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PREVALENCE AND TREATMENT OF HYPERTENSION, DIABETES AND ASTHMA IN KENYA: A REPRESENTATIVE HOUSEHOLD SURVEY IN EIGHT COUNTIES IN 2016
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PREVALENCE AND TREATMENT OF HYPERTENSION, DIABETES AND ASTHMA IN KENYA: A REPRESENTATIVE HOUSEHOLD SURVEY IN EIGHT COUNTIES IN 2016

K. Turpin, P. C. Rockers, T. Vian, M. A. Onyango, R. Laing and V. J. Wirtz

ABSTRACT

Objectives: **In 2014, 27% of total deaths in Kenya were due to non-communicable diseases (NCDs). The objectives of this study were:**
1) To report on the prevalence of households with members diagnosed and treated for hypertension, diabetes, and asthma in eight counties in Kenya, and
2) To explore possible reasons for the variation in prevalence of these three NCDs in the different counties.
Design, Setting and Subjects: **A total of 7,870 households in a representative sample in eight Kenyan counties were screened for the presence of any non-communicable disease. Diagnosis and treatment data on these NCDs was collected and compared using county specific independent data from the 2014 Kenyan Demographic Health Survey (DHS).**
Main Outcome Measures: **Over all the eight surveyed counties, 10.7% of households reported having one or more individuals with an NCD. The county specific prevalence varied from 3% to 30.2%. Of the 7,870 households surveyed, 6.9% reported having a diagnosis of hypertension, 3.2% of asthma, and 2.3% of diabetes.**
Results: **The strongest explanatory variables for the variation in overall prevalence of NCDs related to access to health services and lifestyle risk factors.**

Conclusion: **The prevalence of reported NCDs varies considerably between counties in Kenya. Reasons may relate to a lack of access to diagnostic facilities or differences in lifestyle risk factors. We recommend a comprehensive field survey of biometric, health access, and lifestyle risk factors to determine the true prevalence and related risk factors for NCDs in Kenya.**

INTRODUCTION

In 2012, noncommunicable diseases (NCDs) were the leading global cause of death representing 38 million deaths, about 68% of all deaths (1). Of those NCD deaths, 80% occurred in low- and middle-income countries (LMICs) like Kenya (2). About 80% of NCD deaths are attributable to four diseases: cardiovascular diseases, cancers, diabetes, and chronic respiratory diseases (2,3).

With a gross domestic product of US$1,358 per capita, Kenya is classified as a lower middle-income country (4,5). It has an estimated population of 46 million individuals of whom 45.9% live below the national poverty line (6). The changing lifestyles, aging, health behaviors, limited access to healthcare (2,7–9), and rapid urbanization among other factors has led to an increase in prevalence of NCDs (10). In 2014, 27% of total deaths in Kenya were due to NCDs. The probability of dying from one of the four main types of NCDs for individuals between the ages of 30 and 70 years was 18% (2,3).

Twenty four percent of Kenya's population live in urban areas (3), and 58% of those live in informal settlements or slums (12). The majority of studies conducted on the prevalence of NCDs in Kenya have been in urban areas, and most have focused on negative health behaviors (8) and limited access to health services (9). One study found the prevalence of hypertension was 12.3% (12), while another reported finding a prevalence of 23% for hypertension and 60% for pre-hypertension (10). A study reported a 5.3% age-adjusted prevalence of diabetes in Nairobi (8); however, countrywide data indicates a national prevalence of only 4% (13). Asthma prevalence in urban areas of Kenya has been reported to be close to 20%, which is probably related to air pollution (14). These studies highlight the urban bias in reporting of NCD prevalence.

In order to promote availability and affordability of NCD medicines in Kenya, *Novartis Access*, a pharmaceutical company-led initiative launched in 2015, offered a basket of 15 NCD medicines to public and private nonprofit health organizations for a price of about US$1.50 dollars per monthly treatment (15). Within the scope of the evaluation of this initiative, we studied the prevalence of households with members diagnosed with hypertension, diabetes, asthma, or breast cancer who had been prescribed medication prior to Novartis Access medicines being available.

The objective of this paper is twofold: 1) to report on the prevalence of households with members diagnosed and treated with hypertension, diabetes, and asthma in eight counties in Kenya, and 2) to explore possible reasons, such as accessibility to the county health system or lifestyles and risk factors, for the variation in prevalence of these three NCDs at the county level by incorporating data from the 2014 Kenyan Demographic and Health Survey (DHS) (11).

MATERIALS AND METHODS

A detailed description of the study design of the Novartis Access evaluation can be found elsewhere (15). For this study, eight out of the 47 counties in Kenya were purposively selected. The inclusion criteria included the volume of medicines purchased from the main medicines nonprofit wholesaler, Mission for Essential Drugs & Supply, as well as geographical dispersion (counties not sharing borders), and security (excluding non-secure areas for data collection) (15).

A total of 7,870 households in the eight counties were identified using a two-stage sampling procedure. First, ten enumeration areas (EAs) were selected in each county with probability proportional to size based on the most recent census data. On average the EAs had 100 households and some contained more than one village. In the second stage, ten households that met the eligibility criteria were randomly selected from each EA to be included in the study. In order to do this, all households in each EA were listed in a random order and enumerators proceeded down the list until ten eligible households were selected. Households with at least one adult (member, aged 18 or older) who reported having been diagnosed with an NCD addressed by the *Novartis Access* program and prescribed medication were eligible to participate in the study.

