

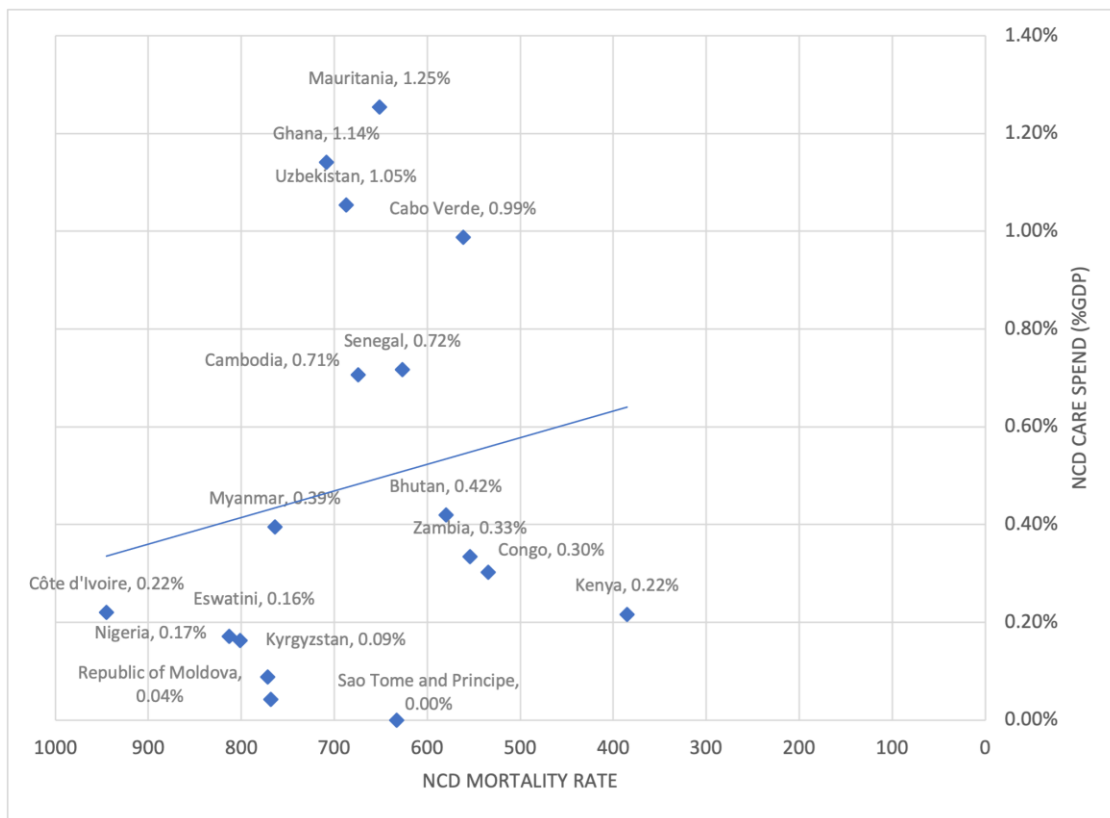
## Market demand for non-communicable disease drugs and diagnostics: availability and affordability gaps in lower middle-income countries

### Introduction

Seven in 10 people worldwide die every year from non-communicable diseases (NCDs) such as cardiovascular diseases, cancer, diabetes and chronic lung diseases. This amounts to an average of 41 million people annually and includes 15 million people who die from NCDs between the ages of 30 and 69 years. More than 85 percent of these “premature” deaths occur in low- and middle-income countries (LMICs).<sup>1</sup>

In September 2018, the United Nations (UN) held the Third High Level Meeting on the Control of Non-Communicable Diseases. The purpose of this meeting was to track progress towards four commitments made in the 2014 UN Outcome Document on NCDs. The agenda was to echo the UN Sustainable Development Goal 3, Target 8, to achieve UHC for all. The progress towards this commitment will be judged by an indicator assessing whether member states are providing ‘drug therapy and counselling for eligible persons at high risk to prevent heart attacks and strokes’.<sup>2 3</sup>

A quick analysis of NCD care spend (as a percentage of GDP) and the age-standardized NCD mortality rate per 100,000 population for lower-middle income countries indicates a strong negative relationship between the two variables, demonstrated below in Figure 1. Global health expenditure data from the World Health Organization (WHO)<sup>4</sup> and data from the World Bank database<sup>5</sup> were utilized for this calculation. Due to unavailability of data for all lower-middle income countries, only 17 countries with complete data were included for this analysis.



