ASSESSING QUALITY OF NON-COMMUNICABLE DISEASE DATA IN KENYA: A CASE STUDY OF MEDICINES SANS FRONTIER PROJECT IN KIBERA

By

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REG. NO: Q51/82764/2015

A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF ARTS IN MONITORING AND EVALUATION OF POPULATION AND DEVELOPMENT PROGRAMMES AT THE
POPULATION STUDIES AND RESEARCH INSTITUTE OF THE
UNIVERSITY OF NAIROBI

DECEMBER, 2019

DECLARATION

This project is my original work and has not been presented for a degree in this or any other university.

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DEDICATION

I dedicate this project to my family that has been my source of support and inspiration throughout the period of conducting and compiling this study.

ACKNOWLEDGEMENTS

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ABSTRACT

The main objective of this study was to assess the quality of Non communicable disease data. The assessment utilized secondary data collected by the Non-communicable disease program and stored in the 'Non communicable disease database'. The study used a cross-sectional study design to answer to its study objectives. This study used quantitative data. Data on age, sex, type of Non-communicable disease, creatinine result counts and date of enrolment into Non-communicable disease programme was extracted. Document review, especially patient files was used to allow for verification of information. Descriptive analysis was the main analysis. The assessment focused on three aspects of data quality; data completeness, data timeliness and data validity.

The findings of the study revealed that there were data quality gaps in the Non-communicable disease data. These gaps included; discrepancies in data completeness and data timeliness. The database had 4893 individual patient records entered into it with 1886 of those having been entered before the beginning of the year 2012. More than 40% of the total 4893 records entered in the 'Non communicable diseases database', had data incompleteness and data timeliness gaps. Data validity was the only data quality principle that passed the test of good quality data.

Based on the findings of the study, assessment concluded that the NCD data at Medicines Sans Frontiers project was not of good quality. The study recommends a systematic review of the programmatic data collection system to address data quality gaps identified in the study.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Good quality data contributes towards making correct and timely decisions on how programmes or organizations are being managed. Experts in data quality have been able to show organizations and companies how to improve their data processes by first understanding the basic procedures that they need to use and how to come up with new ways to collect and analyze quantitative data (Redman, 1996; English, 1999). Data is said to be of high quality if it is fit-to-use in organizations' operations and decision-making processes. Good data quality is that which is confirmed to conform to the set standards of quality (Herzog et al., 2007). Currently about seven standards are used to describe quality of data, these are; relevance, accuracy, timeliness, accessibility and clarity of results, comparability, coherence and completeness (Herzog et al., 2007). Data quality has a direct effect on how we manage health in Africa and the world at large. This study used data completeness, data timeliness and data validity as the goal standards to measure its objectives.

Sub-Saharan Africa (SSA) is experiencing a demographic and epidemiological transition characterized by a rapidly growing urban population. This population suffers from both Non communicable diseases and acute infections, however acute infections management continues to be the main focus of most health systems in SSA (Addo et al., 2007). However, despite a progressive rise in non-communicable diseases, there exists very limited and scanty data on the quality of Non Communicable Diseases data. Non Communicable Disease burden is therefore putting a lot of pressure on the existing health systems,

especially within contexts that are of informal settings (Addo et al., 2007). For example, "the prevalence of diabetes mellitus in Kibera, one of the slum settlements in Kenya, is 5.3%, which is higher than the national average of 4.2%"(Addo et al., 2007). "NCDs are now responsible for over 50% of all hospital admissions and deaths in Kenya, with projections to exceed communicable diseases as the leading cause of mortality by 2025" (Addo et al., 2007).

Currently African countries are experiencing a demographic and epidemiologic transition of disease burden from infectious diseases to non-communicable disease. This is due to rapid movement of populations from rural to urban areas, improved healthcare and economic changes. As a result, populations are increasingly being diagnosed with more than one NCD such as hypertension, diabetes and kidney disease with HIV. "NCD is a worldwide health problem. The incidence and prevalence of NCD has increased in recent years in both developed and developing countries in Sub- Saharan Africa (SSA)" (Addo at al., 2007). "In SSA, NCD affects mainly young adults in their reproductive years and is a significant cause of death" (Isaakidis et al., 2010). This may occur by death from kidney failure, and by cardiovascular deaths, which are increased in those with NCD. Major contributory factors for this worrying picture include late referral to hospital, limited renal replacement therapy (RRT), limited capacity of health workers for NCD detection, prevention and poor awareness of kidney disease in the community. Although cumulative evidence shows that early detection and treatment prevents or delays some of its adverse outcomes" (Messerli et al., 2012). "The majority of subjects at early stage of NCD are undiagnosed and under-treated in SSA" (Khader et al., 2012a). In Kenya, studies have shown an increase in the prevalence of NCD's. This is caused by high risk factors such as

lifestyle and demographic influences. The increase of lifestyle related diseases include, diabetes and hypertension and this is an experience in both urban and rural settings (Khader et al., 2012a). Western and Rift valley regions in Kenya are experiencing a shortage of NCD data for planning and execution of those plans (Johansen et al., 2012).

The Kenyan government through the ministry of health and in collaboration with WHO and donor-funded programmes, has come up with a guideline to manage cardiovascular illness. "It is estimated that 25% of hospital admissions in Kenya are due to cardiovascular (CDV) diseases and 13% autopsies revealed CVD as the cause of death"(MOH, 2018).

Kenya has also developed and launched a national strategy for prevention and control of non-communicable diseases for the period 2015-2020. The development of the Kenya National Strategy for prevention and control of Non-communicable Disease, 2015-2020, gives directions to ensure that there will be significant reduction of preventable burden of NCDs in Kenya (MOH, 2015). Like most of the developing countries, Kenya is facing a double burden of communicable and non-communicable diseases. Despite limited data availability and quality, leading causes of death appears to still be due to infectious disease (mainly HIV) and peri-natal conditions (MOH, 2015). In 2012 NCDs accounted for more than 50% of the total hospital admissions and over 55% hospital deaths (HMIS, 2012).

