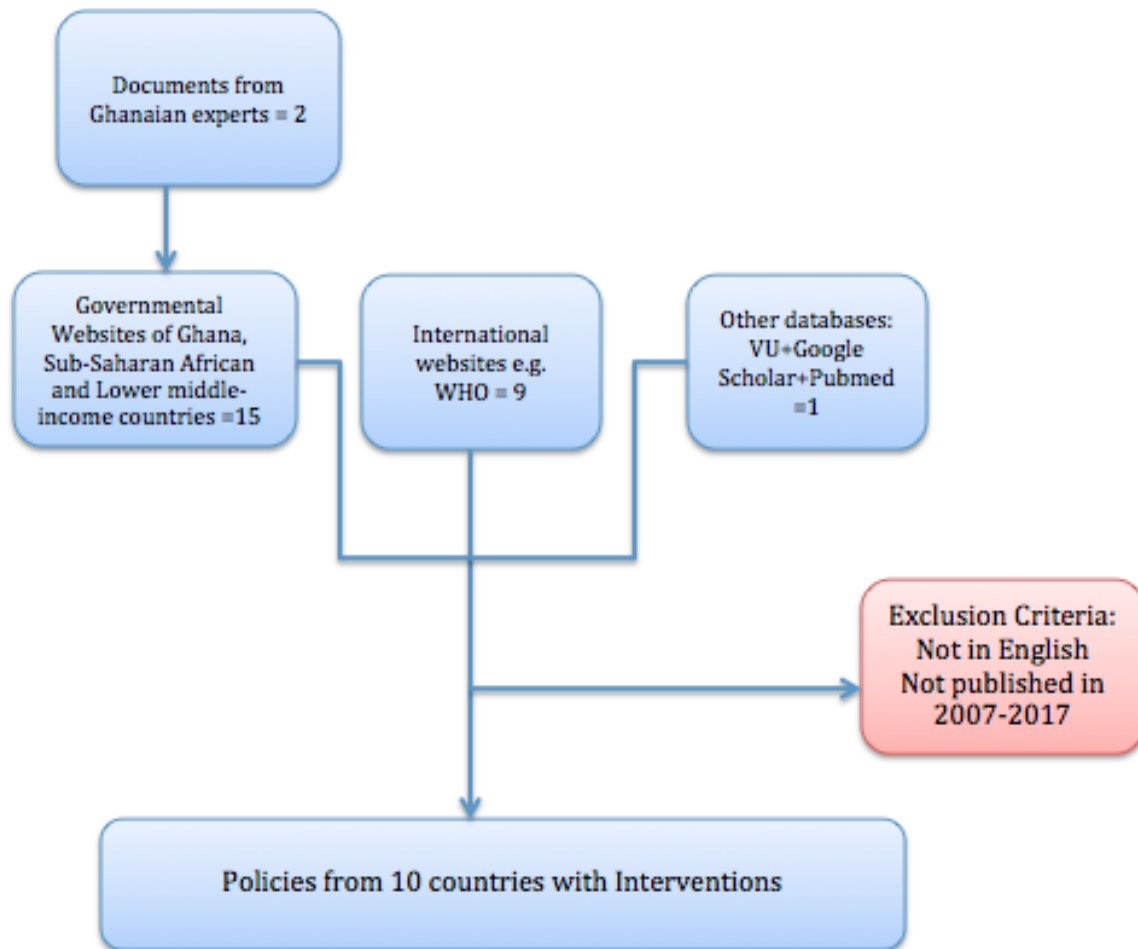


Figure 4: Flowchart of Selection Criteria for Physical Activity and Dietary Policies for Management of Type 2 Diabetes Patients in Ghana, Sub-Saharan Africa and other lower-middle income countries



2.5.5 Conceptual framework

To guide the analysis of the study findings, the Innovative Care for Chronic Conditions (ICCC) framework proposed by the WHO was used to describe physical activity and diet interventions and policies for the management of T2DM in Ghana, Sub-Saharan and other lower middle-income countries.

The ICCC framework is a WHO expansion of the chronic care model to describe health system factors, which influence health outcomes in people with chronic conditions⁹¹. It consists of a central triad of patients and families, community partners and the health care team who are fundamental to supportive management of people with chronic conditions. This triad functions best where the community and health care organization favour prevention of and care for chronic conditions. According to the framework, there must exist a positive policy environment, where *'legislation, leadership, policy integration, partnerships, financing, and allocation of human resources ... allow communities and health care organizations to help patients and families with chronic conditions'* ⁹¹ (see annex 1).

Hence, the framework can be used to analyse interventions and policies for management of patients with chronic conditions, such as T2DM, on three levels: micro, meso and macro levels (see figure 5).

Figure 5: Levels of the Health Care System⁹¹



Source: WHO Innovative Care for Chronic Conditions, 2002

This study focused on physical activity and diet interventions and policies in the management of T2DM patients, and utilizes the framework to address the following where information is available:

1. On the micro level: information or education on, preparedness for and motivation to increase physical activity and improve diet among

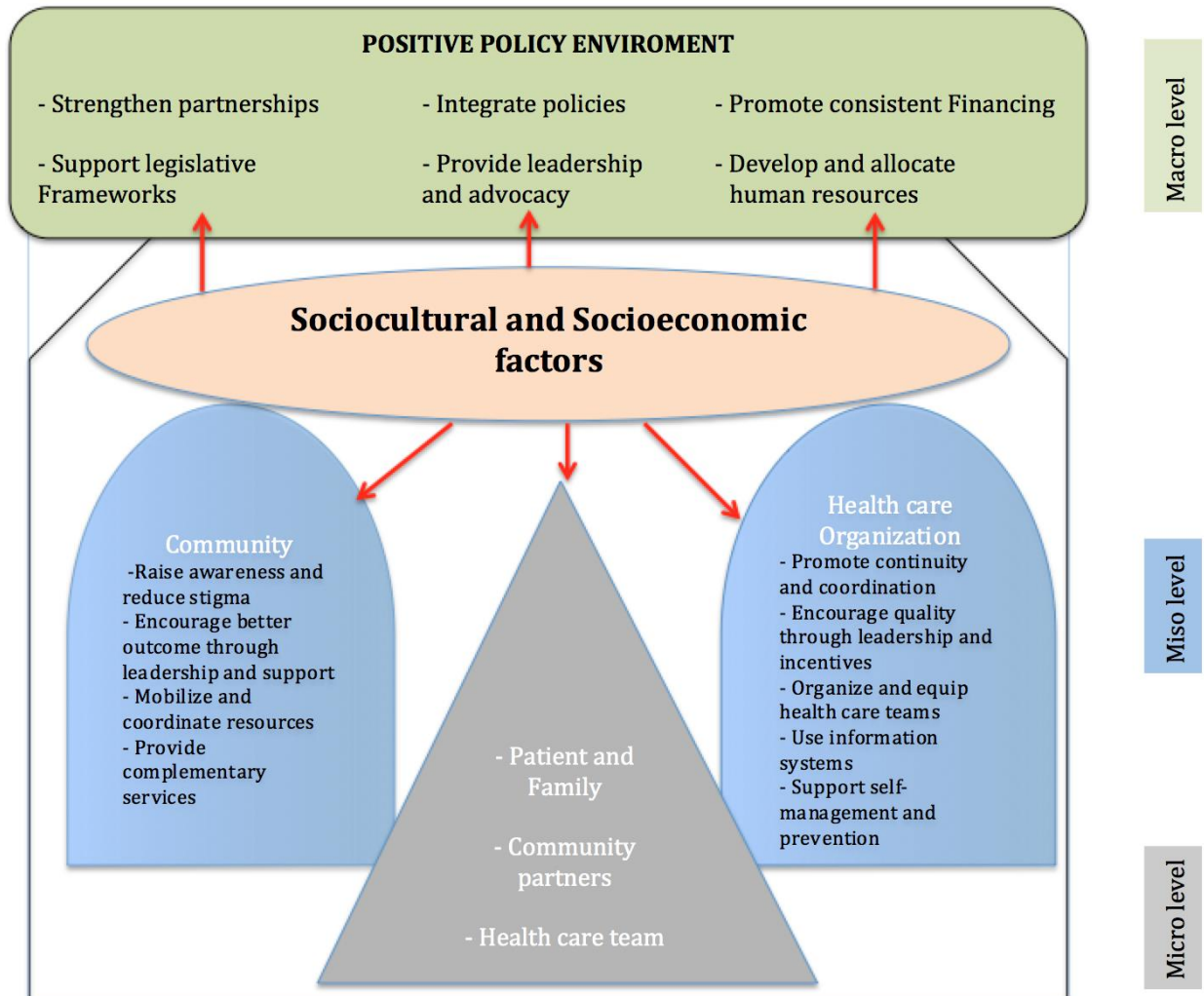
patients. These factors start within the triad of patients and families, the health care team and community partners and depend on how this triad work together to improve health outcomes in patients.

2. On the meso-level:
 - a. health care organization: how interventions and policies promote continuity and coordination within and between different levels of health care; emphasis placed on quality care through leadership and incentives; organized and equipped health care teams; how supportive health care system is to self-management practices; and how information systems are employed for better outcomes.
 - b. community: awareness of community including leaders, on function of physical activity and diet on management of T2DM; resources generation and allocation; and complementary dietary and physical activity services to augment health care service.

3. On the macro-level: how the policy environment provides high-level leadership and advocacy for physical activity and dietary interventions and policies; how these policies are effectively integrated; how interventions are financed in a sustainable and equitable way; how human resource is distributed and developed to provide physical activity and dietary management of T2DM patients; how favourable legislative frameworks are to support improved diets and increased physical activity; and effective partnerships across the various sectors of government

Socio-cultural and socio-economic conditions also influence the management of patients with T2DM with respect to perceptions of diabetes and its treatment as well as financial means to support healthy diabetic diets and participation in physical activity^{30, 92}. These factors, however, could not be explicitly identified in the ICC framework. Thus the ICC framework was adapted to incorporate these aspects for an in-depth analysis of management of T2DM policies and interventions (see figure 6).

Figure 6: Adapted Innovative Care for Chronic Conditions Framework for Better Outcomes in the Management of Type 2 Diabetes Mellitus Patients



2.5.6 Limitations

Limited available research and documentation of interventions in Ghana may influence the study results, and may not provide the best evidence as to the current situation in the country. The researcher tried to overcome this by contacting few diabetes experts in the country, but received limited responses.

Inclusion of only literature in English and those with full access may have also limited the breadth of information obtained in the results.