Data collection

Data collectors and field supervisors were trained using the electronic data collection instrument (SurveyCTO)[1] by the co-investigators. A small study to pilot the instrument was carried out before the roll-out of the study. Informed written consent was obtained for all participants at the time of enrollment. Data collection took place in August 2016.

We defined household NCD prevalence as the prevalence of one or more cases of either hypertension or diabetes or asthma. In each county, households were visited until a total of 100 were identified. As the prevalence was not known before data collection began, data collectors were instructed to continue visiting households until a hundred households with at least one NCD were identified in each county.

Data Analysis: SAS® 9.4 software (16) was used for data analysis. Data on prevalence of NCD diagnosis and treatment was tabulated by diagnosis and county for the screened households. County specific data was extracted from the 2014 Kenyan Demographic and Health Survey (DHS) (11). Microsoft® Excel for Mac Version 15.32 (17) was used to generate scatter plots which compared the county specific NCD prevalence with independent data from the 2014 Kenyan DHS (11). These scatter plots were created to explore potential reasons for the variation in NCD diagnosis prevalence found among the counties. Trend lines and R^2 correlation coefficients were generated with Excel. The percentage of births at a health facility was selected as a proxy for access to health services.

The protocol was approved by the Institutional Review Boards at Strathmore University, Kenya, and at Boston University, USA. Additional permissions were obtained from the Kenyan National Council for Science and Technology.

[1] SurveyCTO is the name of the survey platform for electronic data-collection, based on Open Data Kit (ODK).

RESULTS

Of the 7,870 households screened, 839 households reported at least one individual diagnosed with an NCD and of these, 794 reported receiving treatment.

Figure 1 shows the household NCD prevalence (which includes hypertension, diabetes, and asthma combined) versus surveyed households without NCDs. As depicted, the counties of Narok, Samburu, and West Pokot had the lowest NCD diagnosis prevalence and Nyeri and Kwale counties had the highest.