Most of the focus on health problems in SSA has usually been put on infectious diseases, rather than on non-communicable disease (CND) such as Non communicable disease Kidney disease. Studies have shown that "most screening of specific groups for CKD, for example those with known diabetes (DM) or with hypertension (HTN), may be more cost effective than screening the general of patients with diabetes and hypertension versus

screening of general population" (WHO, 2005). Despite having a number of studies contacted in Sub-Saharan Africa on the prevalence of c non-communicable diseases there is still a large population undiagnosed with Diabetes, hypertension and human immunodeficiency virus (HIV) infection and HIV-associated renal diseases (Johansen et al., 2012). The main objective of this study was to assess the quality of NCD data in an urban slum setting of Kibera, Nairobi, Kenya.

1.2 Description of Medicines Sans Frontieres Monitoring (MSF) and Evaluation System

Monitoring and Evaluation system in MSF was established in the year 2003 with the main focus on HIV/AIDS information. The organization implemented a system known as 'Follow-up and Care of HIV and Aids, (otherwise known as 'FUCHIA system). This is a surveillance system used to track all the details of HIV positive patients from the time of enrollment to lifetime. It tracks data on patient's demographics, vital signs and clinical interventions or conditions (MSF, 2003).

In the year 2008, MSF started a sectional health program on Non Communicable diseases within its main program of HIV. The NCD program is providing care and treatment to the population residing in Kibera slums and its environs. The focus was on diabetes, hypertension, asthma, sickle cell anemia and epilepsy. This list of Non communicable disease conditions was later expanded to include other Non communicable diseases (MSF, 2008).

To ensure that there exists a systematic system of managing Non communicable diseases; MSF developed a robust Monitoring and Evaluation system. The system is developed in a way that it is able to collect and report information that supports the activities and outcomes

of the initiatives taken by MSF to diagnose and manage Non communicable diseases (MSF, 2008).

The system was developed within Epidata platform otherwise known as 'Non communicable disease database' and designed to collect data on demographics, vital signs, clinical interventions and treatment or follow-up outcomes. The system also collects data on HIV for those patients who are co-infected with HIV and Non communicable disease (MSF, 2008).

Data is collected on hard copy forms known as 'Initial Non communicable Disease form' and 'Follow-up Non communicable disease forms'. Initial form is only used once during the enrolment of patients into Non communicable diseases program after they are diagnosed to have Non communicable disease while the follow-up form is used on every consultation the patient visits the health facility for a clinical consultation (MSF, 2008).

The two forms are filed by the receptionists and by either, nurses, clinicians or doctors during any given consultation. The documented forms are then collected and given to the designated data clerks to verify and input the data into the 'Non communicable disease database'. The data clerks are also involved with ensuring that the data in the system is accurate, reliable, consistent and usable after analysis for decision-making (MSF, 2008).

Within the M&E System, there is a Data Manager who ensures that the data clerks are supervised and the right systems of data collection and reporting are put in place and maintained. The Data Manager is also involved with checking the quality of data in the system, analysis and reporting of the results to the specified audiences within and outside

the organization. The Data Manager and program leadership ensures that there exists a feedback mechanism to both the lower and higher levels of the organization (MSF, 2008).

However, there still exists data qualities issues with the NCD data as collected, stored and reported through the 'Non communicable disease database'. Gaps are always identified in the quarterly reports and these are only discussed during the programme review meeting which is not sufficient in providing answers as to why the gaps exits in the reports. Since the database was developed and implemented in the programme, there has never been any planned and actioned activity on data quality assessment of the system.

1.3 Problem Statement

There exists very limited data on data quality assessment of Non Communicable Diseases especially within Diabetes and Hypertension population in Sub-Saharan Africa (Addo et al., 2007). Even with the limited data that is available, there still unanswered questions on its quality. The problem with data is not only about its availability but also on the quality of the data itself (Oostrom et al., 2016). Data availability and its quality on NCD management continues to be a big challenge in Kenya and this has created the need to focus on strategies that will ensure availability and quality of this data for utilization for decision making (MOH, 2015).

Since the development and implementation of 'Non communicable disease database' in MSF project, there has never been a data quality assessment that was done and this generates the questions on whether the data in the database meets the quality standards for its use. Data quality assessment is a practice that is very helpful in identifying gaps in data management and providing recommendations for improvement (Oostrom et al., 2016).

This study aimed at assessing the quality of Non communicable disease data at Medicines Sans Frontieres, Kibera South Clinic, Kibera, Nairobi, Kenya. The choice of Kibera as the study geographic area was because of convenience to access both the facility (Kibera south health centre) and Non communicable disease data. Medicines Sans Frontieres operate Kibera south facility and within its departments, there is NCD management programme.

1.4 Research Questions

This study sought to achieve its objectives by providing answers to the research question below;

What is the quality of Non communicable disease data at Kibera south health Centre?

1.5 Objectives of the study

The general objective of this study was to assess the quality of Non-communicable disease data at Kibera south health centre.

The specific objectives were to:

i. Assess the completeness of NCD data at Kibera south health centre.

ii. Assess the validity of NCD data at Kibera south health centre.

iii. Assess the timeliness of NCD data at Kibera south health centre.

1.6 Justification of the study

In the year 2008, MSF started a sectional health program on Non Communicable diseases within its main program of HIV. The focus was on diabetes, hypertension, asthma, sickle cell anemia and epilepsy. This list of Non communicable disease conditions was later expanded to include other Non-communicable diseases (MSF, 2008).

To ensure that there exists a systematic system of managing Non communicable diseases data, MSF developed Monitoring and Evaluation system known as 'Non communication disease database'. The system is developed in a way that it is able to collect and report information that supports the activities and outcomes of the initiatives taken by MSF to diagnose and manage Non communicable diseases (MSF, 2008).

An assessment of data quality and information use is important in determining the status of the information the system is providing accurate and timely information to programmes for decision making. The 'Non communicable disease database' has not been assessed since its development and implementation to establish whether it is generating quality information for decision making. The study therefore sought to address this gap by assessing the quality of data and information collected and generated by the NCD database. Further to this, the recommendations generated from the assessment can be used to strengthen and improve the quality of NCD data. This research study will also contribute to the existing body of knowledge.

1.7 Scope and Limitations of the Study

This assessment focused on assessing the quality of the available NCD data at Kibera South Clinic situated in Kibera slum, Nairobi, Kenya. This one of the MSF programme sites in

Kenya. The assessment reviewed data from the NCD programme, which is one of the health care departments of the facility. The choice of Non-communicable disease department was informed by the availability of Non communicable disease database and patient paper records. The main source of the data was the NCD database and patient paper records.

