


BMJ Open Availability and prices of medicines for non-communicable diseases at health facilities and retail drug outlets in Kenya: a cross-sectional survey in eight counties

Paul G Ashigbie ¹, Peter C Rockers,¹ Richard O Laing,^{1,2} Howard J Cabral,³ Monica A Onyango,¹ John Paul Likalamu Buleti,⁴ Veronika J Wirtz¹

To cite: Ashigbie PG, Rockers PC, Laing RO, *et al.* Availability and prices of medicines for non-communicable diseases at health facilities and retail drug outlets in Kenya: a cross-sectional survey in eight counties. *BMJ Open* 2020;**10**:e035132. doi:10.1136/bmjopen-2019-035132

► Prepublication history and additional material for this paper are available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2019-035132>).

Received 19 October 2019
Revised 12 April 2020
Accepted 14 April 2020



© Author(s) (or their employer(s)) 2020. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to

Dr Paul G Ashigbie;
gamelle@bu.edu

ABSTRACT

Objectives The objective of this study was to determine the availability and prices of medicines for non-communicable diseases (NCDs) in health facilities and private for-profit drug outlets in Kenya.

Design Cross-sectional study.

Methods All public and non-profit health facilities in eight counties (Embu, Kakamega, Kwale, Makeni, Narok, Nyeri, Samburu and West Pokot) that purchased medicines from the Mission for Essential Drugs and Supplies, a major wholesaler, were surveyed in September 2016. For each health facility, one nearby private for-profit drug outlet was also surveyed. Data on availability and price were analysed for 24 NCD and 8 acute medicine formulations. Availability was analysed separately for medicines in the national Essential Medicines List (EML) and those in the Standard Treatment Guidelines (STGs). Median price ratios were estimated using the International Medical Products Price Guide as a reference.

Results 59 public and 78 non-profit facilities and 135 drug outlets were surveyed. Availability of NCD medicines was highest in private for-profit drug outlets (61.7% and 29.3% for medicines on the EML and STGs, respectively). Availability of STG medicines increased with increasing level of care of facilities: 16.1% at dispensaries to 31.7% at secondary referral facilities. The mean proportion of availability for NCD medicines listed in the STGs (0.25) was significantly lower than for acute medicines (0.61), $p < 0.0001$. The proportion of public facilities giving medicines for free (0.47) was significantly higher than the proportion of private non-profit facilities giving medicines for free (0.09) ($p < 0.0001$). The mean price ratio of NCD medicines was significantly higher than for acute medicines in non-profit facilities (4.1 vs 2.0, respectively; $p = 0.0076$), and in private for-profit drug outlets (3.5 vs 1.7; $p = 0.0013$).

Conclusion Patients with NCDs in Kenya appear to have limited access to medicines. Increasing access should be a focus of efforts to achieve universal health coverage.

INTRODUCTION

The burden of non-communicable diseases (NCDs) has been on the rise, especially in

Strengths and limitations of this study

- To the best of our knowledge this is the first study to evaluate availability of medicines based on the level of care medicines are assigned in the national Essential Medicines List (EML).
- This study also evaluated availability separately for medicines for non-communicable diseases included in the EML and those included in the Standard Treatment Guidelines, highlighting the crucial differences between the two service delivery documents.
- The cross-sectional study design did not allow us to assess trends in availability and price of medicines over time and precludes making strong causal inferences.
- Availability of medicines was evaluated as binary variable (yes/no) and did not count the quantity in stock.
- The sample of participating private for-profit drug outlets was restricted to those nearest to public and non-profit facilities. While this may not be representative of all private for-profit sector facilities, it gave us the opportunity to study the availability and prices consumers would encounter when referred from public and non-profit facilities.

low/middle-income countries (LMICs).^{1 2} Globally, an estimated 40.5 million deaths in 2016 were due to NCDs.² Eighty per cent of these deaths were caused by diseases including cancers, cardiovascular diseases (CVD), chronic respiratory diseases and diabetes. Nearly 80% of NCD deaths occur in LMICs, and people living in sub-Saharan Africa face the highest risk of death.^{2 3} In Kenya, one-half of total hospital admissions and over 55% of hospital deaths are due to NCDs.⁴ Cardiovascular diseases are the leading cause of NCD related deaths followed by cancer, which accounts for 7% of overall mortality in the country.⁵ According to the Kenya Stepwise



Survey for Non-communicable Diseases Risk Factors 2015 Report, the prevalence of hypertension stands at 24%.⁴ With a national prevalence of about 4%, diabetes accounts for more than 8000 deaths annually in Kenya.^{6 7}

In 2011, the United Nations General Assembly adopted a resolution for the prevention and control of NCDs.⁸ This commitment was renewed in 2015 with the adoption of the sustainable development goals (SDGs), target 3.4 of which aims to 'by 2030, reduce by one-third premature mortality from NCDs through prevention and treatment and promote mental health and well-being'.⁹ In 2014, Kenya launched its National Health Policy with the goal of attaining the 'highest possible standard of health in a responsive manner'.¹⁰ Among the six key objectives of this policy, one directly targets NCDs: 'halt and reverse the rising burden of non-communicable conditions'.

Two critical indicators listed in the global monitoring framework for the prevention and control of NCDs adopted by the 66th World Health Assembly in 2013 include affordability and availability of NCD medicines in health facilities.^{11 12}

Several studies have demonstrated limited availability and affordability of NCD medicines in LMICs.^{13–15} Despite the high burden of NCDs in Kenya, there are many challenges regarding access to NCD medicines.^{4 16 17} The government owned Kenya Medical Supplies Agency and the Mission for Essential Drugs and Supplies (MEDS), are the leading suppliers (wholesalers) of medicines to public and non-profit hospitals and clinics. MEDS, a faith-based organisation, supply about 40% of the volume of medicines consumed at public and non-profit facilities and operates in about 33 of the 47 counties in the country,¹⁸ stockouts at these two wholesalers have reportedly been minimal.¹⁹ However, the availability of medicines in health facilities that serve patients (including dispensaries, health centres and hospitals) is generally poor, which may be a reflection of the supplier—retailer supply chain weaknesses and public financing of medicines among other factors.²⁰ Medicines for NCDs were found to be much less available at health facilities compared with medicines for communicable diseases (46% vs 70%).²⁰ The Kenya Service Delivery and Readiness Assessment Report, published in 2014, reported an even lower mean availability of NCD medicines at primary care facilities and hospitals: 25% and 32%, respectively.²¹

There is no pricing policy or the regulation of mark-ups on medicines in Kenya. The country implemented a reduced user fee policy in 2004 which among other things, includes providing medicines for free at levels 2 and 3 facilities.^{19 22} However, studies have shown poor adherence to this policy.^{22 23} Only 19% of the population has insurance coverage, hence most patients pay for medicines out-of-pocket.²⁴ Based on data collected in 2009, the prices of medicines are lower in public facilities compared with faith based facilities, though stock-outs are about three times more common in public facilities (46% vs 14%).¹⁹

