Readiness of the primary health care units and associated factors for the management of hypertension and type II diabetes mellitus in Sidama, Ethiopia

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Background: In low-income nations, such as Ethiopia, noncommunicable diseases (NCDs) are becoming more common. The Ethiopian Ministry of Health has prioritized NCD prevention, early diagnosis, and management. However, research on the readiness of public health facilities to address NCDs, particularly hypertension and type II diabetes mellitus, is limited. Methods : The study used a multistage cluster sampling method and a health facility-based cross-sectional study design. A total of 83 health facilities were evaluated based on WHO's Service Availability and Readiness Assessment (SARA) tool to investigate the availability of services and the readiness of the primary health care unit (PHCU) to manage type II diabetes and Hypertension. Trained data collectors interviewed with PHCU head or NCD focal persons. The study tried to investigate 1) the availability of basic amenities and the four domains: staff and guidelines, basic equipment, diagnostic materials, and essential medicines used to manage DM and HPN, 2) the readiness of the PHCU to manage DM and HPN. The data were processed by using SPSS version 24. Descriptive statistics like; frequency and percentage, inferential statistics like; the chi-square test, and logistic regression models were used to analyze the data. Results: Of the 82 health facilities, only 29% and 28% of the PHCU identified as ready to manage HPN and DM. Facility type, facility location, presence of guidelines, staff trained, groups of antihypertensive and antidiabetic medicines had a significant impact (P<0.05) on the readiness of the PHCU to manage HPN and DM at a 0.05 level of significance. Facilities located in urban were 8.2 times more likely to be ready to manage HPN cases than facilities located in rural [AOR=8.2, 95%CI; 2.4-28.5] and P<0.05. Conclusion and recommendation : The results identified comparatively poor and deprived readiness to offer HPN and DM services at lower-level health facilities(health centers). Equipping the lower-level health facilities with screening and diagnostic materials, essential medicines, and provision of basic training for the health care providers and NCD guidelines should be

available, especially in the lower health care facilities.

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8 **Abstract**

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10 becoming more common. The Ethiopian Ministry of Health has prioritized NCD prevention,

11 early diagnosis, and management. However, research on the readiness of public health facilities

12 to address NCDs, particularly hypertension and type II diabetes mellitus, is limited.

13 **Methods**: The study used a multistage cluster sampling method and a health facility-based cross-

14 sectional study design. A total of 83 health facilities were evaluated based on WHO's Service

15 Availability and Readiness Assessment (SARA) tool to investigate the availability of services

16 and the readiness of the primary health care unit (PHCU) to manage type II diabetes and

17 Hypertension. Trained data collectors interviewed with PHCU head or NCD focal persons. The

18 study tried to investigate 1) the availability of basic amenities and the four domains: staff and

19 guidelines, basic equipment, diagnostic materials, and essential medicines used to manage

20 diabetes mellitus and hypertension, 2) the readiness of the PHCU to manage diabetes mellitus

21 (DM) and hypertension (HPN). The data were processed by using SPSS version 24. Descriptive

22 statistics like; frequency and percentage, inferential statistics like; the chi-square test, and logistic

23 regression models were used to analyze the data.

24 **Results:** Of the 82 health facilities, only 29% and 28% of the PHCU identified as ready to

25 manage HPN and DM. Facility type, facility location, presence of guidelines, staff trained,

26   groups of antihypertensive and antidiabetic medicines had a significant impact (P<0.05) on the

27   readiness of the PHCU to manage HPN and DM at a 0.05 level of significance. Facilities located

28   in urban were 8.2 times more likely to be ready to manage HPN cases than facilities located in

29   rural [AOR=8.2, 95%CI; 2.4-28.5] and P<0.05.

30   **Conclusion and recommendation**: The results identified comparatively poor and deprived

31   readiness to offer HPN and DM services at lower-level health facilities(health centers).

32   Equipping the lower-level health facilities with screening and diagnostic materials, essential

33   medicines, and provision of basic training for the health care providers and NCD guidelines

34   should be available, especially in the lower health care facilities.