This study had two limitations. First, the assessment only focused on Non communicable disease data and not other routine programme data from other departments. The assessment therefore, did not assess how data processes from other departments in the facility are influencing the quality of Non communicable disease data. Lastly, the study was unable to explore the barriers that resulted to low data quality by interviewing relevant personnel. These limitations did not compromise the findings of the study in any way.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature review of the available empirical evidence of Non communicable disease program and its related data quality aspects.

2.2 Empirical Literature on Data Quality

Data quality is defined as the state of quantitative and qualitative pieces or sets of information. Data is said to be of quality if it correctly represents the real-world construct in which it eludes to. Data is considered to be of high quality if it is fit for its intended uses in decision making, operations and planning (Measure, 2017). 'Reliable and timely health information is an essential foundation of public health action and health systems strengthening, both nationally and internationally' (AbouZahr et al., 2005)' This is particularly so when resources are limited and funding-allocation decisions can mean the difference between life and death. 'The need for sound information is especially urgent in the case of emergent diseases and other acute health threats, where rapid awareness, investigation and response can save lives and prevent broader national outbreaks and even global pandemics' (WHO, 2008)

2.3 Empirical Studies on NCD data quality

Data quality is a key element and consideration in the management of health institutions. Good quality data contributes towards making correct and timely decisions on how a program or organizations are being managed (Herzog et al., 2007).

Experts in data quality have been able to show organizations and companies how to improve their data processes by first understanding the basic procedures that they need to use and how to come up with new ways to collect and analyze quantitative data (Redman, 1996; English, 1999). Data is said to be of high quality if it is fit-to-use in organizations' operations and decision-making processes. Good data quality is that which is confirmed to conform to the set standards of quality (Herzog et al., 2007). Currently about seven standards are used to describe quality of data, these are; data relevance, data accuracy, data timeliness, data accessibility and data clarity of results, comparability, coherence and completeness (Herzog et al., 2007).

There are several factors to consider when determining the presence of each of the mentioned standards of quality data. Data relevance measures whether the data available meets the basic needs they were collected for; data accuracy ensures that the right and main variables of interest have been included in the data collection systems. For example, "how frequently are individuals likely to die from certain disease?" (Herzog et al., 2007); timeliness looks into how current information needs to be made available in order to predict incidents, trends and progress of any illness. If the availability of data is delayed then the management of a given disease is affected in the same negative measure; comparability, this is the process of comparing several databases into a data warehouse to ensure use of data, for example are the fields made available within any given database able to allow easy link of individuals across the databases; completeness, this means no records are missing and no record has a missing data element. In many databases especially health ones missing entire record can have very huge consequences on the management of diseases (Herzog et al., 2007).

"In developed countries, Non communicable disease prevalence has been on the increase as a result of rapid aging of the population" (WHO, 2011). For instance, "in the United States of America, rise in the number of those with more than one Non communicable diseases in the period between 2001-2010 was illustrated based on the data obtained from health surveys and health care insurance organizations" (European, 2008). The rise and a possible expectation further increase in the prevalence of Non communicable diseases is a challenge for those involved in policy formulation given the fact that it has weighty effects for future health care and management policies and allocation of resources. In the spirit of reforming "the existing health care and management systems to be better equipped and manage growing proportion of older people with Non communicable disease conditions, many of the developed countries are using the available Non communicable disease in putting into action their plans" (European, 2008).

A study was conducted in the Netherlands to define the tendencies of Non communicable diseases prevalence and multi-morbidity from the year 2001-2011, and the degree to which they can be linked to the population that is aging. "The study relied on data that was from two types of population-based data namely; medical records from general practices and self-reported health status from health interview surveys" (Oostrom et al., 2016). These two sources provided a reliable space on tendencies in the overall populace by ensuring that there is a continuous data collection and reporting process. In using both sources (registration and self-reported data), it was possible to provide a more comprehensive representation of Non communicable disease trends. The study revealed that, there was a growing trend in the Non communicable disease prevalence and multimorbidity distinguishing between a section that is due to the population that is aging and a part that

is due to other standard of living improvements or conditions. The statistical figures obtained from this study showed that the population that is aging only explained a part of the prevalence increase between 2001-2011,therefore not being the sole contributing factor. Other factors therefore contribute to the rise in Non communicable disease prevalence and not the factor on aging. Improved case finding through better detection might result in an increase in the proportion of diagnosed cases was a key factor. Early treatment of disease and their risk factor improvements might high chances of increasing the likelihood of existence for those with Non communicable diseases. "Lifestyle changes and environmental risk factors for Non communicable diseases was found to contribute to increased occurrence of Non communicable diseases" (Remington et al., 2011). "Studies have shown that prevalence and lifestyle exposures to overweight and obesity have gone up and this is almost a global problem" (Hulsegge et al., 2014). This has led to increased incidents of diabetes, cancer and cardiovascular disease. There are other several contributing factors associated with overall situations in the society that may contribute to prevalence of Non communicable diseases. Twenty hour business environment and the universal financial challenges have led to high demands and pressure of achieving those needs and this may have a direct impact on health of the citizens and how they utilize health care services (Karanikolos et al., 2014; Karanikoloset al., 2013). "In the past three decades, the use of health care facilities in the Netherlands has gone up tremendously" (Swinkels et al., 2011). This has resulted to more people visiting medical professionals regularly and therefore more and earlier disease diagnosis is bound to happen (Swinkels et al., 2011). There is a high likelihood that people are today more conscious of their Non communicable diseases, however this can only be clarified by the observed tendencies in the health survey

data. Steady improvement of recording procedures has a positive effect on the estimating prevalence of Non communicable diseases in data that is obtained from general medical practice. "From the Netherland's study, it was shown that their existed a discrepancy between the proportions of the trend attributed to aging of the population from general data and health surveys "(Oostrom et al., 2016). The limitation of this study is that the sample selection was biased to people who were aging and left out children, tanagers and the young adult.

There is need for international comparisons on the burden of Non communicable disease and for this to happen the focus should not only be on ensuring that data is available, but also comparable and of sufficient quality. Data comparability and quality are heavily dependent on the type of data collection method and their sources. Data can either be obtained from patient examination records, or interview survey, specific disease registry, general practice or hospital registry, administrative databases, epidemiological study among other sources. Whichever the source, the quality of the data is dependant of the quality of the processes that were involved in generating the data itself.