Previous studies on availability and price of medicines in Kenya have had two major limitations. First, these did not take into account the level of care of health facilities surveyed. With the goal of ensuring appropriate use of medicines at various levels of care, the national Essential Medicines List (EML), which guides public procurement in Kenya restricts most NCD medicines to level 4 facilities (primary (county) referral hospitals) and above.^{25 26} However, it is not clear if providers or suppliers follow this restriction. Based on this restriction, the free medicines policy at lower levels of care and possibly other factors, availability and prices of medicines might differ by level of care. Second, previous studies did not evaluate availability of medicines in the EML separately from medicines in the National Standard Treatment Guidelines (STGs). Even though the EML and STGs are meant to complement each other in standardising the provision of quality health services in Kenya, there are more medicines listed in the STGs than in the EML which can make the standardisation of care challenging.^{25–30}

The objective of this study was to determine the availability and price of medicines for NCDs in health facilities and private for-profit drug outlets in Kenya. The study compared the availability and prices of NCD medicines to acute medicines in order to highlight potential gaps in the delivery of NCD services. By taking into account the EML restrictions discussed above, and the level of care of health facilities surveyed, this study highlights the disparities in access to medicines by level of care. Because of the inconsistency between the EML and STGs, the study also evaluates separately, the availability of medicines included in the EML and availability of medicines included in the STGs. Findings from this study complement existing evidence on the availability and price of NCD medicines in LMICs, which is necessary to inform the design of policies to enhance access to medicines.^{13 20 21 31–34}

METHODS

Study setting

The data presented in this paper were collected during the baseline study on the evaluation of *Novartis Access*, a low-cost NCD medicines programme implemented by Novartis Pharmaceuticals.^{18 35} *Novartis Access* targets medicines for four NCDs—cardiovascular disease (dyslipidaemia, heart failure and hypertension), diabetes, asthma and breast cancer. Data were collected from eight study counties—Embu, Kakamega, Kwale, Makueni, Narok, Nyeri, Samburu and West Pokot. These counties were a mix of semiurban and rural areas with a total population of 7 million inhabitants, representing 15% of the national population.³⁶ These counties were selected based on their patronage of medicines from MEDS, and safety for field data collection. The selection of these counties had been described in more detail by Rockers *et al.*¹⁸

Health facilities (public and private non-profit facilities) in Kenya are hierarchically classified into dispensaries (level 2), health centres (level 3), primary (county)

referral hospitals (level 4), secondary referral hospitals (level 5) and tertiary hospitals (level 6).¹⁰ Dispensaries are the lowest level of care and offer treatment for simple ailments to outpatients, antenatal care and so on, while tertiary hospitals are the highest level of care and offer more specialised services.^{37 38}

Data collection

Data were collected in September 2016 by trained data collectors in English language, using study instrument programmed in the software application, Survey CTO.³⁹ The study instrument was pilot tested twice by the trained data collectors and revised based on the feedback received from each pilot test.

All of the public and private non-profit health facilities (level 2–level 5) in eight counties that purchase medicines through MEDS were surveyed. No level 6 facility was included in the study. After data collection at each health facility, data collectors asked respondents to identify the nearest private for-profit drug outlet where patients are referred when prescribed medicines are not available at the facility. These private for-profit drug outlets were then visited and administered the same survey instrument used at the facilities.

Data were collected on availability (having or not having the medicine in stock on the day of data collection, based on physical observation by data collectors) and price (in Kenyan Shillings—KES) of 27 NCD medicine formulations and 9 medicine formulations for acute diseases. Price data (how much patients pay if they have to pay for the medicine out of pocket) were collected from the staff in charge of medicines at each facility. For each medicine, data were collected on the originator brand and the lowest priced generic. The selection of the 27 NCD medicines for this study was based on two criteria¹: inclusion of the medicines in the *Novartis Access* portfolio as this study was part of a larger study of the *Novartis Access* programme²; the inclusion of the medicines in the STGs of the Ministry of Health. The acute disease medicine formulations included in this study are all on the EML of Kenya and have been used as reference medicines in evaluating the availability and price of medicines in health systems.³⁴ These medicines were selected by a group of researchers from Boston University based on their frequency of use in primary care and their use in other research studies.^{13 14 20} All the study medicines were listed in the most recent STGs of the Ministry of Health. The list of medicines on which data were collected are shown in online supplementary appendix 1.

Patient and public involvement

Patients were not involved in the design or conduct of the study. Patients may be engaged after endline data collection to disseminate final study results at the county level and to the wider NCD patient community.

Data analysis

Data were analysed using SAS V.9.4 (The SAS Institute).⁴⁰ Three of the NCD medicines which were for cancer (anastrozole, letrozole and tamoxifen) were excluded from this analysis because cancer management in Kenya mainly occurs in tertiary health facilities which were not the focus of this study. Additionally, diclofenac 50 mg tablets were excluded from the analysis because it was the only acute disease medicine that was in the STG but not listed on the national EML. Inclusion of medicines in the EML was determined by their enlistment in either the 2010 or 2016 editions of the EML.^{25 41} Based on this definition, nine of the NCD medicines were included in the EML. The analysis focused on the number of observations and excluded missing data.

The following outcome measures were estimated: (1) the proportion of availability (defined as the proportion of healthcare providers having a branded or generic version of each medicine available in stock) and (2) the median price (and minimum and maximum prices) of each generic or originator medicine across healthcare providers. Availability for NCD medicines was assessed using two approaches. The first analysis focused only on NCD medicine formulations listed in the EML. In the second analysis, availability was analysed for 24 NCD medicine formulations which were listed in the most recent editions of STGs.^{30 42–45} The availability of study medicine formulations was evaluated by provider type and also by level of care. Differences in mean availability between acute and NCD medicines were estimated using the two-sample t-test.