**Figure 1: Correlation between NCD mortality rate and care spend**

The correlation between the NCD mortality rate and NCD care spend in lower middle-income countries emphasises the need to increase spending on the management of NCDs and efficiently use available resources to effectively achieve Sustainable Development Goal 3.

### **Market size for NCD therapeutics and diagnostics**

A recent market size estimation for drugs and diagnostics for chronic diseases estimates the current market size to be US\$ 346 billion growing at a compound annual growth rate of approximately 7.2 percent.<sup>6</sup> An analysis was conducted by the team to better understand the true market demand and gaps for essential NCD medicines and diagnostics in all lower middle-income countries.

The market size estimation was based on identifying the essential drugs and diagnostics for non-communicable diseases except mental disorders – the essential medicine list (EML) has been included in the appendix. By mapping the incidence or prevalence of non-communicable diseases in lower middle-income countries to the clinical dosage requirements the market size for NCD EML in each LMIC country was estimated. The incidence/prevalence data for each non-communicable disease was collected from articles published in peer reviewed journals. A conservative approach was taken for the appropriate clinical dosage requirement, and the minimum dose for a particular condition based on clinical judgement was considered for this purpose.

One assumption made is that since the estimated NCD incidence/prevalence is based on a population sample for each LMIC, these estimates would cover the demand of the entire population if all the patients were diagnosed and treated. Figure 2 shows the estimated market demand for these essential medicines for NCDs in LMICs.



**Figure 2: Expected NCD drugs and diagnostics market size in LMICs**

### **Expected versus actual market demand**

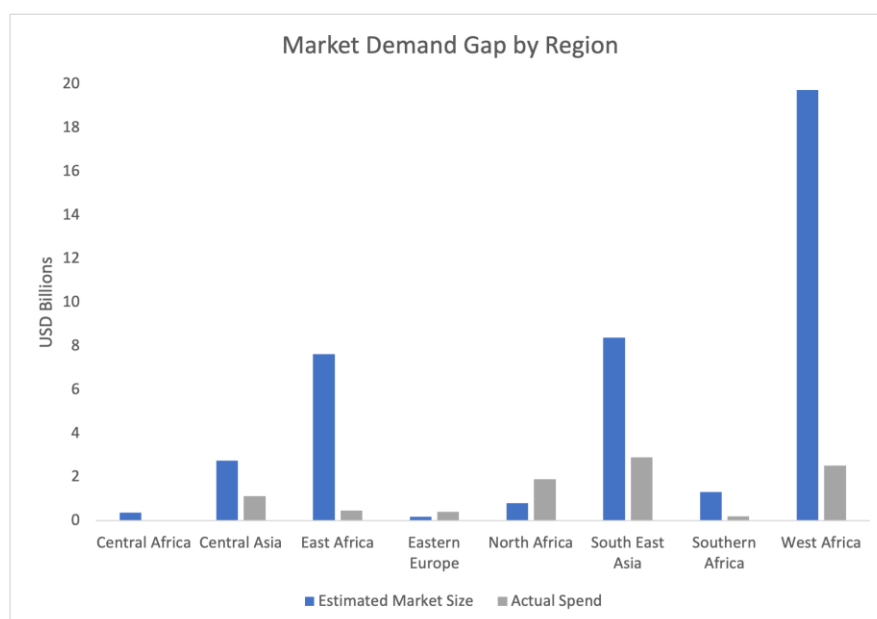
There are certainly some gaps in the actual market demand against the expected market demand. A systematic review of all the studies conducted up to 2014 highlighted affordability and availability gaps across the globe and highlighted why these commitments were so urgently needed. The study showed low use of drugs for secondary prevention of cardiovascular disease (CVD), which is the leading cause of morbidity and mortality among NCDs. The review also showed low use of drugs for hypertension (HTN), the most common risk factor for CVDs worldwide. These drugs were unavailable and unaffordable to many people in lower income countries (LICs).<sup>3 7</sup>

The Defeat-NCD Partnership team performed a quick analysis of the estimated (calculated) vs actual market demand as identified in the WHO global health expenditure database (GHED).<sup>8</sup> The calculation of expenditure in the database is based on several factors including inpatient and outpatient curative care, medical goods, preventative care and governance and administration.<sup>9</sup> Estimated market demand was calculated only for the essential medical drugs and diagnostics as listed in the appendix (table 3).