Limiting this study to physical activity and dietary interventions may have excluded vital lessons to be learnt from other lifestyle modification interventions, where physical activity and diet were not the major focus.

A single researcher conducted the search and study selection, and thus, selection bias may have influenced the findings.

Chapter 3: Analysis of Study Findings

This chapter begins with a brief description of characteristics of interventions and policies found. Then, findings will be presented under the subheadings of the adapted ICCC framework. Under each heading, the sociocultural and socioeconomic factors in the study or within which policies reside are presented where applicable.

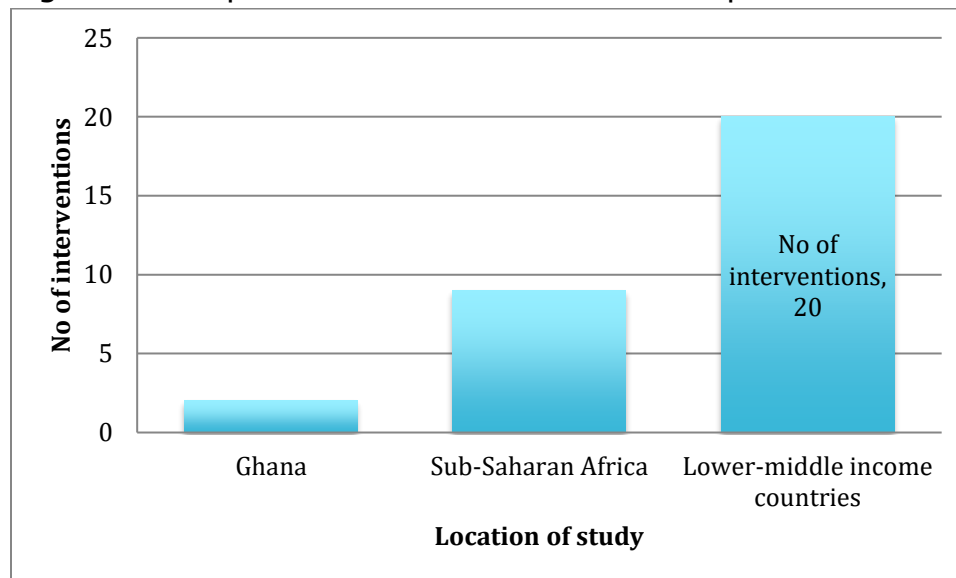
Because few interventions were found in Ghana, and for better comparison and analysis of results obtained from different contexts, findings for Ghana, SSA and lower middle-income countries are presented concurrently under the different headings of the micro and meso levels of the framework. Under the subheadings of the macro level of the framework, policies for Ghana are presented first, then notable findings from policies in other countries are analysed.

3.1 Characteristics of Search Results

3.1.1 Intervention studies

Overall, 29 intervention studies were identified in 10 countries. Seventeen articles reported on studies conducted in India, three on South Africa, two on Ghana, and one each for interventions in Cameroon, Mozambique, Nigeria, Indonesia, Sri-Lanka and Mongolia. One article reported on interventions in Cameroon, Uganda and South Africa (see figure 7 and annex 2, 3 and 4)

Figure 7: Graph of Number of Interventions per Location of Study



(Total number exceeds 29 because one article reported interventions in 3 different countries)

Out of the 29 articles, 14 were of interventions that focused on physical activity alone, 2 focused on diet alone and 13 focused on both physical activity and diet. Interventions that focused on diet and physical activity used education or counselling of patients. Interventions focusing on diet or physical activity alone were trials where patients were given specific diets or physical activity regimes. Seventeen out of the 29 studies done were randomized controlled trials (RCT). All studies measured at least one of the following outcome parameters; blood glucose level, glycated haemoglobin (HbA1c), weight loss, body mass index (BMI), blood pressure, lipid profile and lifestyle (physical activity, diet and quality of life) (see annex 4).

3.1.2 Systematic Reviews

Three systematic reviews (SRs) summarized information on dietary and physical activity interventions and policies⁹³⁻⁹⁵. One SR was of studies in low and middle-income countries (LMICs), which used the Diabetes Prevention Program (DPP) or other interventions for prevention and control of T2DM in patients⁹³. This SR did not factor in the sociocultural contexts or policy environments within which individual interventions were carried out and thus, differs from this study. The SR also differs because it includes low income and upper-middle income countries, which are excluded from this study (with the exception of Uganda). Seven interventions⁹⁶⁻¹⁰² selected for this thesis were also discussed in the systematic review, but these seven are analysed in this thesis based on the original studies, and not the SR.

Another systematic review was of diabetes care models in LMICs⁹⁵. The aim of the SR was to identify changes in diabetes care by evaluating different models in different LMICs. This review differs from my study in that it does not refer exclusively to the use of physical activity and diet in management of people with T2DM, and does not assess whether these models worked or not. The SR also did not limit included studies to only studies for T2DM. The SR was nonetheless included in the study because it provided insight into the diabetes care model in Ghana. It also refers to the peer support program presented in one study my search identified¹⁰³ but does not add new evidence to the peer support program.

The third systematic review looked at dietary and physical activity policies for NCD prevention in low and middle-income countries (LMIC) ⁹⁴. The SR focuses on prevention policies, and does not provide insight into policy implementation. However, it was included in this thesis because it provided information as to policies available in Mongolia, which could not be assessed due to language constraints.

3.1.2 Policies

Overall, nineteen policies were recovered for seven countries. These policies included treatment guidelines, physical activity and dietary guidelines, policies, strategic and action plans, and programme documents. South Africa had the only food regulation found, which is on salt legislation¹⁰⁴. A summary of the policies is outlined in table 2 below.

Table 2: A table showing list of policies by country, type, target group, year and author

	Country	Type	Target Group	Year	Author	Reference
No	Guidelines					
1	Ghana	Standard Treatment Guidelines	Health workers at all levels	2010	MoH, Ghana	105
2	Ghana	Diet and Physical Activity Guidelines	Health workers and educators	2010	MoH, Ghana	106
3	South Africa	Standard Treatment Guidelines	Health workers	2014	Department of Health, South Africa	107
4	South Africa	SEMDSA Guidelines for Management of Diabetes	Health workers	2012	Society for Endocrinology, metabolism and diabetes of South Africa	108
5	Nigeria	Standard Treatment Guidelines	Health workers	2008	Federal MoH, Nigeria	109
6	Nigeria	National Nutritional Guidelines in Non-Communicable Disease Prevention, Control and Management	'All Nigerians, especially health professionals'	2014	Federal MoH, Nigeria	110
7	Sri Lanka	Guideline for Management of NCDs in Primary Health Care	Health workers	2012	MoH, Sri Lanka, WHO, JICA	111
8	Sri Lanka	Food Based Dietary Guidelines for Sri Lankans	Health workers: grass-root level	2011	Nutrition Department, MoH, Sri Lanka	112
9	Uganda	National Guidelines for Management of Common Conditions	Health workers	2016	MoH, Uganda	113
Policy document						
10	Ghana	National Policy for Prevention and Control of NCDs in Ghana	Policy Implementers	2012	MoH, Ghana	114
11	Nigeria	National Policy and Strategic Plan of Action on Non-Communicable Diseases	Policy Implementers	2013	Federal MoH, Nigeria	115

Strategic/Action Plans						
12	Ghana	Strategy for the Management, Prevention and Control of Chronic Non-Communicable Diseases in Ghana	Policy Implementers	2012-2016	MoH, Ghana	116
13	Nigeria	National Strategic Plan of Action on Prevention and Control of Non-Communicable Diseases	Policy Implementers	2015	Federal MoH, Nigeria	117
14	South Africa	Strategic Plan for the Prevention and Control of Non-Communicable Diseases	Policy Implementers	2013-2017	Department of Health, South Africa	118
15	Sri Lanka	The National Policy and Strategic Framework for Prevention and Control of Chronic Non-communicable Diseases	Policy Implementers	2009	Ministry of Healthcare and Nutrition, Sri Lanka	119
16	Sri Lanka	National Multi-sectorial Action Plan for the Prevention and Control of Non-communicable Diseases	Policy Implementers	2016-2020	Ministry of Health, Nutrition and Indigenous Medicine, Sri Lanka	120
Programme Documents						
17	Mongolia	National Programme on Prevention and Control of Non-Communicable Diseases	Programme implementers		MoH, Mongolia	94
18	India	Operational Guidelines for National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS)	State government	2013	Central Government	121
Food Regulation						
19	South Africa	Regulations Relating to the Reduction of Sodium in Certain Foodstuffs and Related Matters	General Public	2012	Department of Health, South Africa	104

3.2 Micro Level (patient interaction)

The micro level of the framework consists of patients and families, members of the health care team and community partners⁹¹. For positive health outcomes in people with chronic conditions such as T2DM, this triad must be well informed about the disease, motivated to actively participate in management of the disease and be prepared with skills necessary for management of the condition⁸⁴.

3.2.1 Patients and families

Five studies aimed to inform patients on the need to improve dietary and physical activity practices through education interventions¹²²⁻¹²⁶.

In one study in India, though exercise frequency and intensity increased, dietary patterns and glucose levels did not change significantly after the education intervention¹²². Here, all participants were advised on increased daily physical activity but only a selected group was educated on dietary adaptations. Selective dietary education may have influenced the findings.

In another study, which aimed to reduce weight in obese diabetics through education, only insulin levels significantly increased by 3.66microU/ml in the intervention group¹²³. 67% of participants in this study in Indonesia were women. It is possible that the gender role influenced women's capability and decision space to change lifestyle, including adjusting diet and increasing physical activity and may have influenced study outcomes.

In one study in South Africa, there were no significant differences in clinical parameters and behaviour changes after the intervention¹²⁴. Non-significant results were attributed to non-professionals offering education programs or the lack of active goal setting by participants. The study also introduced vegetable gardening as a solution to financial barriers to a healthy diet. Vegetable gardening may not have been acceptable to the study population, perhaps as a result of its time consuming nature or the cultural perception of gardening.

In another South African study, however, education intervention through group sessions brought increased motivation for improved self-care behaviours in patients¹²⁶. A dietician, a physician and a health promoter, provided the intervention, resulting in increased adherence to physical activity and dietary advice post-intervention. Positive results in this intervention may indicate that education is more accepted when provided by professionals. However, participants also complained of lack of confidentiality in group discussions¹²⁶.