Median, minimum and maximum prices of study medicines were estimated for observations for which medicines were not given for free (ie, price was not equal to zero). All price analyses were conducted in September 2016 KES. Using the supplier prices from the 2015 edition of the International Medical Products Price Guide (IMPPG) which is published by Management Sciences for Health as a reference, the median price ratio for each medicine formulation was estimated.⁴⁶ Due to the limited availability of originator brands, median price ratios were estimated for only generics. Only 23 of the study medicines had supplier prices reported in the IMPPG which was used for the median price ratio computation. First the prices from the IMPPG (in 2015 US dollars) were inflated to 2016 rates, using the average of 2015 and 2016 annual inflation rates (0.7) obtained from the US inflation calculator.⁴⁷ The September 2016 price data were converted from KES to US dollars using 15 September 2016 exchange rate of obtained from *xe.com*. Median price ratios were compared among public, private non-profit and private for-profit drug stores, and across levels of care (levels 2, 3, 4 and 5) using analysis-of-variance with the Tukey-Kramer adjustment procedure to compare pairs of means. Differences in mean price ratios between acute and NCD medicines were estimated using the two-sample t-test. The proportion of facilities giving each medicine

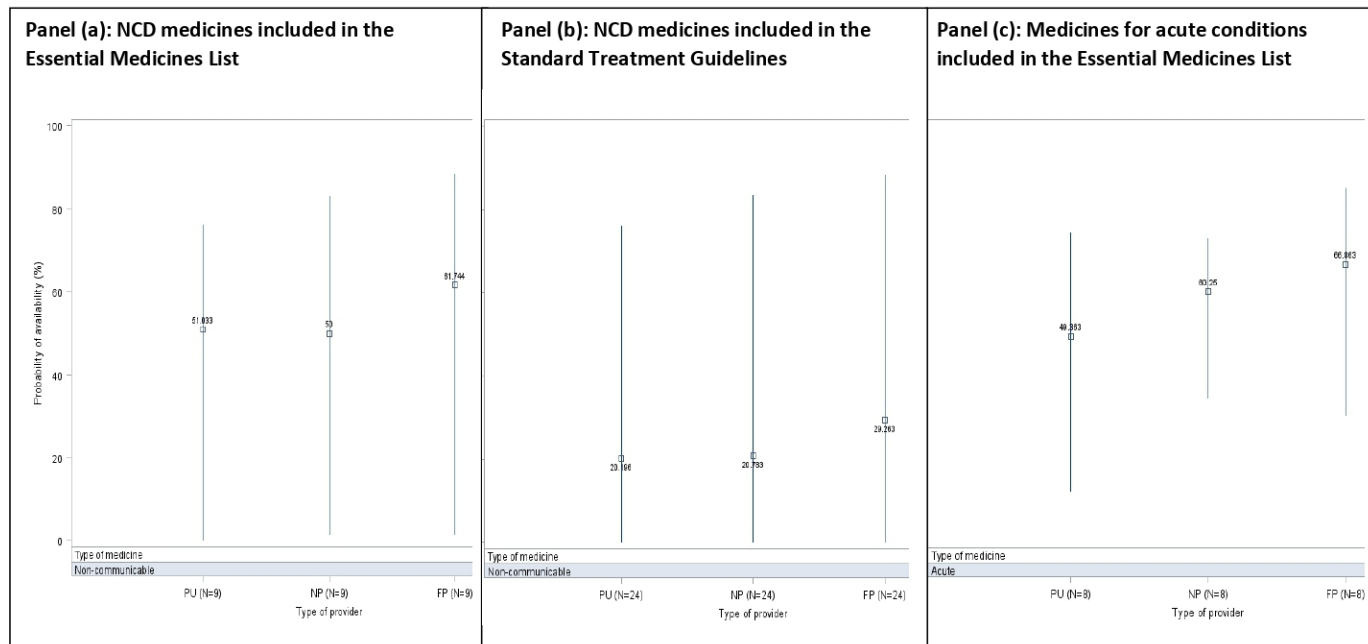


Figure 1 Facility level mean proportion of availability by provider type for NCD medicines included in the EML, NCD medicines listed in STGs and acute medicines included in the EML. The box indicates the mean and the bars indicate the minimum and maximum. EML, Essential Medicines List; FP, private for-profit drug outlet; NCD, non-communicable disease; NP, private non-profit facility; PU, public facility; STG, Standard Treatment Guidelines.

for free was also estimated, stratified by provider type and level of care.

RESULTS

A total of 272 healthcare providers were surveyed—59 public facilities, 78 private non-profit facilities and 135 private for-profit drug outlets. There was 100% response rate from health facilities, while two of the private for-profit drug outlets declined to participate in the study. The total number of participating healthcare providers varied across study counties, from a minimum of 12 in Samburu to a maximum of 48 in Embu county (online supplementary appendix 2). More than half (n=77; 61%) of study facilities were level 2 (dispensaries), 18% (n=23) were level 3 (health centres), while 20.6% (n=26) were level 4 (primary referral facilities). There were few (n=5; 4%) level 5 (secondary referral) facilities.

Medicines availability

We first present results on the availability of STG and EML medicines by provider type. This is followed by results on availability stratified by level of care. Finally, we focus on how availability patterns indicate non-compliance with the EML.

Availability by provider type

Figure 1 compares the availability of NCD medicines listed in the EML, NCD medicines listed in the STGs and medicines for acute conditions listed in the EML, by provider type. For each of the three categories of medicines, availability was highest in private for-profit drug outlets (61.7, 29.3% and 66.9% for NCD medicines on the EML, NCD

medicines on the STG and acute disease medicines) compared with public and non-profit providers. Across all provider types, availability of medicines listed in the EML was higher than availability of medicines listed in the STGs. Comparing medicines on the EML, the mean proportion of NCD medicine availability (0.55) was not significantly different from the mean proportion of acute medicine availability (0.61) (p=0.55). Considering medicines in the STGs, the overall mean proportion of NCD medicine availability (0.25) was significantly lower than the overall mean proportion of acute medicine availability (0.61); p<0.0001. Online supplementary appendix 3 presents the overall availability of each study medicine disaggregated by provider type and branded vs generic formulations. Generally, generics were more common than originator brands across all providers. Only two originator brands of study medicines were available in public facilities compared with 19 in private non-profit, and 21 in private for-profit drug outlets. Several medicines included in the EML had a proportion of availability of over 50%. However, salbutamol, an important medicine for asthma relief had an availability of less than 40% across the different types of providers. Thirteen medicines had very low availability including CVD medicines such as bisoprolol, ramipril, simvastatin, valsartan and diabetes medicines such as glimepiride.

Availability by level of care

Figure 2 presents the proportion of availability of NCD medicines listed in the STGs and acute disease medicines (listed in the EML) by level of care. For NCD medicines in the STGs availability increases with increasing level of