Country name	Estimated market size	Actual market spend(GHED)	Market demand gap
Republic of Benin	814	29	785
Kingdom of Bhutan	53	29	23
Republic of Cabo Verde	38	15	23
Kingdom of Cambodia	1137	329	808
Republic of Congo	371	39	332
Republic of Cote d'Ivoire	1773	411	1363
Kingdom of Eswatini	79	73	7
Republic of Ghana	2098	355	1743
Republic of Kenya	3626	235	3390
Kyrgyz Republic	445	120	325
Republic of Moldova	183	400	-217
Republic of the union of Myanmar	3727	741	2986
Nepal	1973	529	1444
Federal Republic of Nigeria	13859	1291	12568
Democratic Republic of Sao Tome and Principe	15	5	9
Republic of Senegal	1124	429	695
Democratic Socialist Republic of Sri Lanka	1504	1277	227
United Republic of Tanzania	4000	239	3761
Republic of Tunisia	806	1911	-1104
Republic of Uzbekistan	2316	1014	1302
Republic of Zambia	1232	138	1093

**Table 1: Comparison of NCD market demand vs spend for LMIC (USD Millions)**

In the absence of only medical goods data for NCDs, the comparison was performed utilising the entire NCD care expenditure dataset as reported by GHED. It was expected that given the scope of global health expenditure, spend should be higher than expected demand.



**Figure 3: Market demand gap by region**

NCD expenditure data was only available for 21 countries in the GHED. Although Moldova and Tunisia had higher NCD expenditure than the expected market size (which might be due to a difference in methodologies for accounting expenditures), all other countries had a larger expected market size. Figure 3 shows the regional market demand gap by region for 21 countries.

The gap does indicate that a sub-population of patients are either undiagnosed or remain untreated. To better understand the extent of this disparity, a deep dive analysis was conducted for undiagnosed hypertension and diabetes cases in Myanmar, Rwanda, India and Nepal. Diagnoses for hypertension and diabetes can be missed in the early stages, and if left untreated can result in several clinical complications. Table 2 below shows the extent of undiagnosed hypertension and diabetes cases in these four countries.

	Diabetes		Hypertension	
	Reported cases	Undiagnosed cases	Reported cases	Undiagnosed cases
India	77 Mn	24.5 Mn	189.6 Mn	66.6 Mn
Myanmar	1.3 Mn	2.4 Mn	0.06 Mn	1.12 Mn
Rwanda	0.17 Mn	0.07 Mn	0.2 Mn	0.77 Mn
Nepal	0.7 Mn	1 Mn	2.7 Mn	2.7 Mn

**Table 2: Undiagnosed cases for India, Rwanda, Nepal and Myanmar**

### Myanmar

In 2020, the International Diabetes Federation (IDF) and Myanmar Diabetes Association indicated an overall diabetes prevalence rate of 3.7 percent and total number of diabetes cases in Myanmar to be approximately 1,282,700.<sup>10</sup> A national survey on the prevalence of diabetes and risk factors for NCDs conducted in 2013-2014 reported the prevalence of diabetes as 10.5 percent for the adult population aged between 25 and 65 years.<sup>11</sup> This was an extensive survey showing the magnitude of the problem of diabetes and risk factors for major NCDs for the whole country. This survey showed the higher prevalence of diabetes than the estimated prevalence of diabetes by the IDF. A similar multistage sampling study conducted in 2013-2014 in Myanmar indicated the prevalence of diabetes as 10.8 percent and pre-diabetes of 19.7 percent.<sup>12</sup> Many people with diabetes were found to lack knowledge and awareness of diabetes. Diabetes prevalence in Myanmar is high, and relatively higher than that reported in many Association of Southeast Asian Nations (ASEAN) countries. Based on the prevalence of diabetes and reported number of diabetes cases, there is likely to be approximately 2.37 million undiagnosed diabetes cases in Myanmar.