35   **Keywords: Ethiopia,** Noncommunicable disease, Prevention, Health facility readiness, Health

36   service delivery

37   **Introduction**

39   NCDs are chronic diseases resulting from genetic, physiological, environmental, and behavioral

40   factors(12). The World Health Organization (WHO) projections showed that in 2016 a total of

41   56.9 million deaths occurred worldwide. The deaths caused specific mortality due to NCDs

42   accounted for 40.5 million (71%). When we see age-standardized death rates, 29.8 million deaths

43   in people less than 70 years of age, an estimated 17.0 million (57%) of the death were due to

44   NCDs(3). This result shows that globally, the leading cause of mortality and premature death is

45   occurring due to NCDs with preventable risk factors such as tobacco use, physical inactivity,

46   unhealthy diet, and the harmful use of alcohol. The diseases require lifetime management and

47   pose life-threatening problems when not controlled (4,5). Both diseases have societal and

48 economic consequences due to their complications for a country, society, and the individual too

49 (3,7).

50 Globally, NCDs are causing a significant health impact on humans, especially in adulthood.

51 Hypertension and Diabetes Mellitus (DM) are common chronic diseases that quickly increase in

52 prevalence(5). These diseases contribute to cardiovascular diseases (CVD), accounting for 17

53 million (31%) deaths globally. Seventy-five percent of all CVD associated deaths occur in

54 developing countries (8)

55 Worldwide, the burden of diabetes is associated with metabolic risks (disproportionate between

56 weight and height) and behavioral factors (i.e., diets lower in fruits and vegetables, smoking, and

57 sedentary lifestyle). In 2017, weight and height were disproportionately responsible for 30.8% of

58 deaths and 45.8% of disability adjusted life in years (DALYs); dietary risk was responsible for

59 24.7% of deaths and 34.9% of DALYs.(9).

60 In 2010, an estimated 1.33 billion (1.32–1.34 billion) individuals had Hypertension, with 346

61 million (336–356 million) in high-income nations and 985 million (977–994 million) in low- and

62 middle-income countries.

63 Between 2000 and 2010, the age-standardized prevalence of Hypertension increased by 2.5%.

64 The number of people with Hypertension increased by 354 million from the four types of NCDs

65 (diabetes, hypertension, chronic obstructive pulmonary disease, and cancer). And whose

66 prevalence rates noted to be increasing were hypertension and diabetes mellitus (10)

67 In Africa, the prevalence of NCDs is rising rapidly. It is projected to cause almost three-quarters

68 as many deaths as communicable, maternal, perinatal, and nutritional diseases by 2020,

69 exceeding the most general causes of death by 2030 (3).

70   According to community-based studies, diabetes and Hypertension prevalence among adults in

71   Ethiopia ranged from 2.0 percent to 6.5 percent and 9.3 % to 30.3 %, respectively (5,6). Around

72   42.3% of DM patients have hypertension comorbidity (13). However, the overall prevalence of

73   poor glycaemic control and uncontrolled Hypertension in patients attending public health

74   facilities was 45.2% and 48.6 %, respectively(14,15). The growth in prevalence of hypertension-

75   DM comorbidity demands appraisal of facilities' readiness to manage both hypertension and DM

76   diseases.

77   Ethiopia is one of the highly populated African countries next to Nigeria, with an estimated

78   population of 114,963,588 by 2020(16). This contributed a lot to the acquirement of

79   communicable diseases. However, in recent years, the rise of infectious diseases is changing its

80   place with NCDs(17). In the country, NCDs are estimated at around 42%. Among these, 27% of

81   premature deaths occur before 70 years of age. Disability Adjusted Life Years (DALYs) due to

82   NCDs in the country has increased from 20% in 1990 to 69% in 2015(18), which means the risk

83   of dying from NCDs is increased two folds than that of the communicable, maternal, neonatal,

84   and nutritional problems together (19).

85   Regarding the preparedness of PHCU to manage DM and HPN a study conducted in Nepal,

86   Peru, and Mozambique, all three countries, lack of functioning equipment and supplies,

87   diagnostic tests are not available, and the unavailability of medications and laboratory tests will

88   raise the patient's out-of-pocket expenses when traveling to other health facilities. Essential

89   types of equipment like blood pressure monitoring apparatus and glucometers with their

90   respective consumables were not available or out-of-date. The same study revealed that there are

91   no clear referral procedures and transportation to the PHCU, a lack of tailored guidelines, and

92   insufficient information, education, and communication materials(54,55)

93   According to a service availability and readiness assessment (SARA) survey conducted in 2016,

94   about 54% of all health facilities had the general service readiness index in Ethiopia, except

95   health posts. However, in line with the sustainable development goals (SDGs) and the Health

96   Sector Transformation Plan (HSTP) 2016-2020 of Ethiopia, services for the management of

97   NCDs are being delivered at the District, Zonal and Regional Hospitals in Ethiopia (20).

98   Even though hospitals are expected to provide higher specialized care to patients with NCDs and

99   their associated medical complications, they didn't qualify them. The NCD services coverage

100   was estimated at 61% in southern nations, nationalities, and peoples region (SNNPR). Of the

101   total 89 hospitals found in the area, only 41 and 49 provided diabetes and cardiovascular disease

102   management, respectively (21).

