Evidence on access to medicines for chronic diseases from household surveys in five low- and middle-income countries

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The 2011 United Nations (UN) General Assembly Political Declaration on Prevention and Control of Non-Communicable Diseases (NCDs) brought NCDs to the global health agenda. Essential medicines are central to treating chronic diseases such as hypertension and diabetes. Our study aimed to quantify access to essential medicines for people with chronic conditions in five low- and middle-income countries and to evaluate how household socioeconomic status and perceptions about medicines availability and affordability influence access. We analysed data for 1867 individuals with chronic diseases from national surveys (Ghana, Jordan, Kenya, Philippines and Uganda) conducted in 2007–10 using a standard World Health Organization (WHO) methodology to measure medicines access and use. We defined individuals as having access to medicines if they reported regularly taking medicine for a diagnosed chronic disease and data collectors found a medicine indicated for that disease in their homes. We used logistic regression models accounting for the clustered survey design to investigate determinants of keeping medicines at home and predictors of access to medicines for chronic diseases. Less than half of individuals previously diagnosed with a chronic disease had access to medicines for their condition in every country, from 16% in Uganda to 49% in Jordan. Other than reporting a chronic disease, higher household socioeconomic level was the most significant predictor of having any medicines available at home. The likelihood of having access to medicines for chronic diseases was higher for those with medicines insurance coverage [highest adjusted odds ratio (OR) 3.12 (95% confidence intervals (CI): 1.38, 7.07)] and lower for those with past history of borrowing money to pay for medicines [lowest adjusted OR 0.56 (95% CI: 0.34, 0.92)]. Our study documents poor access to essential medicines for chronic conditions in five resource-constrained settings. It highlights the importance of financial risk protection and consumer education about generic medicines in global efforts towards improving treatment of chronic diseases.

Keywords   Access to medicines, household surveys, non-communicable diseases, medicines insurance coverage, resource-constrained settings

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KEY MESSAGES

- Five national surveys from low- and middle-income countries showed very low access to essential medicines for chronic conditions.

- The likelihood of having access to medicines for chronic diseases was higher for those with medicines insurance coverage and lower for those with past history of borrowing money to pay for medicines.

Introduction

The negative impact of non-communicable diseases (NCD) on human development in poor regions of the world has long been overshadowed by the global fight against HIV/AIDS, malaria and tuberculosis (Di Cesare *et al.* 2013). However, in part because of their socioeconomic determinants, NCDs continue to have disastrous effects in low- and middle-income countries (LMICs). Over three-quarters of annual deaths attributable to NCDs occur in LMICs. Furthermore, age-standardized death rates of most NCDs are higher in LMICs than in high-income countries (Murray *et al.* 2012).

The 2011 United Nations high-level meeting on prevention and control of NCDs brought the issue to the forefront of global health discussions and led to specific recommendations encouraging the use of existing knowledge and proven therapies to treat NCDs more effectively in LMICs (Ki-Moon 2014). Essential medicines are a major component of treating most prevalent NCDs such as cardiovascular diseases and diabetes (Hogerzeil *et al.* 2013). Obstacles to accessing medicines exist at many places in the healthcare systems (Atun *et al.* 2013).

A conceptual framework addressing the complex network of barriers to medicines access from a health system perspective has been recently developed (Bigdeli *et al.* 2013). Demand-side barriers related to affordability, perceptions and sociocultural characteristics of individuals and communities are a key component of this framework. These barriers can be directly measured with household surveys (Wagner *et al.* 2011). We analysed existing data from household surveys developed by the World Health Organization (WHO) to quantify medicines access by individuals with chronic diseases and to investigate how socioeconomic status, behavioural factors and perceptions about medicines availability and affordability influence access to essential medicines for NCDs in five countries with different healthcare systems and pharmaceutical sector profiles (Table 1).

Materials and methods

Survey methodology and data collection

The WHO methodology to measure medicines access and use with standardized rapid cluster sample household surveys has been previously described (Vialle-Valentin *et al.* 2012). Trained enumerators use preset criteria to identify the most knowledgeable person about the health of household members and their use of medicines. This person answers a structured questionnaire about household composition, illnesses and experiences in seeking healthcare and obtaining medicines for every sick household member, and perceptions about medicines availability and affordability.

