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The Measurement of Non-Communicable Diseases in 25 Countries with Demographic and Health Surveys

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The Measurement of Non-Communicable Diseases in 25 Countries with Demographic and Health Surveys

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Abstract

This report provides an overview of NCD data that have been collected by The DHS Program. The main objectives of this report are: 1) to describe the procedures and questions used to collect data on NCDs in DHS surveys; 2) to present prevalence rates and differentials of hypertension and diabetes; 3) to compare NCD data collection efforts of DHS and WHO; and 4) to discuss future NCD data collection by DHS.

Twenty-five DHS countries were identified as having one or more surveys that collected biomarker or self-reported data on at least one of the following NCDs: hypertension, diabetes, prostate cancer, breast cancer, and cervical cancer. Most of the NCD data collected in the 39 surveys examined in this report are self-reported data. Biomarker data are available only for hypertension and diabetes in 13 countries and 3 countries, respectively. Age ranges of respondents eligible for biomarker testing varied across surveys. While earlier surveys focused on respondents in DHS standard age ranges (15-49 for women and 15-54(59) for men), recent surveys were designed to collect biomarker data on older adults. Procedures used in collecting biomarker measurements in DHS surveys are largely consistent and follow WHO guidelines. The analysis results suggest large disparities in prevalence rates of hypertension and diabetes across DHS countries by age, wealth, education, and residence. The report concludes that DHS has made a substantial contribution to understanding the issue of NCDs in developing countries by collecting data on several important NCDs. However, the expansion of NCD data collection must necessarily be judged by weighing increased cost against the potential utility of the data. Systematic data collection on NDCs may be more relevant in middle-income countries than in low-income countries.

Executive Summary

Non-communicable diseases (NCDs) are becoming a pandemic for numerous populations around the world. While suffering from communicable or infectious diseases, low- and middle-income countries are now being afflicted with NCDs and facing the phenomenon known as the “double burden” of disease.

A key strategy identified as a tactical approach to reducing global NCD rates is enhancing surveillance; however, limited efforts on monitoring the trends of NCDs have been carried out in low- and middle-income countries.

Surveys in the Demographic and Health Survey (DHS) Program are among the few surveys providing nationally representative data on NCDs, including hypertension, diabetes, prostate cancer, breast cancer, and cervical cancer for select countries. Of the 25 DHS countries with at least one survey that included biomarker or self-report data on NCDs (mostly middle-income countries), only Armenia (2010 DHS), Namibia (2013 DHS), and South Africa (1998 DHS) collected data on all five of the listed NCDs in the same survey. Most of the DHS data on NCDs are self-reported. DHS collected biomarker data for measuring hypertension in 13 countries and biomarkers on diabetes in 3 countries.

This report begins with a description of how biomarkers for hypertension and diabetes are measured and which questions collect self-reported data in each survey. In countries with biomarker data, prevalence rates of hypertension and diabetes are estimated. Their associations with socio-demographic characteristics are also examined for women and men in each country. Indicators of breast cancer and cervical cancers based on self-reported data from the Namibia 2013 data are presented.

The results of the analysis suggest large disparities in prevalence rates of hypertension and diabetes among respondents by age, wealth, education, and urban/rural residence across the countries. As expected, older respondents have a higher prevalence of NCDs than younger respondents in both women and men. Diabetes is more prevalent among respondents in the higher education groups compared with those with lower education, and the same can be seen among those in the upper wealth quintiles compared with the lower wealth quintiles, in the majority of the countries.

The report concludes that DHS has made a substantial contribution to understanding the issue of NCDs in developing countries by collecting data on several important NCDs. However, the expansion of NCD data collection must necessarily be judged by weighing increased cost against the potential utility of the data. Systematic data collection on NDCs may be more relevant in middle-income countries than in low-income countries.

1 Introduction

Over the past decades non-communicable diseases (NCDs) have accelerated into a global epidemic, leading to more deaths than all other causes of mortality combined in the world (World Health Organization [WHO], 2014). In 2012, the age-standardized mortality rates from NCDs were highest among low- and middle-income countries at 673 deaths per 100,000 people, compared to the global NCD mortality rates at 539 deaths per 100,000 (WHO, 2014). NCD mortality rates in the African, South-East Asian, and Eastern Mediterranean regions exceed 650 deaths per 100,000 (WHO, 2014). These mortality rates were significantly higher than that of major infectious diseases, such as HIV/AIDS, tuberculosis, and malaria (Murray, Ortblad, Guinovart et al., 2014). Accordingly, numerous populations have suffered from NCDs along with communicable diseases in developing countries as the double burden of diseases (Boutayeb, 2006).

This report focuses on hypertension, diabetes, and several types of cancer collected by the Demographic and Health Survey Program (DHS) in selected countries. As a risk factor for several NCDs, including coronary heart disease and stroke, hypertension leads to over 9 million deaths annually and had a global prevalence rate of 40% in 2008 (WHO, 2015a). African countries have the highest prevalence of hypertension among adults aged 25 and older at 46% (WHO, 2013). As with many other NCDs, the mortality rates due to elevated blood pressure have been highest in low- and middle-income countries at 80% (WHO, 2013).

Type 2 diabetes or diabetes mellitus (T2DM) is a major contributor to disease burden worldwide. Over 387 million people currently live with T2DM, which causes over 5 million deaths each year (International Diabetes Federation [IDF], 2015). In 2011, the IDF declared that countries in the Mediterranean and North Africa (MENA) region had the highest prevalence of T2DM at 12.5%, closely followed by the North America and Caribbean (NAC) region at 11.1% (Whiting, Guariguata, Weil & Shaw, 2011). The largest diabetic populations reside in China and India at 98.4 and 65.1 million, respectively (IDF, 2013). Projections for prevalence rates over the next 20 years indicate an increase of over 100% in African countries and just under 100% in the MENA region (IDF, 2013). At this rate, the global diabetic population will increase by 55% to 590 million by 2030 (IDF, 2013).

In 2008, cancer caused over 7 million deaths globally, of which 75% occurred in low- and middle-income countries (Jemal et al., 2011). Although cancer incidence rates in developing countries are lower than developed countries, the mortality rates are comparable. (Jemal et al., 2011). For example, despite the lowest incidence compared to other cancers, breast cancer has been the leading cause of cancer deaths

among women in low- and middle-income countries (Jemal et al., 2011). Men who develop prostate cancer in African or Asian countries are also more likely to die from the cancer than men in developed countries (Haas, Delongchamps, Brawley, Wang & Rosa, 2008). A lack of early detection services, changes in reproductive patterns, and physical inactivity could be attributable to the disproportionate burden associated with cancer-related mortality in developing countries (Jemal et al., 2011).

NCDs have been recognized as a major hindrance to economic development in low- and middle-income countries (Beaglehole, Bonita, Horton et al., 2011). More specifically, an economic output of 47 trillion dollars may be lost by 2030 due to cardiovascular disease, cancer, chronic respiratory diseases, mental health problems, and diabetes (Bloom, Cafiero, Jané-Llopis et al., 2011). This potential economic loss is approximately 75% of the global Gross Domestic Product (GDP) in 2010, an amount adequate to eliminate poverty from the world (Bloom, Cafiero, Jané-Llopis et al., 2011). A recent study also suggested that HIV and NCDs account for the slow progress in health-related Millennium Development Goals (MDGs) in low-income countries (Stuckler, Basu, & McKee, 2010). Reducing the disease burden of NCDs is therefore of vital importance to achieve sustainable development after 2015.

Despite the demonstrated need for addressing NCDs, limited efforts have been made on data collection to monitor the levels and trends of NCDs in low- and middle-income countries. The DHS is one of the few Programs that have collected NCD data in selected countries for the last two decades. This report provides an overview of NCD data that have been collected by The DHS Program. The main objectives of this report are: 1) to describe the procedures and questions used to collect data on NCDs in DHS surveys; 2) to present prevalence rates and differentials of hypertension and diabetes for which biomarker data are collected in DHS; 3) to compare the efforts in NCD data collection by the DHS and WHO; and 4) to make recommendations for future data collection on NCDs.

2 Data and Methods

2.1 DHS Surveys with NCD Data

This report assessed NCD data collected by the DHS Program, which has conducted nationally representative household surveys that provide detailed, accessible information on the demographic, nutritional, and health status of populations in low- and middle-income countries. Funded largely by the United States Agency for International Development (USAID), The DHS Program was initiated in 1984 and has conducted more than 300 surveys in 90 countries. Through implementation of household-based surveys The DHS Program collects, analyzes, and disseminates data on a wide range of topics including reproductive health, infant and child mortality, nutrition, communicable diseases, and non-communicable diseases, among other topics (ICF International, 2012).