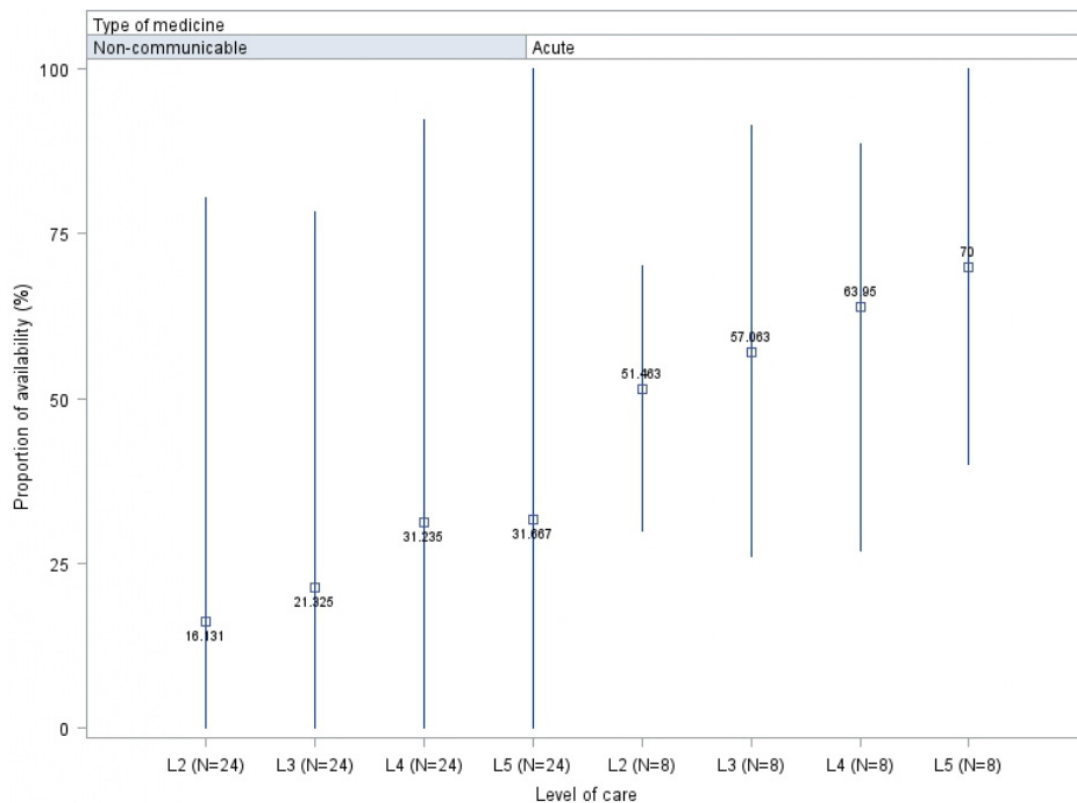


Figure 2 Facility level mean proportion of availability by level of care for medicines listed in the Standard Treatment Guidelines and acute disease medicines. The box indicates the mean and the bars indicate the minimum and maximum. L2, level 2 facilities; L3, level 3 facilities; L4, level 4 facilities; L5, level 5 facilities; N, number of medicines surveyed.

care, from 16.1% at level 2 facilities to 31.7% at level 5 facilities. A similar trend was observed for acute disease medicines. At each level of care, the availability of acute disease medicines was more than two times the availability of NCD medicines listed in the STGs. The findings at level 5 facilities should be interpreted with caution because of the small sample size—only five facilities were surveyed at this level of care.

Online supplementary appendix 4 presents the availability of study medicines by county. The mean proportion of availability of study medicines ranges from 0.24 in West Pokot to 0.42 in Makeni.

Non-compliance of public and non-profit facilities with the EML

Twelve of the NCD medicines in this study were not on the EML. However, each of these medicines was found at all levels of care. The proportion of health facilities stocking these medicines ranged from 0.01 to 0.2. As mentioned earlier, all of the study NCD medicines included in the EML were assigned level 4 and above except salbutamol inhaler which was assigned level 2 and above. However, more than half of levels 2 and 3 facilities were stocking four of these medicines (amitriptyline 25 mg, furosemide 40 mg, metformin 500 mg and omeprazole 20 mg) (online supplementary appendix 3). Among acute medicines, diazepam 5 mg was restricted to level 4 and above, however, the proportion of level 2 and level 3 facilities stocking this medicine were 0.5 and 0.6, respectively.

Medicine prices

In this section, we first present results on medicine prices by provider type, followed by results on prices stratified by level of care.

Medicine prices by provider type

There were wide variations in medicine prices across and within provider types. The within provider type variations appeared to be more pronounced in private drug outlets compared with public sector facilities. For example, the price of 1 g vial of generic ceftriaxone ranged from 30 to 800 KES in private drug outlets, 10 to 550 in private not-for-profit facilities and 50 to 400 in public facilities.

The mean proportion of public facilities giving medicines for free (0.47) was significantly higher than the mean proportion of private non-profit facilities giving medicines for free (0.09) ($p < 0.0001$). For example, generic metformin 500 mg tablets/caps was provided for free at 38.5% ($n = 15/39$) of public facilities and 14.9% ($n = 7/47$) of private non-profit facilities. Drug outlets did not offer any medicines for free. There was large variability in the free provision of medicines among public health facilities which was unrelated to county (data not shown). The mean proportion of non-profit facilities giving NCD medicines for free (0.05) was significantly less than the mean proportion giving acute medicines for free (0.18), $p < 0.0001$. However, this difference was not