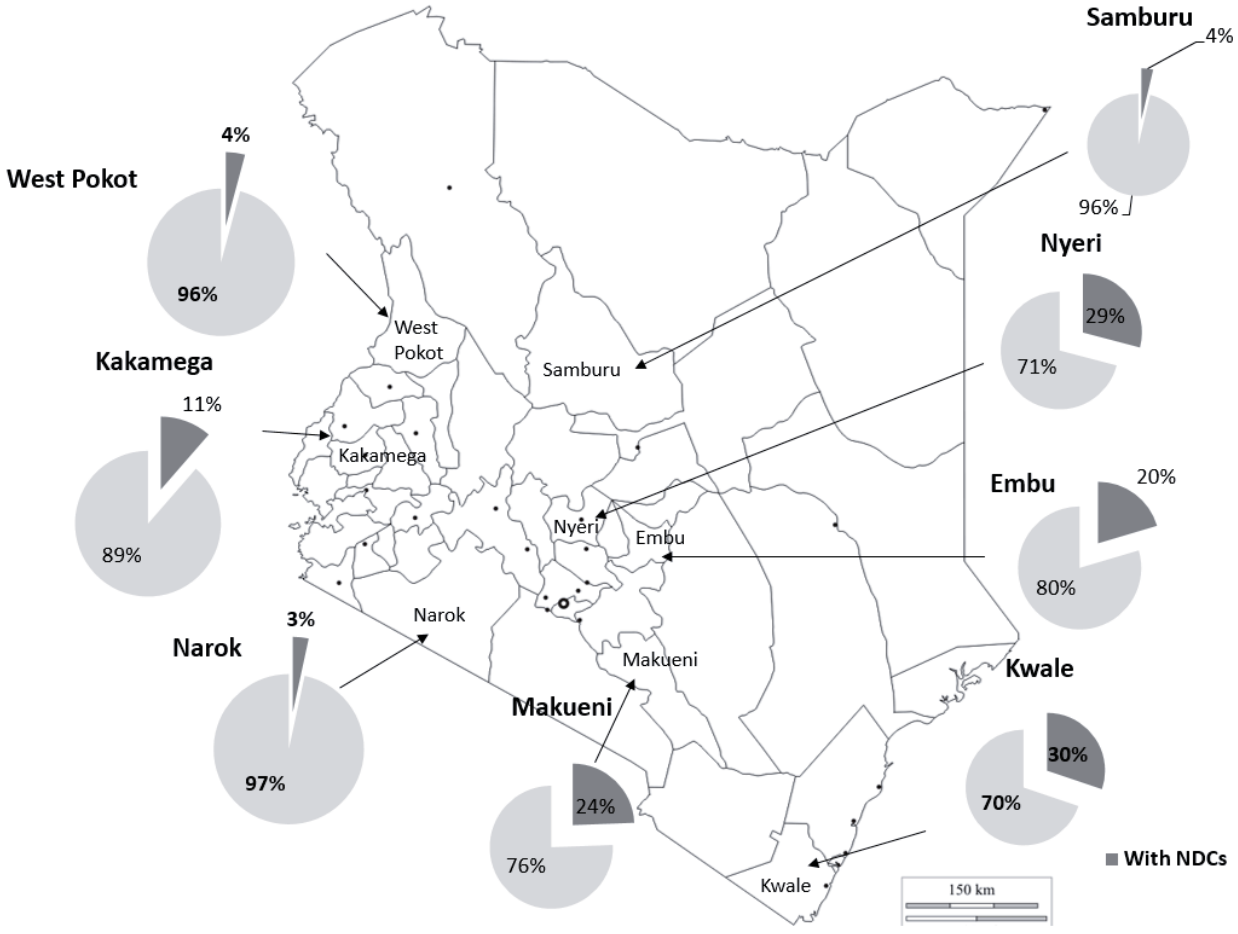


Figure 1: Prevalence of diagnosis of three non-communicable diseases by county

Table 1 numerically confirms that Kwale and Nyeri counties had the highest NCD diagnosis prevalence of the households interviewed, and Narok, West Pokot, and Samburu had the lowest. Of the surveyed population, 6.9% reported having a diagnosis of hypertension, 3.2% of asthma, and 2.3% of diabetes. Nyeri had the highest hypertension prevalence with 24.7% and Samburu the lowest with 1.3%. For households with an

individual diagnosed with asthma, Kwale had the highest prevalence with 15.9% and Narok the lowest with 0.9%. The diabetes prevalence did not vary as much between the counties; however, Nyeri had the most with 7.7% and Narok the lowest with 0.8%.

The majority of patients, 94.7%, who were diagnosed reported that they had received treatment. However, there were slight differences in treatment prevalence between the counties (Table 1). Compared to other counties, Kakamega had the lowest treatment prevalence for all three highlighted NCDs at 87.4% and Kwale the highest at 98.7%.

Table 1

Prevalence of households with at least one member diagnosed and treated for NCDs

	Overall	Narok	Kwale	Embu	Nyeri	Kakamega	West Pokot	Makueni	Samburu
Households Visited (n)	7870	2504	741	538	405	1048	1197	459	978
Reported NCD diagnosis (%)	**10.7**	**3.0**	**30.2**	**20.4**	**29.1**	**11.4**	**3.7**	**24.4**	**3.7**
Hypertension (%)	6.9	1.7	13.9	15.6	24.7	8.3	1.7	19.8	1.3
Diabetes (%)	2.3	0.8	3.6	4.5	7.7	2.8	1.3	5.2	1.1
Asthma (%)	3.2	0.9	15.9	2.6	4.2	2.7	1.2	4.1	1.6
Breast Cancer* (%)	0.1	-	0.1	-	0.2	-	-	0.2	0.1
Heart Failure* (%)	0.4	0.2	0.4	0.4	0.7	0.8	0.3	2.4	-
Dyslipidemia * (%)	0.1	0.1	0.1	-	-	0.1	0.1	0.7	0.1
Reported treatment out of those diagnosed (%)	94.7	96.1	98.7	96.4	93.2	87.4	95.5	92.0	97.2
Hypertension (%)	93.7	95.2	100.0	96.4	92.0	87.4	95.0	91.2	100.0
Diabetes (%)	97.3	100.0	100.0	95.8	100.0	86.2	100.0	100.0	100.0
Asthma (%)	96.0	95.7	97.5	92.9	100.0	85.7	100.0	94.7	100.0

Figure 2 depicts the percent of the population in each county that lives in an urban area. The data shows the more urban the population the higher the prevalence of hypertension.