The presence of a diagnosed chronic disease was assessed in all surveys by the same question: 'Has anyone in this household ever been told by a doctor or other healthcare provider that they have a chronic disease? A chronic disease is an illness that will not go away or takes a long time to go away, even when treated.' If the answer was yes, the respondent was asked to identify the chronic disease(s) from the following list of diseases read by the enumerator: 'hypertension/high blood pressure, heart disease/heart attack consequence, diabetes/high blood sugar, asthma/wheezing/chronic difficulty breathing, HIV infection/AIDS, arthritis/chronic body pain, epilepsy/seizures/fits, chronic stomach pain, stroke consequence, high cholesterol, cancer, tuberculosis, liver disease, depression and other.'

For every individual with a chronic condition, enumerators recorded the diagnosis, which medicines were prescribed, their monthly cost, whether or not medicines costs were covered by health insurance, and adherence to treatment. In addition, they recorded the name and source of all medicines found at home. The authors coded all medicines recorded by enumerators into therapeutic classes using the WHO 15th Model Essential Medicines List (EML) classification in effect at the time of the surveys (World Health Organization 2014).

We analysed five surveys from LMICs (Table 1). Data collection took place in May–June 2008 (Ghana), July–August 2008 (Uganda), September–October 2008 (Kenya), April–June 2009 (Philippines) and March–April 2010 (Jordan). The open source software EpiData Entry v·2·0 (The EpiData Association, Denmark) was used for data entry.

Study variables

This study reports results on three main outcome variables. Reporting a chronic disease in the household was used to assess need for care and to control for access to diagnostic services. Having any medicines present in the home at the time of the survey was used as a measure of basic household access to medicines. Our primary outcome measure of access to appropriate medicines was the presence in the home at the time of the survey of one or more medicines in the therapeutic category needed to treat the reported chronic disease.

Predictor variables included gender and age of every household member with chronic disease. The socioeconomic profile of households was assessed according to the level of education of the respondent and self-reported monthly expenditure quintile; expenditure quintile boundaries were calculated from the most recent national household economic survey adjusted for household size. Geographic access to sources of care was measured as reported presence of specific types of healthcare provider (public hospital or health center, private or mission hospital or health provider, private pharmacy or drug retail outlet) within 15 min travelling distance; households in capital cities

Table 1. Selected socioeconomic, demographic and pharmaceutical country indicators

Country	Ghana	Kenya	Uganda	Jordan	Philippines
World Bank Income Category	Low	Low	Low	Middle	Middle
World Bank 2008 gross domestic product (GDP) per capita ($US current exchange rate)	1234	786	454	3797	1921
Population living with less than $1.25 a day[a] (% of total population)	30%	20%	52%	1%	23%
Population (millions)	23.83	38.76	31.78	5.98	91.98
Population > 60 years (% of total population)	6%	4%	5%	5%	7%
Age standardized mortality rate by NCDs (per 100 000 population)	699	729	786	711	599
Age standardized mortality rate by cardiovascular diseases (per 100 000 population)	343	344	369	433	320
Health expenditures (% gross domestic product)	7.9%	4.5%	7.6%	8.6%	3.8%
Number of physicians (per 10 000 population)	1.11	1.36	1.14	26.5	10.2
Pharmaceutical expenditures (% gross domestic product)	n/a	1.7%	n/a	3.1%	n/a
Number of licensed pharmaceutical manufacturers	34	45	14	16	61
Number of registered pharmaceutical products	2488	13 000	7792	7700	26 775
Active national monitoring system of medicines retail prices	No	Yes	No	Yes	Yes
Population covered by national or social sickness funds (% of total population)	66%	22%	n/a	75%	38%
Medicines are free for elderly who cannot afford them	Yes	Yes	Yes	Yes	Yes
NCD medicines are free for those who cannot afford them	Yes	No	Yes	Yes	Yes
Population covered by private health insurance (% of total population)	n/a	1%	n/a	8%	n/a

WHO 2011 Pharmaceutical Sector Country Profiles (World Health Organization 2011).
[a]Adjusted for international Purchasing Power Parity.

were coded separately on this measure since all types of providers tend to be highly prevalent in large urban areas.

The surveys also measured the household respondent's agreement with several statements related to domains that could limit medicines access: perceived healthcare and medicines affordability; previous borrowing to pay for medicines; availability of free medicines in the public sector; ability to obtain credit to pay for medicines in private retail outlets; perceived quality, convenience and availability of medicines in public and private outlets; knowledge about generics and price differences between similar medicines; and asking for least expensive products when purchasing.