According to statistics published by the Myanmar Ministry of Health in 2020, 675,101 hypertensive patients were receiving care from the public healthcare system.<sup>13</sup> However, based on several studies conducted recently, the prevalence of hypertension in Myanmar is approximately 30 percent,<sup>14</sup> resulting in approximately 9.75 million cases remaining outside the public healthcare database and possibly without proper disease management. Based on a WHO STEPwise approach to Surveillance of NCDs (STEPS) survey in 2009, the overall percentage of respondents with hypertension diagnosed within one year was 10.9 percent, while 9.3 percent of respondents had been diagnosed more than one year ago. In all, 33.6 percent of the respondents had never had their blood pressure measured.<sup>15</sup>

### Rwanda

In Rwanda, diabetes mellitus prevalence is estimated between 3.1 percent and 4.3 percent based on several sample studies conducted in the region.<sup>16 17</sup> According to the World Health Organization, in 2016, 2.8 percent of the Rwandan population are estimated to have diabetes.<sup>18</sup> The latest reported number of diabetes cases based on IDF and Association Rwandaise des Diabétiques is 168,900 (2.7 percent of the population).<sup>19</sup> A 2013 survey done by Rwanda Ministry of Health estimated that 50 percent of the diabetes cases in the country were undiagnosed. This led to the government implementing several policy measures for early diagnosis of diabetes.<sup>20</sup> However, based on the prevalence rate of diabetes there are still an estimated 28,000 to 105,000 undiagnosed diabetes patients in Rwanda.

A nationally representative STEPS survey to assess the prevalence of hypertension using the estimated the overall prevalence of hypertension at 15.9 percent, which is expected to increase to 17.82 percent by 2025.<sup>21 22</sup> Only 22 percent of cases were diagnosed. With the estimated prevalence of 15.9 percent, approximately 1.19 million people are living with hypertension in Rwanda. Health Management Information System (HMIS) data from 2019 shows that round 63,692 persons with hypertension enrolled in care, leaving out a large estimated population of untreated cases.

## **Nepal**

The current reported number of diabetes cases in Nepal is 696,900 (4 percent of the population) based on the data shared by International Diabetes Federation and Nepal Diabetes Association.<sup>23</sup> The burden of diabetes in Nepal has rapidly increased in the last few years, with a prevalence likely nearing 10 percent with a steady annual growth rate of 3 percent since 2000. A few surveys and studies estimate the country-wide prevalence to be 9.1 percent,<sup>24</sup> and a systematic review conducted of prevalence studies reported a pooled prevalence of 8.4 percent.<sup>25</sup> A study conducted in 2006 found that 54.4 percent of all the diabetes cases in their sample were undiagnosed mostly due to lack of awareness.<sup>26</sup> Given current reported cases and prevalence rate estimates, over one million cases of diabetes remain undiagnosed in Nepal.<sup>27</sup>

Undiagnosed hypertension was highly prevalent in Nepal and there were substantial inequalities between different demographics and regions. The overall prevalence of hypertension as indicated by various surveys indicate the prevalence rate between 22.4 to 38.6 percent.<sup>28</sup> Although there are no clear statistics provided for registered hypertensive cases in Nepal, there have been several national cross-sectional survey studies conducted to determine the number of undetected hypertensive cases. These studies indicate that the percentage of undiagnosed hypertensive cases remains high at around 50 percent.<sup>29</sup> Approximately 2.7 million hypertensive patients remain undetected in the country.

## **India**

The 2019 National Diabetes and Diabetic Retinopathy Survey report released by the Ministry of Health and Family Welfare indicates the prevalence of diabetes at 11.8 percent.<sup>30</sup> The International Diabetes Federation indicates that there are 77 million diabetes patients in India at a prevalence rate of 8.9 percent.<sup>31</sup> The difference between the two figures indicates that at least 24.5 million diabetes cases remain undetected in India, although several studies have indicated the prevalence rate to be higher. 42 percent of people with diabetes in India are not aware of their disease status, and a large subset of these people are at risk of the disease not being detected, despite having health insurance and/or having access to healthcare.<sup>32 33 34 35</sup>

A systematic review and meta-analysis study including 142 study results for hypertension in India to assess prevalence has indicated an overall prevalence of around 29.8 percent among the adult population in India. The undiagnosed hypertensive prevalence rate remains at 26 percent,<sup>36</sup> leading to approx. 66.6 million undiagnosed hypertensive cases in India. If the hypertension guidelines established by Government of India are compared with the internationally accepted hypertension guidelines this number grows to more than 180 million. Similarly, there remains a low adherence to treatment post diagnosis which can be directly correlated to the availability of funds to support NCD care management.