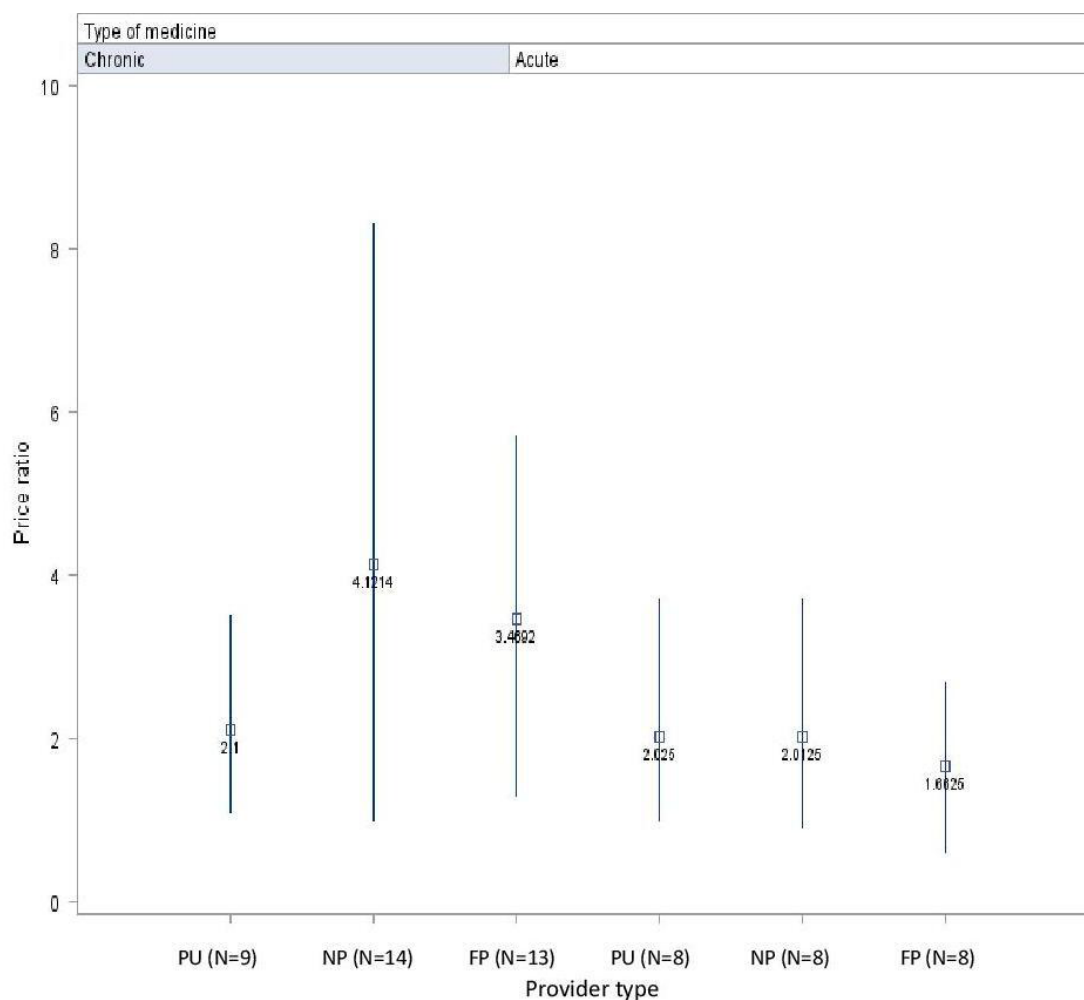


Figure 3 Mean price ratios of non-communicable disease medicines and acute disease medicines by provider type. The box indicates the mean and the bars indicate the minimum and maximum. FP, private of-profit drug outlet; N, number of medicines surveyed; NP, private non-profit facility; PU, public facility.

significantly different in public facilities (0.45 for NCD medicines and 0.54 for acute medicines), $p=0.3119$.

The median price ratio ranged from 0.6 for paracetamol syrup in private for-profit drug outlets to 8.3 for simvastatin 20 mg tablets/caps in private non-profit health facilities. There was more variability in median price ratios for NCD medicines (figure 3). The mean price ratio was 2.29 in the public sector, 3.61 in the private non-profit sector, and 2.95 in drug outlets (table 1 and figure 3). The mean price ratio of NCD medicines (2.1) was not significantly different from the mean price ratio of acute medicines (2.0) in public facilities $p=0.3517$. However, the mean price ratio of NCD medicines was significantly higher than the mean price ratio of acute medicines in non-profit facilities (4.1 vs 2.0, respectively), $p=0.0094$; and in drug outlets (3.5 vs 1.7), $p=0.0014$.

Medicine prices by level of care

Online supplementary appendix 5 presents the proportion of facilities dispensing medicines for free and the median prices of medicines by level of care. There were wide price variations across the different levels of care and

within each level of care. Even though levels 2 and 3 facilities were expected to be providing medicines for free, the proportion of level 2 facilities which gave specific medicines for free ranged from none to 42%. The proportion of level 3 facilities that provided medicines for free ranged from none to 67%. More levels 2 and 3 facilities provided medicines for free compared with level 4 facilities. There were no clear trends in price ratios by level of care.

DISCUSSION

This study has revealed important findings on the availability and price of NCD medicines in Kenya. It is the first study to report on disparities in availability of medicines by level of care within public and non-profit facilities and take into account the EML restriction on medicines with respect to level of care.

Medicines availability for NCD and acute conditions

While the availability for many EML medicines was higher than 50%, availability was far below the international target of 80% availability.^{15 48} This is concerning

Table 1 Percentage of healthcare providers dispensing medicines free of charge and median price ratios by provider type (using Management Sciences for Health supplier prices as a reference)

Medicine tablets or capsules except otherwise noted	Public facilities		Private non-profit facilities		Median price ratios		
	Number surveyed*	Percentage dispensed for free (number)	Number surveyed*	Percentage dispensed for free (number)	Public	Non-profit	Drug stores
Medicines for CVD							
Amlodipine 10 mg	2	50 (1)	12	8.3 (1)	1.3	2.7	2.7
Amlodipine 5 mg	17	17.6 (3)	16	0	2.3	6.3	5.0
Atenolol 50 mg	31	32.3 (10)	38	15.8 (6)	–	3.7	4.6
Bisoprolol 10 mg	0	–	1	0	–	3.4	–
Bisoprolol 5 mg	1	0 (0)	0	–	–	–	–
Captopril 25 mg	0	–	3	0	–	4.4	2.0
Furosemide 40 mg	41	43.9 (18)	57	12.3 (7)	1.6	3.3	3.3
Hydrochlorothiazide 50 mg	12	58.3 (7)	16	0	2.3	6.4	4.7
Ramipril 10 mg	0	–	1	0	–	–	–
Ramipril 5 mg	0	–	1	0	–	–	–
Simvastatin 20 mg	0	–	1	0	–	8.3	5.7
Valsartan 80 mg	0	–	1	0	–	–	–
Medicines for diabetes							
Glibenclamide 5 mg	34	35.3 (12)	44	11.4 (5)	3.5	5.3	5.3
Glimeperide 1 mg	0	–	1	0	–	–	–
Glimeperide 2 mg	0	–	3	0	–	–	–
Glimeperide 4 mg	0	–	3	0	–	–	–
Metformin 1000 mg	0	–	1	0	–	2.6	1.3
Metformin 500 mg	39	38.5 (15)	47	14.9 (7)	2.0	3.3	3.3
Medicines for asthma							
Salbutamol 100 MCG/DOS inhaler	24	41.7 (10)	35	14.3 (5)	1.1	1.0	1.4
Other NCD medicines							
Amitriptyline 25 mg	40	45 (18)	50	16 (8)	1.3	3.5	2.3
Omeprazole 20 mg	45	35.6 (16)	65	15.4 (10)	3.5	3.5	3.5
Acute medicines							
Amoxicillin 250 mg Dispersible tab	21	52.4 (11)	27	22.2 (6)	1.4	0.9	0.9
Amoxicillin 250 mg	41	43.9 (18)	53	18.9 (10)	1.9	1.9	1.9
Amoxicillin 500 mg	7	71.4 (5)	37	13.5 (5)	1.5	1.7	1.7
Ceftriaxone 1 g/vial Inj	40	40.0 (16)	57	12.3 (7)	2.9	3.7	1.7
Ciprofloxacin 500 mg	15	40.0 (6)	45	8.9 (4)	2.7	2.7	2.7
Co-trimoxazole 8+40 mg/mL Susp.	31	67.7 (21)	51	27.5 (14)	1.1	2.1	1.7
Diazepam 5 mg	34	44.1 (15)	51	21.6 (11)	3.7	2.1	2.1
Paracetamol 24 mg/mL Susp	44	75.0 (33)	57	24.6 (14)	1.0	1.0	0.6
Mean		43.8		8.7	2.1	3.4	2.9

Medicines on the EML (2010 or 2016) are highlighted in bold.