There are other several factors that might have had a direct effect on the rise of Non communicable disease prevalence estimation; these are among others; timely and enhanced uncovering of diseases developments in medical treatments, and changing lifestyles (Remington et al., 2011). Availability of information and data related to Non communicable disease has made it possible for developed countries to make policies and allocate resources to health systems that have ensured that Non communicable disease are detected early and early management provided. This has reduced deaths that are as a result of Non communicable disease. Many of the developed countries are also working towards

improving their lifestyles in both diet and physical body management (Swinkels et al., 2011).

Although there is improved reduction of Non communicable disease prevalence and deaths in the developed countries, the low-income and middle-income countries are still experiencing a high burden of the epidemic and both population ageing and rapid social environmental changes that are leading to an increase in the prevalence of common preventable risk factors drive this. Major Non communicable disease causes are financial constrains that are related to accessing management and treatment options that are available. This means that quality of Non communicable disease disease management that one can access depends on how much that person has the ability to pay. Those with no resources to pursue healthy choices suffer the most. Non communicable diseases cost in low-income and middle-income countries are high and are often paid by patients as out-of-pocket expenses and this has a direct contribution to family poverty. The disadvantage for people in low-income and middle-income countries is that the increase in Non communicable diseases and their risk factors is concurrent with unresolved communicable disease epidemics, specifically HIV/AIDS in Sub-Saharan Africa (Swinkels et al., 2011).

"Chronification of certain diseases and growing life expectancy of populations of most countries are leading to an increase in the number of people living with one or more Non communicable diseases" (Kathleen et al., 2006). The term Non communicable diseaseity refers to "a wide framework for understanding the phenomenon of Non communicable disease conditions in relation to patients, their families, communities and health systems, forces the societies to reconsider current models of service provisions and the role of patients with regard to their conditions" (Boyd et al., 2010; Allotey et al., 2011). It

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suggests that medium-term modifications should be carried out to put in order the provisions of health services in an innovative way and this requires the use of new information systems as a management tool for interventions planning to provide healthcare for patients (Juan et al., 2012).

"It is public knowledge that there exists not even a single source of information from which we can obtain all the data necessary for routine monitoring of Non communicable diseases" (Lix et al., 2006). This has resulted to the use of a wide range of different data collection and reporting methods. "These methods includes; demographic statistics, population surveys, specific disease registers, hospital discharge data sets and other administrative databases as well as algorithms designed to obtain information from electronic health records and other complex systems"(Gijsen, et al., 2006; Barber et al., 2010; Knox et al., 2008; Singh, 2009; Gorina et al., 2011). In each of the mentioned approaches, there exists advantages and disadvantages. The main disadvantage of administrative healthcare databases is that they only offer information about attended morbidity. "Their main advantage is that they contain data already recorded for other purposes, which proves to be easier to handle than other systems. They are also able to provide cross-sectional and longitudinal data on the prevalence and incident of diseases in their population" (Lix et al., 2006). In organizations like Spanish National Service, where each patient is allocated a most interactions with users happen at the primary care level. "This has resulted to the information provided by primary care health professionals to be very useful especially with the computerization of medicals information" (Gijsen et al., 2006).

Data entry quality and completeness regarding diagnosis in a primary care set up is in most cases pre-determined by a variety of factors related to the organization of the health service, the patients and the doctors themselves. The structure of patient flow and the processes involved in service provision contributes to the quality of data generated in the health facility using the available data collection and reporting tools. Quality of Non communicable disease data should be emphasised even before its availability is considered. There is need for development of policies that are geared towards detecting and managing Non communicable diseases especially in the Sub-Saharan Africa and for this to happen availability of quality, data on Non communicable diseases is key.

Attention to health problems in Sub-Saharan Africa has in most cases concentrated on infectious diseases and not non-communicable disease (NCD) such as CKD. "Screening of specific populations for CKD, such as those with known diabetes (DM) or with hypertension (HTN), may be more cost effective than screening the general of group with DM and HTN versus screening of general population"(WHO, 2005). There is limited information on studies contacted in sub-Saharan Africa that have assessed the quality of Non communicable disease data (Herzog et al., 2007).

"Systems that are termed to be robust and strong for capturing health program data are essential to tracking progress toward health objectives and will be central in supporting decisions that are informed by data (MEASURE, 2017)". To ensure quality of data programs should make a deliberate decision and plan of carrying out data quality assessment using standard tools. There are two types of data quality tools: data quality Audit tool and Routine data quality assessment tool (MEASURE, 2017).

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2.4 Summary of Literature Review

It is evident that, from the literature review, data quality is a key element and consideration in the management of Non communicable diseases. Good quality data contributes towards making correct and timely decisions on how health programs or organizations are being management. Data is said to be of high quality if it is fit-to-use in organizations' operations and decision-making processes. Good data quality is that which is confirmed to conform to the set standards of quality (Herzog et al., 2007). Relevance, accuracy, timeliness, accessibility and clarity of results, comparability, coherence and completeness are the key standards of quality data (Herzog et al., 2007).

There exists data quality gaps in the available Non communicable disease data. Some of the gaps include: incompleteness; timeliness and accuracy. While there exists several data sources and data systems on Non communicable diseases, there are still huge data quality gaps that need to be addressed.

It is evident that there exists data quality gaps in every data source or data collection process on Non communicable diseases. There exists no single source or data collection process that can claim to be able to collect all data related to Non communicable diseases while maintaining 100% data quality standards.

2.5 Analytical Framework

This assessment adopted the "Conformance to data quality" framework by Herzog et al., 2007. This framework states that, there are two main keys to the improvement of data quality – they are; prevention of errors during data collection and prevention of errors

during entry of data into a database. The truth is that errors in large data sets will continue to exist and data validation and correction cannot be ignored (Maletic et al., 2000).