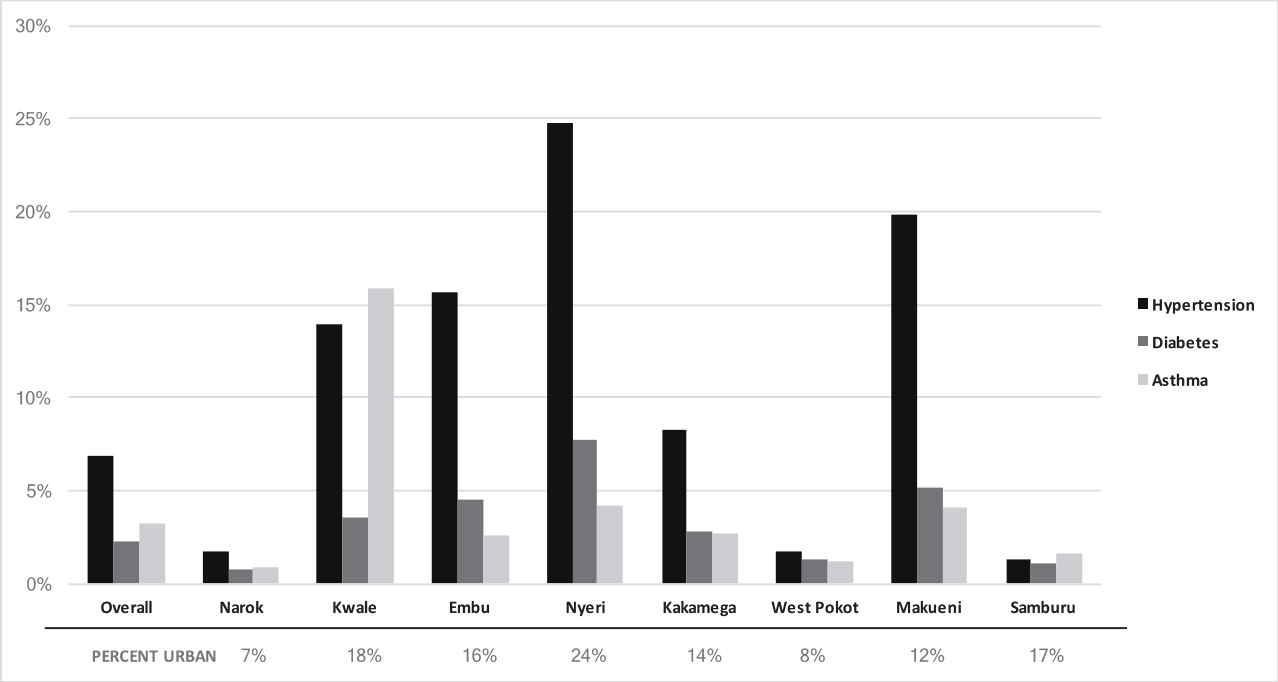


Figure 2: Prevalence of hypertension, diabetes and asthma by county

Correlating NCD Prevalence with possible Explanatory Variables: In order to investigate whether our data showed trends reflecting prevalence or a lack of diagnosis the NCD prevalence data was compared to the 2014 Kenyan DHS (11). Figures 3-5 depict variables for health service accessibility and Figures 6-8 represent lifestyle and risk factors that may contribute to NCD prevalence. A detailed list with direction and correlation coefficient for a longer selection of variables is available upon request from the authors.

Health System Factors: As seen in Figure 3, there is a positive correlation (R^2 of 0.5486) between births at health facilities and NCD prevalence. This indicates the more women had children in health facilities the more likely individuals in their county were to be diagnosed with NCDs.

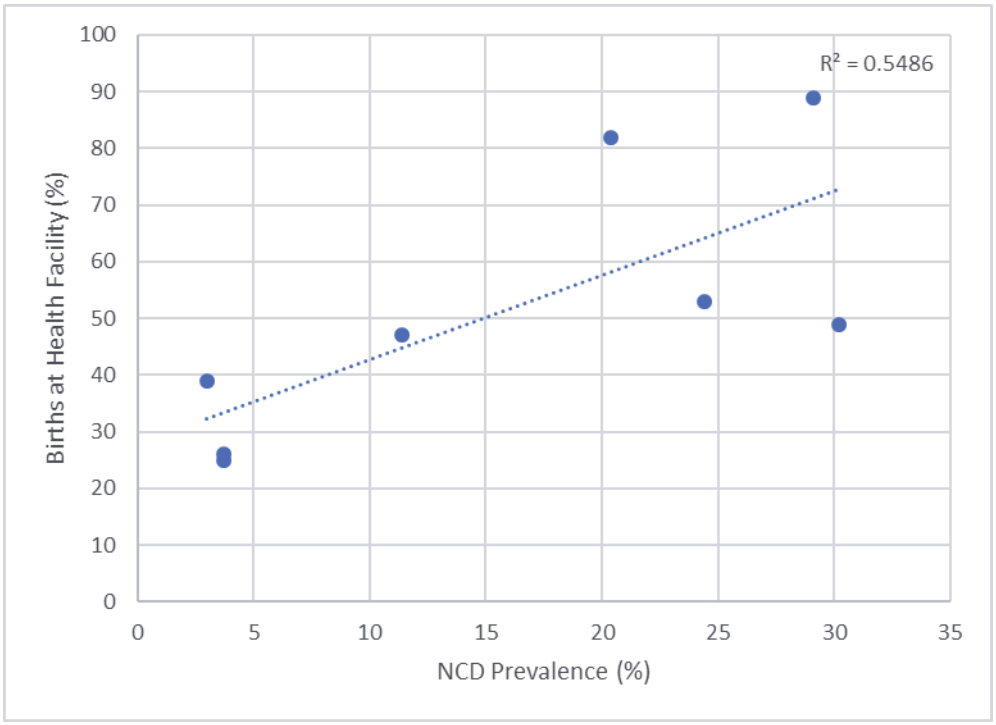
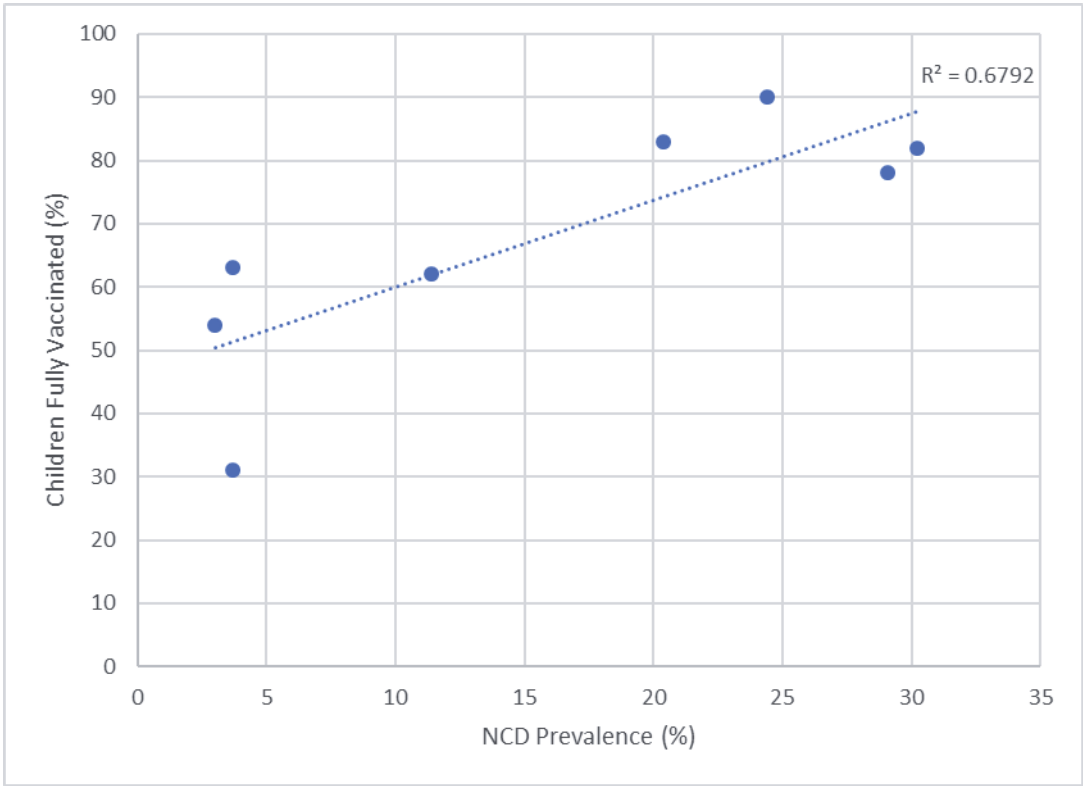