*Refers to the number of facilities that have the medicine in stock and which reported a price for it.

CVD, cardiovascular diseases; EML, Essential Medicines List; NCD, non-communicable disease.

in particular for NCD medicines. We found significantly lower availability of NCD medicines listed in the STGs compared with medicines for acute conditions. This is

despite the fact that one-half of total hospital admissions and over 55% of hospital deaths in Kenya are due to NCDs.⁴ The mean availability of NCD medicines included

in the STGs was two to three times lower than those found in other studies in Kenya.^{13 20 21} The low availability of some of these NCD medicines may indicate low demand, or the preference of prescribers and patients for other therapeutic options within the same classes of medicines which were not assessed in our study. Considering the high burden of NCDs globally, and the rapidly increasing burden in LMICs, efforts are needed to ensure the reliable supply of NCD medicines in health facilities at all levels in Kenya.

Our study assessed the availability of medicines specifically at levels 2, 3, 4 and 5 facilities with availability higher at higher levels of care (though the differences were not statistically significant). Among the programmatic objectives of the EML is the promotion of appropriate use of medicines. For this reason, several NCD medicines are limited to certain levels of care. Despite the limitation of NCD medicines to level 4 facilities and above, we found many of these medicines in several levels 2 and 3 facilities suggesting there is demand for NCD medicines at these lower level facilities. If the barrier to availability is the limitation of NCD medicines to level 4 facilities and above, then additional measures such as building the capacity of lower level care facilities to provide these medicines may be needed to ensure access. It is also important to note that 12 NCD medicine formulations that were not listed in the EML were available across all levels of care. Though the availability of these medicines were lower than those on the EML, it still raises the question of whether the EML is being implemented to its optimal potential in the country.

The generally low availability of originator brands, especially in the public sector is in line with international recommendations to promote the use of generic medicines to increase efficiency in medicines expenditure.^{32 49 50} Nonetheless, the limited availability of originator medicines in the public sector does not necessarily translate into higher rates of prescribing of generics. The 2012 Pharmaceutical Country Profile of Kenya indicates that prescribing by International Non-proprietary Names (INN) is neither obligatory in the public sector nor in the private sector.⁵¹ Only 32% of medicines are prescribed by INN. Thus, it is important to promote prescribing by INN to further promote the use of generic medicines.

Prices of medicines

Though it is government policy to provide medicines for free at levels 2 and 3 facilities in Kenya, our findings suggest that there is a large variation in policy adherence and each facility decided whether to charge for the medicines dispensed. Free dispensing varied across and within provider type (except for private drug outlets where no medicine was given for free), across level of care and by county. Patient knowledge of which facilities charge for medicines and which do not increases the complexity of efforts to find affordable medicines. There was no hospital at which paracetamol syrup and co-trimoxazole

suspension, medicines frequently prescribed for children, were given for free.

There were large price variations across and within provider type, level of care and county. Drug outlets and private non-profit facilities exhibited similar patterns in relation to pricing. Both types of providers charged higher prices than public facilities. Private non-profit providers were significantly less likely to offer medicines for free compared with public facilities. Additionally, the mean price ratios of NCD medicines were significantly higher than the mean price ratio of acute medicines in both private non-profit facilities and private drug outlets, though no significant differences were observed in the public sector. This may indicate relatively higher mark-ups on NCD medicines in non-profit and private drug outlets. Other studies have reported higher prices at private for-profit drug outlets.^{19 20 52} A study by Health Action International also demonstrated higher mark-ups on medicines in private non-profit providers.⁵³ The government of Kenya also charges import declaration fees on medicines which may contribute to higher prices.⁵¹ Considering the low availability of NCD medicines in public facilities, patients' best option may have been to access their medicines at private non-profit facilities and private drug outlets at higher prices. The high cost of NCD medicines has been shown to be a financial burden on households in Kenya.^{54 55}

Strengths and limitations

As mentioned earlier, this study is the first study that evaluates availability taking into consideration the level of care medicines are assigned in the EML. In addition, this study also evaluates availability separately NCD for medicines included in the EML and those included in the STGs, highlighting the differences between the two documents. The cross-sectional nature of the study does not allow us to assess trends in availability and price over time and precludes strong causal inference. While this study adds to the evidence base on the availability and prices of NCD medicines in Kenya, the findings may not be generalisable to the whole country because the study counties were not randomly selected from across the country. In addition, we evaluated availability as binary variable (yes/no) and did not count the quantity available. Furthermore, the sample of the private for-profit drug outlets was restricted to the nearest ones from public and non-profit facilities. Even though this sample is not representative of all private for-profit sector providers in each county, it allows studying the availability and prices consumers would encounter when referred from public and non-profit facilities.

CONCLUSION

We found evidence that the availability of NCD medicines in Kenya is significantly lower than the target level of 80%. Availability is poorest in the public sector, and generally highest in the private for-profit sector. Availability

increased with increasing level of care. Our findings suggest that NCD patients in Kenya do not have reliable access to NCD medicines, particularly at public health facilities. Increasing access at public facilities, particularly levels 2 and 3 facilities, should be a focus of the Kenyan government's efforts to achieve universal health coverage. Pricing policies or guidelines may be useful to streamline medicine prices in the country.

Author affiliations

¹Department of Global Health, Boston University School of Public Health, Boston, Massachusetts, USA

²Faculty of Community and Health Sciences, University of the Western Cape School of Public Health, Bellville, South Africa

³Department of Biostatistics, Boston University School of Public Health, Boston, Massachusetts, USA

⁴Programs Department, Innovations for Poverty Action, Nairobi, Kenya

Twitter John Paul Likalamu Buleti @JBuleti

Contributors PGA, PCR, ROL, MAO, JPLB and VJW participated in the conception and design of the study. These authors also participated in the development and piloting of study instruments and the supervision of data collection. PGA, PCR, ROL, MAO, JPLB, HJC and VJW contributed significantly to data analysis and writing of the manuscript and have approved of the final version submitted for publication.