DHS typically employs a two-stage cluster sampling design to select survey respondents. Stratification is applied in the sampling design to improve the representativeness of the sample by reducing sampling errors. In the first stage, a sample of enumeration areas (EAs) is selected in each stratum with probability proportional to size, based on a national master sampling frame that usually comes from the country's most recent census. In the second stage, after a complete household listing is obtained for each of the selected EAs, a sample of households is selected by equal probability systematic sampling. All women age 15-49 in all the selected households and all men age 15-59 (15-49 or 15-54 in some surveys) in those households selected for the man's interview are eligible to participate in the survey (ICF International, 2012).

Three types of questionnaires are typically used in DHS surveys—the *household questionnaire*, the *woman's questionnaire*, and the *man's questionnaire*—to collect data on general household characteristics and data on individual characteristics. Based on the household questionnaire, eligible women and men are identified to be interviewed with the woman's questionnaire and man's questionnaire, respectively.

The sample size for a standard DHS survey ranges from 5,000 to 30,000 households, and many countries conduct a DHS survey every five years, on average. Using cross-sectional data from consecutive surveys, trends can be estimated for specific health problems. The findings contribute to identifying priority areas for program implementation and policy development (Corsi et al., 2012).

This report focuses on 25 DHS countries that have collected data on at least one of the following NCDs: hypertension, diabetes, prostate cancer, breast cancer, and cervical cancer. Most of the datasets used for this report are from *standard DHS* surveys, with a few exceptions. Guatemala's data are from an *interim*

DHS survey, which collected nationally representative data using a smaller sample size and a narrower scope than the standard DHS. Data from Peru are based on the *continuous DHS* survey conducted annually between 2009 and 2012. Uzbekistan conducted a *special DHS* survey to specifically assess the health status of the population. The South African 1998 DHS differed from the standard DHS in that it collected information on an expanded set of health measures. Finally, the 2010 Colombia survey was embedded within a much broader population and health data collection effort. Table 1 shows the surveys that collected NCD data, including biomarkers and/or self-reported data.

Table 1. DHS surveys with data on hypertension, diabetes, prostate cancer, breast cancer, and cervical cancer, 1990- 2013

Country	Year	Hypertension	Diabetes	Prostate Cancer	Breast Cancer	Cervical Cancer
Albania	2008/09	✓			✓	✓
Armenia	2000				✓	
	2005	✓			✓	
	2010	✓	✓	✓	✓	✓
Azerbaijan	2006	✓	✓			
Bangladesh	2011	✓	✓			
Benin	2011/12	✓	✓			
Bolivia	2003					✓
	2008					✓
Brazil	1996					✓
Burkina Faso	2010					✓
Colombia	1990					✓
	2005				✓	✓
	2010				✓	✓
Côte d'Ivoire	2011/12				✓	✓
Dominican Republic	1996				✓	✓
	2002				✓	✓
	2007				✓	✓
	2013				✓	✓
Egypt	2008	✓	✓			
Guatemala	1998/99					✓
Honduras	2005/06				✓	✓
	2011/12			✓	✓	✓
Jordan	2002				✓	
	2007				✓	✓
	2012				✓	✓
Kyrgyz Republic	2012	✓				
Lesotho	2009	✓	✓		✓	✓
Namibia	2013	✓	✓	✓	✓	✓
Peru	2009				✓	✓
	2010	✓	✓		✓	✓
	2011	✓	✓		✓	✓
	2012	✓	✓		✓	✓
Philippines	2003				✓	✓
South Africa	1998	✓	✓	✓	✓	✓
Tajikistan	2012				✓	✓
Tanzania	2011					✓
Ukraine	2007	✓				
Uzbekistan	2002	✓	✓			
Total number of countries		**13**	**10**	**4**	**13**	**18**

The surveys with NCD data were conducted between 1990 and 2013. Of the 25 countries, 13 collected information on hypertension, including both self-reported status and blood pressure measurements for eligible respondents. Ten surveys collected self-reported data on diabetes and two surveys measured fasting blood glucose for eligible respondents. Questions on screening for prostate cancer, breast cancer, and cervical cancer were included in 4, 13, and 18 countries, respectively. Seven countries (Armenia, Bolivia, Colombia, Dominican Republic, Honduras, Jordan, and Peru) had NCD data for multiple years. Only three countries (Armenia, Namibia, and South Africa) collected data on all five NCDs together in one survey.

2.2 DHS Biomarkers and Self-reported Data on NCDs

DHS collected most of the NCD data by asking respondents whether they were aware of a specific NCD, had screening tests or medical examinations for an NCD, or were diagnosed with an NCD by a health professional. In addition to self-reported data, biomarker data were collected in selected surveys for hypertension and diabetes only.

Hypertension

In all 13 countries, DHS measured systolic and diastolic blood pressure of survey respondents. Table 2 shows the surveys that collected biomarker data on hypertension and the age ranges of respondents measured. Age ranges of respondents eligible for blood pressure measurement varied across the surveys. In most of the surveys, women and men eligible for interview (women age 15-49 and men age 15-49 or 59) in selected households were measured for blood pressure. The 1998 South Africa survey collected blood pressure measurements for all respondents age 15 and above. Several surveys collected blood pressure data only from older adults. For example, the 2011 Bangladesh DHS measured blood pressure data for women and men age 35 and older while the 2013 Namibia DHS measured those age 35-64.

In DHS surveys, blood pressure is typically measured with a fully automatic digital blood pressure measuring device with automatic upper-arm inflation and automatic pressure release. Field staff received training prior to the survey on use of the device according to the manufacturer's recommended protocol. In most countries, blood pressure was measured three times. The first measurement was discarded, and the average of the last two measurements was reported as the respondent's blood pressure, in millimeters of mercury (mmHg). The exception is the 2002 Uzbekistan DHS survey, which took two measurements of systolic and diastolic blood pressure and used the second measurement to determine if the person was hypertensive.

In addition to biomarker measurements, respondents were asked whether they had ever been told by a doctor or other health professional that they had hypertension or high blood pressure. Respondents who gave a positive response received a follow-up question on current treatment to control blood pressure. In some countries, namely, Albania, Armenia, Benin, Egypt, Kyrgyz Republic, Ukraine, and Uzbekistan, respondents were also asked if they were diagnosed with hypertension more than once. The specific questions asked on hypertension can be found in Table 2.

Table 2. DHS biomarkers and questions on hypertension

Biomarkers/questions	Age ranges for biomarker collection	DHS surveys
Biomarkers: systolic and diastolic blood pressure measurements	15-49	Albania 2008/2009
	15-49	Armenia 2005
	15-49	Azerbaijan 2006
	35 and older	Bangladesh 2011
	Women: 15-49, men: 30-64	Benin 2011/2012
	15-59	Egypt 2008
	15-49	Kyrgyz Republic 2012
	Women: 15-49, men: 15-59	Lesotho 2009
	35-64	Namibia 2013
	40 and older	Peru 2010
	40 and older	Peru 2011
	40 and older	Peru 2012
	15 and older	South Africa 1998
	15-49	Ukraine 2007
	Women: 15-49, men: 15-59	Uzbekistan 2002
Have you ever been told by a doctor or other health worker that you had hypertension or high blood pressure? IF YES: Are you currently receiving any of the following treatment/advice by a doctor or other health worker to control your blood pressure[1]?		Albania 2008/2009 Azerbaijan 2006 Armenia 2005 Armenia 2010 Bangladesh 2011 Benin 2011/2012 Egypt 2008 Kyrgyz Republic 2012 Lesotho 2009 Namibia Peru 2011 Peru 2012 South Africa 1998 Ukraine 2007 Uzbekistan 2002
Have you ever been told by a doctor or other health worker that you had hypertension or high blood pressure? IF YES: Were you told on more than one different occasion by a doctor or other health professional that you had hypertension or high blood pressure?		Albania 2008/2009 Azerbaijan 2006 Armenia 2005, 2010 Benin 2011/2012 Egypt 2008 Kyrgyz Republic 2012 Ukraine 2007 Uzbekistan 2002

[1]The wording of this question varied across surveys.