Data quality is a key element and consideration in the management of health institutions. Good quality data contributes towards making correct and timely decisions on how a program or organizations are being management. Through research experts in data quality have been able to show organizations and companies how to improve their data processes by first understanding the basic procedures that they need to use and how to come up with new ways to collect and analyze quantitative data (Redman, 1996; English, 1999;). Good data quality is that which is confirmed to conform to the set standards of data quality (Herzog et al., 2007). The framework states that there are seven standards that are used to describe quality of data, these are; relevance, accuracy, timeliness, accessibility and clarity of results, comparability, coherence and completeness (Herzog et al., 2007). It goes further to explain that data, completeness, data timeliness, data validity and data accuracy are the most important standards to ensuring data quality.

To achieve the good quality data program management should ensure that data completeness is achieved; Organizations and programs should strive for completeness of data so that all eligible record are used in compiling and reporting of the data. It is better to complete the data for a discrete unit and make that available, than have, lots of incomplete data available, as analysis carried out on incomplete data will not be comprehensive (Chapman , 2005).

Data completeness is the level at which data field has been answered in whole or in its entirety. Measurement of data completeness can ensure that patient or client profiles and clinical measurements are answered in whole and that an entire picture of the patient situation is realized. Partially complete or missing data, for example missing age, missing sex, or missing date of birth can negatively affect the results of any given assessment. Incomplete data results in to poor service delivery and wrong decision-making (Herzog et al., 2007)

Data Timeliness; this refers to the time expectation for accessibility and availability of information. It can be measured as the time between when information is expected and when it is readily available for use (Chapman, 2005). The frequency at which data is updated in any given data set or database is very important and this is to the currency, timeliness and needs to be formalized and documented. This includes the addition of new data as well as the frequency of release of corrected data (Chapman, 2005). In data quality management terms, currency is mostly used in the context of a "us-by" period for data (sometimes also known as timeliness), and could be related to when the data were last checked and/or updated (Chapman, 2005).

Data validity; Validity is a measurement that is very important for programming, research and decision making processes not only for health institutions but also for companies and other organizations especially those involved with research. The rate at which data is used successfully depends with the validity and accuracy of the data itself (BMC, Health, 2014). "The need for sound information is especially urgent in the case of emergent diseases and other acute health threats, where rapid awareness, investigations and response can save

lives and prevent broader national outbreaks and even global pandemics" (Aqil et al., 2009).

2. 6 Operationalization of the Assessment

This study borrowed some of the key data quality standards mentioned above in measuring its objectives. It specifically used data validity, data timeliness and data completeness standards to assess the quality of the available Non-communicable disease data in trying to answer to the study questions. From the framework, data validity, data timeliness and data completeness were mentioned as the most important standards in assessing data quality. These standards are very relevant to this study and they were key in assessing the quality of Non communicable disease data.

This assessment borrowed three data aspects of data quality from the analytical framework. These data quality aspects were; data completeness, data timeliness and data validity. Data was collected using the following variables; age, sex, type of NCD disease, creatinine result counts and date of NCD enrolment. Data completeness was measured by assessing the number of records with missing data on the study variables selected for the study Assessment of data timeliness was measured by assessing the level at which data was updated on age, sex, type of NCD disease, creatinine result and date of NCD enrolment variables in both the files and database plus the number of reports generated from the system and dissemination, discussed and decisions made. Data validity was measured by assessing the structure and format of data variables. The uniformity of data coding on each of the study variables was assessed. The summary on the measurement of the data quality standards is presented in table 2.1 below:

Table 2.1: Indicators of Measurement

Data Quality Standard	Variables of measurement	Measurement
Data Completeness	age, sex, type of NCD disease, creatinine result counts and date of NCD enrolment	- Assessment on the of variables with Partially complete or missing data
Data Timeliness	age, sex, type of NCD disease, creatinine result and date of NCD	- Frequency at which data is updated in the database and patients files. - Availability of reports generated from the database. - Frequency at which reports are generated from the database.
Data Validity	age, sex, type of NCD disease, creatinine result and date of NCD	- Assessment on the uniformity of the variables of the study.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents the methodology that was utilized in the study. It divided into four sections, which include; research design, sampling procedures, data collection and analysis. The chapter begins by describing the study design that was used, the reasons behind the selection of the study design, the study sample, methods that were used in data collection and data analysis that was used.

3.2 Research Design

This assessment used the cross sectional study design. This is a type of study design that categorizes exposure and identify cases in a study. Exposures are then measured based on records created at that time. This type of study design makes it possible for the researcher to formulate hypotheses about the mostly likely associations between an outcome and an exposure and to further investigate the potential relationships (Biochem at al., 2014). In cross sectional study design, the researcher uses administrative databases or medical records

This study sought to assess the quality of Non communicable disease data while obtaining data from the 'Non communicable disease database', which collects and repots on all data related to Non communicable disease care and management.

3.3 Data Collection

This study used secondary quantitative data collected and entered in the 'Non communicable disease database'. This was a descriptive data on diagnosis and management of Non communicable diseases at MSF-Kibera project. Data on age, sex, type

of NCD disease, creatinine result counts and date of NCD enrollment variables was extracted from the NCD database that is operational in MSF. Document review especially patient files was used because it allowed for verification of information, which was useful to the objectives of this study. The data obtained through the document review was helpful in supporting the data generated from the Non communicable disease database hence enriching the findings of the study. Document review as a methodology of study is defined as a way of collecting data through review of existing information, which could be from hard copies and electronic sources (CDC, 2009). This study relied on patient hard copy files for the document review and verification. Extra data was collected from the patient files and documented on the summary sheets that were later translated into electronic excel sheets for analysis.

3.4 Description of 'Non Communicable Disease Database'

The 'Non communicable disease database' is built within the Epi-data platform. The database contained a total 4892 records since its implementation in the program. The first record was entered in the year 2008 and last record entered in the year 2017. However, the study analyzed data of Non communicable disease patients enrolled in the program between 1st January 2012 and 31st 2017. This period was selected because it was the time the system of data collection, collation and input into the system was complete and consistent in the facility. The data collected before the year 2012 had a high percentage of data incompleteness, untimeliness and data entry was not done in a consistence manner. The choice of the database was based on the fact that it was the only available database at the facility collecting data on Non communicable diseases in the MSF selected site for this study. The database collects data on patient demographics, vitals and clinical data from the

patients, these include; patient name, patient age, patient sex, date of visit, temperature, body mass index, lab tests, NCD diagnosis and medial drugs dispensed to the patients.