One education study produced improvement in all parameters and was conducted in recently diagnosed overweight or obese T2DM patients in Mongolia¹²⁵. Mean HbA1c levels decreased from 8.5 to 6.0% and total cholesterol also reduced from 3.92mmol/l to 3.13mmol/l. These positive outcomes were attributed to the recent diagnosis of patients, which helped for compliance to recommendations. The recommendations were also described as simple, easy to perform and cost-effective, and may have been easier for participants to follow. The culturally specific recommendation, which suggested that participants should eat earlier in the day and shift heavier meals to either breakfast or lunch, was also a possible factor in achieving positive outcomes¹²⁵.

Two studies, both in India, also provided pharmacist-led counselling on diabetes itself, diet, exercise and other lifestyle changes to patients^{127, 128}. At the end of the intervention in one study, mean blood glucose levels significantly decreased from 198.31mg/dl in the intervention group to 142mg/dl by the second visit after baseline¹²⁷. QoL scores also improved significantly in the intervention group, but no significant changes were observed in the control group¹²⁷. Positive results may be attributed to the effectiveness of patient counselling in behavioural change and the strategic positioning of pharmacists in the health care chain to provide quality education for informed decision-making.

In the other study, post-prandial blood glucose levels reduced significantly in the test group from 237.0mg/dl at baseline to 204.47mg/dl post-intervention and high-density lipoprotein (HDL) also increased significantly from 34.9 mg/dl at first visit to 36.6mg/dl at the final visit¹²⁸. No significant changes were observed in the control group. Authors of this study explained that patients were anxious for information on healthy lifestyles and this, coupled with pharmacist-led counselling, may have improved health outcomes. This may be because in developing countries, most individuals visit pharmacists for health care due to costs of consultation in health facilities³²

Efficacy of education of patients by non-physician health workers was demonstrated in a systematic review on interventions for management of diabetes in LMIC⁹³. The SR suggested that these interventions might be a cheaper way to make education of patients more accessible⁹³. However, this review provides recommendations for the context of a high-income country (USA), and did not factor in the low health worker: population ratios

pertinent in developing countries¹²⁹. Presence of a health workforce may influence effectiveness, or otherwise, of these interventions.

Motivation of patients may increase adherence to treatment and lifestyle changes¹³⁰. Two studies aimed to motivate patients to improve health outcomes, one through motivational interviewing and the other through short message services (SMS)^{131, 132}.

In a study in Sri Lanka, nurses were trained to educate participants in the intervention group using motivational interviewing¹³¹. Nurses conducted sessions and follow up visits, taught participants to set goals and helped them develop action plans that were culturally appropriate¹³¹. Twenty eight percent of participants in the intervention group achieved HbA1c target as against 8% in the control group. This study was carried out in a context where emphasis on lifestyle changes is rare in routine clinical care of T2DM patients¹³¹. The new motivational approach may have empowered participants and provided them with self-confidence to manage their condition, contributing to positive outcomes.

In a pilot study in India, short message service (SMS) was used as a motivational tool to improve adherence to dietary and physical activity recommendations¹³². But at the end of the intervention, there were no statistically significant differences between the control and intervention group for dietary and physical activity adherence. Nonetheless, frequent contact with a health worker through SMS was acceptable to patients. In this setting, routine clinical care involved constant self-management education of T2DM patients at the recruitment site¹³². Thus, both control and intervention groups may have been well motivated through education sessions to follow dietary and physical activity advice, explaining the findings. There may not always be a clear distinction between education and motivation, but one may provide the other, relative to how the intervention is carried out.

Three studies also aimed to motivate and prepare patients with tools, which may enhance adherence to exercise recommendations^{98, 133, 134}. Pedometers are instruments used to objectively monitor number of steps taken by the user. They provide a form of target setting for patients, which may motivate for increased physical activity¹³⁵.

In one study, walking with a pedometer and a heart rate monitor (HRM) was compared to walking alone, in terms of effect on quality of life (QoL)

¹³³. Post intervention, there was no significant difference between the control and intervention group, may be because both groups had improved quality of life from walking, as increased physical activity is known to improve QoL ¹³⁶.

In a second study, clinical parameters and general wellbeing between the intervention group (walking with pedometer and HRM) and the control group (no exercise intervention) were compared. The intervention group had a significant post-intervention reduction in HbA1c (from 7.25% to 6.5%), compared to the control group⁹⁸. The synergistic effects of physical activity and use of a motivational tool may explain the positive outcomes. General well-being scores also increased significantly by 28.8% in the intervention group but decreased in the control group by 12.1%⁹⁸. There was no blinding in this intervention study. Control group participants may have been aware of extra care being given to peers in the intervention group, and this may have negatively affected their wellbeing.

A third study provided pedometers for two exercise intervention groups, one supervised (group A) and one home-based (group B) ¹³⁴. Post-intervention, mean overall wellbeing had significantly increased by 43% for group A and 19.2% for group B. This improvement was significant when both groups were compared individually with the control, but there was no significant difference between groups A and B. Pedometers may provide an exciting option for effective target setting in exercise, and could be acceptable to patients. Group B members were instructed to contact researchers whenever necessary, and this may have provided a form of supervised atmosphere, which may have provided motivation and thus influenced the non-significant findings between groups A and B.

Education interventions appear to produce positive outcomes when they are provided by professionals and are culturally appropriate and specific to the local situation. Lack of professional educators and focused targets for participants may be barriers to positive outcomes. Motivation, through counselling and provision of tools to assist adherence to recommendations may also contribute to positive outcomes.

3.2.2. Health care team

The framework suggests use of expertise of different cadres of health workers caring for people with chronic conditions to provide an avenue that helps patients to achieve healthy lifestyle skills⁹¹.

Two studies described training of health workers to prepare them for counselling of T2DM patients on healthy lifestyle, including healthy diets and increased physical activity^{131, 137}.

In the Sri-Lankan study (described above under 3.2.1¹³¹), clinical psychologists prepared project nurses who carried out the intervention by training these nurses in motivational interviewing for goal setting and problem solving¹³¹. This training and use of an existing cadre in counselling was acceptable to health workers and may have contributed to the positive results in participants¹³¹.

However, the other study, which trained and employed 'less qualified mid-level health workers' in an RCT for management of T2DM patients had different results¹³⁷. After 12 months of group sessions for participants, there were no significant differences between the intervention and control group in the reduction of HbA1c, attaining 5% reduction in weight, or quality of life. The authors believe poor outcomes were due to lack of favourable environment for sessions and ineffective delivery of educational sessions by trained health workers. Retention rate of the study was low (55%) and may indicate that participants were unwilling to visit the facility when they were not sick. Low retention may have influenced health outcomes, as patients are more likely to participate in health promotion activities and follow recommendations, when they perceive them to be beneficial¹³⁸.

These findings suggest that interventions where qualified health workers are trained to educate patients may contribute to better health outcomes, while lack of an enabling environment and low participation of patients act as barriers to positive health outcomes.

3.2.3 Community partners

When selected community members are empowered and educated on the management of patients with T2DM, with regards to healthy lifestyle i.e., diet and physical activity, they may contribute significantly to positive health outcomes⁹¹.

Three articles were found where community partners were trained to help in the management of T2DM patients, using physical activity and diet^{102, 103, 139}.

One study investigated the effectiveness of recruited community health workers (CHW) in prevention and management of diabetes in a rural Indian community¹⁰². For management of people with diabetes, the study analysed

effectiveness of the program in improving healthy lifestyle and achieving glycaemic control. There was integration of community members, researchers and other groups in the design and implementation of the program. Community elders helped in the selection of CHW, who were then trained by a panel of experts, including an endocrinologist and a dietician. A combination of one-on-one and group sessions were held in the local language for all 1681 community members (with or without T2DM). General advice was given on healthy diet and increased physical activity, and a diabetes educator further advised T2DM patients on blood glucose control. Post-intervention, mean systolic blood pressure values decreased by 6.21mmHg and blood glucose levels reduced significantly by 19.08mg/dl in participants with T2DM. There was also a significant increase in physical activity and in vegetable intake (increase by 0.19 servings per day) for participants with T2DM¹⁰². This study was deemed a success and the inclusion of community elders and clinical specialists in the training were said to have contributed to positive outcomes. The intervention employed a blanket approach in education, which targeted the whole community. A blanket approach may have provided social support for people with T2DM, including assistance in cooking healthy meals, increasing and maintaining physical activity and decreased stigma.

In another Indian study, community-recruited peer mentors were used to provide a peer support intervention to 32 women in a rural community¹³⁹. A physician, a psychologist and a nutrition specialist trained peer mentors on self-management of diabetes, physical activity and dietary advice. After the intervention, there were no significant changes between the support group and the control group. The study was conducted among peri-menopausal women, who often play the role of caregivers in the Indian rural setting¹³⁹. Thus, adherence may have been difficult for participants, although most participants reported usefulness of the program. Community elders were also not included in planning the intervention, and context-specific contributions may have been missed.

In one article, self-management for diabetes through peer support programs in three SSA countries was explored¹⁰³.

In Cameroun, peer supporters were trained for monthly meetings with participants (n=100) using culturally existing tribal, religious or occupational links. At the end of 6 months there was a 96% retention rate of participants and acceptability of the program was high¹⁰³. Mean HbA1c

significantly declined from 9.6% to 6.7% and blood pressure and BMI also decreased significantly¹⁰³. Monthly meetings were conveniently scheduled and included sessions on healthy diets, as well as cooking practices, and exercise. Peer supporters also visited participants individually to discuss personal issues and provided a link to clinical care of participants. These, together with the considerations for the sociocultural hierarchical system, may have influenced the positive outcomes.

A similar program in Uganda utilized diabetes 'champions' to provide support to participants (n=26). Here, support was provided through mobile phones as well as one-on-one sessions¹⁰³. Topics discussed were similar to the Cameroun program, but additionally a handbook was designed for training of both 'champions' and participants. Also, the mobile networks connected not only 'champions' to participants, but also these two to nurses in health care services. At the end, mean diastolic pressure dropped from 85.39 to 76.27mmHg and mean HbA1c declined from 11.1 to 8.3%. Participants also reported an overall improvement in dietary behaviour. Matching of 'champions' to one or two patients provided a more individualized support system, and may also have helped patients adhere better to recommendations.

In South Africa, the peer support project was implemented for women in a local town¹⁰³. Here, women with diabetes in the township were brought together for discussions on exercise, diet and stress management. They were then paired up as 'diabetes buddies' to provide encouragement through visits, phone calls and text messages. Though no clinical or behavioural changes were reported, the program was noted to be successful in terms of its acceptability and engagement of participants, who texted 'buddies' an average of 5 times a week¹⁰³.