Analysis

Anonymized country survey datasets were imported into StataSE V·11·2 (StataCorp, USA). All analyses were performed with the Stata survey logistic regression commands that account for clustered sample design. We included in our final models all potential predictor variables that exhibited a bivariate association ($P < 0·10$) with the access to medicines variable in any of the five country survey analyses.

After describing household characteristics, we explored the determinants of reporting a chronic disease in the household in a multivariate model with relevant household-related (household size, socioeconomic status and geographic location) and patient-related (gender, age) variables. We then investigated determinants of having any medicines present in the home in a multivariate model that included potential predictors collected in the surveys (household size, reported illnesses, socioeconomic status, proximity to healthcare facilities, respondent opinions on medicines availability and affordability).

Our primary analysis focused on individuals reported to have one or more diagnosed chronic diseases. A household member

was classified as having access to medicines for chronic diseases when the following criteria were met: (1) the respondent reported that the person in question had a chronic disease, was prescribed at least one medicine in the therapeutic class appropriate for that disease, and took the medicine as recommended; and (2) enumerators found a medicine of the same therapeutic class in the household. For instance, a household member reported to have diabetes was counted as having access to medicines if (s)he was prescribed a product coded as an antidiabetic agent, reported taking it regularly, and a product coded as an antidiabetic was found at home.

Results

Characteristics of sampled households and individuals with chronic disease(s)

About 1000 households were surveyed in each country (Supplementary Tables S1, S2). The proportions of households reporting chronic diseases were higher in surveys from middle-income countries (Jordan 47%, Philippines 39%) than from low-income countries in Africa (Ghana 16%, Kenya 26% and Uganda 29%). Similar patterns were seen in the proportions of households with older members (Jordan 27%, Philippines 22%; Ghana 19%, Kenya 14% and Uganda 13%) and the proportions of households having any medicines present during the survey (Jordan 91%, Philippines 67%; Ghana 52%, Kenya 51% and Uganda 42%).

Both level of education and distribution of expenditure quintiles differed sharply between surveys from middle- and low-income countries. The proportions of households reporting education above the secondary level and in the top quintile of monthly expenditures were highest in the Jordan

Table 2 Characteristics of individuals with chronic disease(s)

	Ghana	Kenya	Uganda	Jordan	Philippines
Individuals in sampled households (N)	5323	5837	5891	5603	5288
Individuals with chronic disease(s) (N)	165	313	321	583	485
Proportion estimates (95% confidence intervals)					
Female	65% (56–72%)	54% (49–59%)	58% (52–64%)	47% (44–51%)	52% (48–55%)
Age					
Under 40	24% (18–32%)	49% (42–55%)	50% (44–56%)	16% (13–20%)	27% (22–32%)
40–60	43% (35–51%)	38% (31–44%)	34% (29–40%)	49% (44–53%)	45% (41%–50%)
Over 60	33% (25–42%)	14% (11–18%)	16% (12–21%)	35% (31–40%)	28% (23–33%)
Diagnosed with					
Hypertension	46% (38–53%)	19% (14–25%)	27% (22–33%)	52% (47–57%)	50% (44–56%)
Diabetes	17% (12–24%)	12% (8–16%)	8% (5–12%)	39% (35–44%)	16% (11–22%)
Hypercholesterolemia	0% (0–0%)	1% (0–3%)	0% (0–0%)	17% (14–21%)	12% (9–16%)
Chronic heart disease	4% (1–9%)	3% (1–6%)	4% (2–7%)	15% (12–18%)	9% (6–12%)
Asthma	10% (7–15%)	20% (15–25%)	13% (10–17%)	7% (5–10%)	18% (15–22%)
Arthritis	10% (6–17%)	13% (9–17%)	9% (6–13%)	17% (14–20%)	17% (13–22%)
Chronic gastric pain	5% (3–11%)	14% (11–19%)	33% (28–38%)	9% (7–12%)	7% (5–11%)
More than one chronic disease	16% (11–24%)	15% (11–20%)	19% (15–24%)	44% (40–48%)	32% (27–38%)
Medicines access					
Had medicine(s) at home	79% (70–86%)	73% (66–79%)	56% (48–64%)	94% (91–96%)	80% (73–85%)
Reported at least partial medicines coverage	46% (38–54%)	4% (2–7%)	2% (1–5%)	72% (67–76%)	10% (7–14%)
Obtained all recommended medicines free-of-charge	12% (7–20%)	18% (13–26%)	22% (17–29%)	43% (38–49%)	6% (4–9%)
Accessed medicines to treat chronic disease[a]	35% (26–45%)	33% (27–40%)	16% (12–22%)	49% (43–54%)	38% (31–44%)