Since the development and implementation of the 'Non communicable disease database', no data quality assessment had been carried out on the system. This therefore made it difficult for the program to confirm the quality and usability of the data collected and stored in the database and this assessment was to find answers to this gap. Quarterly reports that are routinely generated always have programmatic discrepancies in the numbers. To identify the root causes of these data discrepancies a data quality assessment was required.

3.5 Methods of Data Analysis

The assessment used a descriptive statistics method of analysis in achieving its objectives. This method of analysis helps to describe and understand the features of a given data set. They help to provide simple summaries about a sample and the measures. Summary tables were loaded with data that was used to provide the results of the study and give a comparison between different characteristics from the data that was available for the study. The database collects data on the following age sex, weight and height characteristics. Using Microsoft Excel, the study analyzed the available data on the following variables; age, sex, date of enrolment into NCD program and latest creatinine measurements.

The study used the following indicators to satisfy its objectives;

  I.   Total number of patients diagnosed with a specific Non communicable disease

  II.   Number of records with missing data on one or more variables

  III.   Total number of records with un-uniformity in data variables

  IV.   Number of records with un-incomplete data variables

CHAPTER FOUR

DATA QUALITY ASSESSMENT OF NON COMMUNICABLE DISEASE DATA

4.1 Introduction

This chapter presents results, which are in line with the objectives of the assessment. The chapter begins by presenting results on the key data quality standards that were adopted by the assessment. These standards are; data completeness, data timeliness and data validity.

4.2 Data Completeness

Data completeness is the level at which data field has been answered in whole or in its entirety. Measurement of data completeness can ensure that patient or client profiles and clinical measurements are answered in whole and that an entire picture of the patient situation is realized. Partially complete or missing data, for example missing age, missing sex, or missing date of birth can negatively affect the results of any given assessment. Incomplete data results in to poor service delivery and wrong decision-making (Herzog et al., 2007). For this assessment, the focus was on the number of records with missing data.

The results on data completeness are presented in table 4.1 below. The table contains data on yearly enrolment of NCD patients with missing information or incomplete records on: sex, age, type of NCD and creatinine clearance.

The results showed that the 'Non communicable disease database' had a total of 4893 individual patient records entered into it since the beginning of the NCD program, however, of the total 4893 records, 1886 records that were entered before the beginning of the year 2012 had a percentage of more than 40% of data incompleteness, data timeliness and data

validity. This assessment analyzed data collected on the following variables; age, sex, date of enrolment into NCD program and latest creatinine measurements. The assessment accepted any data that had data discrepancies of less than 10%. For this reason, the study assessed a total of 3008 records that were entered in the database between 1st January 2017 and December 2017. Of the total 3008 records analyzed; 20 records did not have type of Non communicable disease specified, 19 did not have age specified and only 195 records or patients had their latest creatinine documented. The small number of patients who did not have creatinine done was due to the clinical team not adhering to the treatment guideline. These findings revealed a big gap in the way data is collected and documented especially from the clinical and laboratory departments where there exists the biggest gap. From the year 2015 the proportion of records that had gaps in data completeness in creatinine result count compared to the total number of patients enrolled per year increased up to 100% in the year 2017. The results above are in agreement with those of (Herzog et al., 2007) study, which found out that over 50% of the data variables analyzed in the assessment had data completeness gaps

Through informal discussions with the facility staff, some of the reasons that contributed to low data quality were; high staff turnover especially in the clinical and data entry departments, absence of data quality audit plan and guideline - this was found to be one of the major reasons for poor data quality, there was no prove of any data quality audits that was done since the NCD program was started and lastly some of the staffs were not well oriented on the NCD data collection tools.

Table 4.1: Number of records on Patients Enrolled per Year (1st January 2012-31st December 2017) with Missing Data

	Years						
Variable	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total**
Number of records missing age	**0**	**0**	**4**	5	6	4	19
Number of records sex	0	0	0	0	1	0	1
Number of records missing creatinine Results count	662	750	837	277	240	47	2813
Number of records missing type of Non communicable disease	0	1	8	3	5	3	20
Totals number of records missing one or more records	**720**	**821**	**884**	**294**	**242**	**47**	**3008**

4.3 Data Timeliness

Data timeliness refers to the time expectation for accessibility and availability of information. It can be measured as the time between when information is expected and when it is readily available for use (Chapman, 2005). The focus of this assessment was on data frequency.

The results on data timeless are presented in table 4.1 above. The table contains data on yearly enrolment of NCD patients with missing information or incomplete records on: sex, age, type of NCD and creatinine clearance.

Generally, the results showed that most of the variables assessed in this study, had a good degree of data frequency. However, the assessment also showed that there was a very big percentage of missing data on the creatinine measurement variable. A total of 2813 records representing 94% of the total records assessed, did not have data on creatinine clearance

results hence making it hard to use the data for decision making. These findings confirmed the argument in the study of (Herzog et al., 2007) who in their study found out that data timeliness is a very important standard in measuring data quality, it is still one of the key data aspects that many health programmes are struggling with Gaps in the implementation of NCD guideline, delayed data entry of creatinine results in the NCD database and missing of creatinine results from the lab or clinicians were the reasons highlighted as causing this huge gap in the availability of creatinine data. Lack of adherence to NCD guideline resulted to high number of patients not having been done creatinine test.

The assessment revealed that the programme only generate, review, discuss and make decision on reports on quarterly timelines as compared to monthly periods. Generation and review of reports on monthly timelines provides an opportunity for the program teams to identify gaps in data and correct them in good time as compared to the quarterly timelines.

4.4 Data Validity

Data validity ensures that data is clear, unambiguous and in a uniform structure, where the entity types and attributes have the same basic structure and format (Redman, 1996). This assessment focused on the clarity, unambiguity and uniformity of data.

The results on data validity are presented in table 4.2 below. The table contains data on individuals who were uniformly coded and diagnosed with specific type of NCD, how many of those were children and adults.

The results showed that all of the variables namely; age, sex, type of NCD disease, creatinine result and date of NCD enrolment were confirmed to be consistent in the coding

and structure all through the database. Data collected on all of the variables was on the same format all through the database for each patient record. This was the only data quality principle that passed the test of good quality data. Through observation, each of the variable data was analyzed for uniformity, unambiguity and clarity.