In all three peer support programs, T2DM patients were constantly advised on the importance of clinical care and pharmacological treatment. Pharmacological advice may have improved adherence to medications, which could have also contributed to positive clinical outcomes.

The findings show that there is general acceptance of community partners for encouraging physical activity and diet in people with T2DM. Counselling from trained community health workers and interactions with peers seem to result in better health outcomes.

3.2 Meso level

3.2.1 Health Care Organization

From the ICCC framework, the building blocks for health care organization for chronic conditions are to:

3.2.1a Promote continuity and coordination

Continuous and coordinated services, where medication, diet, physical activity and foot and eye care are harmoniously managed in patients with T2DM contribute to good health outcomes⁷¹. It is recommended for coordination to exist among the different levels of the health system, i.e., primary, secondary and/or tertiary, as well as among different health care providers, such as dietitians, physicians and pharmacists⁹¹.

Unfortunately, no interventions were found where continuity and coordination were promoted in health care organization with regards to physical activity and diet for T2DM patients.

3.2.1b Encourage quality care through leadership and incentives

In relation to management of patients with T2DM, senior officials in health care may improve health outcomes by providing an enabling environment for quality care in the health system⁹¹.

One article reviewed how the National Diabetes Research Centre (NDRC) in Ghana initiated a program to promote quality care of T2DM patients in the country⁹⁵. The NDRC, together with local and international support, spearheaded the Ghana Diabetes Education Program in 1995¹⁴⁰. Under this intervention, two diabetes care teams each consisting of a doctor, a nurse and a dietician, were trained to train other health workers. They also developed guidelines for institutional training of health workers and for management of diabetes. Also, they developed materials for patient education. The diabetes care teams then trained regional teams, who further trained district teams in management of diabetes. The program also provided supplies for establishment of diabetes clinics in some regional health facilities⁹⁵. Subsequently, no articles have been published on the sustained effects of this intervention. The top-down approach employed to provide the intervention may not have been acceptable to health care teams at the periphery, and may have influenced adoption of this program. The socioeconomic contexts may also not have been factored in and may have affected long-term sustainability of the program.

3.2.1c Organize and equip health care teams

Equipping health care workers with the right tools, education and guidelines for management of chronic conditions may facilitate quality health care services⁹¹.

In one study, non-physician clinical staff in selected government facilities were trained and provided with basic equipment, so as to include management of hypertension and diabetes at the primary care level in Cameroon⁹⁶. Most parameters showed no significant change, although reduction in fasting blood glucose (FBG) was significant (-7.8mmol/L) and there was also an association of more decrease in FBG of patients with higher number of visits. Non-significant outcomes may have been a result of high attrition rates of patients (70.6%), which affected the quality of the study. Outcomes may also be due to loss of trained staff to reassignments and relocation, resulting in non-operational services in some facilities⁹⁶.

Studies described under '3.2.2 Health Care Team' also aimed to equip health care workers by training them on education of patients^{124, 131}, with varying outcomes.

Clinical guidelines found in country policy documents emphasize lifestyle changes in management of T2DM patients where possible¹⁰⁵⁻¹¹³.

The Standard Treatment Guidelines (STGs) for Ghana recommend increased physical activity, tailored to a patient's requirement and ability. It also recommends elimination of refined sugars from a diabetic diet and encourages consumption of complex carbohydrates, fruits and vegetables¹⁰⁵. Aside a reference to 'soft drinks' and added sugar to beverages, the guidelines are not explicit on foods, such as locally produced sweets and snacks, which may also be sources of refined sugars. This may result in difficulties in translation of recommendations to practice. The guidelines also recommend referral of all people with diabetes to a dietician. This may be a challenge as 80% of all registered dieticians are located in the capital city Accra¹⁴¹. Ghana also has Dietary and Physical Activity Guidelines, which provide recommendations for both adults and children¹⁰⁶. But enquiry from one registered dietician revealed that these guidelines are not readily available in health facilities¹⁴².

Sri Lanka has specific guidelines for management of NCDs. Dietary and physical activity recommendations are similar to those for Ghana, and the

guidelines further refer to the 'Food Based Dietary Guidelines for Sri Lankans' for context-specific recommendations¹¹².

The South African and Nigerian guidelines go further to stress training of members of the diabetes care team to educate patients on lifestyle modification and self-management¹⁰⁷⁻¹⁰⁹. They also stress that education should be locally applicable, equitable and accessible and encourage education of families and communities. Nigeria also has specific nutritional guidelines for NCDs, including T2DM¹¹⁰. Treatment guidelines for South Africa advocate a patient-centred approach, and provide specific recommendations with respect to how, when and how much carbohydrates, proteins, fats, fruits and vegetables are to be consumed in a T2DM patient^{107, 108}. Specific guidelines for management of diabetes in South Africa are provided by a document from the Society for Endocrinology, Metabolism and Diabetes of South Africa (SEMDSA) ¹⁰⁸. Supplementary information from specialists in the field may explain how explicit South African guidelines are on context-specific and cultural recommendations.

3.2.1d Support patients in self-management and prevention

The health system can guide patients to increase physical activity and improve diets, when they provide support mechanisms⁹¹, such as supervision, regular counselling, and recreational areas for patients.

Ten studies used supervised exercises as interventions for T2DM patients^{98-101, 133, 143-147}. Two have been discussed under 3.1.1 Patients and families^{98, 133}. Two studies had significant outcomes but sample size was too small ($n \leq 10$ for intervention group) for these studies to be representative^{100, 143}.

But one study with a similar sample size was conducted in Ghana and is subsequently described, as it is relevant to the objectives of this thesis. In this study, physiotherapists carried out supervised exercise sessions for T2DM patients in a tertiary facility in Ghana¹⁴⁶. Post-intervention, there were no significant differences in physiological parameters or in quality of life between the intervention group and the control group. Non-significant results may be because of the study design, i.e., small sample size (intervention $n=9$) and short duration of intervention (8 weeks). Secondly, both groups were being managed routinely at the diabetic clinic at Korle Bu Teaching Hospital (KBTH), where education and self-management sessions were given. Thirdly, other factors, such as socioeconomic influences and social support, may have effects on the QoL of an individual with T2DM and these may not have been factored into the prescribed intervention.

In another RCT, three groups were compared (n=279) in India: one group underwent structured exercises in a supervised setting, the second group was advised to increase physical activity and the third was given no intervention¹⁴⁷. At the end of the intervention, there was significant decrease in HbA1c in the structured exercise group as compared to the control (by 0.69%). Participants of this study were sedentary adults, majority of who were overweight or obese (92%). A structured, supervised environment may have been better at improving adherence to exercise recommendations, compared to advice alone or no intervention. The study interventions provided no significant changes in BMI or lipid levels for all groups¹⁴⁷. This may be because a dietician prescribed diabetic meals for all participants, which may have standardized weight management in the study.

In another supervised exercise study, men with T2DM in Mozambique were taken through a structured exercise intervention¹⁴⁴. After the intervention, mean systolic and diastolic blood pressures were significantly lower in the intervention group compared to the control group (SBP and DBP reduced from 131 to 129mmHg and 80 to 77mmHg respectively in intervention group). Other measured parameters showed no significant difference between groups, which could be because all study participants were already physically active prior to the study. Participants walked for at least an hour a day as a means of transport, and this may have influenced the results. It may also be inferred that additional exercise in an already active individual with T2DM may help reduce blood pressure and contribute to reduced cardiovascular risk.

The physiological effects of exercise interventions, i.e., aerobic exercise and resistance training, were factors that influenced positive health outcomes in patients undergoing supervised exercise regimes in three other studies in Nigeria and India^{99, 101, 145}. These interventions may have been successful due to the supervised environment, within which they were carried out. A systematic review also showed effectiveness of exercise interventions in other low and middle-income countries⁹³. However, all these exercise interventions were carried out in hospital or clinic settings. Interventions in the health facility may not be accessible on a regular basis for all T2DM patients, and may be sources of indirect expenditures, such as transport costs.

Two studies were identified where the health system supported dietary therapy for management of T2DM patients^{97, 148}.

Abubakari et al assessed the effects of an alternative vegetarian diet on T2DM patients in Ghana¹⁴⁸. Post-intervention, there was significant decrease in mean blood glucose level by 47% and increase in mean HDL by 25%. However, small sample size (n=23), short study duration (21 days) and lack of a control group influence the quality of the study and findings may not be generalizable.

Researchers in the other study also provided low glycaemic index (GI) and medium glycaemic load (GL) foods to Indian patients with T2DM⁹⁷. Post intervention, HbA1c levels decreased significantly from 8% to 7.1%. Positive outcomes may have been due to the culturally acceptable nature of meals in the Indian context, which made meals easier to prepare by family members⁹⁷. But sample size was too small to be representative (n=15).

3.2.1e Use information systems

Information on dietary pattern and physical activity of a population can provide the health system with areas, which require more focus for health promotion⁹¹. Keeping track of patients, their condition and their health behaviours also informs decisions concerning their long-term management⁹¹.

No interventions were found where use of information systems improved dietary and physical activity in T2DM patients.

The findings suggest that there are limited interventions for promoting continuity and coordination and use of information systems. Clinical guidelines recommend physical activity and diet, but support from other associations may help develop culturally appropriate and context-specific guidelines. Physically active patients and supervised environments appear to provide positive outcomes in patients. But exercise interventions are usually carried out for a short period of time, and long-term health and socio-economic effects of interventions are not explored in these studies.

3.2.2 Community

Community contribution in managing patients with T2DM, where physical activity and diet are concerned, may produce positive outcomes for these patients⁹¹. Building blocks for this include:

3.2.2a Raise awareness and reduce stigma

For the community to be able to contribute to management of patients with T2DM, they need to be aware themselves of what T2DM is and the role of physical activity and diet in its prevention and management.

The search results produced one community-based study which targeted awareness creation in the entire community as described above under '3.2.3 Community Partners'¹⁰². The whole community was educated by CHW on lifestyle changes for primary and secondary prevention of T2DM and its complications. Raised awareness may have provided an enabling environment to assist behaviour change in T2DM patients¹⁰².

3.2.2b Better outcomes through leadership and support

Political structures in the community can provide clear leaders who can take on duties for management of patients with T2DM⁹¹. Religious leaders, community and family heads are examples of leaders who can take up this role.