[a]Household respondent named medicines prescribed to the sick member to treat the disease and taken regularly. In addition, enumerators found a medicine of the same category in the household.

survey (97 and 20%, respectively) and lowest in the Uganda survey (43 and 4%, respectively). In addition, variations in geographic access to care were evident, from 5% of sampled households having no healthcare facility within 15 minutes of travelling distance in Jordan to 35% in Uganda.

As shown in Table 2, the proportions of individuals reported as having chronic disease(s) was highest in Jordan: 583/5603 household members (10·4%) and lowest in Ghana: 165/5323 household members (3·1%). Except in Jordan, women were more afflicted: 65% in Ghana, 58% in Uganda, 54% in Kenya, 52% in Philippines and 47% in Jordan. The proportion of individuals with more than one chronic disease was highest in Jordan (44%) and lowest in Kenya (15%). Disease distribution among those with a chronic condition differed markedly across surveys as shown by the proportions of individuals with hypertension (from 52% in Jordan to 19% in Kenya) or diabetes (from 39% in Jordan to 8% in Uganda). The proportion of individuals with a chronic disease reporting at least partial insurance coverage of their medicines costs was highest in Jordan (72%) and Ghana (46%) whereas it was almost nil in Kenya (4%) and Uganda (2%).

Close to half of the individuals with chronic diseases had access to medicines indicated for their condition in Jordan (49%). This proportion was lower in the Philippines (38%), Ghana (35%) and Kenya (33%). In Uganda, fewer than 2 out of 10 individuals with a chronic condition had access to medicines for their chronic disease (16%).

Access to diagnostic services for chronic conditions

The odds of being recognized as having a chronic disease increased significantly with age across surveys (Figure 1). In addition, men were significantly less likely to be acknowledged as having a chronic disease in Ghana [odds ratio: 0·56, 95% confidence intervals (0·36–0·87), $P < 0.05$], Kenya [0·80, (0·66–0·98), $P < 0.05$], and in Uganda [0·68, (0·52–0·87), $P < 0.01$] whereas no gender difference was apparent in the non-African surveys. The odds of being recognized with a chronic disease did not depend on the household socioeconomic status, except in the Kenya survey where poor households appeared less likely to report chronic diseases [0·68, (0·47–0·99), $P < 0.05$]. In Uganda, living in the capital city increased the likelihood of being diagnosed with a chronic disease [2·35, (1·70–3·24), $P < 0.001$] while belonging to a larger household had a statistically significant negative effect [0·94, (0·91–0·98), $P < 0.01$].