Table 4.2: Number of Patients coded uniformly and diagnosed with NCD and enrolled between the years 2012 and 2017: Type of NCD, Age and Sex Desegregations

	Male		Females		Totals				
Type of Non communicable disease	**<15**	**>=15**	**<15**	**>=15**	**<15**	**>=15**	**Males**	**Females**	**All ages**
Number of patients with Diabetes	0	138	0	286	0	424	138	286	424
Number of patients with Hypertension	1	620	1	1401	2	2021	621	1402	2023
Number of patients with Asthma	79	108	76	179	155	287	187	255	442
Number of patients with Epilepsy	0	4	0	24	0	28	4	24	28
Number of patients with Sickle cell Anaemia	7	25	8	51	15	76	32	59	91

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents summary, conclusion and recommendations of the assessment. The chapter begins by summarizing the findings of the assessment of MSF Non communicable disease data collection system. It gives the conclusion on the status of the quality of NCD data at MSF and finally recommendations from the assessment on improving NCD data quality, policy formulation or review and programme review plans for further research.

5.2 Summary

This assessment was conducted to determine the quality of Non communicable disease data. Specifically the assessment used the following data quality standards; data completeness, data timeliness and data validity. In achieving the objectives of this assessment, available quantitative data was analyzed. Quantitative data was obtained from NCD data database that was developed in Epidata software platform and the analytical framework of this assessment guided the analysis.

The assessment revealed that there existed data quality weakness on the NCD data. These weaknesses included; gaps in data completeness and data timeliness, for example; of the 3008 patients enrolled into NCD care and treatment between 1st January 2017 and December 2017; 20 records did not have type of Non communicable disease specified, 19 did not have age specified and only 195 records or patients had their latest creatinine documented.

Reports were generated, reviewed and discussed for decision making only on quarterly timelines as compared to monthly timelines. This created a lapse in the timely data audits, data reviews and information dissemination for decision-making processes. There was no evidence of a data quality assurance guideline and in the same way, no facility supervision visits were being conducted.

However, there were a number of strengths that were identified, these included; existence of an NCD data collection and reporting database, existence of user-friendly data collection tools (in hardcopy form), existence of data management unit. The data assessment revealed good results on data validity.

5.3 Conclusion

In conclusion, the assessment found that there exists data quality gaps in the Non communicable disease data. There were data quality issues on data completeness and data timeliness (Herzog et al., 2007). As presented in the results section of this write-up a huge number of records especially on the creatinine results variable did not have data available.

The assessment revealed that the program only generates, review, discuss and make decision on reports on quarterly timelines as compared to monthly periods. Generation and review of reports on monthly timelines provides an opportunity for the program teams to identify gaps in data and correct them in good time as compared to the quarterly timelines.

The assessment revealed that, there existed no data quality standard operating procedures and guidelines, this contributed largely to the gaps identified on data completeness. No data quality assurance had ever been undertaken on the NCD data and can be attributed the

data quality weaknesses identified in this assessment. Data quality standard operating procedure is a vital tool in ensuring that good data quality is achieved in the programme.

Data validity is the only indicator that scored well in this assessment, through observation, each of the variable data was analyzed for uniformity, unambiguity and clarity. Data collected on all of the variables was on the same format all through the database for each patient record. In the view of the findings above, this assessment concluded that the available NCD data was not of good quality for decision making in managing NCD treatment at MSF Programme.

5.4 Recommendations

Based on the findings obtained from this study, the following recommendations were made. The recommendations were both on policy, programme and future research.

5.4.1 Recommendation for Policy and Programmes

To address the gaps on data completeness and timeliness as highlighted in the findings of this study, a data quality guideline that will help the data management team in the organization to clean-up, verify and maintain reliability of the data should be developed and the teams sensitized and trained on its use and implementation. The availability of this document will play a great role in ensuring that gaps in data completeness and data frequency as identified in this assessment do not occur.

To prevent errors that result during data entry, the database should have inbuilt controls that will ensure the completeness and accuracy of data during data entry. Validated data entry systems where compulsory field are ensured and also skip patterns are implemented

for non-mandatory fields should be implemented. The databases also need to be validated to ensure data integrity, for example; key fields are captured, logic and data range are implemented.

The organization needs to develop and implement a data quality assurance strategy. There should be data quality audit tools that all of the staffs will be trained on so that they are used during data quality assurance exercises. This will help to work on the gaps in data timeliness and completeness as revealed by this study results.

There should be monthly and quarterly supportive supervision and data auditing activities with the participation of both Monitoring and Evaluation and program teams. This will help the organization identify areas with data and skill gaps so that mechanisms for addressing the identified are put in place early. The exercise will also check on the timeliness of data entry and if the data quality guidelines are being implemented in the correct way.

The organization's management should invest in a well structured Monitoring and Evaluation department that has the required skills and knowledge in M&E and the team is well motivated to encourage high level performance. The program should ensure that all of the key staffs have been trained on the NCD care and management protocols

5.4.2 Recommendation for Further research

Further studies should focus on assessing the capacity of health organizations to develop and implement robust Data collection and reporting systems on Non-communicable diseases and how the quality of this data can be maintained to inform data use and decision-making. There still exists a big need of assessing the quality of Non communicable disease

data; this therefore calls for future assessments using different assessment tools and methodologies, for example use of a questioner and interviewing the health service providers on the challenges of collecting, analysing and using Non communicable disease data.

REFERENCES

AbouZahr, C and Boerma, T. 2005. Health information systems: The Foundations of Public Health. Bulletin World Health Organization. 83(8) 578-583

Allotey, P., Reidpath D.D., Yasin S., Chan C.K., De-Graft Aikins A. (2011). Rethinking health-care systems: a focus on chronicity. Lancet. PMID:21074257

Addo, J., Smeeth, L., Leon, D. (2007). Hypertension In Sub-Saharan Africa: Hypertension. http://hyper.ahajournals.org

Aqil, A.,Theo L., Dairiku H., (2009). PRISM framework: a paradigm shift for designing, strengthening and evaluating routine health information systems. Health policy plan. Oxford University Press.

Barber, J., Muller S., Whitehurst T., Hay E. (2010). Measuring morbidity: self-report or health care records?. Family Practice. PMID .

Biochem., Med. (2014). Observational and interventional study design types. Biochem Medica. Zagreb.