Figure 3: Births at Health Facility (DHS 2014) vs. NCD Prevalence



Similarly, in Figure 4, there is a strong correlation between children being fully vaccinated and a high NCD prevalence in the county. The R^2 value for the trend line is 0.6792, which means the data points when compiled follow a similar trajectory.

Figure 4: Children Fully Vaccinated (DHS 2014) vs. NCD Prevalence

Figure 5 shows the NCD prevalence of individuals based on the distance they must travel to reach the nearest public facility. From the information collected the scatter plot demonstrates that the closer individuals live to the health facility the more likely an individual in their community would be to receive a diagnosis of an NCD. The correlation (R^2=0.2908) is weaker than previous correlations.

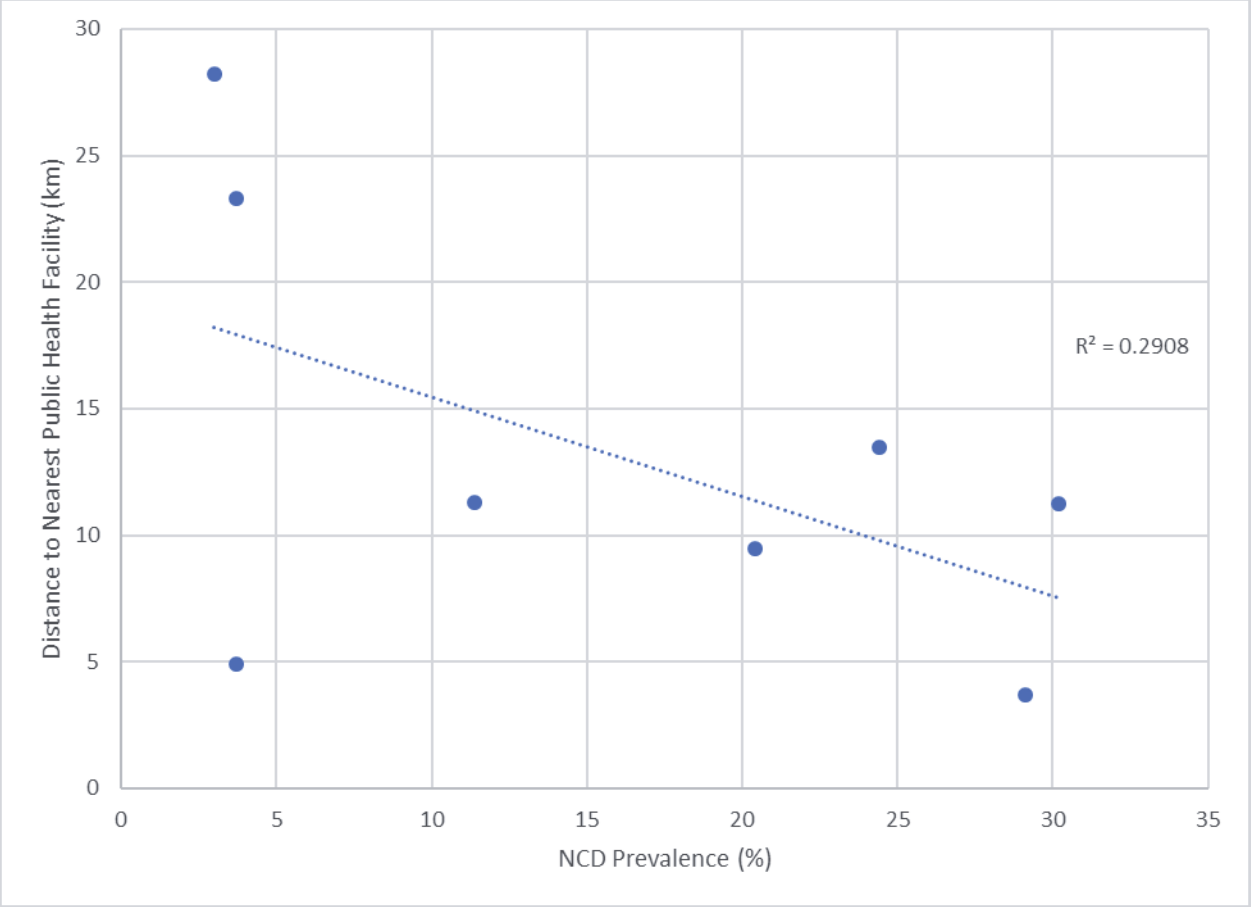


Figure 5: Distance to Nearest Public Facility (km) (DHS 2014) vs. NCD Prevalence