Community leaders in one study (presented above under '3.2.3 Community Partners')¹⁰² were described as instrumental in selection of candidates for training as diabetes educators, and this may have contributed to the success of the intervention.

3.2.2c Mobilize and coordinate resources

Generating funds and other local resources in the community can provide a means for promoting increased physical activity and healthy diets. The community can be a source of invaluable resources for effective interventions⁹¹.

Again, the only study identified where human resources were mobilized in the community to increase physical activity and improve diet in T2DM patients was the community-based intervention in a rural Indian community (presented above under '3.2.3 Community Partners')¹⁰².

3.2.2d Provision of complementary services

Where gaps are identified in the health system with regards to management of T2DM patients, community partners may step in to fill these gaps⁹¹.

Informal or evidence-based alternative services can also be employed to complement health care services for best outcomes⁹¹.

Three studies in India investigated the use of yoga to supplement clinical services^{139, 149, 150}.

All three studies made mention of the perceived benefits of yoga as both an exercise and a relaxing technique for T2DM patients.

Two studies focused on menopausal women with T2DM and had conflicting results^{139, 149}. In one, yoga contributed to significant decrease in mean FBG and PPBG (20.62% and 14.52% respectively)¹⁴⁹, whereas in the other, the influence of yoga on glycaemic outcomes was neutral¹³⁹. Nonetheless, these results are not generalizable to all individuals with T2DM.

The third study was carried out in a more heterogeneous study population of a larger sample size, and investigated effects of yoga on lipid levels in T2DM patients¹⁵⁰. After the three-month intervention, reduction in mean values of weight (62.20kg to 59.60kg), triglycerides (151.88mg/dl to 130.11mg/dl) and low-density lipoproteins (LDL) (144.74mg/dl to 120.51mg/dl) were significant. Yoga as an intervention may provide physical activity and stress management components, both of which contribute to positive health outcomes in T2DM patients¹⁵⁰. It may have worked in this setting also because yoga is a common, culturally accepted practice and thus patients may adhere to it.

Participation of the entire community in management of T2DM patients appears to have positive results. Studies on yoga appear inconclusive, but may have positive outcomes as well. However, research in this area is thin and makes it difficult to objectively assess effectiveness of different interventions in different contexts.

3.3 Macro level (Positive Policy Environment)

3.3.1 Provide leadership and advocacy

National leaders and policy makers can be encouraged to make adoption of healthy diets and increased physical activity a priority in a country. This helps for policies, strategies and plans to incorporate these lifestyle changes⁹¹.

All countries searched had either an NCD policy or a strategic plan to address NCDs, and each refers to the role of physical activity and diet. Each policy or strategic plan also referred to the need to advocate for prioritization of NCDs on the national agenda^{94, 114-121}. Increased local and global interest in NCDs may have helped to advocate for policies on NCD prevention and control¹⁵.

3.3.2 Integrate policies

Policies for chronic diseases are described as more effective where disease prevention and management strategies are integrated across sectors and where health promotion is emphasized for the whole population⁹¹.

In Ghana, the NCD policy, which was revised in 2012, has awareness creation for healthy diet and lifestyle as a priority area¹¹⁴. The policy recommends dissemination of population-level guidelines on healthy diets and inclusion of healthy-living contents in the curricula of tertiary institutions. There is further recommendation on liaison with the food industry to make healthy options for food more affordable. The strategic plan for NCD prevention and control also mentioned key activities, which focuses on physical activity and diet for the population¹¹⁶. These include sustainable education programs, updated national dietary guidelines, salt reduction program, reduction in prices of healthy foods and compilation of list of common local foods and their salt content¹¹⁶. However, no plans to encourage the creation of exercise friendly environments in the community or in workplaces were identified.

No programs or interventions were found which addressed affordable healthy meal options, salt reduction or provision of updated population level dietary and physical activity guidelines.

Annual reports and the Programs of Work of the Ministry of Health and its agencies from 2012 to 2015 did not provide evidence on implementation of policy recommendations on physical activity and dietary lifestyles of adults in Ghana¹⁵¹⁻¹⁵⁶. But in 2016, a pilot program was started- the Base of Pyramid Project-which is intended to raise awareness in the community on diabetes, train health workers in diabetes care as well as to assist patients in self-management¹⁵⁷.

The South African Strategic Plan for NCD prevention and control lists interventions that target physical activity and diet as cost-effective ways of preventing and controlling NCDs¹¹⁸. Recommended awareness creation campaigns on physical activity and diet were carried out^{158, 159} as reported in the annual report for 2015/2016 and some selected institutions were also educated on healthy meals at work¹⁶⁰. However, legislation for salt could not be enforced due to procurement problems¹⁶⁰. Suggested liaisons with other ministries, such as Ministry of Industry were also not realized¹⁶¹.

The Nigerian Strategic action plan for NCDs stresses education of the general public and health workers on the role of exercise and diet in the prevention and control of NCDs, within specified time frames¹¹⁷. The National NCD Policy also called for enforcement of legislations, which govern the food industry and for increased places for physical activity at workplaces, in the community etc.¹¹⁵. No programs or interventions were found where policy recommendations had been implemented in Nigeria.

Although policy documents could not be assessed due to language, a systematic review described the policy environment in Mongolia⁹⁴. In the Mongolia NCD programme, there were outlined action plans and responsibilities for different inter-sector stakeholders. Plans included improvements in urban planning and increasing avenues for exercising.

In Sri-Lanka, the strategic plan adopts a multi-sectorial approach, where the health ministry takes up the role of leadership to emphasize the need for health promotion and risk reduction of NCDs in the country¹²⁰. The strategic plan outlines activities for reducing unhealthy diets and physical activity. As the plan was for 2016-2020, no reports to assess implementation of recommendations were identified.

India has comprehensive operational guidelines for the programme on prevention and control of NCDs¹²¹. This guideline outlines health promotion activities at different levels of the health system, and encourages inter-level collaboration for better health outcomes. However, a review of the NCD response in India indicated that the country may have good policies, but implementation of these policies needed to be improved¹⁶².

3.3.3 Promote Consistent financing

In care for chronic conditions, low cost interventions have been proven to work where resources are scarce⁹¹. Financial resources need to be allocated to strategies and plans to contribute to sustainable and effective implementation.

The Ghana NCD strategic plan makes reference to allocating earmarked funds to the NCD prevention and control strategies¹¹⁶. Suggested sources of funds included diaspora bonds and taxation of unhealthy foods. But no explicit costing or budgetary allocations were indicated.

For South Africa, no budgetary allocations were made either, but cost-effectiveness of the different suggested strategies for NCD prevention and

control were outlined¹¹⁸. These strategies may provide a guide to which programs can be taken up where resources are limited.

India outlines financial guidelines in the NCD programme operational guidelines for state governments¹²¹. Financial guidelines provide an itemized costing of NCD units depending on the level of health care. It further separates expenditure into recurring and non-recurring costs. Such guidelines provide a yardstick by which government officials at different levels can manage resources efficiently.

Sri Lanka also has a five-year costing schedule for all components of the strategic plan for NCD control¹²⁰. Funds are to be provided by international organizations, including a loan from the World Bank. These funds may provide assistance to NCD programs, but conditionality of loans may influence decision space of policy makers and implementers¹⁶³.

3.3.4 Develop and allocate human resources

Health care professionals in training need to be given requisite skills necessary for management of T2DM patients, where adequate lifestyle changes are concerned. This would require school curricula to be adjusted to meet the current demands of the burden of disease, including chronic diseases and T2DM⁹¹.

Curricula for health professionals from Ghana and other countries were unavailable during the search. But one curriculum found for physician assistants trained in the College of Health, Yamfo in Ghana had no outlined lectures or sessions for training on healthy diets and increased physical activity¹⁶⁴. Though there was a session on nutrition, the focus was more on nutrition in children.

A pilot program carried out in six hospitals in Ghana introduced the Buddy Doctor Initiative (BDI) ¹⁵⁷. Through MoH-Novo Nordisk Pharma collaboration, specialist physicians are paired with general practitioners to guide the latter in improving health outcomes in diabetes care. This program may help develop human resource in Ghana, but may leave out non-physician health workers who form the majority of the health workforce in Ghana²³.

Post-graduate training can also be used as an avenue to enforce evidence based treatment guidelines, strategies and plans for governments⁹¹. Continuous Professional Development (CPD) policies in Ghana require health professionals to attain a minimum number of mandatory points from CPD sessions to qualify for annual registration in the various governing councils for health workers¹⁶⁵⁻¹⁶⁷. Though commendable, the recommended topics for CPD sessions did not include strategies to aid in lifestyle and behavioural change for patients with T2DM or other chronic diseases. A list of accredited CPD programs, however, included sessions for guidelines in the management of patients with diabetes¹⁶⁸. Diabetes management sessions may incorporate diet and physical activity guidelines, but this was not explicitly stated.

Different or new cadres can also be introduced specifically to provide counselling, education, peer support or treatment services for patients with chronic conditions⁹¹. With assistance from WHO, a pilot of the Package of Essential NCD (PEN) Interventions for Primary Health Care in low resource settings program was implemented in Ghana in 2009¹⁶⁹. Twenty health workers of different cadres in primary level facilities were trained in integrated management of Diabetes and Hypertension¹⁷⁰. This training may help improve care of people with T2DM at the community. This intervention may also contribute to maintaining the gatekeeper system in healthcare. Policy level programs for developing and allocating human resources in the other countries were not identified during the search.

3.3.5 Support legislative frameworks

Legislative frameworks that regulate the type of food readily available on the market and also establish exercise-friendly community and working environments provide an enabling environment for good health outcomes⁹¹. The NCD policy in Ghana emphasizes healthy diet through making healthier options for food cheaper, and by regulating processed foods available on the market¹¹⁴. No documents on food regulation and were found. However, a sugar policy process document from the MoTI, which aimed to increase refined sugar production in the country, did not factor in the MoH as a relevant stakeholder for consultation¹⁷¹. This may indicate a lack of partnership between different government sectors and may influence success of national health strategies. Another factor could be conflicting interests between the MoH and MoTI.

The only legislative document found to aid in healthy diet and increased physical activity was the salt regulation act from South Africa¹⁰⁴. This regulation ensures that foods available on the market have a reduced salt content to meet the daily recommended >5g consumption requirement. But reports indicate that these regulations may be hard to enforce^{160, 161}.

3.3.6 Strengthen partnerships

When policies are integrated across sectors, strengthened partnerships among different sectors of government to develop strategies, plans and interventions may help promote good health outcomes⁹¹.