Keeping medicines at home

We hypothesized that keeping medicines at home depends on the household medical needs, but also on the socioeconomic level of households, the availability of medicines in the community, and the opinions about medicines availability and affordability of the person responsible for the health of household members. Table 3 shows that the most significant predictors of having medicines at home across countries were related to the medical needs of members and socioeconomic
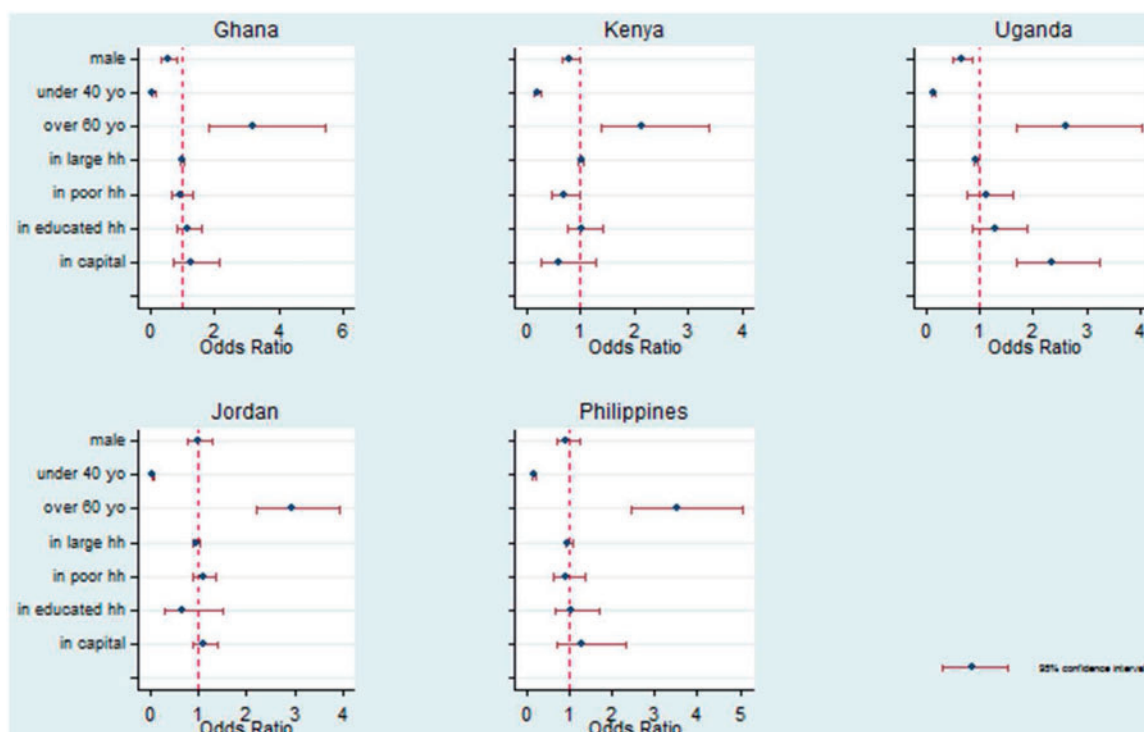
Figure 1 Predictors associated with having a reported chronic disease

level of households. Reporting a chronic disease was the most significant predictor, ranging from [2·06 (1·31–3·22), $P < 0.01$] in Uganda to [4·51 (2·93–6·93), $P < 0.001$] in Ghana, followed by reporting a recent acute illness. In all surveys, poverty was associated with decreased odds ranging from [0·46 (0.34–0.62), $P < 0.001$] in Kenya to [0·92 (0.67–1.25), not significant (ns)] in Uganda, while higher levels of education were associated with increased odds in four countries, ranging from [1.22, (0.87–1.71), ns] in Ghana to [1·93 (1·46–2·54), $P < 0.001$] in Uganda. With regards to respondent's opinions, being familiar with the word ''generic'' increased the odds of having medicines at home in four surveys, ranging from [1.29 (0.53–3.14), ns] in Uganda to [2.41 (1.30–4.47), $P < 0.01$] in the Philippines. Having a positive opinion about medicines availability in public facilities had a statistically significant negative association with keeping medicines at home in Kenya [0.63 (0.43–0.92), $P < 0.05$] and Uganda [0.64 (0.46–0.88), $P < 0.01$]. Other predictive effects were less pronounced and varied across surveys.

Determinants of access to medicines for chronic diseases

Determinants of access to medicines for chronic diseases are presented in Table 4. Even though results varied across surveys, common patterns emerged. In particular, risk protection in the form of reported insurance coverage of medicines costs increased the likelihood of having access to medicines, ranging from [1.32, (0.69–2.55), ns] in Jordan to [3.12 (1.38–7.07), $P < 0.01$] in the Philippines. Obtaining medicines free-of-charge also increased the likelihood of access in four countries, ranging from [1.18 (0.33, 4.23), ns] in Ghana to [3.49 (2.14–5.69),

$P < 0.001$] in Kenya. Factors that tended to decrease the odds of access to medicines for chronic diseases were: household poverty ranging from [0.35 (0.21–0.58), $P < 0.001$] in Kenya to [0.70 (0.39–1.26), ns] in Uganda; a history of borrowing money to pay for medicines ranging from [0.56, (0.34–0.92), $P < 0.05$] in the Philippines to [0.92, (0.28–3.00), ns] in Ghana; younger age ranging from [0.27 (0.09–0.80), $P < 0.05$] in Ghana to [0.70 (0.36–1.34), ns] in Uganda; and belonging to larger households ranging from [0.86 (0·78–0.94), $P < 0.01$] in Jordan to [1.03 (0.95–1.11), ns] in Uganda.