Diabetes

Diabetes has been assessed by biomarkers and self-reports in the DHS surveys; however, fasting blood glucose was measured as a biomarker for diabetes in only three surveys—the 2010 Bangladesh DHS, the 2013 Namibia DHS, and the 2002 Uzbekistan DHS. In Bangladesh and Namibia, biomarkers were collected only from respondents in households selected for the man's interview. The Bangladesh DHS tested all

household members age 35 or older; Namibia restricted the testing to women and men age 35-64 in the households selected for testing. In the Uzbekistan, diabetes biomarkers were only collected for women age 15-49 and men age 15-59 in households selected in Tashkent City.

A similar procedure was used in Bangladesh and Namibia to measure fasting blood glucose. After an overnight fast, a blood sample was obtained from consented respondents from the middle or ring finger and analyzed using the HemoCue 201+ blood glucose analyzer. The finger was cleaned with a swab containing 70 percent isopropyl alcohol, allowed to dry, and pricked with a retractable, non-reusable lancet. The first two drops of blood were wiped away, and the third drop was drawn into the glucose microcuvette by capillary action after placing the tip of the microcuvette in the middle of the blood drop. The outside of the microcuvette was wiped clean with gauze and placed in the analyzer to obtain a glucose measurement. The HemoCue 201+ analyzer displays the blood glucose measurements in milligrams per deciliter (mg/dL), and the measurement was converted into millimoles per liter (mmol/L) to compare with the World Health Organization's cutoffs for diabetes. The 2002 Uzbekistan survey measured glycosylated hemoglobin (HbA1c) levels in venous blood samples collected after fasting.

Eight countries included a question on diagnosis with diabetes by a medical professional as a self-reported measure of diabetes. Table 3 summarizes biomarkers and questions used in respective surveys for estimating the prevalence of diabetes.

Table 3. DHS biomarkers and questions on diabetes

Biomarkers and questions	Age ranges for biomarkers	DHS surveys
Biomarkers (fasting blood glucose measurement)	35 and older 35-64	Bangladesh 2011 Namibia 2013
Biomarkers (Hemoglobin A1c measurement)	Women: 15-49, men:15-59	Uzbekistan 2002
Has a doctor or other health professional ever told you that you had diabetes?		Azerbaijan 2006 Bangladesh 2011 Egypt 2008 Lesotho 2009 Namibia 2013 Peru 2011 Peru 2012
Has a doctor ever told you that you had diabetes?		Benin 2011-12
Have you ever, at any time in your life had: diabetes? IF YES: Was the diabetes diagnosed by a doctor?		Uzbekistan 2002

Prostate cancer

Questions about prostate cancer were included in the most recent DHS surveys in four countries—Armenia, Honduras, Namibia, and South Africa. In Armenia and Namibia, the surveys asked if the respondent had

ever had a prostate cancer examination; however, there was no follow-up question to ascertain the test results. Honduras included questions about having any symptoms of prostate cancer, reasons for not taking the prostate cancer exam, and intention to take the exam in the future. These questions were not included in the other three countries. The 1998 South Africa survey included a question to determine if a respondent was ever told by a health professional that they had cancer. If respondents reported being diagnosed with cancer, a follow-up question was asked to record the type of cancer. Table 4 summarizes the questions on prostate cancer in these four surveys.

Table 4. DHS questions on prostate cancer

Questions	DHS surveys
In the past three years since 2007, have you visited a primary health care facility to conduct a preventive (prophylactic) health examination? IF YES: During this visit, have you been given prostate examination?	Armenia 2010
In the past 12 months, have you had any of the following symptoms? • Decrease of the urine • Increased the number of times of urination • Problems when urinating • Drips or stains • Could not get rid of all the urine • Urinates with blood Have you ever taken a prostate exam? IF YES: Which exam, the blood or the rectal? IF YES: When was the last time you had a prostate exam?	Honduras 2012
Have you ever heard of prostate cancer? IF YES: Have you ever had a test or exam to see if you have prostate cancer?	Namibia 2013
Has a doctor or nurse or staff member at a clinic or at hospital told you that you had or have any of the following conditions: cancer? IF YES: Did the doctor/nurse/staff member at a hospital tell you what kind of cancer you have? IF YES: What kind of cancer were you told you had or have?	South Africa 1998

Breast cancer

DHS collected data on breast cancer in 13 countries. All of the countries assessed whether respondents had ever had a breast exam, except Albania. The Albania DHS only addressed respondent awareness of mammogram or breast cancer screening; other screening questions were not included. The screening questions in 12 countries asked if respondents have: 1) ever had any breast exam; 2) ever conducted a breast self-exam; 3) ever had a breast exam by a medical professional; and 4) ever been diagnosed with breast cancer. Table 5 lists all of the DHS questions asked on breast cancer and the respective surveys in which they are found.

Six countries (Burkina Faso, Côte d'Ivoire, Dominican Republic, Namibia, Peru, and Philippines) assessed whether respondents had received a breast exam over various time periods. In the Dominican Republic,

respondents were asked about breast cancer screening in the past 12 months while in Peru the time reference was the past five years. Burkina Faso, Côte d'Ivoire, Namibia, and Philippines did not include a specific reference period for the breast exam.

In Armenia, Colombia, Jordan, and Lesotho the DHS survey asked about respondents' experience with breast cancer self-examination. Jordan and Lesotho specifically asked if respondents did a breast cancer self-exam in the past 12 months whereas Armenia and Colombia did not include a defined reference period. The countries did not have a follow-up question asking respondents if they took any further action based on the results of their breast cancer self-exam.

Nine countries (Armenia, Brazil, Colombia, Dominican Republic, Honduras, Jordan, Lesotho, Namibia, and Tajikistan) included a question on breast cancer screening by a medical professional or equipment (e.g., mammography). Of these countries, only Colombia (DHS surveys in 2005 and 2010) ascertained the results of mammography and asked respondents (through follow-up questions) if a biopsy was requested. The DHS in Colombia and South Africa also assessed if respondents had been diagnosed with breast cancer.

Table 5. DHS questions on breast cancer

Questions	DHS surveys
Any breast exam	
Have you ever taken the screening of breast cancer or cervical cancer?	Burkina Faso 2010
Have you ever had a breast cancer test?	Côte d'Ivoire 2011
Have you taken any breast test in the last 12 months?	Dominican Republic 1996 Dominican Republic 2002 Dominican Republic 2007
Have you ever examined your breasts to detect or check for breast cancer?	Namibia 2013
When was the last time that you took a breast exam?	Dominican Republic 2013
Have you ever had a breast test in the last five years?	Peru 2009 Peru 2010 Peru 2011 Peru 2012
Have you ever screened/examined for cancer? IF YES: What part of your body was screened: Breast?	Philippines 2003

(Continued)

Table 5. – *Continued*

Questions	DHS surveys
Self-examination	
Have you ever given yourself a breast exam?	Armenia 2000 Armenia 2005 Armenia 2010 Colombia 2005 Colombia 2010
Have you had a breast cancer self-exam or an exam by a health specialist to detect breast cancer in the last 12 months?	Jordan 2002
Have you had a breast cancer self-exam to detect breast cancer in yourself within the last 12 months?	Jordan 2007 Lesotho 2009
Breast exam by a medical professional	
Has a health care provider ever given you a breast exam?	Armenia 2000 Armenia 2005 Armenia 2010
In the medical or gynecological consultation, have you done a breast exam?	Colombia 2005 Colombia 2010
Have you had a breast cancer self-exam or an exam by a health specialist to detect breast cancer in the last 12 months?	Jordan 2002
Has a doctor or other health professional examined your breasts to detect or check for breast cancer?	Namibia 2013
Has a health care provider ever given you a breast exam, such as a manual, an ultrasound, a mammogram or any other breast exams?	Tajikistan 2012
Have you had a breast cancer clinical exam to detect breast cancer in the last 12 months?	Jordan 2012 Lesotho 2009
Have you ever taken mammography?	Colombia 2005 Colombia 2010 Honduras 2005/2006 Honduras 2011
When was the last time that you took mammography?	Dominican Republic 2013
Have you ever taken a gynecology exam? IF YES: Was mammography a part of the last exam?	Brazil 1996
Have you ever been diagnosed with breast tumor?	Colombia 2005 Colombia 2010
Has a doctor or nurse or staff member at a clinic or at hospital told you that you had or have any of the following conditions: cancer?	South Africa 1998
IF YES: Did the doctor/nurse/staff member at a hospital tell you what kind of cancer you have?	
IF YES: What kind of cancer were you told you had or have?	