## **Role of the Defeat-NCD marketplace in bridging the gaps**

Global health expenditure data indicates that majority of NCD care spend still stems from out-of-pocket (OOP) expenditure in LMICs.<sup>37</sup> This indicates the need for better public infrastructure to assist the demands of NCD patients. Several studies indicate that the OOP costs for counselling and drug therapy for CVD and related conditions such as HTN, angina or diabetes imposed a significant economic burden on households, driving some into poverty and, in many cases, were a reason for not seeking or adhering to care.<sup>3 38 39 40 41 42 43</sup> The evidence also suggested a gender gap in secondary treatment of CVD in countries at all levels of development, with women less likely to take proven effective treatment than men.<sup>344</sup> It highlighted how the poor were least likely to obtain treatment, and the devastating impact on them of OOP costs.<sup>3 45</sup>



The Defeat-NCD Partnership has established a marketplace to facilitate the bulk purchase of non-communicable disease essential drugs and diagnostics for governments of LMICs.

The Defeat-NCD Marketplace offering improved negotiating power for nations to lower the purchase price for essential NCD drugs and diagnostics. The volume of the aggregated purchase demands gives individual nations access to economies of scale. Consequently, this leads to greater purchasing power. For buyers such as government health ministries and other providers of healthcare, the resulting reduction in the prices will allow them to reach more people who need NCD screening, treatment, and care. Achieving this outcome is the aim of the Defeat-NCD Marketplace.

The Defeat-NCD Marketplace also simplifies the procurement process, reducing both the unit cost of goods as well as transaction costs. With a similar budget, more drugs and diagnostics can be purchased to support undiagnosed and untreated patients. The Defeat-NCD Marketplace also improves the visibility of available resources from different suppliers, supporting manufacturers to plan for bulk orders thus reducing operational costs.

The key objectives of the Defeat-NCD Marketplace are to create a competitive environment that serves the interests of buyers and suppliers; to ensure that the underlying technology is easily scalable; and to build mutual trust and confidence by providing transparency to the procurement process.

To learn more about the marketplace initiative and ongoing work, please visit [Defeat NCD Partnership](#) website.

### **Copyright, attribution, and acknowledgements**

Copyright © 2021 The Defeat-NCD Partnership

Attribution – Please cite this research paper as follows: The Defeat-NCD Partnership 2021. “Market demand for non-communicable disease drugs and diagnostics”.

The development of this Defeat-NCD Partnership research paper has been led by Praveen Pardeshi (Programme Coordinator for Global Scale-up), with substantive contributions from Antony Chan (Business Development Analyst) and Shruti Choudhary (External Collaborator), editorial support from Steven Lipscombe (Partnership Development Specialist), and under the guidance of Mukul Bhola (Chief Executive Officer).

For further information please contact The Defeat-NCD Partnership secretariat by email: [secretariat@defeat-ncd.org](mailto:secretariat@defeat-ncd.org) or telephone: + 41 22 917 8334

### **About The Defeat-NCD Partnership**

The Defeat-NCD Partnership is a practical response to the widespread call for action on non-communicable diseases (NCDs). Formally launched alongside the UN General Assembly in 2018, we are a ‘public-private-people’ partnership anchored in the United Nations but extending well beyond to include governments, multilateral agencies, civil society, academia, philanthropies, and the private sector.

Our vision is clear — universal health coverage for NCDs. To achieve this, our core mission focuses on assisting approximately 90 low-resource countries via comprehensive action across four interconnected service pillars: national NCD capacity building, community scale-up of NCD services, affordability and accessibility of essential NCD supplies, and sustainable NCD financing.