Lifestyle and Other Risk Factors: Figures 6-8 were generated to show whether lifestyle factors impact the prevalence of NCD diagnosis. In Figure 6 the prevalence of NCD diagnosis was compared to information collected on women who were described as overweight or obese in the 2014 Kenyan DHS (11). The scatter plot shows a R^2 of 0.5789. These results suggest that the more obese or overweight the county's female population, the more likely the county was to have individuals diagnosed with NCDs.

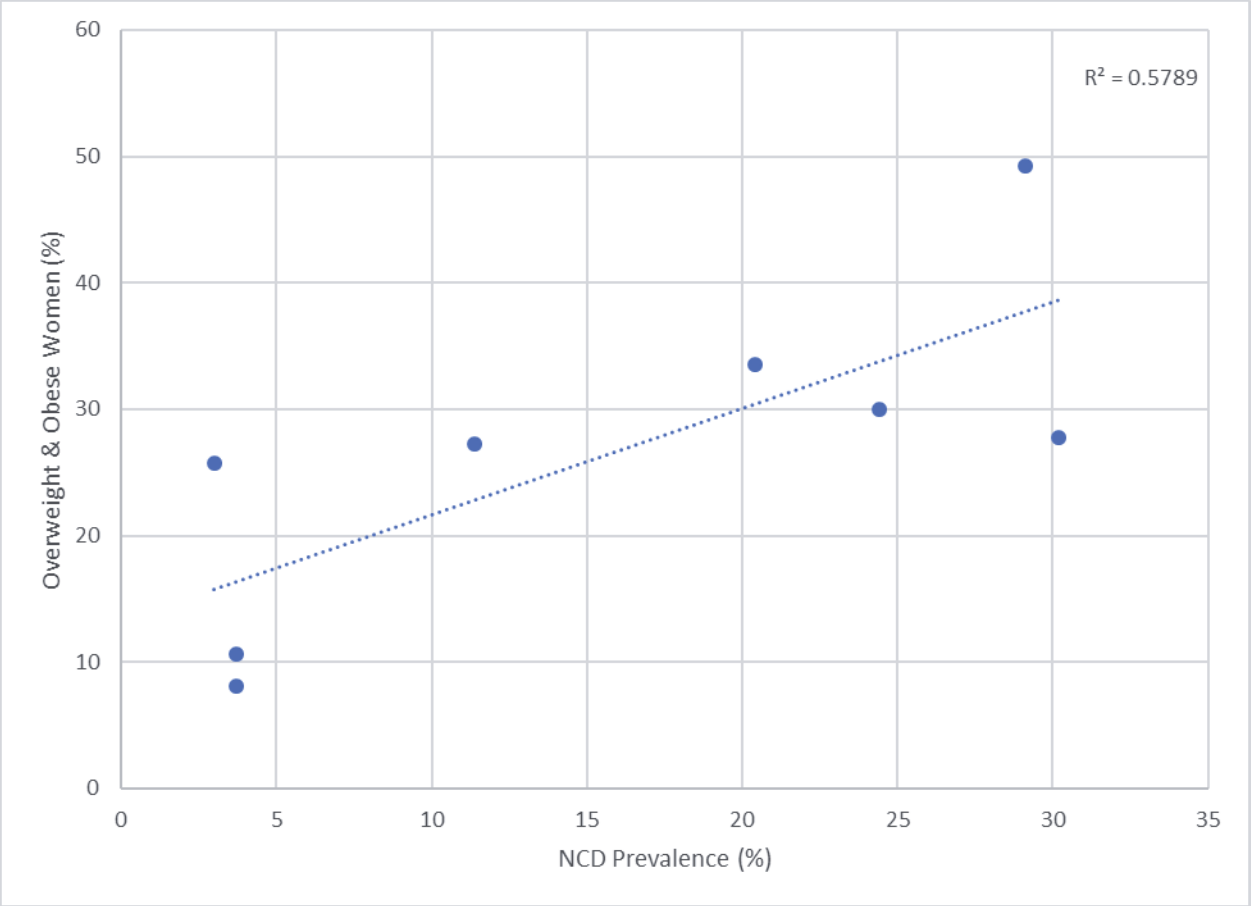


Figure 6: Overweight & Obese Women (BMI ≥25) (DHS 2014) vs. NCD Prevalence

The median years of education completed in each county was compared to NCD prevalence in Figure 7. The R^2 correlation coefficient was 0.4552, indicating the more educated the county, the more likely individuals would be diagnosed with NCDs.