Cervical cancer

Data on cervical cancer were collected in DHS surveys in 18 countries. Of these, 15 countries (Armenia, Bolivia, Brazil, Colombia, Côte d'Ivoire, Dominican Republic, Guatemala, Honduras, Jordan, Lesotho, Namibia, Peru, Philippines, and Tajikistan) addressed whether respondents had received a cervical cancer screening test. Most of the countries focused on the pap-smear test, with different recall periods—12 months

(Dominican Republic), three years (Armenia, Bolivia), and five years (Peru, Philippines). Table 6 lists the DHS screening questions on cervical cancer.

While Tanzania and Albania only assessed respondents' awareness of cervical cancer screening, South Africa collected information on the diagnosis of cervical cancer. The 2010 DHS in Colombia also asked if respondents had ever been vaccinated for cervical cancer. Thus, the majority of DHS countries focused on people's behavior regarding cancer testing rather than collecting information on the test results.

Table 6. DHS questions on cervical cancer

Questions	DHS surveys
Have you ever had a PAP smear test? IF YES: Did you receive the results of the last pap-smear test? (Guatemala, Honduras 2005/2006, 2011)	Guatemala 1998 Honduras 2005/2006 Honduras 2011 Jordan 2007 Jordan 2012 Lesotho 2009
Have you ever had a PAP smear test to check for cervical cancer?	Armenia 2010
Have you ever given a cervical smear for Papanicolau test or Pap test, also known as "a cytology smear test"?	Tajikistan 2012
Have you had a PAP smear test in the last 12 months?	Dominican Republic 1996 Dominican Republic 2002 Dominican Republic 2007
When was the last time that you had a PAP smear test?	Dominican Republic 2013
Have you had a PAP smear test in the last 3 years?	Armenia 2010 Bolivia 2003 Bolivia 2008
What was the results of the last test?	Bolivia 2003 Bolivia 2008
Have you had a PAP smear test in the last five years?	Peru 2009 Peru 2010 Peru 2011 Peru 2012 Philippines 2003
Have you ever taken a gynecology exam? Was a PAP smear test a part of the last exam?	Brazil 1996
Have you ever had a cervical cancer test?	Côte d'Ivoire 2011
Have you ever taken the screening of breast cancer or cervical cancer? (Burkina Faso)	Burkina Faso 2010
Have you ever had a test or exam to see if you have cervical cancer? (Namibia) IF YES: What type of exam did you have to see if you have cervical cancer? (Namibia)	Namibia 2013
Have you ever had a cytology test? (Colombia) If YES: Did you receive the results of the last cytology test? (Colombia 2005, 2010) IF YES: Based on the results, was biopsy requested? (Colombia 2010)	Colombia 1990 Colombia 2005 Colombia 2010

(Continued)

Table 6. – *Continued*

Questions	DHS surveys
Have you ever taken a vaccine to prevent cervical cancer?	Colombia 2010
Has a doctor or nurse or staff member at a clinic or at hospital told you that you had or have any of the following conditions: cancer? IF YES: Did the doctor/nurse/staff member at a hospital tell you what kind of cancer you have? IF YES: What kind of cancer were you told you had or have?	South Africa 1998

2.3 Analysis

This report first assesses the prevalence rates of hypertension and diabetes for countries in which biomarker data are available. Specifically, the analyses summarize: 1) response rates for measuring blood pressure and fasting blood glucose; 2) prevalence rates of hypertension and diabetes; 3) differentials in prevalence rates by age, education, wealth status, and residence; 4) adjusted effects of age, education, wealth status, and residence associated with hypertension and diabetes.

Prevalence rates of hypertension and diabetes were estimated based on biomarker measurements and self-reported data. Cutoff points recommended by the World Health Organization (WHO) and the National Institute of Health (NIH) were used for the classification of hypertension. Individuals were considered hypertensive if their systolic blood pressure was 140 mmHg or higher or if their diastolic blood pressure was 90 mmHg or higher. Individuals were also considered hypertensive if they had a normal blood pressure reading but were taking antihypertensive medication. For diabetes, according to WHO recommendations, individuals with fasting plasma glucose value of 7.0 mmol/l or higher were classified as diabetic. Similar to hypertension, individuals who did not have an elevated level of blood glucose but were taking medications to treat diabetes were considered to be diabetic.

We also assessed behavioral indicators related to breast cancer and cervical cancer to illustrate proxy measures to biomarkers collected in the DHS surveys. Data from one of the most recent DHS surveys, the 2013 DHS in Namibia, was used to illustrate indicators on breast cancer and cervical cancer.

All analyses were conducted separately for women and men in each country. When multiple surveys are available in one country (e.g., Peru), only the most recent survey was analyzed. Sampling weights and the effects of the complex DHS sample design were taken into consideration.

3 Results

3.1 Coverage Rates for Blood Pressure Measurement

Coverage rates for blood pressure and diabetes measurements were assessed in 10 DHS countries. Table 7 shows the percentage of eligible women and men whose blood pressure was measured and the number of respondents with valid blood pressure measurements.

Table 7. Percentage (unweighted) of eligible women and men who had their blood pressure measured, and the number of respondents with valid blood pressure measurements (weighted), DHS surveys in 10 countries, 2006-2013

Country/survey	Age range	Percentage measured for blood pressure (unweighted)	Number of eligible respondents (unweighted)	Number of respondents with valid blood pressure measurements (weighted)
Albania 2008/09				
Women	15-49	96.0	3793	3564
Men	15-49	94.0	3069	2829
Azerbaijan 2006				
Women	15-49	99.0	8444	8391
Men	15-59	94.0	2717	2547
Bangladesh 2011				
Women	35 and older	92.3	4311	3959
Men	35 and older	86.3	4524	3869
Benin 2011/12				
Women	15-49	93.4	5494	5132
Men	30-64	91.1	2876	2625
Egypt 2008				
Women	15-59	99.4	6290	6237
Men	15-59	99.9	5718	5702
Kyrgyz Republic 2012				
Women	15-49	99.0	8208	8105
Men	15-49	97.0	2413	2328
Lesotho 2009				
Women	15-49	96.0	4017	3857
Men	15-59	96.0	3317	3167
Namibia 2013				
Women	35-64	80.7	2584	2048
Men	35-64	70.7	2163	1406
Peru 2012				
Women	40 and older	96.5	16543	16821
Men	40 and older	93.8	15226	14457
Ukraine 2007				
Women	15-49	74.0	6841	5379
Men	15-49	74.0	3178	2452

The number of respondents with valid blood pressure measurements was obtained by removing observations without measurements for any of the following reasons: *refused, don't know, technical problems, other problems,* and *missing*. The response rates for blood pressure measurements ranged from 70.7% among men in Namibia to 99.9% among men in Egypt. Ukraine had the lowest response rate for both women and men primarily because respondents refused to be measured. In Namibia, refusal and participants' absence in the household were the two main reasons for the low response rate. The estimated

prevalence of hypertension from biomarker measures in these two countries could be biased by the nonresponse.

3.2 Prevalence of Hypertension and Differentials by Selected Socio-demographic Characteristics

The estimated prevalence of hypertension, high blood pressure, and intake of antihypertensive medicine is summarized in Table 8. The results indicate that prevalence of hypertension is highest among women and men in Namibia, 44.0% and 44.6%, respectively. However, blood pressure data in Namibia were collected from older respondents (age 35 to 64) while other countries collected data from younger respondents (usually, age 15 to 49). These differences in the age range of respondents within and between countries render comparative analysis difficult at this time.