Amlodipine
Enalapril, 2.5 mg, 5 mg
Lisinopril, 20 mg, 40mg (5 and 10mg)
Ramipril, 5 mg, 10 mg (2.5,5)
Losartan, 25 mg, 50 mg, 100 mg
Telmisartan, 40 mg, 80 mg
Hydrochlorothiazide 12.5 mg, 25 mg, 50mg
Chlorthalidone, Tablet
Indapamide SR, Tablet
Bisoprolol, 1.25 mg, 5 mg
Atenolol, 25 mg, 50 mg, 100 mg
Metoprolol, 25mg, 50mg
Carvedilol, 3.125mg, 6.25mg, 12.5mg, 25mg
Hydralazine, 1.20 mg in ampoule, Infusion; 2. 25 mg, 50 mg, Tablet
Methyldopa, 250 mg, Tablet
Labetalol, 1. 100 mg, Tablet; 2.5 mg/mL, Injectable Solution
Nifedipine, 10 mg (5 mg and 20 mg also available), Tablet (long acting)
Simvastatin, 5 mg, 10 mg, 20 mg, 40 mg, Tablet
Atorvastatin, 40 mg, 80 mg, Tablet
Aspirin/acetylsalicylic acid (low dose), 75–100 mg, Table
Glyceryl trinitrate, 500 g , Tablet
Isosorbide dinitrate, 5mg , Tablet
Verapamil, 40 mg, 80 mg Tablet
Heparin, 1000 IU/mL, 5000 IU/mL, 20,000 IU/mL, (in 1-mL ampoule)
Digoxin, 1. 250 g/mL in 2-mL ampoule, 1. Injection, 2. 50 g/mL, 2. Oral liquid, 3. 62.5 g; 50 g, 3. Tablet
Furosemide, 1. 10 mg/mL in 2-mL ampoule, Injection, 2. 20 mg/5 mL, Oral liquid, 3. 40 mg Tablet
Spironolactone, 25 mg, Tablet
Streptokinase, 1.5 million IU in vial, Powder For injection
Metformin, 500 mg, Tablet
Gliclazide, 30 mg, 60 mg, 80 mg, Controlled-release tablets
Glibenclamide (not suitable for patients over 60 years old, 2.5 mg, 5 mg
Soluble insulin (human), 40 IU/mL in 10-mL vial; 100 IU/mL in 10-mL vial, Injection
Soluble insulin (analogue) ,40 IU/mL in 10-mL vial, 100 IU/mL in 10-mL vial, Injection
Intermediate-acting insulin (as compound insulin zinc suspension or isophane insulin) (human), 40 IU/mL in 10-mL vial; · 100 IU/mL in 10-mL vial, Injection Intermediate-acting insulin (analogue), · 40 IU/mL in 10-mL vial; 100 IU/mL in 10-mL vial Injection
Salbutamol 1. 100 g (as sulfate) per dose 2. 100 g (as sulfate) per dose 3. 5 mg (as sulphate)/mL
Formoterol · 100 g + 6 g per dose, · 200 g + 6 g per dose, Dry powder inhaler
Ipratropium bromide, 20 g/metered dose, Inhalation (aerosol)
Theophylline, 300 mg, 400 mg, 600 mg, Tablet
Beclometasone, · 50 g (dipropionate) per dose, 100 g (dipropionate) per dose (as CFC free forms)
Budesonide, 100 g per dose, 200 g per dose
Epinephrine (adrenaline), 1 mg (as hydrochloride or hydrogen tartrate) in 1-mL ampoule
Prednisolone, 1. 5 mg/mL, 2. 5 mg, 25 mg
Hydrocortisone 100 mg (as sodium succinate) in vial
Tamoxifen, 20 mg
Cisplatin, 50 mg/50 mL, 100 mg/100 mL
Carboplatin, 50 mg/5 mL, 150 mg/15 mL, 450 mg/45 mL, 600 mg/60 mL
Gemcitabine, 200 mg in vial, 1 g in vial
Paclitaxel, 6 mg/mL
5-fluorouracil (5-FU), 50 mg/mL in 5-mL ampoule
Docetaxel, 20 mg/mL; 40 mg/mL
Vinorelbine, 10 mg/mL in 1-mL vial; 50 mg/5 mL in 5-mL vial
Aspirin, · 50 mg to 150 mg, · 100 mg to 500 mg
Ibuprofen, 200 mg/5 mL, 200 mg, 400 mg, 600 mg
Paracetamol, 120 mg/5 mL, 125 mg/5 mL, 100 mg, · 100 mg to 500 mg
Codeine, 30 mg (phosphate), Tablet
Morphine, 20 mg–200 mg (morphine sulfate) Granules (slow release; to mix with water) 10 mg in 1- mL ampoule (morphine hydrochloride or morphine sulfate) Thermometer
Stethoscope
Blood pressure measuring device
Measurement tape
Weighing machine
Peak flow meter
Spacers for inhalers
Glucometer
Nebulizer
Pulse oximeter
Blood cholesterol
Lipid profile