Boyd, CM., Lisa R., Katherine F., Daniel S., Bruce L., Jennifer W., Carol G., Lya K., Stephen W., Jill M., Chad B., (2010). The Effects of Guided Care on the Perceived Quality of Health Care for Multi-morbid Older Persons: 18-Month Outcomes from a Cluster-Randomized Controlled Trial. J Gen Intern Med.

Centers for Disease Control. (2009). Guidelines for evaluating surveillance systems. www.wpro.who.int/wpsar.

Chapman, A.D., Muñoz, M.E., de S., and Koch, I. (2005). Environmental Information: Placing. Biodiversity Informatics.

English, L.P. (1999). Improving Data Warehouse and Business Information Quality: Methods for Reducing Costs and Increasing Profits. New York: John Wiley & Sons.

European Observatory on Health Systems and Policies. (2002. Health Systems in Transition, country-based reports. http://www.euro.who.int/en/about-us/partners/observatory/health-systems-in-transition-hit-series/hit-summaries.

Gene, V., Glass., Kenneth D., Hopkins. (1984). Statistical methods in education and psychology. Prentice-Hall. Education.

Gijsen, R., Poos. (2006). Using registries in general practice to estimate countrywide morbidity in The Netherlands. Public Health. ScienceDirect.

Gorina, Y., Kramarow E.A. (2011). Identifying chronic conditions in Medicare claims data: evaluating the chronic conditions data warehouse algorithms. Health Serv Res. 46: 1610 -1627. 10.1111 /j.1475-6773.2011.01277.

Health Information Management System. (2012). https://www.healthit.gov/sites

Herzog., Th, N., Scheuren, F.J., Winker W.E. (2007). Data quality and Record Linkage Technique. Springer, New York, NY

Hickman, M., Stimson, G., Howe, S., Farrell, M., Taylor, C., Cox, S., Harvey, J., Frischer, M. and Tilling, K. (1999). Estimating the prevalence of problem drug use in inner London: A discussion of three capture-recapture studies. PubMed

Hulsegge, G., Picavet HS., Blokstra A., Nooyens AC., Spijkerman AM., van der Schouw YT, et al., (2014). Today's adult generations are less healthy than their predecessors: generation shifts in metabolic risk factors: the Doetinchem Cohort Study. European journal of preventive cardiology.

Isaakidis et al., (2010). High survival and treatment success sustained after two and three years of first-line ART for children in Cambodia. J Int AIDS Soc. International Journal for Research, Policy and Parctice.

Johansen, K. (2012). United States Renal Data System 2011 Annual Data Report: Atlas of chronic kidney disease and end stage renal disease in the United States. Kidney Disease; Kidney disease undergoing cardiac rehabilitation. Am J Kidney Dis.

Juan et al., (2012). Nervous System Diseases-Advances in Research and Treatment.

Kathleen, Strong., Colin, Mothers., Joanne, Epping.–Jorbanrobert Beaglehole (1 April 2006). Preventing chronic disease: a priority for global health: International Journal of Epidemiology.

Karanikolos M., Mladovsky P., Cylus J., Thomson S., Basu S., Stuckler D, et al. (2013). Financial crisis, austerity, and health in Europe. Lancet. Kenya National Guideline for Cardiovascular diseases management. (2018). www.health.go.ke/wp-content.

Kidder, Fine. (1987). Qualitative and quantitative methods. Autumn fall. *https://onlinelibrary.wiley.com › doi › abs*

Khader A, Farajallah L, Shahin Y et al.(2012a) Cohort monitor-ing of persons with hypertension: an illustrated example from a primary healthcare clinic for Palestine refugees in Jordan. Tropical Medicine & International Health17, 1163–1170.

Knox, S.A., Harrison C.M., Britt HC., Henderson J.V. (2008). Estimating prevalence of common chronic morbidities in Australia. Med J Aust.

Lix, L., Yogendran M., Burchill C., Metge C., McKeen, N., Moore D., Bond R., (2006). Defining and validating Non communicable diseases: an administrative data approach. Winningpeg: Manitoba Centre for Health Policy.

Maletic., and Marcus. (2000). Data cleansing. Beyond integrity Analysis. CiteSeerx

Messerli, F., Bangalore, S., Julius, Stevo., (2012). Risk/Benefit Assessment of β-Blockers and Diuretics Precludes Their Use for First-Line Therapy in Hypertension: Circulation. PMID: 18490538

Measure. (2017). Data Quality Assessment Tool. A curriculum on basic concepts and practice - Syllabus (sr-16-135a). Chapel Hill, NC: MEASURE Evaluation, University of North Carolina. http://www.measureevaluation.org/sifsa.

MOH. (2015). Kenya National Strategy for Prevention and Control of Non-Communicable Disease. Mental Health, Public Health.

MOH. (2018). Kenya National Guideline for Cardiovascular diseases management, Public Health

MSF. (2000). MSF Monitoring and Evaluation Framework. https://evaluation.msf.org

MSF. (2008). MSF Monitoring and Evaluation Framework. www.who.int/tdr/publications.

MSF. (2008). MSF NCD data collection and entry guideline. https://fieldresearch.msf.org

MSF. (2008). MSF Project document. https://www.msf.org/reports-and-publications.

Redman, T.C. (1996). Data Quality for the Information Age. Association for Computing Machinery.

Remington, PL., Brownson, RC., Centers for Disease C., (2011). Fifty years of progress in chronic disease epidemiology and control. Morbidity and mortality weekly report Surveillance summaries. Suppl 4:70–7.

Sigh, J.A. (2009). Accuracy of veterans affairs databases for diagnoses of Non communicable diseases. Prev Chronic Dis.

Swinkels H., Trendcijfers, G., Gebruik, G., voorzieningen, et al., (2011). Statistics Netherlands. CBS.

Van Oostrom SH, Picavet HSJ, de Bruin SR, Stirbu I, Korevaar JC, Schellevis FG, et al. (2016). Multimorbidity ofNon communicable diseases and health care utilization in general practice. BMC Family Practice. PubMed

World Health Organization. 2008a. Assessing the National Health Information System: An Assessment Tool Version 4.00. World Health Organization: Geneva, Switzerland

WHO. (2005). preventing chronic disease: a vital investment. http://www.who.int/chp/chronic_disease_report/en/.