Table 8. Prevalence of hypertension, high blood pressure, and medication taking behavior among women and men, DHS surveys in 10 countries, 2006-2013

Country/survey	Age range	High blood pressure (systolic 140 or higher/diastolic 90 or higher)	Normal blood pressure and taking antihypertensive medication	Prevalence of hypertension	Number of respondents
Albania 2008/09					
Women	15-49	19.5	0.5	20.1	3564
Men	15-49	27.6	0.3	27.9	2829
Azerbaijan 2006					
Women	15-49	12.2	3.7	15.8	8391
Men	15-59	19.0	0.8	19.8	2547
Bangladesh 2011					
Women	35-96	25.5	6.3	31.8	3959
Men	35-95	16.2	3.2	19.5	3869
Benin 2011/12					
Women	15-49	7.7	2.0	9.6	5132
Men	30-64	25.4	2.7	28.1	2625
Egypt 2008					
Women	15-59	8.7	4.5	13.2	6237
Men	15-59	9.5	1.6	11.1	5702
Kyrgyz Republic 2012					
Women	15-49	6.4	2.2	8.5	8105
Men	15-49	4.4	0.5	4.9	2328
Lesotho 2009					
Women	15-49	11.3	4.3	15.6	3857
Men	15-59	12.4	1.2	13.6	3167
Namibia 2013					
Women	35-64	36.0	8.0	44.0	2048
Men	35-64	38.7	5.9	44.6	1406
Peru 2012					
Women	40-96	20.2	7.3	27.5	16821
Men	40-96	24.3	3.8	28.1	14457
Ukraine 2007					
Women	15-49	20.8	2.9	23.7	5379
Men	15-49	30.4	0.8	31.2	2452

Table 9 and 10 present the weighted prevalence of hypertension among women and men by age groups, educational levels, wealth quintiles, and residence. The analysis revealed that in every country, the estimated prevalence of hypertension was higher among older respondents than that of younger respondents regardless of their sex. In Peru, for instance, women in their 40s, 50s, and 60s or older had a hypertension

prevalence of 12.5%, 23.5%, and 45.9%, respectively. A similar linear trend was also found among men in the same age groups with the hypertension prevalence of 15.5%, 25.8%, and 42.8%. Thus, hypertension has been a major health concern especially among older populations in recent years.

The distribution of hypertension prevalence by educational levels substantially differed between countries and gender groups. In Ukraine, respondents with no formal education had the highest prevalence of hypertension while the prevalence was highest among respondents with higher education in Lesotho. In Bangladesh, the estimated prevalence did not substantially differ among women by educational levels while a clear difference was found among men. More specifically, the estimated hypertension prevalence for men with no formal education and higher education was 16.4% and 34.2%, respectively.

A substantial variation was also found for the estimated hypertension prevalence by wealth quintiles. In Albania, for instance, the poorest quintile had the highest prevalence of hypertension for both women at 26.5% and men at 32.4%. However, the richest quintile was most affected by hypertension in Peru at the prevalence of 33.1% for women and 36.1% for men. The results highlighted the importance of country- and gender-specific analysis of hypertension by educational background and wealth levels.

The analysis of hypertension prevalence by type of residence revealed that rural residents in Albania, Azerbaijan, and Ukraine had a higher prevalence than urban residents for both women and men. In Bangladesh, Benin, Egypt, Lesotho, Namibia, and Peru, the prevalence was higher among urban residents than that of rural residents. In Kyrgyz Republic, the distribution of hypertension prevalence differed by type of residence and gender groups. While the prevalence was higher among women in rural areas than that of women in urban areas, the urban-rural difference among men was trivial (5.1% versus 4.9%).

In accordance with the findings from descriptive analysis, multivariate analysis revealed that older women and men had a higher odds of having hypertension than younger respondents in every country (see Appendix Tables A1 and A2). In Albania, For instance, the odds of having hypertension among female respondents who were 40 to 49 year olds was 6.8 times higher than that of those women who were 15 to 29 year olds by holding their educational levels, socioeconomic status, and type of residence constant ($p<0.001$). The results suggested that age has a strong independent association with hypertension across the countries while education, wealth levels, and type of residence may be independently associated with hypertension only in a few countries.

Table 9. Prevalence of hypertension among women by socio-demographic characteristics, DHS surveys in 10 countries, 2006-2013

Characteristics	Albania 2008/09	Azerbaijan 2006	Bangladesh 2011	Benin 2011/12	Egypt 2008	Kyrgyz Republic 2012	Lesotho 2009	Namibia 2013	Peru 2012	Ukraine 2007
Age										
15-29	7.4	5.8	N/A	5.2	4.6	2.5	8.5	N/A	N/A	7.6
30-39	22.3	17.9	18.0	11.0	10.8	9.3	19.8	26.6	N/A	23.4
40-49	35.1	31.2	27.7	21.1	20.5	22.2	34.9	44.4	12.5	45.8
50-59	N/A	N/A	35.6	N/A	41.6	N/A	N/A	55.3	23.5	N/A
60 or above	N/A	N/A	46.0	N/A	N/A	N/A	N/A	55.4	45.9	N/A
Education*										
No	0	11.7	32.7	9.7	18.8	0	9.1	52.8	30.3	48.8
Primary	24.5	15.8	28.0	10.2	20.7	2.6	17.1	42.9	29.4	25.7
Secondary	18.6	16.1	35.3	9.1	8.5	8.3	13.9	41.7	25.4	24.6
Higher	7.6	14.4	33.1	7.9	8.8	8.9	18.5	45.2	23.7	23.0
Wealth Quintile										
Lowest	26.5	18.2	24.8	7.8	11.6	9.7	10.7	32.5	22.7	25.6
Second	19.6	17.2	27.6	7.7	12.3	10.3	13.0	41.2	22.4	25.3
Middle	22.9	16.9	27.7	9.9	13.9	8.3	16.6	44.6	27.9	25.5
Fourth	19.8	14.9	34.0	10.9	13.6	9.7	16.6	52.9	29.1	21.6
Highest	12.3	12.5	43.8	11.0	14.2	5.7	18.2	48.4	33.1	21.4
Residence										
Urban	15.8	14.4	40.2	10.5	14.8	6.4	18.8	50.6	29.6	22.1
Rural	23.5	17.7	29.3	8.9	11.9	9.8	14.0	38.3	22.5	27.2
Total	20.1	15.8	31.8	9.6	13.2	8.5	15.6	44.0	27.5	23.7
Number of respondents	3564	8391	3959	5132	6237	8105	3857	2048	16821	5379

*Seven observations for educational attainment were missing in Namibia.

N/A=data not available

Table 10. Prevalence of hypertension among men by socio-demographic characteristics, DHS surveys in 10 countries, 2006-2013

Characteristics	Albania 2008/09	Azerbaijan 2006	Bangladesh 2011	Benin 2011/12	Egypt 2008	Kyrgyz Republic 2012	Lesotho 2009	Namibia 2013	Peru 2012	Ukraine 2007
Age										
15-29	17.5	8.5	N/A	N/A	5.4	2.3	7.6	N/A	N/A	14.1
30-39	29.5	16.6	9.5	25.2	8.3	5.3	16.4	30.8	N/A	37.2
40-49	40.2	29.8	15.6	26.6	15.7	10.2	21.1	40.9	15.5	51.6
50-59	N/A	43.0	20.6	31.8	28.7	N/A	35.4	57.2	25.8	N/A
60 or above	N/A	N/A	29.1	43.4	N/A	N/A	N/A	65.2	42.8	N/A
Education*										
No	17.6	33.1	16.4	27.3	15.4	100.0	15.8	43.4	31.3	43.2
Primary	32.4	48.2	16.8	28.0	12.8	4.5	11.9	43.1	27.7	0.0
Secondary	26.6	19.3	20.2	30.7	8.6	4.9	12.6	42.9	26.3	32.9
Higher	19.1	20.5	34.2	25.5	14.0	5.0	28.4	58.8	30.9	29.5
Wealth Quintile										
Lowest	32.4	21.5	12.9	25.4	10.0	3.9	14.0	30.3	22.1	36.3
Second	30.0	22.8	15.8	25.4	11.1	4.5	10.7	43.8	21.5	28.5
Middle	30.8	24.6	16.7	26.7	10.3	5.8	10.7	40.9	27.9	31.4
Fourth	27.8	15.4	20.9	29.7	10.9	6.7	14.4	50.5	31.5	36.1
Highest	20.5	15.7	30.4	32.1	13.0	4.1	17.9	52.9	36.1	26.6
Residence										
Urban	24.0	17.8	25.1	31.0	11.7	5.1	17.3	50.9	30.8	31.2
Rural	31.5	22.5	17.7	25.9	10.7	4.9	12.2	37.8	22.4	31.3
Total	27.9	19.8	19.5	28.1	11.1	4.9	13.6	44.6	28.1	31.2
Number of respondents	2829	2547	3869	2625	5702	2328	3167	1406	14457	2452

*Three observations for educational attainment were missing in Namibia.

N/A=data not available

3.3 Coverage Rates for Blood Glucose Measurement

Table 11 shows the percentage of eligible women and men in Bangladesh and Namibia whose blood glucose was measured. The number of respondents with valid blood glucose measurements was obtained by removing observations with the responses: *refused, don't know, technical problems, other problems,* and *missing*.