No interventions or policies with inter-sectorial partnerships were found in Ghana, even though policies and strategies found mentioned the importance of such partnerships. A recent news release, however, revealed that the MoYS was to begin yoga sessions in schools¹⁷². This may be an indication of interest of the MoYS in improving healthy lifestyles for young adults.

Sri Lanka, through its multi-sectorial approach, formed an NCD unit within the MoH¹²⁰. The NCD unit has representatives from all government sectors including Finance and Education. Within this unit, the Ministries of Trade, Consumer Affairs and Agriculture together with MoH are mandated to develop regulations to make healthier foods more assessable while the Ministries of Local Government and Sports also share responsibility for increased physical activity in the public¹²⁰. Such partnerships may provide an enabling environment for improved access to healthy foods and increased physical activity. The action plan is from 2016 to 2020; as such reports on implementation were not available.

Prevention and Control of NCDs appears to be a priority in all countries searched. Strategies and plans often include recommendations for increased physical activity and improved diet but implementation of strategies appears limited or may be unreported. Budgetary allocation, human resource development and inter-sectorial partnerships for increased physical activity and dietary education also do not feature prominently in policies and strategic plans.

Chapter 4: Discussion

Discussion

This chapter discusses how interventions and policies presented in the preceding chapter relate to the Ghanaian context.

4.1 Micro-level

At the level of patient-interaction, education and counselling of patients, use of motivation and training of health workers and community members appear to be positive for better outcomes.

Different health workers can assist patients in improving diets and increasing physical activity, if they are trained in effective patient education. Pharmacist-led counselling helped improve health by providing education in diet and physical activity for patients in India^{127, 128}. This intervention may be practical in Ghana, where people usually stop by the pharmacist when unwell and only proceed to the health facility when symptoms persist.

Nurses in India also helped T2DM patients through motivational interviewing¹³¹. Health workers at the primary level in Ghana may be willing to provide education sessions, but are usually under-resourced and burdened with acute conditions, making it difficult for effective interactions with patients. Interventions, which utilize community partners, may help to reduce health worker workload, by shifting tasks to community members.

Community health workers, chosen from and by the community in India helped to educate the public, and improve health outcomes in people with T2DM¹⁰². In Ghana, community health workers have helped in health promotion and vaccination in maternal and child care through the CHPS compounds and health centres. If trained to do so, CHW may present an avenue for health education for people with T2DM.

Most interventions worked when culturally appropriate recommendations were made. In Mongolia, the culture of late eating was targeted and addressed in a culturally sensitive manner, producing positive outcomes¹²⁵. Education of the community on healthy eating and exercising in India, using culturally appropriate recommendations also produced good outcomes¹⁰². Ghanaians eat together during daily meals and at community gatherings. Individuals with T2DM may have difficulty requesting for or preparing specific meals, and may also be against the idea of eating separate meals for fear of stigmatization. When cultural practices are considered in

interventions, it may make it easier for Ghanaians with T2DM to get access to healthy foods.

Gender role of women may have influenced effectiveness of interventions in Indonesia and India^{123, 139}. This role of culture may need to be considered in the Ghanaian context also, as Ghanaian women similarly play caregiver roles.

Use of technology, such as pedometers and SMS, helped patients to monitor and adhere to recommended daily physical activity in India¹³²⁻¹³⁴. Sustainability and affordability of tools such as pedometers may affect applicability on a large scale in Ghana. SMS interventions may be implemented in Ghana, but low literacy of older Ghanaians may influence effective interventions in the elderly.

Vegetable gardening may not have been acceptable in South Africa and may have contributed to poor outcomes¹²⁴, but in Ghana, farming practices are common, especially in rural areas. Thus, gardening may be an acceptable introduction to people with T2DM.

4.2 Meso Level

4.2.1 Health Care Organization

In health care organization, leadership, support of patient self-management and equipping health workers appear to have positive influence on health outcomes.

Leadership from the NDRC in Ghana resulted in improved management of people with T2DM⁹⁵. Training of health workers and formulation of guidelines may have helped improve health care for diabetes in the country, but the program left out health workers in sub-districts, municipalities and towns, where most of the primary care facilities are located.

Guidelines for management of T2DM assist health workers to make informed decisions concerning patient care. In Ghana, guidelines call for referral of patients to dieticians, even though dieticians are few. Guidelines, which include culturally specific dietary advice, as was in South Africa and Nigeria¹⁰⁷⁻¹⁰⁹, may provide health workers with the requisite knowledge, and reduce the need for referral.

Supervised exercises appear to be effective interventions in most contexts, but not in Ghana¹⁴⁶. Supervised interventions are carried out in the health

facility for a short duration, and may not be sustainable or applicable on a long-term basis. Patients usually go for monthly reviews at facilities, and may be reluctant to visit daily for exercise interventions. Exercise interventions in health facilities may also have the unintended effect of indirect costs to patients.

Nonetheless, groups of Ghanaians have embraced exercising through clubs and these groups provide motivation through peer influence, which may promote healthier lifestyles. In South Africa, Uganda and Cameroun, peer groups provided support for individuals with T2DM to learn to adopt increased physical activity¹⁰³. Combining physical activity with motivation may provide good outcomes, as seen in India^{98, 134}. Thus, supervised exercises (meso level interventions) may be shifted to community peers (micro level interventions) within groups of people with diabetes in Ghana, for better health outcomes. Peer groups can further provide assistance in other self-management practices such as setting goals and targets and cooking healthier meals.

Interventions, which train health workers for short time such as was done in Cameroon, may lose skilled personnel, and the success of the interventions may be affected⁹⁶. In Ghana, health workers may refuse postings to resource-deprived settings, such as rural areas. Career advancement, private practice or job dissatisfaction are some factors which may cause the few who take up posts in deprived settings to vacate positions.

4.2.2 Community

Engaging community leaders contributed to significant positive outcomes in India. In Ghana, religious and community leaders play a pivotal role in cultural influence. These leaders may choose willing educators to champion healthy lifestyle in the community and in patients, or may be themselves champions.

Complementary services may augment health care services in Ghana, as yoga appeared to do in India^{149, 150}. Yoga is not currently a culturally accepted exercise regime in most parts of Ghana, even though the MoYS may introduce yoga to schools¹⁷². Cultural dances during social gatherings were common in the past, but have reduced in modern times. These dances

are an example of a more acceptable activity to increase exercise in T2DM patients.

4.3. Macro Level

There are many policies, strategies and plans for NCD prevention and control, showing their importance in most countries. A few programs implemented in Ghana show there is some interest in diabetes in Ghana, especially with regards to health worker training. WHO PEN interventions, Buddy Doctor initiative, and Base of Pyramid Project are policy responses, which may help prepare health workers for diabetes care. CPD sessions in Ghana provide a channel through which educational material for lifestyle changes in diabetes management can be offered. But generally, there seems to be paucity in implementation of plans and strategies in Ghana, as well as in other countries researched.

Allocation of financial resources contributes to implementation of successful interventions and strategies. Ghana's NCD strategic plan lacks explicit costing for implementation of activities. Financial guidelines, as provided by India, may provide assistance to local governments on effective use of resources¹²¹. As Sri Lanka did, a clear breakdown of budget requirements may also help to procure international assistance for implementation of activities for NCD prevention and control¹²⁰. Where conditionality of loans presents a challenge, cost-benefit analysis, as in the case of South Africa, may be used for advocacy to increase government allocation for NCD programs¹¹⁸.

Partnerships across government sectors help for increased political will and a widespread approach to influence lifestyle changes. Sri Lanka opts for a plan where inter-sectorial roles are outlined, with targets and timelines¹²⁰. In Ghana, partnerships could not be found although ministerial appointments are offered in a patronage system to members of the same political party, and thus provides an avenue for partnership.

Legislation may help provide affordable healthy food options on the market, but laws on food regulation were absent in Ghana. However, as observed from South Africa, the availability of a salt legislation does not always indicate that laws will be enforced¹⁰⁴.

The WHO ICCC framework helped to address patients and families, the community and health system, as well as the policy environment. Links between the components of the framework helped to see how management of a patient with T2DM does not depend on one factor, but on the interaction of multiple factors. The ICCC framework, however, did not indicate the influence of sociocultural and socioeconomic factors. The framework was therefore adapted, and this helped for a holistic analysis of physical activity and dietary interventions and policies in the management of people with T2DM.

The framework provided demarcated levels within the health system i.e., the micro, meso and macro levels. These demarcations helped to breakdown the complexities of the health system into manageable sections for ease of analysis. However, there exists some fluidity within the components of different levels, such as community partners at the micro level and the community at the meso level. Thus, the framework may oversimplify this fluid health system, and may hinder comprehensive analysis of interventions and policy responses within the health system.

Chapter 5 Conclusion and Recommendations

5.1 Conclusion

There have been some interventions and policies in Ghana, as well as in SSA and lower middle-income countries, which use physical activity and diet, to improve health outcomes in the management of people with T2DM. General interventions that are effective on the micro level include education and motivation of patients by health workers and trained CHW in India, peer support groups in South Africa, Uganda and Cameroun and the use of culturally appropriate education sessions in Mongolia and India. These interventions may be applied to the Ghanaian context due to the role of pharmacists and CHW in the country, as well as the upcoming peer influence in fitness clubs.

Supervised exercises on the meso level may be effective interventions for people with T2DM in many countries, but not in Ghana. Exercise interventions may be shifted to peer and community groups in Ghana for increased social support and reduced costs, which may result in effective implementation.

Context specific and culturally appropriate guidelines in South Africa and Sri Lanka may improve health worker competence in providing dietary and physical activity recommendations. In Ghana, context-specific guidelines may help supplement the inadequate number of dieticians to help improve outcomes in T2DM patients.

Community-based studies also improved health outcomes for people with T2DM when community elders were involved in India. The role of community and religious leaders in Ghana may help provide positive outcomes if they are involved in intervention planning and implementation. Leadership in health care organization in Ghana brought about training of health workers and formulation of guidelines for management of diabetes patients in the country. This notwithstanding, lower level cadres of health workers were left untrained and sustainability of the intervention may have been difficult.

At the macro level, most countries show political advocacy, with policies and strategic plans. Most policies in Ghana and other countries adopt an integrated approach for prevention and control of NCDs. Physical activity

and diet also feature prominently in policies and plans for most countries. Implementation reports for plans and strategies were however unavailable in most countries but Ghana appears to have implemented few programs for health worker training and one for public awareness creation.