Discussion

LMIC health system policymakers need information about existing obstacles to community access to medicines for chronic conditions, information that is sorely lacking (Heneghan et al. 2013). In each of the five WHO national surveys carried out to evaluate access to medicines, we found that less than half of individuals diagnosed with a chronic disease and reported to be taking a prescribed medicine, actually had a medicine for that disease available at home. In Uganda, this proportion was below 2 in 10 individuals. To our knowledge, this study is the first to provide direct evidence about the widespread lack of access to medicines for chronic conditions in resource-limited settings, complementing and reinforcing indirect evidence about the lack of availability and affordability of medicines for chronic diseases in public and private healthcare facilities of LMICs (Cameron et al. 2009; Kotwani 2010; Cameron et al. 2011).

Table 3 Multivariate determinants of having medicines at home

	Ghana	Kenya	Uganda	Jordan	Philippines
Reporting chronic disease(s)	4.51*** [2.93, 6.93]	3.82*** [2.54, 5.73]	2.06** [1.31, 3.22]	2.48** [1.27, 4.82]	3.93*** [2.32, 6.65]
Reporting acute illness(s) in past 2 weeks	2.44*** [1.60, 3.72]	3.13*** [2.39, 4.09]	1.33* [1.01, 1.75]	1.2 [0.62, 2.32]	1.37 [0.85, 2.20]
Poor[a]	0.75* [0.57, 0.97]	0.46*** [0.34, 0.62]	0.92 [0.67, 1.25]	0.56* [0.32, 0.99]	0.89 [0.63, 1.26]
Highest education in household above secondary	1.22 [0.87, 1.71]	1.52* [1.08, 2.15]	1.93*** [1.46, 2.54]	1.41 [0.27, 7.42]	1.03 [0.52, 2.02]
In capital city	1.11 [0.62, 1.99]	0.65 [0.37, 1.14]	1.45 [0.88, 2.39]	1.90* [1.13, 3.19]	0.47 [0.17, 1.31]
No public or private health care facility within 15min travelling distance	0.79 [0.55, 1.15]	0.43* [0.19, 0.99]	0.76 [0.54, 1.08]	1.26 [0.45, 3.51]	0.9 [0.33, 2.50]
Had to borrow money or sell things in the past to pay for medicines	1.33 [0.87, 2.02]	0.72* [0.53, 0.97]	0.93 [0.69, 1.24]	0.98 [0.60, 1.61]	0.61[+] [0.37, 1.01]
Can usually afford to buy medicines that are needed	1.09 [0.77, 1.56]	0.79 [0.55,1,14]	1.51* [1.09, 2.10]	1.88* [1.17, 3.02]	0.88 [0.57, 1.35]
Can obtain credit for medicines at the local private pharmacy, if need be	1.39 [0.88, 2.19]	1.09 [0.73,1.62]	0.80[+] [0.63, 1.02]	0.86 [0.47, 1.55]	0.61 [0.33, 1.12]
Can obtain medicines free-of-charge at the local public health facility	1.39 [0.91, 2.12]	1.12 [0.78, 1.61]	1.06 [0.66, 1.70]	0.86 [0.53, 1.40]	0.98 [0.68, 1.41]
Asks for the least expensive product when buying a medicine	1.09 [0.71, 1.67]	1.18 [0.82, 1.68]	0.95 [0.73, 1.24]	1.36 [0.69, 2.66]	0.60* [0.38, 0.95]
Would obtain prescribed medicines if insurance reimbursed part of cost	1.05 [0.65, 1.67]	0.98 [0.75, 1.29]	1.53[+] [0.98, 2.39]	0.65 [0.30, 1.39]	1.43 [0.91, 2.22]
Positive opinion about medicines availability at public healthcare facility	0.94 [0.70, 1.28]	0.63* [0.43, 0.92]	0.64** [0.46, 0.88]	0.7 [0.41, 1.21]	0.92 [0.60, 1.42]
Positive opinion about medicines availability at private pharmacy	1.01 [0.69, 1.49]	1.16 [0.84, 1.59]	1.09 [0.73, 1.64]	1.18 [0.55, 2.55]	0.94 [0.65, 1.36]
Heard the word 'generic' before to describe a medicine	2.39* [1.15, 4.97]	1.50* [0.96, 2.35]	1.29 [0.53, 3.14]	0.97 [0.50, 1.92]	2.41** [1.30, 4.47]

Exponentiated coefficients; 95% confidence intervals in brackets.
[a]From households in the two lowest pre-defined country-specific expenditure quintiles based on data from recent national household surveys reporting per capita gross national income or consumption.
[+] P < 0.10, *P < 0.05, **P < 0.01, ***P < 0.001.