**Table 3: Essential medicine and device list for NCD market size estimation**

- 
- <sup>1</sup> WHO. NCD fact sheet.
- <sup>2</sup> WHO. Non-communicable disease progress monitor 2020.
- <sup>3</sup> Murphy A, Palafox B. The household economic burden of non-communicable diseases in 18 countries.
- <sup>4</sup> WHO. Global health observatory data repository.
- <sup>5</sup> World Bank. World Bank database.
- <sup>6</sup> BCC Research. Chronic disease management: Therapeutics, device technologies and global markets.
- <sup>7</sup> Shannon Harry, Chow Clara, Rangarajan Sumathy, Teo Koon, et al. Availability and affordability of cardiovascular disease medicines and their effect on use in high-income, middle-income, and low-income countries: an analysis of the pure study data.
- <sup>8</sup> WHO. Global health expenditure database.
- <sup>9</sup> WHO. Global health expenditure database documentation.
- <sup>10</sup> IDF. International diabetes federation Myanmar country profile.
- <sup>11</sup> Ko Ko, Ye Myint, Maung Maung Thant, Kyar Nyo Soe Myint, Khin Sanda, Khaing Lwin, Htet Htet Khin, Tin Win Aung, Kyaw Myint Oo, Tint Swe Latt, Than Than Aye. Myanmar diabetes care model: Bridging the gap between urban and rural healthcare delivery.
- <sup>12</sup> Moe Wint Aung, Than Than Aye, El Sandar Oo. Diabetes mellitus in Myanmar: Socio-cultural challenges and strength.
- <sup>13</sup> Moore Molly. Health in Myanmar - Statistics Facts.
- <sup>14</sup> Haakon E. Meyer, Maung Maung Than Htike, Ko Ko Zaw, Win Myint Oo, Tint Swe Latt, Lhamo Y Sherpa, Marius B Bjertness, Aung Soe Htet and Espen Bjertness. Prevalence and determinants of hypertension in Myanmar - a nationwide cross-sectional study.
- <sup>15</sup> Grover Shekhar, Sinha Dharendra, Gupta Sanjay, Gupta Prakash, and Mehrotra Ravi. The changing face of risk factors for non-communicable disease in Myanmar: findings from the 2009 and 2014 WHO STEPS surveys. *Journal of Public Health*, pages 1–7, 10 2018.
- <sup>16</sup> Gale Edwin A M, Barnighausen Till, Beran David, Kengne Andre Pascal, et al. Diabetes in Sub-Saharan Africa: From clinical care to health policy.
- <sup>17</sup> Bavuma CM, Musafiri S, Rutayisire PC, Ng'ang'a LM, Mcquillan R, Wild SH. Socio-demographic and clinical characteristics of diabetes mellitus in rural Rwanda: Time to contextualize the interventions? A cross-sectional study, 2020.
- <sup>18</sup> WHO. WHO diabetes Rwanda country profile.
- <sup>19</sup> IDF. International Diabetes Federation Rwanda country profile.
- <sup>20</sup> WHO. Rwanda STEPS noncommunicable disease risk factor survey 2012- 2013.
- <sup>21</sup> Marie-Rosette Nahimana, Aypio Nyandwi, Marie Aimee Muhimpundu, Olushayo Olu, Jeanine Umutesi Condo, Andre Rusanganwa, Jean Baptiste Koama, Candide Tran Ngoc, Jean Bosco Gasherebuka, Martin O. Ota, and Joseph C. Okeibunor. A population-based national estimate of the prevalence and risk factors associated with hypertension in Rwanda: implications for prevention and control. *BMC Public Health*, 18(1):2, 2017.
- <sup>22</sup> Dukunde Angelique. Prevalence of hypertension in Rwandan population using Gibbs method.
- <sup>23</sup> IDF. International Diabetes Federation Nepal country profile.
- <sup>24</sup> WHO. WHO Diabetes Nepal country profile.
- <sup>25</sup> Gyawali Bishal, Sharma Rajan, Neupane Dinesh, Mishra Shiva Raj, Teijlingen Edwin Van, and Kallestrup Per. Prevalence of type 2 diabetes in Nepal: a systematic review and meta-analysis from 2000 to 2014. *Global Health Action*, 8:29088–29088, 11 2015.
- <sup>26</sup> Shrestha Umid Kumar, Singh D, and Bhattarai Madhur. The prevalence of hypertension and diabetes defined by fasting and 2-h plasma glucose criteria in urban Nepal. *Diabetic medicine : a journal of the British Diabetic Association*, 23:1130–5, 11 2006.
- <sup>27</sup> Poudel Resham Raj. Diabetes and endocrinology in Nepal. *Indian journal of endocrinology and metabolism*, 18(1):118–119, 01 2014.
- <sup>28</sup> Nepal Ministry of Health. Nepal demographic and health survey.
- <sup>29</sup> Hasan Md. Mehedi, Tasnim Fariha, Tariqujjaman Md, Ahmed Sayem, Cleary Anne, and Mamun Abdullah. Examining the prevalence, correlates and inequalities of undiagnosed hypertension in Nepal: a population-based cross-sectional study. *BMJ Open*, 10(10), 2020.
- <sup>30</sup> Current Affairs Plus. National diabetic retinopathy survey report (2015- 2019).
- <sup>31</sup> IDF. International diabetes federation India country profile.
- <sup>32</sup> Claypool Kaja T, Chung Ming-Kei, Deonarine Andrew, Gregg Edward W, and Patel Chirag J. Characteristics of undiagnosed diabetes in men and women under the age of 50 years in the Indian subcontinent: the national family health survey (nfhs-4)/demographic health survey 2015–2016. *BMJ Open Diabetes Research and Care*, 8(1), 2020.
- <sup>33</sup> Joshi Shashank R, Saboo Banshi, Vadivale Muruga, Dani Sameer Indravadan, Mithal Ambrish, Kaul Upendra, Badgandi Mohan, Iyengar Shamanna Seshadri, Viswanathan Vijay, Sivakadaksham Natarajan, Chattopadhyaya Partha Sarathi, Biswas Arup Das, Jindal Sushil, Khan Idris Ahmed, Sethi Bipin Kumar, Rao Vala Dayasagar, and Dalal Jamshed Jal. Prevalence of diagnosed and undiagnosed