Cost benefit analysis in South Africa, financial guidelines in India and budget costing in Sri Lanka provide lessons for efficient use of financial resources for policy implementation and for lobbying of funds.

Inter-sectorial partnerships help to determine responsible stakeholders in implementation of policy action plans, as seen in Sri Lanka. Patronage within the ruling political party may provide an avenue to establish such inter-sectorial partnerships for health within the Ghana government.

5.2 Recommendations

Translation of interventions to the Ghanaian context requires a mix of interventions from different levels for implementation on short and long-term basis. At the end of the study, the researcher suggests the following recommendations for interventions, policy and research.

5.2.1 Interventions

- The MoH and MoE should train health workers, including pharmacists and CHW and community volunteers in motivational interviewing and education, using culturally appropriate recommendations and techniques.
- MoH and other stakeholders must employ a community-based approach in interventions, involving community and religious leaders. This provides an enabling environment for people with T2DM to safely follow these lifestyle recommendations. Priority must be given to low socioeconomic and under-resourced settings, such as rural and urban poor areas. Interventions could also be tailor-made for specific groups, such as the elderly and women in the society.
- Health care facilities, diabetes associations, churches and workplaces must establish self-help groups for patients with T2DM. Group members could be targeted for interventions, and encouraged in motivation and social support
- The National Diabetes Research centre, together with the MoH must revise and re-implement the Diabetes Education Program in Ghana, factoring in a focus on primary health care workers and long-term sustainability measures.

5.2.2. Policy

- The MoH should liaise with the MoFA to develop food regulation policies for affordable healthy foods. These policies will only be effective if enforcement measures and sanctions are put in place simultaneously.
- The MoH must revise Standard Treatment Guidelines and Dietary and Physical Activity Guidelines to provide culturally appropriate recommendations for managing people with T2DM with respect to physical activity and dietary practices. Guidelines should also be sufficiently distributed to all health care facilities, especially those that lack dietitians.
- The MoH should revise NCD strategic plans to include measurable activities, specific timeframes for implementation, budgetary allocation and costing, as well as stakeholders responsible for each activity. Accountability mechanisms must also be established to ensure efficient implementation.

5.2.3. Research

- Research institutions must carry out both qualitative and quantitative studies on factors that influence effective interventions in the Ghanaian context.
- Research could also be conducted on continuity and coordination of care in T2DM patients in Ghana, and the use of information systems in the management of T2DM patients.

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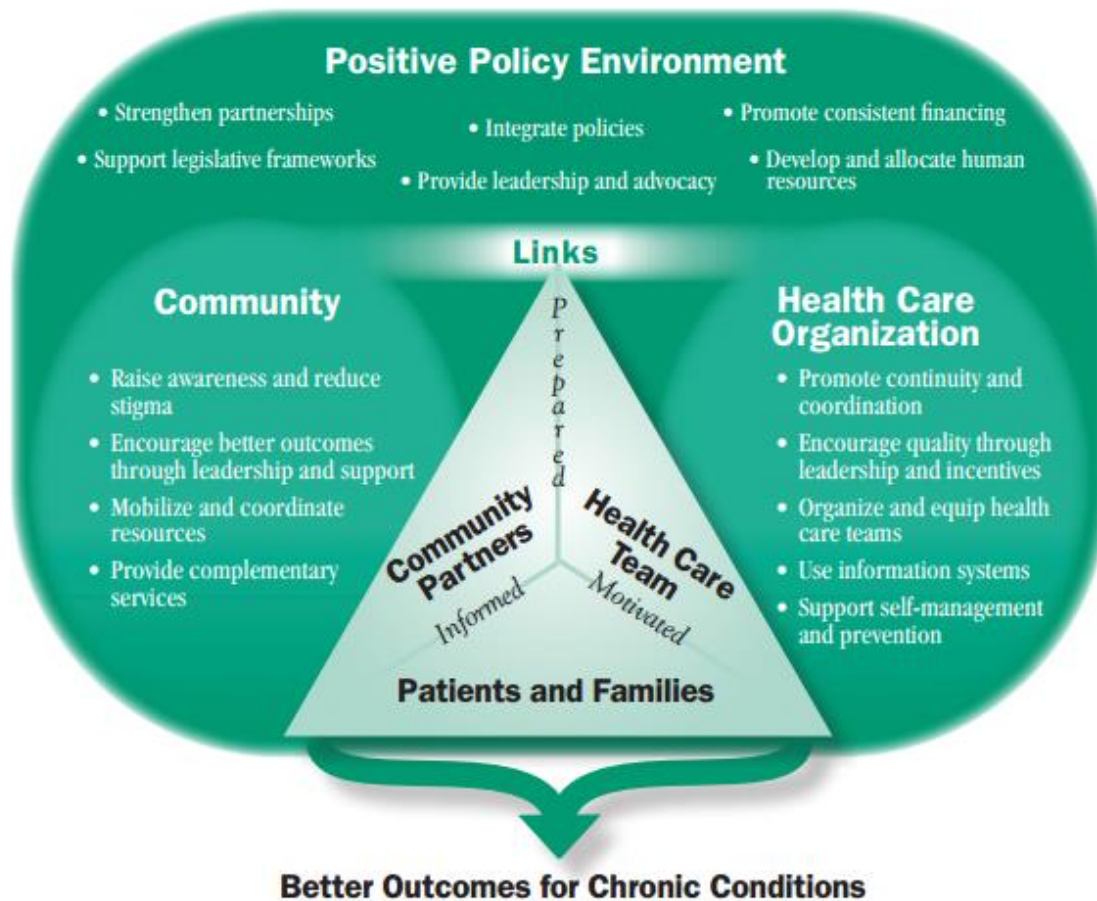
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Annex

Annex 1: The Innovative Care for Chronic Conditions Framework

Innovative Care for Chronic Conditions Framework



Source WHO, 2002⁹¹

Annex 2: Table Showing Characteristics of Intervention Studies

No	Authors	Study Location	Sample size	Retention Rate	Study Design	Intervention Duration	Intervention on:	Intervention
96	Labhardt et al	Central District, Cameroon	796	18.10%	Integrated primary health care program	2years	Equipping health care teams (Meso level)	Equipped and trained non-physician health workers
97	Pande et al	Mumbai, India	15	100%	Prospective study	4 weeks	Supporting self management (Meso level)	Low glycaemic index and medium glycaemic load diet plan
98	Shenoy et al	Amritsar, Punjab, India	40	NS	RCT	8 weeks	Supporting self management (Meso level)	Supervised exercise sessions with pedometers and heart rate monitors
99	Misra et al	New Delhi, India	30	NS	Experimental study	12 weeks	Supporting self management (Meso level)	Supervised progressive resistance exercise training

100	Arora et al	Amritsar, Punjab, India	30 (10 per group)	NS	RCT	8 wk.	Supporting self management (Meso level)	Supervised exercise sessions
101	Adeniyi et al	Kano, Nigeria	32	90.60%	Experimental study	12 weeks	Supporting self management (Meso level)	Supervised exercise sessions
102	Balagopal et al	Rural India	1681 (Diabetes prevalence 7%)	81.90%	Intervention study	6 months	Community partners (micro level) and community (meso level)	Community-based education
103	Fisher et al	Uganda, South Africa, Cameroun	Uganda= 46 South Africa= 22 Cameroun= 100	NS	Intervention study	Uganda= 3 months, South Africa= 3 months, Cameroun= 6months	Community partners (Micro level)	Peer support and buddy system
122	Bhushan et al	Haryana, India	50	NS	Mixed study: cross sectional survey and intervention study	2 months	Patients (Micro level)	Education in nutrition and exercise
123	Masrul et al	Surabaya, Indonesia	110	NS	Experimental study	6 months	Patients (micro level)	Modified diet and exercise consultation.
124	Muchiri et al	North West Province, South Africa	82	92.70%	RCT	June 2010- Nov 2011	Patients (Micro level)	Education in nutrition and exercise, including vegetable gardening

125	Sonomtseren et al	Ulaanbaatar city, Mongolia	92	87%	Intervention study	6 months	Patients (Micro level)	Education sessions with distribution of education materials
126	Van der Does et al	Western Cape, South Africa	84	NS	Intervention study	4 weeks	Patients (micro level)	Education of patients with dietician, health promoter or physician
127	Adepu et al	South India	70	100%	Randomized, prospective controlled study	6 months	Patient Interaction	Pharmacist-led counselling
128	Malathy R et al	Erode, Tamil Nadu, India	207	NS	RCT	3 months	Patients (micro level)	Pharmacist-led counselling
131	Jayasuriya et al	Western Province, Sri Lanka	30 control, 30 intervention	Intervention: 90% and control: 83%	RCT	6months	Health care workers (micro-level)	Nurse-led counselling
132	Shetty et al	Chennai, India	215	NS	RCT	1 year	Patient Interaction	SMS messages on education, including physical activity and dietary advice

133	Shenoy et al	Amritsar, Punjab, India	40	NS	RCT	8 weeks	Patients (Micro level) and supporting self-management (meso level)	Group A: unsupervised exercises Group B: Supervised exercise sessions with pedometer and heart monitor
134	Guglani et al	Guru Nanak Dev University, Amritsar	102	88%	RCT	16 weeks	Patients (micro level) and Supporting self management (Meso level)	Supervised exercises group and unsupervised exercise group, both with pedometers
137	Mash et al	Cape Town, South Africa	1570	Intervention: 55.1% Control: 55.2%	Cluster randomized controlled trial	6 months	Health care workers (micro-level)	Education by health promoters from district health facilities
139	Sreedevi et al	Kerala, India	124	NS	RCT	3 months	Community Partners (micro level) and Complementary services (Meso level)	Yoga intervention group and peer support intervention group
143	Shenoy et al	Amritsar, Punjab, India	30 (10 per group)	NS	RCT	16 weeks	Supporting self management (Meso level)	Supervised exercise sessions

144	Yan et al	Maputo, Mozambique	41	100%	RCT	12 weeks	Supporting self management (Meso level)	Low intensity or vigorous intensity supervised exercise
145	Hameed et al	New Delhi	48	85%	RCT	8 weeks	Supporting self management (Meso level)	Supervised exercise sessions
146	Bello et al	Accra, Ghana	18	100%	RCT	8 weeks	Supporting self management (Meso level)	Physiotherapist-supervised sessions
147	Sanghani et al	Ahmedabad (Gujarat). India	279	87%	RCT	6 months	Supporting self management (Meso level)	Physiotherapist and fitness professional supervised exercises in patients
148	Abubakari et al	Tamale, Ghana	23	NS	Clinical Trial	21 days	Supporting self management (Meso level)	Vegetarian diet for participants
149	Madanmohan et al	India	15	NS	RCT	6 weeks	Complementary services (Meso level: Community)	Yoga
150	Shantakumari et al	Kerala, India	100	NS	RCT	3 months	Complementary services (Meso level)	Yoga