Table 11. Percentage of women and men eligible for blood glucose measurement who had valid measurements, DHS surveys in Bangladesh and Namibia, 2011-2013

Country/survey	Age range	Percentage measured for fasting blood glucose (unweighted)	Number of eligible respondents (unweighted)	Number of respondents with valid blood glucose measurements (weighted)
Bangladesh 2011				
Women	35 and older	98.7	3884	3815
Men	35 and older	98.5	3796	3717
Namibia 2013				
Women	35-64	75.0	2584	1874
Men	35-64	63.8	2163	1223

In Bangladesh, over 90% of eligible respondents provided their blood samples for measuring their blood glucose while the coverage rates were lower in Namibia. More specifically, only 75% of eligible women and 63.8% of eligible men provided their blood glucose data. As such, the estimated prevalence of diabetes may be biased.

3.4 Prevalence of Diabetes and Differentials by Selected Socio-demographic Characteristics

Table 12 summarizes the estimated prevalence of diabetes, high blood glucose, and medication taking behavior in Bangladesh and Namibia. The estimated prevalence of diabetes in Bangladesh was approximately 11.3% for women and 10.7% for men. In Namibia, the prevalence was 5.7% for women and 6.8% for men. As with the estimated prevalence of hypertension, a comparative analysis remains difficult because Bangladesh and Namibia included a different age range of respondents. This age difference may have partially contributed to the observed difference in diabetes prevalence between these countries.

Table 12. Prevalence of diabetes, high blood glucose, and medication taking behavior, DHS surveys in Bangladesh and Namibia, 2011-2013

Country/survey	Age range	Fasting blood glucose 7 mmol/L or above	Normal FPG and taking medication	Prevalence of diabetes	Number of respondents
Bangladesh 2011					
Women	35 and older	9.7	1.6	11.3	3815
Men	35 and older	9.5	1.1	10.7	3717
Namibia 2013					
Women	35-64	4.8	0.8	5.7	1874
Men	35-64	5.5	1.3	6.8	1223

The prevalence of diabetes in Bangladesh and Namibia by socio-demographic characteristics is shown in Table 13. The results indicate that in both Bangladesh and Namibia the prevalence of diabetes is highest among respondents who are older, more educated, and live in households in the upper wealth quintiles. Among both women and men, those in urban areas have a higher prevalence of diabetes than those in rural areas. The data on socio-demographic characteristics provide useful insights into the differentials associated with diabetes in Bangladesh and Namibia.

Multivariate analysis suggested that age, education, and wealth status are independently associated with diabetes with some variations between countries and gender groups (see Appendix Table A3). In Bangladesh, for instance, women and men in the richest class had 2.8 and 2.1 times higher odds of having diabetes than respondents in the poorest class by holding their age, education, and type of residence constant. The results suggested that type of residence was not associated with diabetes in this analysis.

Table 13. Prevalence of diabetes by socio-demographic characteristics, DHS surveys in Bangladesh and Namibia, 2011-2013

	Bangladesh 2011		Namibia 2013	
Characteristics	**Women**	**Men**	**Women**	**Men**
Age				
15-29	N/A	N/A	N/A	N/A
30-39	9.4	6.6	2.9	4.4
40-49	10.7	9.8	6.7	4.4
50-59	13.8	12.8	6.3	10.4
60 or above	11.6	12.3	7.2	13.3
Education				
No	8.7	7.9	5.3	2.2
Primary	12.6	9.9	5.1	5.1
Secondary	17.4	10.5	5.8	8.2
Higher	23.1	21.5	7.3	14.6
Wealth Quintile				
Lowest	6.7	7.9	1.5	5.1
Second	7.1	7.6	3.6	1.2
Middle	7.9	7.3	4.2	4.9
Fourth	12.3	10.4	9.6	7.2
Highest	21.4	19.5	9.3	13.8
Residence				
Urban	17.3	14.9	8.0	8.7
Rural	9.5	9.3	3.7	5.0
Total	11.3	10.7	5.7	6.8
Number of respondents	3815	3717	1874	1223

N/A = data not available

3.5 Breast Cancer and Cervical Cancer in Namibia

Table 14 lists the questions on breast and cervical cancer in the Namibia 2013 DHS survey, along with response options, and unweighted results. The dataset included two breast cancer screening questions and four cervical cancer screening questions.

Table 14. Screening questions on breast and cervical cancer in the Namibia 2013 DHS survey

Questions	Response Options	Number of respondents	Unweighted percentage
Have you ever examined your breasts to detect or check for breast cancer?	Yes	322,7	32.2
	No	6,784	67.2
	Missing	7	0.1
Has a doctor or other health professional examined your breasts to detect or check for breast cancer?	Yes	2,248	22.4
	No	7,721	77.1
	Don't Know	39	0.4
	Missing	10	0.1
Have you ever heard of cervical cancer?	Yes	6,580	65.7
	No	3,431	34.3
	Missing	7	0.1
Have you ever had a test or exam to see if you have cervical cancer?	Yes	2,559	38.9
	No	3,933	59.8
	Don't Know	7	0.1
	Missing	81	1.2
What type of exam did you have to see if you have cervical cancer? (Pap smear)	Yes	2,392	23.9
	No	7,533	75.2
	Don't Know/Not Sure	7	0.1
	Missing	86	0.9
What type of exam did you have to see if you have cervical cancer? (Visual inspection with acetic acid)	Yes	62	0.6
	No	9,863	98.5
	Don't Know/Not Sure	7	0.1
	Missing	86	0.9

The breast cancer screening questions addressed whether a breast exam was conducted by the woman herself or by a medical professional. For both questions, there were only seven individuals or 0.1% whose data were missing. The number of missing observations was also small in the cervical cancer screening questions. Screening respondents with two questions on awareness of cervical cancer and previous test-taking behavior achieves a more reliable estimate of the percentage of women who received the pap-smear test.

4 NCD Data Collection by WHO

While the global health community has a myriad of NCD data collection tools available compared with the survey questionnaire procedure used by DHS, the WHO approach is recognized as one of the most utilized. To identify areas for improvement in DHS procedures, this chapter describes the NCD data collected by WHO and how they are collected; then the WHO approach is compared with the DHS survey questionnaire approach.

4.1 The WHO STEPS Approach

To facilitate NCD data collection among member countries, WHO created a STEPS approach or framework that consists of three data collection steps: 1) *questionnaire* to collect self-reported data on socio-demographic characteristics and NCD risk behaviors; 2) *physical measurements* to obtain data on anthropometry and blood pressure levels; and 3) *biochemical measurements* to collect biomarker data (e.g., fasting blood glucose) through laboratory tests (WHO, 2015b). Because the third step requires adequate laboratory resources, WHO suggests that the first two steps are appropriate for most developing countries.

The STEPS questionnaire consists of core, expanded, and optional modules. The core module includes essential questions that need to be included in every survey (e.g., "Have you ever consumed an alcoholic drink?"), and the expanded module includes follow-up questions to obtain more detailed information on the same topic (e.g., "During the past 30 days, when you consumed alcoholic drinks, how often was it with meals?). The optional module includes a set of questions on a different NCD-related topic that the previous two modules do not explore (e.g., injury, mental health) (WHO, 2015c). Therefore, individual countries can select the most relevant questions in the STEPS questionnaire.

For the second and the third steps of the STEPS approach WHO employs internationally established and accepted methods for collecting and measuring biomarker measures. Individuals age 18 and older are identified as hypertensive if the average measured blood pressure is raised (SBP $\geq$ 140 or DBP $\geq$ 90) or if the adult respondent is actively taking medication for hypertension (WHO, 2015a [Global Reference of Core Indicators]). Diabetes is identified from a fasting blood glucose measure (FBG $\geq$126 mg/dl (7.0 mmol/l) or if the adult respondent is actively taking medication for elevated blood glucose (WHO, 2015a [Global Reference of Core Indicators]). Table 15 shows the indicators used to confirm diagnosis of an NCD.

Table 15. Reference indicators used to confirm diagnosis of an NCD

Indicator	Definition	Estimated by
Mean SBP	Mean systolic blood pressure (mmHg)	Based on measured BP. For multiple readings, the first reading is dropped and remaining are averaged.
Prevalence of raised BP	Percent of defined population with raised BP (SBP ≥ 140 OR DBP ≥ 90 OR on medication for raised blood pressure).	Based on measured BP. For multiple readings, the first reading is dropped and remaining are averaged.
Mean FBG	Mean fasting blood glucose of defined population in mmol/l or mg/dl.	Based on measured FBG.
Prevalence of raised FBG	Percent of defined population with FBG ≥126 mg/dl (7.0 mmol/l) or on medication for raised blood glucose.	Based on measured FBG.