Table 4 Multivariate determinants of access to medicines for individuals reporting a chronic disease

	Ghana	Kenya	Uganda	Jordan	Philippines
Male	0.75 [0.29, 1.94]	1.18 [0.80, 1.73]	0.95 [0.52, 1.74]	0.66[+] [0.43, 1.03]	1.01 [0.59, 1.71]
Under 40 years old	0.27[+] [0.09, 0.80]	0.52* [0.28, 0.98]	0.7 [0.36, 1.34]	0.37** [0.18, 0.75]	0.66[+] [0.43, 1.02]
Over 60 years old	2.22 [0.70, 7.08]	0.57 [0.22, 1.43]	1.66 [0.63, 4.39]	0.87 [0.55, 1.37]	1.03 [0.56, 1.91]
In large household[a]	0.90[+] [0.79, 1.02]	0.92* [0.85, 1.00]	1.03 [0.95, 1.11]	0.86** [0.78, 0.94]	0.96 [0.82, 1.13]
In poor household	0.6 [0.21, 1.70]	0.35*** [0.21, 0.58]	0.7 [0.39, 1.26]	1.88* [1.09, 3.24]	0.73 [0.43, 1.24]
In household with highest education above secondary	1.01 [0.37, 2.75]	0.81 [0.41, 1.59]	2.14[+] [0.99, 4.63]	2.45[+] [0.90, 6.69]	1.11 [0.33, 3.68]
Living in capital	1.12 [0.21, 6.08]	1.44 [0.48, 4.35]	0.18** [0.06, 0.50]	4.23*** [2.28, 7.86]	0.62[+] [0.35, 1.10]
Living within 15min from public healthcare facility	0.53 [0.19, 1.49]	0.96 [0.42, 2.20]	2.23* [1.11, 4.48]	0.8 [0.41, 1.56]	1.38 [0.70, 2.75]
At least partial medicines coverage	2.59[+] [0.89, 7.56]	2.19 [0.55, 8.69]	3.17 [0.29, 34.96]	1.32 [0.69, 2.55]	3.12** [1.38, 7.07]
All medicines obtained free-of-charge	1.18 [0.33, 4.23]	3.49*** [2.14, 5.69]	3.19* [1.33, 7.65]	1.19 [0.61, 2.32]	0.45 [0.14, 1.46]
Had to borrow money or sell things in the past to pay for medicines	0.92 [0.28, 3.00]	0.89 [0.43, 1.84]	0.9 [0.45, 1.80]	0.76 [0.49, 1.18]	0.56* [0.34, 0.92]
Can usually afford to buy medicines that are needed	3.61** [1.49, 8.75]	1.04 [0.50, 2.16]	1.12 [0.49, 2.52]	1.28 [0.73, 2.25]	0.91 [0.50, 1.68]
Would obtain prescribed medicines if insurance reimbursed part of cost	2.24 [0.78, 6.38]	1.35 [0.79, 2.31]	2.09[+] [0.95, 4.59]	0.7 [0.35, 1.40]	0.62* [0.38, 0.99]
Positive opinion about medicines availability at local private pharmacy	2.30* [1.04, 5.10]	0.83 [0.39, 1.78]	0.9 [0.51, 1.59]	1.3 [0.69, 2.48]	0.85 [0.49, 1.46]

Exponentiated coefficients; 95% confidence intervals in brackets.
[a]Household with nine plus members.
[+] P < 0.10, *P < 0.05, **P < 0.01, ***P < 0.001.

We observed large variations in the proportion of individuals with chronic disease(s) between surveys from LMICs. These differences are unlikely to be related to differences in the incidence of chronic diseases given similar proportions of elderly individuals and similar age standardized mortality rates for NCDs in the survey countries (Lozano *et al.* 2012). Lower proportions of reported chronic conditions in the African surveys may reflect higher barriers to accessing care and differences in the structure and efficiency of health care delivery systems (Ensor and Cooper 2004; Sachs 2012). In addition, chronic diseases were more likely to be reported in women than men in the three surveys from low-income countries, an observation consistent with previous reports suggesting that in resource-constrained settings, women may carry an advantage in accessing care by the nature of their reproductive health needs and their predominant caregiver role in the family (Wagner *et al.* 2013; Rilkoff *et al.* 2013).