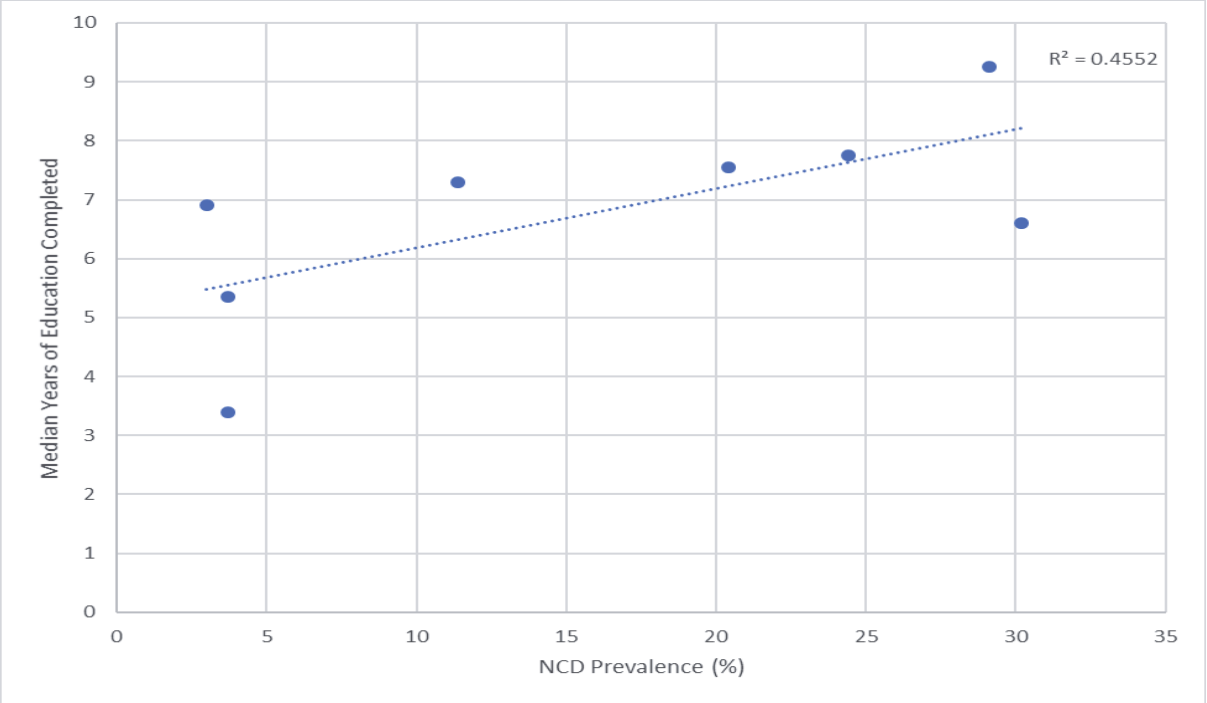


Figure 7: Median Years of Education Completed (DHS 2014) vs. NCD Prevalence

DISCUSSION

The aim of this paper was to analyze the prevalence distribution of diagnosed and treated NCDs in eight counties of Kenya. The paper expands the understanding of prevalence and treatment of NCDs in the country. First, there is a large variation in the prevalence of NCDs between counties. In addition, differences in the mean proportion of people in a county who said they had received treatment for their diagnosis ranged from 87.4% to 98.7%. Treatment rates were highest for diabetes and lowest for hypertension.

In the 2014 Kenya DHS 9% of women and 3% of men reported having been diagnosed with hypertension (11), which when averaged is roughly 6% percent of the population. This is consistent with the results of this study which show 6.9% of individuals in the 7,870 households visited had been diagnosed with hypertension. Additionally, it corroborates our finding that females were almost twice as likely to have a hypertension diagnosis (11). The prevalence of diagnosed diabetes and asthma, however, varied from previously reported numbers. Prior studies had reported the prevalence of diabetes at 4% (13) and asthma at 20% (14). Our study showed lower rates with 2.3% of individuals in all households reporting having been diagnosed with diabetes, and 3.2% with asthma. These findings may reflect that prior studies generally collected data from urban areas while our representative study included mostly rural areas.

Overall, the prevalence of NCDs varied greatly by county. The key question is whether the low prevalence of diagnosed NCDs in Narok, West Pokot, and Samburu and the high prevalence in Nyeri, Kwale, and Makueni was due to a level of diagnostic facilities or whether there was an absence or

excess of these conditions in these different environments. As stated above Kwale and Nyeri had the highest while Narok, West Pokot, and Samburu had the lowest diagnosis prevalence. Interestingly, Narok, West Pokot, and Samburu are all in the Rift Valley Region, which has the smallest urban population (11) (data not shown but available upon request). This suggests that counties with a greater proportion of urban households were more likely to have higher prevalence of NCDs. However, the 2014 Kenya DHS collected responses from women ages 15- 49 in all regions of the country describing various problems they encounter when accessing health care (11). One of the challenges cited was the distance to a health facility (11). This may suggest an alternative explanation for the high prevalence of NCDs in urban areas. As this study does not measure whether lack of access to health facilities is a driver of low prevalence this observation requires further investigation. Therefore, our preliminary analysis suggests that access or lifestyle risk factors may explain some of this variation.

One of the major strengths of this study was that households were randomly selected and counties surveyed did not overlap. This is important because it helps to maintain a representative sample population. A potential limitation is that survey teams in different counties may have had varying success in eliciting accurate reports of NCDs in households. Additionally, our methodology specifically selected households with diagnosed and treated NCDs. This means the study inevitably missed a sample of the population with undiagnosed NCDs.