diabetes and hypertension in India—results from the screening India’s twin epidemic (site) study. *Diabetes Technol Ther*, 14(1):8–15, Jan 2012.

<sup>34</sup> Chakraverty Anita. Diabetes often goes undiagnosed in India.

<sup>35</sup> CADI Research Foundation. Diabetes in India.

<sup>36</sup> Talukdar Debjyoti, Tripathi Mallika, Tripathi Vrijesh, and Singh Surujpal Teeluck. Prevalence and associated factors of undiagnosed hypertension among women aged 15–49 years in India: an analysis of national family health survey-4 data. *Journal of Human Hypertension*, 2020.

<sup>37</sup> WHO. GHED.

<sup>38</sup> Huffman Mark D, Rao Krishna D, Pichon-Riviere Andres, Zhao Dong, Harikrishnan S, Ramaiya Kaushik, Ajay V S, Goenka Shifalika, Calcagno Juan I, Caporale Joaquin E, Niu Shaoli, Li Yan, Liu Jing, Thankappan K R, Daivadanam Meena, Esch Jan van, Murphy Adrianna, Moran Andrew E, Gaziano Thomas A, Suhrcke Marc, Reddy K Srinath, Leeder Stephen, and Prabhakaran Dorairaj. A cross-sectional study of the microeconomic impact of cardiovascular disease hospitalization in four low- and middle-income countries. *PLOS ONE*, 6(6):1–10, 06 2011.

<sup>39</sup> Murphy Adrianna, Jakab Melitta, McKee Martin, and Richardson Erica. Persistent low adherence to hypertension treatment in Kyrgyzstan: How can we understand the role of drug affordability? *Health Policy and Planning*, 31(10):1384–1390, 06 2016.

<sup>40</sup> Murphy Adrianna, Mahal Ajay, Richardson Erica, and Moran Andrew E. The economic burden of chronic disease care faced by households in Ukraine: a cross-sectional matching study of angina patients. *International Journal for Equity in Health*, 12(1):38, 2013.

<sup>41</sup> Smith-Spangler Crystal M, Bhattacharya Jay, and Goldhaber-Fiebert Jeremy D. Diabetes, its treatment, and catastrophic medical spending in 35 developing countries. *Diabetes Care*, 35(2):319–326, 2012.

<sup>42</sup> Wang Qun, Brenner Stephan, Kalmus Olivier, Banda Hastings Thomas, and Allegri Manuela De. The economic burden of chronic non-communicable diseases in rural Malawi: an observational study. *BMC Health Services Research*, 16(1):457, 2016.

<sup>43,44</sup> Chow Clara K, Rangarajan Sumathy, Dagenais Gilles, Diaz Rafael, et al. Use of secondary prevention drugs for cardiovascular disease in the community in high-income, middle-income, and low-income countries (the pure study): a prospective epidemiological survey.

<sup>45</sup> O’Donnell Owen, Stuckler David, Perel Pablo, AlHabib Khalid F, et al. Inequalities in the use of secondary prevention of cardiovascular disease by socioeconomic status: evidence from the pure observational study.