Funding This study was funded by Sandoz International GmbH. The funder played no role in the study design, data collection, data analysis or the writing of the manuscript. The data generated from this study is owned by Boston and the publications of the results are not subject to control by the funding organisation (see also agreement <http://sites.bu.edu/evaluatingaccess-novartisaccess/agreements/>)

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval This research study was reviewed and approved by the Institutional Review Boards of the Boston University Medical Campus and Strathmore University in Kenya.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available in a public, open access repository. Deidentified data are publicly available and can be requested at: <http://sites.bu.edu/evaluatingaccess-novartisaccess/kenya/data/>. The terms of use of the data are also available at this website. If you have any questions about the data please contact the Department of Global Health, Boston University School of Public Health at: sphgh@bu.edu.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iD

Paul G Ashigbie <http://orcid.org/0000-0001-8221-6785>

REFERENCES

- NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in blood pressure from 1975 to 2015: a pooled analysis of 1479 population-based measurement studies with 19.1 million participants. *Lancet* 2017;389:37–55.
- Bennett JE, Stevens GA, Mathers CD, *et al*. Ncd countdown 2030: worldwide trends in non-communicable disease mortality and progress towards sustainable development goal target 3.4. *The Lancet* 2018;392:1072–88.
- WHO. *Global status report on non-communicable diseases 2010*. Geneva: World Health Organization, 2011. https://www.who.int/nmh/publications/ncd_report_full_en.pdf
- Ministry of Health, Kenyan National Bureau of Statistics, World Health Organization. Kenya stepwise survey for non-communicable diseases risk factors, 2015. Available: <http://www.health.go.ke/wp-content/uploads/2016/04/Steps-Report-NCD-2015.pdf> [Accessed 13 Nov 2016].
- World Health Organization (WHO). Non-communicable diseases country profiles [Internet], 2014. Available: http://apps.who.int/iris/bitstream/10665/128038/1/9789241507509_eng.pdf?ua=1 [Accessed 13 Nov 2016].
- International Diabetes Federation. *IDF Diabetes Atlas - Africa*. 9th Edition, 2019. https://diabetesatlas.org/upload/resources/material/20191218_144539_afr_factsheet_en.pdf
- World Health Organization. Diabetes country profiles, 2016. Kenya. Available: https://www.who.int/diabetes/country-profiles/ken_en.pdf [Accessed 26 Dec 2019].
- United Nations. Resolution adopted by the General Assembly. Political Declaration of the High-level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases, 2011. Available: https://www.who.int/nmh/events/un_ncd_summit2011/political_declaration_en.pdf [Accessed 26 Nov 2018].
- United Nations. Sustainable Development Goals - 17 Goals to transform our world. Available: <http://www.un.org/sustainabledevelopment/health/> [Accessed 7 Apr 2016].
- Ministry of Health. Kenya health policy 2014-2030 - Towards attaining the highest standard in health, 2014. Available: https://www.afidep.org/?wpfb_dl=80 [Accessed 16 Sep 2016].
- World Health Organization. Sixty-sixth World Health Assembly, Provisional agenda item 13.1. Draft comprehensive global monitoring framework and targets for the prevention and control of non-communicable diseases, 2013. Available: http://apps.who.int/gb/ebwha/pdf_files/WHA66/A66_8-en.pdf?ua=1 [Accessed 15 Oct 2013].
- World Health Organization. Non-communicable diseases global monitoring framework: Indicator definitions and specifications. Available: http://www.who.int/nmh/ncd-tools/indicators/GMF_Indicator_Definitions_Version_NOV2014.pdf [Accessed 15 Oct 2018].
- Cameron A, Roubos I, Ewen M, *et al*. Differences in the availability of medicines for chronic and acute conditions in the public and private sectors of developing countries. *Bull World Health Organ* 2011;89:412–21.
- Chow CK, Ramasundarahettige C, Hu W, *et al*. Availability and affordability of essential medicines for diabetes across high-income, middle-income, and low-income countries: a prospective epidemiological study. *Lancet Diabetes Endocrinol* 2018;6:798–808.
- Ewen M, Zweekhorst M, Regeer B, *et al*. Baseline assessment of who's target for both availability and affordability of essential medicines to treat non-communicable diseases. *PLoS One* 2017;12:e0171284.
- International Diabetes Federation. *IDF Diabetes Atlas*, 2015. Available: <http://www.diabetesatlas.org/resources/2015-atlas.html> [Accessed 13 Nov 2016].
- World Health Organization. World Health Organization - Non-communicable Diseases (NCD) Country Profiles., 2014. Available: http://www.who.int/nmh/countries/ken_en.pdf [Accessed 3 Jun 2016].
- Rockers PC, Laing RO, Ashigbie PG, *et al*. Effect of Novartis access on availability and price of non-communicable disease medicines in Kenya: a cluster-randomised controlled trial. *Lancet Glob Health* 2019;7:e492–502.
- Ministry of Health, Ministry of Public Health and Sanitation. Access to Essential Medicines in Kenya - A Health Facility Survey, 2009. Available: <http://apps.who.int/medicinedocs/documents/s18695en/s18695en.pdf> [Accessed 13 Nov 2016].
- Cepuch C. Availability of essential medicines for chronic disease vs. communicable disease in Kenya as an indicator of age-related inequities in access [Internet] [Thesis]. University of Western Cape, 2012. Available: <http://etd.uwc.ac.za/xmlui/handle/11394/3306> [Accessed 17 Nov 2016].
- Government of Kenya. *Kenya service availability and readiness assessment mapping (SARAM) report*. Nairobi Kenya: Ministry of Health, 2014. <http://apps.who.int/healthinfo/systems/datacatalog/index.php/ddibrowser/42/download/145>
- Opwora A, Waweru E, Toda M, *et al*. Implementation of patient charges at primary care facilities in Kenya: implications of low adherence to user fee policy for users and facility revenue. *Health Policy Plan* 2015;30:508–17.
- Chuma J, Musimbi J, Okungu V, *et al*. Reducing user fees for primary health care in Kenya: policy on paper or policy in practice? *Int J Equity Health* 2009;8:15.
- Barasa E, Rogo K, Mwaura N, *et al*. Kenya national Hospital insurance fund reforms: implications and lessons for universal health coverage. *Health Syst Reform* 2018;4:346–61.