CONCLUSION

The baseline survey for the *Novartis Access* program shows the prevalence of three major NCDs varied dramatically in the eight counties surveyed in Kenya. The strongest explanatory variables for NCD prevalence from the DHS were related to access to and utilization of health services, as well as lifestyle risk factors such as births at health facilities, vaccination, overweight and obesity, and urbanization. However, the question as to whether the low prevalence in some areas is related to a lack of disease or a lack of diagnostic capacity remains open. We recommend a comprehensive field survey of biometric, health access, and lifestyle risk factors to determine the true prevalence and related risk factors for NCDs in Kenya. This will assist in the national response to the increasing NCD problem. If there truly is a low prevalence in certain areas, this will allow the government and partners to divert resources to high prevalence areas and promote practices that would prevent the emergence of NCDs in low prevalence areas.

REFERENCES

1. World Health Organization. Global Status Report on noncommunicable diseases 2014 [Internet]. 2014 [cited 2017 Jan 26]. Available from: http://apps.who.int/iris/bitstream/10665/148114/1/9789241564854_eng.pdf?ua=1

2. Haregu TN, Oti S, Egondi T, Kyobutungi C. Co-occurrence of behavioral risk factors of common non-communicable diseases among urban slum dwellers in Nairobi, Kenya. Glob Health Action [Internet]. 2015 [cited 2017 Jan 26];8:28697. Available from: http://www.ncbi.nlm.nih.gov/pubmed/26385542

3. (WHO) WHO. Non communicable Diseases Country Profiles [Internet]. 2014. Available from: http://apps.who.int/iris/bitstream/10665/128038/1/9789241507509_eng.pdf?ua=1

4. United Nations Statistics Division. UNdata | country profile | Kenya [Internet]. 2017 [cited 2017 Feb 9]. Available from:

http://data.un.org/CountryProfile.aspx?crName=kenya

5. World Bank. WB Update Says 10 Countries Move Up in Income Bracket [Internet]. 2015 [cited 2017 Feb 9]. Available from: http://www.worldbank.org/en/news/press-release/2015/07/01/new-world-bank-update-shows-bangladesh-kenya-myanmar-and-tajikistan-as-middle-income-while-south-sudan-falls-back-to-low-income

6. World Bank. Kenya | Data [Internet]. 2016 [cited 2017 Jan 26]. Available from: http://data.worldbank.org/country/kenya

7. Kenya STEPwise Survey for Non-Communicable Diseases Risk Factors, 2015 Report [Internet]. Ministry of Health, Kenyan National Bureau of Statistics, World Health Organization; 2016. Available from: http://www.health.go.ke/wp-content/uploads/2016/04/Steps-Report-NCD-2015.pdf

8. Ayah R, Joshi MD, Wanjiru R, Njau EK, Otieno CF, Njeru EK, et al. A population-based survey of prevalence of diabetes and correlates in an urban slum community in Nairobi, Kenya. BMC Public Health [Internet]. 2013 [cited 2017 Jan 26];13. Available from: http://www.biomedcentral.com/1471-2458/13/371

9. Oti SO, van de Vijver S, Kyobutungi C. Trends in non-communicable disease mortality among adult residents in Nairobi's slums, 2003-2011: applying InterVA-4 to verbal autopsy data. Glob Health Action [Internet]. 2014 [cited 2017 Jan 26];7:25533. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25377336

10. Joshi MD, Ayah R, Njau EK, Wanjiru R, Kayima JK, Njeru EK, et al. Prevalence of hypertension and associated cardiovascular risk factors in an urban slum in Nairobi, Kenya: a population-based survey. BMC Public Health [Internet]. 2014;14:1177. Available from: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4246542%7B&%7Dtool=pmcentrez%7B&%7Drendertype=abstract

11. Statistics KNB of, Health/Kenya M of, Council/Kenya NAC, Institute KMR, Development/Kenya NC for P and. Kenya Demographic and Health Survey 2014 [Internet]. 2015 [cited 2017 Mar 2]. Available from: http://dhsprogram.com/publications/publication-FR308-DHS-Final-Reports.cfm

12. van de Vijver SJM, Oti SO, Agyemang C, Gomez GB, Kyobutungi C. Prevalence, awareness, treatment and control of hypertension among slum dwellers in Nairobi, Kenya. J Hypertens [Internet]. 2013;31(5):1018–24. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23425703

13. World Health Organization. Diabetes Country Profiles: Kenya [Internet]. 2016 [cited 2017 Feb 15]. Available from: http://www.who.int/diabetes/country-profiles/ken_en.pdf?ua=1

14. World Health Organization. WHO | Bronchial asthma: Fact sheet. WHO [Internet]. 2010 [cited 2017 Feb 15]; Available from: http://www.who.int/mediacentre/factsheets/fs206/en/

15. Rockers PC, Wirtz VJ, Vian T, Onyango MA, Ashigbie PG, Laing R. Study protocol for a cluster-randomised controlled trial of an NCD access to medicines initiative: evaluation of Novartis Access in Kenya. BMJ Open [Internet]. 2016 Nov 25 [cited 2016 Dec 28];6(11):e013386. Available from: http://bmjopen.bmj.com/lookup/doi/10.1136/bmjopen-2016-013386

16. SAS® 9.4. Cary, NC: SAS Institute Inc.

17. Microsoft Excel for Mac 15.32. 2017.

18. Gabrysch S, Campbell OM. Still too far to walk: Literature review of the determinants of delivery service use. BMC Pregnancy Childbirth. 2009; 9:34. doi: 10.1186/1471-2393-9-34.