Annex 3: Table Showing Characteristics of Patients in Intervention Studies

No	Study population	Country	Recruitment site	% of women	Age(years)	Education level	Socioeconomic status	Physical activity status
96	Labhardt et al	Cameroun	District primary care centres	69	Mean =60	NS	Two thirds of population in study setting are from remote rural areas	NS
97	Pande et al	India	Tertiary Hospital	40	42 - 58	NS	73% Municipal employees	NS
98	Shenoy et al	India	University Health Centre	27.5	40 -70	NS	NS	NS
99	Misra et al	India	Medical OPD and diabetes clinic	27	24-50	NS	NS	Most patients were following aerobic exercise prescriptions
100	Arora et al	India	University Health Centre	46.7	40-70	NS	NS	Inactive lifestyle
101	Adeniyi et al	Nigeria	Diabetes clinic	72.4	Female: 46.2 Male: 51.5	NS	NS	Sedentary patients
102	Balagopal et al	India	Rural community	NS	≥18	Illiteracy rate ranged from 9.7% to 50.5%	Income In Indian Rupees: <1500= 36.7%, 1500-3000= 37.3%, >3500=25.8%	Sedentary: 25.8%, Light=37.7%, Moderate=11.7 % Heavy=24.7
103	Fisher et al	Uganda, South Africa,	NS	South Africa =100	Varies	NS	NS	NS

		Cameroun						
122	Bhushan et al	India	City	56	40-60	NS	NS	Only walking 32%
123	Masrul et al	Indonesia	Tertiary Hospital	67.3	Mean: Intervention: 55.9. Control: 57.9	High education: 70.9% Low education: 29.1%	Government employee: Intervention 41.9% Control 49.1% Self employed Intervention 7.2% Control 7.2%	Inactive lifestyle
124	Muchiri et al	South Africa	Community health centres	85.5	40-70	No formal education Intervention 4.9 Control 12.2	Unemployed (>80 %), Pension: (>45 %) other forms of grants (>14 %)	NS
125	Sonomtseren et al	Mongolia	Health Centres	59		NS	NS	NS
126	Van der Does et al	South Africa	Rural primary care facilities	81%	Mean 51.6	NS	People from a low socioeconomic area	NS
127	Adepu et al	India	Community Pharmacies	31	> 30	NS	NS	NS

128	Malathy et al	India	Selected multi-specialty hospitals and one diabetic clinic	58.9	>30	Illiteracy: Intervention 29.2% Control 31.4%	NS	NS
131	Jayasuriya et al	Sri Lanka	Diabetes clinic	83	≥40 and < 70	NS	NS	NS
132	Shetty et al	India	Hospital setting		30 – 60	NS	NS	NS
133	Shenoy et al	India	University Health Centre	32.5	40 – 70	NS	NS	NS
134	Guglani et al	India	University	27	40-70	NS	NS	NS
137	Mash et al	South Africa	Community health centres	73.8	Mean: Control: 56.4 (11.6) Intervention 55.8 (11.5)	NS	People in under-served communities	Exercise, days/week Control 3.0 (2.3) Intervention 3.5 (2.4)
139	Sreedevi et al	India	Rural Health centre	100	30-65	NS	Income Mean (Indian rupees): Control 1602, Yoga group 986.57 Peer support 717	NS
143	Shenoy et al	India	University Health Centre	47	Mean Age: Intervention PRT: 49.6 Intervention AE: 52.2 Control: 58.4	NS	NS	Inactive lifestyle

144	Yan et al	Mozambique	Diabetes clinic	0	40 – 70	NS	NS	Physically active participants
145	Hameed et al	India	Out-patient clinics	27	35 and 55	NS	NS	Inactive lifestyle
146	Bello et al	Ghana	Diabetes clinic	NS	20–65	NS	NS	Inactive lifestyle
147	Sanghani et al	India	Diabetes clinics	44	30 to 60	NS	NS	Sedentary patients
148	Abubakari et al	Ghana	Tertiary Hospital	NS	25-70	NS	NS	NS
149	Madanmohan et al	India	Diabetes clinic	100	36 – 63	NS	NS	NS
150	Shantakumari et al	India	Diabetes clinic	48	44.5 and 45.5	NS	NS	NS

NS: Not stated

Annex 4 Table showing Outcome measures of Intervention Studies

No	Authors	Comparison Group	Significant positive outcome measures
96	Labhardt et al*	None	No significant outcomes
97	Pande et al	None	Mean HbA1c decreased from 8.0 to 7.1% (p<0.001). Fasting blood glucose decreased also from 173.6mg% to 137.8mg% (p<0.001). Total cholesterol fell from 173.5mg% to 134.6mg% (p<0.001)
98	Shenoy et al	One control and one intervention group	Decrease in HbA1c from 7.25% to 6.5% in intervention group (p= 0.0023) compared to no change in control. Increase in general wellbeing in intervention group by 28.8% compared to decrease in control group by 12.1% (p=0.0001)
99	Misra et al	None	Improvement in insulin sensitivity (p<0.000). HbA1c declined by 0.33% (p<0.001)
100	Arora et al	One control and two intervention groups	PRT group: 17.7% and AE group: 17.9% decrease in HbA1c (p<0.05) PRT group: 6.5% and AE group: 6.2% decrease in SBP (p<0.05). PRT group: 8.6% increase in General wellbeing (p<0.05)
101	Adeniyi et al	None	Fasting glucose, Triglycerides and waist circumference in all participants and systolic blood pressure (in men only)
102	Balagopal et al*	None	Fasting blood glucose reduced by 19.08 mg/dl (p<0.001). Knowledge on benefits of moderate physical activity increased by 12%. Systolic BP decreased by 6.21mmHg (p<0.001). Physical activity increased by 14% (p< 0.001). Vegetable consumption increased by 0.19 servings per day (p<0.001)
103	Fisher et al	None	Cameroun = decreased in BMI from 28.6 to 25.5kg/m ² , systolic BP from 142 to 124.4mmHg and diastolic from 84.4 to 77.7 mmHg) HbA1c decreased from 9.6% to 5.7% (p values not stated) Uganda =HbA1c decreased from 11.1% to 8.3%. Diastolic BP decreased from 85.4 to 76.3 (p values not stated)
122	Bhushan et al	None	Physically active (walking) participants increased from 32% at baseline to 72% (p<0.001). Frequency of being mentally tense often decreased from 60% to 30% (p<0.001)
123	Masrul et al	One control and one intervention group	Total consumption of energy lower in intervention group (1774.3kcal) compared to control (1956.7) (p<0.05)
124	Muchiri et al	One control and one intervention group	Intervention group had decreased median energy intake (5988kJ/d) compared to control (6946kJ/d) (p=0.017)

125	Sonomtseren et al	None	Average loss of 4.9% of mean weight from baseline, fasting blood glucose reduced significantly from 11.6 to 8.2 mmol/l ($p<0.000$). Mean HbA1c levels decreased from 8.5 to 6.0% ($p<0.000$). Normal range, pre-diabetic and diabetic classifications of participants had changed from 18.8%, 5% and 76.3% to 56.3%, 16.3% and 27.5% respectively. Total cholesterol reduced from 3.92mmol/l to 3.13mmol/l. ($p<0.000$)
126	Van der Dos et al	None	NA
127	Adepu et al	One control and one intervention group	56.3mg/dl decrease in glucose levels ($p<0.05$), improved QoL in test group ($p<0.05$)
128	Malathy R et al	One control and one intervention group	Triglyceride levels decreased from 150.9 to 140.6mg/dL ($p<0.001$) in intervention group compared to control group. HDL increased from 34.9mg/dL to 36.6mg/dL ($p=0.05$)
131	Jayasuriya et al	One control and one intervention group	Decrease in HbA1c in intervention group (from 9.8% to 7%) compared to control (from 9.8 to 8.3%) ($p=0.035$). 28% of intervention group reaching target compared to 8% in control ($p<0.001$)
132	Shetty et al	One control and one intervention group	Fasting plasma glucose decreased in intervention group from 185 to 166mg/dl ($p<0.002$). Two hour post prandial glucose levels decreased from 263 to 220mg/dl in intervention group ($p<0.002$)
133	Shenoy et al	One control and one intervention group	No significant between group outcomes
134	Guglani et al	One control and two intervention groups	Overall well being compared to control: supervised group=43% and unsupervised group =19.2% ($p<0.001$)
137	Mash et al	One control and one intervention group	No significant between group outcomes.
139	Sreedevi et al	One control and two intervention groups	Decrease in diastolic bp of yoga group by 3mmHg (0.035)
143	Shenoy et al	One control and two intervention groups	Decrease in HbA1c by 0.69% in intervention group compared to control group ($p<0.01$)
144	Yan et al#	One control and two intervention groups	Systolic BP reduced from 131 to 129mmHg in intervention and diastolic bp reduced from 80 to 77mmHg in intervention group ($p<0.05$)
145	Hameed et al	One control and one intervention group	Decrease in HbA1c in intervention group compared to control by 0.6% ($p<0.001$)
146	Bello et al	One control and one intervention group	No significant between group outcomes.
147	Sanghani et al	One control and two intervention groups	Structured exercise reduced HbA1c by 0.69%in intervention group compared to control ($p=0.02$)

148	Abubakari et al	None	47%decrease in glucose levels (p=0.000) 24.5% increase in HDL (p=0.001)
149	Madanmohan et al	None	FBG decreased by 20.6% (p=0.0035). PPBG decreased by 14.5% (p= 0.0012). Total Cholesterol decreased by 5.1% (p=0.016). 7% of participants attained complete relief, 27% were much better than before, 1% was worse than before
150	Shantakumari et al	One control and one intervention group	Reduction in weight in intervention group (from 62.2 to 59.60kg) p<0.05. Decrease in total cholesterol in intervention group (from 244.8 to 219.5mg/dl) p<0.001

*Outcomes refer to only outcomes for people with diabetes in the study

NA= not applicable. This was a qualitative study

#= Results for both intervention groups were combined and compared with control group.