Although the STEPS instrument may not be utilized as frequently as the DHS questionnaire, literature has reported NCD data collected with the STEPS questionnaire (Nath, Garg, Deb et al., 2009; Msyamboza, Ngwira, Dzowela et al., 2011). Nath et al., for instance, reported the results of a cross-sectional NCD study based on the first step or questionnaire-based assessment in urban India while Msyamboza et al. reported the results of all three steps for a national NCD assessment in Malawi. Thus, the STEPS instrument can be adapted and utilized in accordance with available financial resources and the purpose of the study.

4.2 WHO and DHS Surveys: A Comparison

WHO and the DHS program employ comparable questions for the assessment of hypertension and diabetes, but WHO has collected limited data on cancer outcomes. More specifically, the core questions regarding cancer in the STEPS questionnaire only address cervical cancer except for a few country-specific questionnaires that examine breast cancer. The WHO survey instrument does not include questions on prostate cancer.

In 2003, WHO used another questionnaire to collect NCD-related data in the World Health Survey. A notable difference between this questionnaire and the DHS questionnaire is that WHO employed descriptive vignettes to illustrate (and personalize) the questions for survey respondents. In the section on diabetes, for instance, a vignette regarding amputation is presented to the respondent, followed by questions about mobility. While amputation may result from a highway injury or conflict in some regions, it can also indicate poorly managed blood glucose levels. In accordance with the context of each country, adding similar groupings of questions/vignettes to the DHS questionnaire may increase the data collected on diabetes and its complications.

Tables 16 through 18 list selected NCD questions on hypertension, diabetes, and cervical and breast cancer from WHO surveys. Survey language is taken from the STEPS instrument and from the questionnaire used for the World Health Survey in 2003.

Table 16. Example questions on hypertension in WHO surveys

Have you ever been told by a doctor or other health worker that you have raised blood pressure or hypertension?

IF YES:

- Have you been told in the past 12 months?
- In the past two weeks, have you taken any drugs (medication) for raised blood pressure prescribed by a doctor or other health worker?
- Have you ever seen a traditional healer for raised blood pressure or hypertension?
- Are you currently taking any herbal or traditional remedy for your raised blood pressure?

Vignette: NAME has a lot of swelling in his legs due to his health condition. He has to make an effort to walk around his home as his legs feel heavy.

- Overall in the last 30 days, how much of a problem did NAME have with moving around?
- In the last 30 days, how much difficulty did NAME have in vigorous activities, such as running 3 km (or equivalent) or cycling?

Table 17. Example questions on diabetes in WHO surveys

Have you ever had your blood sugar measured by a doctor or other health worker?

IF Yes: Have you ever been told by a doctor or other health worker that you have raised blood sugar or diabetes?

IF YES:

- Have you been told in the past 12 months?
- In the past two weeks, have you taken any drugs (medication) for diabetes prescribed by a doctor or other health worker?
- Are you currently taking insulin for diabetes prescribed by a doctor or other health worker?
- Have you ever seen a traditional healer for diabetes or raised blood sugar?
- Are you currently taking any herbal or traditional remedy for your diabetes?

Have you ever been diagnosed with diabetes (high blood sugar)?

IF YES:

- Have you ever been treated for it?
- Have you been taking insulin or other blood sugar lowering medications in the last 2 weeks?
- Are you following a special diet, exercise regime or weight control program for diabetes?

Vignette (outcome of long-term diabetes): Please try to imagine what it would be like to live in the following health state: Below the knee amputation in one leg, with no prosthesis but with basic crutches available.

- Overall, how much difficulty would a person in this state have with self-care, such as washing or dressing himself / herself?
- Overall, how much difficulty would a person in this state have with moving around?
- Overall, how much of bodily aches and pains would a person in this state have?

Table 18. Example questions on cervical and breast cancer in WHO surveys

Have you ever had a screening test for cervical cancer, using any of these methods described above? (see STEPS instrument for more information)
When was the last time you had a pelvic examination, if ever? (By pelvic examination, I mean when a doctor or nurse examined your vagina and uterus?)
The last time you had the pelvic examination, did you have a PAP smear test? (By PAP smear test, I mean did a doctor or nurse use a swab or stick to wipe from inside your vagina, take a sample and send it to a laboratory?)
When was the last time you had a mammography, if ever? (That is, an x-ray of your breasts taken to detect breast cancer at an early stage.)

5 Discussion and Conclusion

5.1 Contribution of DHS to NCD Data Collection

With the increased disease burden caused by NCDs in developing countries, international donors have recognized the importance of addressing NCDs in these countries. USAID (2012) has striven to ameliorate NCDs along with strengthening the ongoing efforts of health systems combating infectious diseases in resource-poor settings. Other donors, including WHO, have substantially increased the budget for NCDs (Institute for Health Metrics and Evaluation [IHME], 2014; WHO 2013). Collecting reliable NCD data is of vital importance for monitoring and evaluating the global NCD control efforts.

In line with these efforts, the DHS Program has been collecting data in many countries on two of the most important risk factors for NCDs: obesity and tobacco use. For example, as of 2013, DHS surveys in 49 countries had collected data on use of tobacco by women and men (Ansara et al., 2013). Such systematic tracking of these risk factors provide important data for tobacco control efforts in many countries and should be recognized as a major contribution that DHS is making to NCD data collection.

Among the NCDs examined in the analysis, DHS has been measuring survey respondents' blood pressure in more than 10 countries, using a largely consistent approach that follows WHO guidelines. Despite numerous challenges in collection of diabetes biomarkers (e.g., interviewer training, fasting requirement, and high cost), DHS has included measuring fasting blood glucose in two recent surveys—the 2010 Bangladesh DHS and the 2013 Namibia DHS. In addition, self-reported history of diagnosis and treatment of these illnesses (hypertension and diabetes) were collected. These surveys provided important data for countries to estimate prevalence rates of hypertension and diabetes, to identify high-risk groups, and to assess care-seeking behaviors in the population. For several types of cancers that are leading causes of cancer mortality, DHS surveys in a number of countries collected self-reported data on screening tests for these cancers. In some countries, multiple data points are available to assess trends.

While recognizing the contributions DHS has made to NCD data collection, it is essential to consider recommendations for future NCD data collection efforts. Opportunities and challenges coexist.

5.2 Opportunities and Challenges in Expanding NCD Data Collection in DHS Surveys

As an established program for collecting nationally representative population and health data through household surveys in more than 90 countries, the DHS Program has the advantage of incorporating NCD data collection activities into existing standardized tools. However, as demonstrated in this analysis, while

biomarker data collection in DHS surveys is largely consistent, questions used to collect self-reported data are not standardized across surveys and countries. Countries may collect data on the same topic (e.g., cervical cancer) but the questions used have a different recall period, which renders international comparison unrealistic. For instance, the recall period for the experience of taking a Pap smear test varied substantially (e.g., 12 months, three years, five years, or ever). The development of a NCD survey module with standardized questions would contribute greatly to overcoming this challenge, and provide comparative measures for assessing the health status and behaviors of populations in low- and middle-income countries.

During Phase 7 of the DHS Program, an NCD module to standardize data collection on NCDs is being developed. This module will be included in the standard DHS questionnaire at the country's request. Some major caveats to the development of an NCD module should be considered.

Age ranges for NCD data collection

If NCD data are going to be systematically collected, a major issue is whether the questions or biomarkers should be limited to certain ages, for example, 35 and older. In recent surveys in Bangladesh and Namibia, for example, biomarkers for hypertension and diabetes were collected for older adults. However the standard age ranges for DHS interviews that collect detailed data are 15-49 for women and 15-54(59) for men. This limits our ability to link biomarker data with individual background and behavioral data, which is important for studying the factors associated with these illnesses. The standard age range in DHS surveys also limits the utility of the data collected on self-reported NCD measures (e.g., screening tests). Given the finite budgets of DHS surveys, extending the age range of surveys to include older adults would necessarily have to come at the cost of reducing the sample size at younger ages, which is not desirable for measuring indicators that are more relevant to younger populations.

Challenges in biomarker tests

The inclusion of blood pressure measurement in DHS surveys is the easiest component to put in place. The equipment is simple and inexpensive, and respondents are generally happy to cooperate. However, the additional training costs involved should not be underestimated. In some surveys (e.g., Egypt), addition of the blood pressure component added at least a full day to the interviewer training. Where the training is already lengthy and intense, adding an extra module on blood pressure measurement should be judged in relation to the potential impact on other aspects of the training and the burden on interviewers/health staff in the field. Also, while providing blood pressure measurements to respondents may improve rapport, the costs may need to be weighed against the potential utility of collecting the data.