The presence of medicines in households was strongly associated with reporting one or more chronic conditions. Reporting chronic diseases and having medicines at home may be proxy measures for access to medical care in a given setting. Indeed, the presence of medicines at home was linked to the socioeconomic status of households, i.e. poor and less educated households were less likely to keep any kind of medicine at home. We also found that respondents who were aware of the existence of generic medicines were more likely to keep medicines at home, as did those who had a negative opinion about medicines availability in public healthcare facilities. These observations may corroborate previous reports suggesting that knowledge and perceptions about diseases, health services, and medicines influence consumer behaviour in resource-constrained settings (Patel *et al.* 2012). They also underline the value of consumer surveys to evaluate and monitor acceptability, a key dimension of access to both health services and medicines (Thiede *et al.* 2007).

The presence of medicines at home does not necessarily mean that sick household members have access to appropriate medicines. That is why our definition of access was 2-fold: medicines indicated for the disease were reported as prescribed and taken, *and* their presence at home was verified by enumerators. Using this definition, our study underscores the economic dimension of access to medicines: a history of borrowing money to buy medicines decreased the likelihood of accessing medicines for chronic diseases whereas having insurance that covered some or all medicines costs increased access in each survey. Confidence intervals are wide because each survey's insured population with chronic disease was small. Nevertheless, our results provide important insight in the context of each country. At the time of the surveys, national health insurance programmes existed in Jordan and Ghana, covering, respectively, 75 and 66% of the total population, and providing free medicines to the poor. The positive association of poverty with medicines access in the Jordanian survey suggests that universal health coverage policies may have had a positive impact on equity in access to medicines in that country. In contrast, access to medicines for chronic diseases in Ghana was associated with belonging to a richer household and with positive opinions about the availability of medicines in the private sector; these results may suggest that in 2008 the rich had better financial and geographic access to medicines than the poor, supporting earlier evidence that the national health insurance

programme in Ghana favoured wealthier people at that time (Mills *et al.* 2012). Taken together, our findings illustrate that financial risk protection does not necessarily facilitate access to medicines for the poor (Evans *et al.* 2013; Kutzin 2013).

Our study also shows that consumer opinions about medicines do matter in resource-constrained settings, supporting arguments to promote more active participation of the population in order to improve access to medicines (Bigdeli *et al.* 2013; Van Olmen *et al.* 2011). In poor countries, consumer education on lifestyles that prevent NCDs and on the importance of adherence to treatments ought to be components of campaigns to improve use of medicines for chronic diseases, as well as promoting the use of quality generics, curbing unaffordable prices, and changing inappropriate prescribing by providers (James *et al.* 2009).

Finally, our study provides direct evidence about the lack of access to essential medicines to treat chronic diseases in several resource-constrained settings at a time when the international community coalesces to address the global epidemic of NCDs (Alleyne *et al.* 2013). It supports calls from the World Health Assembly to endorse the 2011 UN General Assembly Political Declaration on the Prevention and Control of NCDs to expand access to essential medicines for NCDs (World Health Assembly 2013). In some ways, the situation described by our findings evokes the early stages of the global HIV/AIDS epidemic, when very few infected patients had access to treatment. Countries used international aid to expand access to antiretroviral medicines, especially among the poor, and in the process strengthened pharmaceutical sectors (Embrey *et al.* 2009). Countries may be able to expand access to essential medicines for chronic diseases by building upon these efforts and by developing more equitable risk protection schemes.

Our study has significant limitations pertaining to the survey methodology that have been described in detail elsewhere (Vialle-Valentin *et al.* 2012). The WHO indicator survey methodology uses a small sample size and streamlines the data collection process to make it affordable in poor settings. As a result, remote areas may be under-represented, and variance underestimated. Of particular relevance here, even though enumerators are trained to follow strict criteria and interview the most knowledgeable person about the health of household members, the respondent may not be the person with the chronic disease. In addition, the questionnaire does not collect enough information to allow investigating access to healthcare and insurance coverage at the household level: e.g. we could not evaluate if and how household access to healthcare services and access to health insurance impact having medicines at home. In addition, enumerators did not collect data on the quality of the medicines they found and our analyses could not take into account medicines quality, a component of access that is particularly crucial in LMICs where medicines of substandard quality are a common finding (Twagirumukiza *et al.* 2009).

Conclusion

This article presents data on access to medicines for chronic diseases from five LMICs against which future progress can be measured.

Supplementary Data

Supplementary data are available at *HEAPOL* online.

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