- 25 Ministry of Health. *Kenya essential medicines list*. 2016 Edn. Republic of Kenya, 2016.
- 26 Ministry of Medical Services, Ministry of Public Health and Sanitation. Kenya Essential Medicines List 2010, 2010. Available: <http://apps.who.int/medicinedocs/documents/s18694en/s18694en.pdf> [Accessed 4 May 2018].
- 27 Ministry of Health. Protocol for the identification and management of hypertension in adults in primary care [Internet], 2015. Available: <http://www.jkuat.ac.ke/departments/hospital/wp-content/uploads/2015/08/Hypertension-Protocol.pdf> [Accessed 4 May 2018].
- 28 Ministry of Public Health and Sanitation. Guidelines for asthma management in Kenya, 2011. Available: <http://apps.who.int/medicinedocs/documents/s21973en/s21973en.pdf> [Accessed 4 May 2018].
- 29 Ministry of Public Health and Sanitation. National clinical guidelines for the management of diabetes mellitus, 2010. Available: <https://www.worlddiabetesfoundation.org/sites/default/files/WDF09-436%20National%20Clinical%20Guidelines%20for%20Management%20of%20Diabetes%20Mellitus%20-%20Complete.pdf> [Accessed 4 May 2018].
- 30 Ministry of Medical Services, Ministry of Public Health and Sanitation. Clinical Guidelines for the Management and Referral of Common Conditions at Levels 4-6: Hospitals. Volume III, 2009. Available: <http://apps.who.int/medicinedocs/documents/s21000en/s21000en.pdf> [Accessed 4 May 2018].
- 31 ICHA, IHME, Kenya Red Cross, MOH, Kenya. Burden of disease: generating evidence, guiding policy in Kenya, 2016. Available: http://www.healthdata.org/sites/default/files/files/policy_report/2016/PolicyReport_The%20Global-Burden-of-Disease-Generating-Evidence-Guiding-Policy-Kenya_2016.pdf
- 32 Cameron A, Laing R, World Health Rep. Cost savings of switching private sector consumption from originator brand medicines to generic equivalents, 010. Available: <http://www.who.int/entity/healthsystems/topics/financing/healthreport/35MedicineCostSavings.pdf> [Accessed 9 Jun 2017].
- 33 Vialle-Valentin CE, Serumaga B, Wagner AK, *et al*. Evidence on access to medicines for chronic diseases from household surveys in five low- and middle-income countries. *Health Policy Plan* 2015;30:1044–52.
- 34 World Health Organization, Health Action International. Measuring medicine prices, availability, affordability and price components, 2008. Available: http://www.who.int/medicines/areas/access/OMS_Medicine_prices.pdf [Accessed 18 Nov 2016].
- 35 Rockers PC, Wirtz VJ, Vian T, *et al*. Study protocol for a cluster-randomised controlled trial of an ncd access to medicines initiative: evaluation of Novartis access in Kenya. *BMJ Open* 2016;6:e013386.
- 36 Kenya National Bureau of Statistics;. 2019 Kenya population and housing census - Volume 1: Population by county and sub-county, 2019. Available: <file:///C:/Users/paulk/Downloads/VOLUME%201%20KPHC%202019.pdf> [Accessed 24 Dec 2019].
- 37 National Coordinating Agency for Population, Development, Ministry of Health, Central Bureau of Statistics, ORC Macro. Kenya service provision assessment survey 2004. Nairobi, Kenya, 2005. Available: <https://dhsprogram.com/pubs/pdf/spa8/00FrontMatter.pdf#1,%22name%22:%22FitH%22,786> [Accessed 6 May 2018].
- 38 East LA, Arudo J, Loeffler M, *et al*. Exploring the potential for advanced nursing practice role development in Kenya: a qualitative study. *BMC Nurs* 2014;13:33.
- 39 Dobility, Inc. SurveyCTO [Technology for digital data collection], 2017. Available: <http://www.surveyccto.com>
- 40 SAS Institute Inc. *SAS/STAT software*. Cary, NC USA, 2002. <https://www.sas.com/>
- 41 Ministry of Medical Services and Ministry of Public Health & Sanitation. Kenya Essential Medicines List 2010, 2010. Available: <http://apps.who.int/medicinedocs/documents/s18694en/s18694en.pdf> [Accessed 1 Dec 2017].
- 42 Ministry of Public Health and Sanitation. *Guidelines for asthma management in Kenya*. Ministry of Public Health and Sanitation:Division of Leprosy, Tuberculosis and Lung Disease, 2011. <http://apps.who.int/medicinedocs/documents/s21973en/s21973en.pdf>
- 43 Ministry of Public Health and Sanitation. National Clinical Guidelines for Managing Diabetes Mellitus, 2010. Available: <https://www.worlddiabetesfoundation.org/sites/default/files/WDF09-436%20National%20Clinical%20Guidelines%20for%20Management%20of%20Diabetes%20Mellitus%20-%20Complete.pdf> [Accessed 11 Mar 2018].
- 44 Ministry of Health Kenya. *Protocol for the identification and management of hypertension in adults in primary care*. Ministry of Health Kenya:Healthy Heart Africa, 2015. <http://www.jkuat.ac.ke/departments/hospital/wp-content/uploads/2015/08/Hypertension-Protocol.pdf>
- 45 Ministry of Medical Services, Ministry of Public Health and Sanitation. *Clinical guidelines for the management and referral of common conditions at levels 2-3: primary care*. Volume II. Ministry of Medical Services and Ministry of Public Health and Sanitation, 2009. <http://chs.uonbi.ac.ke/sites/default/files/chs/chs/Clinical%20Guidelines%20Vol%20II%20Final.pdf>
- 46 MSH (Management Sciences for Health). *International medical products price guide, 2015 edition (updated annually)*. Medford, 2016. <http://mshpriceguide.org/wp-content/uploads/2017/04/MSH-2015-International-Medical-Products-Price-Guide.pdf>
- 47 US Inflation Calculator. Historical Inflation Rates. Coin News Media Group LLC (Coin News), 2008. Available: <https://www.usinflationcalculator.com/inflation/historical-inflation-rates/> [Accessed 2 May 2019].
- 48 World Health Organization. Global action plan for the prevention and control of non-communicable diseases: 2013–2020, 2013. Available: http://apps.who.int/iris/bitstream/10665/94384/1/9789241506236_eng.pdf [Accessed 10 Mar 2018].
- 49 Sun J, Ren L, Wirtz V. How much could be saved in Chinese hospitals in procurement of anti-hypertensives and anti-diabetics? *J Med Econ* 2016;19:881–8.
- 50 Holmes CB, Coggin W, Jamieson D, *et al*. Use of generic antiretroviral agents and cost savings in PEPFAR treatment programs. *JAMA* 2010;304:313–20.
- 51 Pharmaceutical Country Profile - Kenya. Ministry of medical services; who, 2010. Available: http://www.who.int/medicines/areas/coordination/kenya_pharmaceuticalprofile_december2010.pdf [Accessed 9 Jun 2017].
- 52 Gelder S, Ewen M, Noguchi N. Price, availability and affordability: an international comparison of chronic disease medicines - Background report prepared for the WHO Planning Meeting on the Global Initiative for Treatment of Chronic Diseases held in Cairo in December 2005, 2006. Available: <https://apps.who.int/iris/bitstream/handle/10665/116493/dsa560.pdf?sequence=1&isAllowed=y> [Accessed 9 Jun 2017].
- 53 Ewen DM. Prices and availability of locally produced and imported medicines in Kenya - Survey report, Health Action International, 2018. Available: <http://haiweb.org/wp-content/uploads/2018/07/Locally-Produced-and-Imported-Medicines-in-Kenya.pdf> [Accessed Jul 2018].
- 54 Ongarora D, Karumbi J, Minnaard W, *et al*. Medicine prices, availability, and affordability in private health facilities in low-income settlements in Nairobi County, Kenya. *Pharmacy* 2019;7. doi:10.3390/pharmacy7020040. [Epub ahead of print: 24 Apr 2019].
- 55 Onyango MA, Vian T, Hirsch I, *et al*. Perceptions of Kenyan adults on access to medicines for non-communicable diseases: a qualitative study. *PLoS One* 2018;13:e0201917.