The inclusion of blood glucose testing in DHS surveys is much more challenging than blood pressure measurements because it requires additional expensive equipment and detailed training. The requirement that individuals fast before the test also increases the complexity of data collection and requires callbacks in many cases. It is important to keep good records of the number of callback visits required to obtain the data in order to evaluate the complexity of collecting blood glucose readings and to assess data quality. In the case of biomarker collection for diabetes, the cost-benefit analysis should be even more critical in deciding whether to include fasting blood glucose measurement.

In addition to these challenges in collecting biomarkers, estimating prevalence rates for hypertension and diabetes requires more detailed information on the medication(s) an individual is taking to determine if he/she is on antihypertensive treatment. Currently, DHS surveys only asked if the respondent is taking any medications to control elevated blood pressure, without soliciting details on the drugs.

In conclusion, the DHS Program has made a substantial contribution to understanding the demographic, nutritional, and health status of populations in low- and middle-income countries for the past three decades. Having a more systematic approach to what is included in the module and how the data are collected will be useful in addressing the issue of NCDs worldwide. However, the collection of NCD-relevant data in DHS surveys should be considered a “niche” module that is relevant primarily to middle-income countries. NCD data collection in DHS surveys is, for the reasons discussed, less relevant for many low-income countries. At this stage, we do not advocate expanding NCD data collection as a whole in the DHS Program.

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Appendix

Table A1. Results of multiple logistic regression of hypertension among women by demographic characteristics in odds ratio

	Albania 2008/09	Azerbaijan 2006	Bangladesh 2011	Benin 2011/12	Egypt 2008	Kyrgyz Republic 2012	Lesotho 2009	Namibia 2013	Peru 2012	Ukraine 2007
Age										
15-29	REF	REF	N/A	REF	REF	REF	REF	N/A	N/A	REF
30-39	3.60***	3.51***	REF[2]	2.40***	2.44***	3.91***	2.59***	REF[2]	N/A	3.71***
40-49	6.77***	7.49***	1.73***	5.27***	4.91***	10.96***	5.70***	2.25***	REF	10.35***
50-59	N/A	N/A	2.64***	N/A	13.01***	N/A	N/A	3.77***	2.14***	N/A
60 or above	N/A	N/A	4.28***	N/A	N/A	N/A	N/A	4.03***[3]	6.26***	N/A
Education										
No	REF[1]	REF	REF	REF	REF	REF[1]	REF	REF	REF	REF[1]
Primary	REF[1]	2.11	0.88	1.12	1.07	REF[1]	2.30	0.66*	1.26**	REF[1]
Secondary	0.79*	1.65	1.17	1.17	0.86	2.84	2.03	0.65*	1.08	0.66
Higher	0.42***	1.76	0.92	0.71	0.70	2.87	1.95	0.55*	0.97	0.58
Wealth Quintile										
Lowest	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Second	0.67*	0.97	1.22	1.05	0.96	1.05	1.29	1.50*	1.06	1.03
Middle	0.88	0.96	1.17	1.35	1.16	0.88	1.64*	1.73**	1.43**	1.18
Fourth	0.95	0.84	1.52**	1.51	1.01	1.12	1.66*	2.13***	1.54***	0.97
Highest	0.63	0.67	2.31***	1.59	1.13	0.80	1.62	1.67*	1.75***	1.02
Residence										
Urban	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Rural	1.32	1.14	0.78*	0.97	0.86	1.43*	0.78	0.60**	0.82*	1.28*
Total										
Respondents	3564	8391	3959	5132	6237	8105	3857	2035	16809	5379
df	(9, 424)	(10, 292)	(11, 570)	(10, 709)	(11, 1187)	(9, 290)	(10, 371)	(11, 490)	(10, 1366)	(9, 483)
F-statistic	27.78	38.78	17.76	16.42	51.64	36.12	17.63	13.40	109.15	47.49

Notes: [1]Due to a small sample size, two categories are combined. [2]Respondents who are 35 to 39 years old. [3]Respondents who are 60 to 64 years old.
*p<0.05 **p<0.01 ***p<0.001

Table A2. Results of multiple logistic regression of hypertension among men by demographic characteristics in odds ratio

	Albania 2008/09	Azerbaijan 2006	Bangladesh 2011	Benin 2011/12	Egypt 2008	Kyrgyz Republic 2012	Lesotho 2009	Namibia 2013	Peru 2012	Ukraine 2007
Age										
15-29	REF	REF	N/A	N/A	REF	REF	REF	N/A	N/A	REF
30-39	1.97***	2.17***	REF[1]	REF	1.64**	2.38***	2.30***	REF[1]	N/A	3.59***
40-49	3.12***	4.94***	1.83**	1.39**	3.39***	4.93***	3.29***	1.56**	REF	6.58***
50-59	N/A	9.12***	2.74***	2.35***[4]	7.68***	N/A	7.43***	3.20***	1.88***	N/A
60 or older	N/A	N/A	4.83***		N/A	N/A	N/A	4.77***[2]	4.26***	N/A
Education										
No	REF	REF	REF	REF	REF	REF[3]	REF	REF	REF	REF[3]
Primary	1.82	2.03	0.99	0.97	1.05	REF[3]	1.14	0.98	1.00	REF[3]
Secondary	1.50	0.39	1.18	1.02	1.09	0.21	1.46	0.93	1.04	0.88
Higher	1.19	0.45	2.32***	0.69	1.77**	0.20	2.88**	1.60	1.09	0.75
Wealth Quintile										
Lowest	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Second	0.95	1.09	1.21	1.05	1.10	1.24	0.69	1.54	1.03	0.75
Middle	1.08	1.26	1.25	1.12	0.95	1.50	0.72	1.25	1.49***	0.78
Fourth	1.05	0.62	1.55**	1.28	0.94	1.64	0.94	1.61	1.62***	1.07
Highest	0.80	0.57	2.17***	1.48	0.92	0.95	0.88	1.43	1.84***	0.69
Residence										
Urban	REF	REF	REF	REF	REF	REF	REF	REF	REF	REF
Rural	1.23	1.12	0.93	0.86	0.98	0.85	0.94	0.58**	0.90	0.88
Total										
Respondents	2829	2547	3869	2625	5702	2328	3167	1399	14440	2452
df	(10, 422)	(11, 291)	(11, 570)	(11, 687)	(11, 1157)	(9, 290)	(11, 370)	(11, 482)	(10, 1368)	(9, 446)
F-statistic	8.08	13.21	18.91	3.46	25.49	5.35	11.54	10.31	60.14	22.58

Notes: [1]Respondents who are 35 to 39 years old. [2]Respondents who are 60 to 64 years old. [3]Due to a small sample size, two categories are combined. [4]Due to an issue of collinearity, two groups are combined. *p<0.05 **p<0.01 ***p<0.001

Table A3. Results of multiple logistic regression of diabetes by demographic characteristics in odds ratio.

	Bangladesh 2011		Namibia 2013	
	Women	**Men**	**Women**	**Men**
Age				
15-29	N/A	N/A	N/A	N/A
30-39	REF[1]	REF[1]	REF[1]	REF[1]
40-49	1.17	1.56	2.20*	0.96
50-59	1.76**	2.23**	2.22	2.58*
60 or above	1.70*	2.38***	3.30*[2]	4.20***[2]
Education				
No	REF	REF	REF[3]	REF[4]
Primary	1.41*	1.22	0.83	2.61
Secondary	1.64*	1.15	0.72	3.79
Higher	1.88*	2.24***	0.61	5.16*
Wealth Quintile				
Lowest	REF	REF	REF	REF
Second	1.04	0.91	2.60	0.19*
Middle	1.10	0.83	3.17*	0.65
Fourth	1.65*	1.15	7.45***	0.82
Highest	2.81***	2.07**	7.14**	1.32
Residence				
Urban	REF	REF	REF	REF
Rural	0.87	1.00	0.83	0.83
Total				
Respondents	3815	3717	1862	1217
df	(11, 568)	(11, 570)	(11, 481)	(11, 464)
F-statistic	9.20	7.21	3.79	2.92

Notes: [1]Respondents who are 35 to 39 years old. [2]Respondents who are 60 to 64 years old. [3]Seven observations for the education attainment were missing. [4]Three observations for the education attainment were missing.
*p<0.05 **p<0.01 ***p<0.001