103   However, despite the availability of NCD-related services in these hospitals, the mortality rate

104   due to NCDs is high, which is 29% (22), and the uptake of the NCD services is low, especially in

105   government hospitals/ facilities (17). Failure to optimally utilize the NCD services is associated

106   with high morbidity and mortality. The SARA tool covers questions on essential services

107   through service availability (whether the facility offers a variety of services for the treatment and

108   diagnosis and readiness (whether the facilities have the items required to deliver at the visit).

109   However, the SARA tool is not used to fill the gaps to be filled.

110   ## Methods and materials

111   ### Study setting and population

112   ### Study area/setting

113

114 The study area was Sidama regional state which is the newly established region in Ethiopia. In

115 the region, 708 health facilities are found viz 18 hospitals, 137 health centers, and 553 health

116 posts.

117 Sidama region is located 273 km south of Addis Ababa. The region was previously a part of

118 Southern Nations, Nationalities, and Peoples'Region (SNNPR) with Zonal Administration level.

119 It has become Ethiopia's 10th regional state in a referendum conducted in November 2019. The

120 administrative center for Sidama is Hawassa City. According to the 2017th census conducted by

121 the Central Statistics Agency (CSA), the region's total population was 2,954, 136 with an area of

122 6538 km^2. Sidama has a population density of 452/km^2 with an average household size of 4.99

123 persons. Of the population, 5.51% are urban inhabitants, and 0.18 % is pastoralists. A large area

124 of the Sidama land produces coffee, which is the major cash crop in the region. Enset

125 (*Ensetventricosum*) is the single most crucial root crop grown in the study area and is a staple

126 food on which the bulk of the population depends heavily for survival (23).

127 The study was conducted from February 2021-July 2021

128 **Population**

129 **Source population**

130 The source for the study is primary health care units (health centers, primary hospitals, and

131 general hospitals) found in the region.

132

133

134 Inclusion and exclusion criteria

135 **Inclusion criteria**

136 •   All health centers,

137 • Primary Hospitals

138 • General hospitals

139 **Exclusion criteria**

140 • Health centers which were closed during the survey time

141 • Unwilling heads and NCD focal persons of facilities were excluded from the study

142 Study design, study setting, and sampling technique

143 The study design

144

145 This study employed a facility-based cross-sectional study design. The study used the WHO

146 Service Availability and Readiness Assessment (SARA) tool to investigate the availability of

147 services and the primary health care unit (PHCU) readiness to manage type II diabetes and

148 Hypertension.

149 Sample size

150

151 We reviewed different papers (24,25,26,27) to get inputs required to estimate sample size and

152 used the following formulae..

153 n = [[(z2 * p * q) + ME2] / [ME2 + z2 * p * q / N]]*d (28)

154 Where:

155 n is the sample to be calculated,

156 Z2 is the square of the normal deviate at the required confidence level,

157 ME is the margin of error,

158 p is the anticipated proportion of facilities with the attribute of interest,

159 q is 1− p , and

160   d is the design effect

161   n = [[(1.962*0.47*0.53) + 0.152] / [0.152+ (1.962*0.47*0.53)/708]]* 2

162   n = [[0.97944256]/[0.0238516138]]*2

163   n = [41.0639954266]*2

164   n = 82

165   A total of 82 PHCU were included in the study.

166   **Sampling technique**

167

168   As described in figure 1 below, a multistage cluster sampling technique was employed. After

169   getting the list of clusters (Woreda's) in the region, the study woredas were selected to draw the

170   selected health facilities, and a simple random sample procedure was used.

171   As described in figure 1 above, according to the Sidama regional health bureau census of health

172   facilities, 2020 health facilities were selected by using a simple random sampling method as

173   follows.

174   **Data collection tools, data collection, and data management**

175

176   The WHO SARA questionnaire was used to assess the readiness of the PHCU to manage T2 DM

177   and HPN(29). As presented in table 1 the tool consisted of four basic domains, basic amenities,

178   staff training and guidelines, essential diagnostic equipment, and basic medicines.

179   The data were collected during the working days (Monday-Friday) while the health facilities

180   were in their usual routine activities. The data collectors with the primary investigator (PI)

181   interviewed the person in charge of the NCD unit at the primary and general hospitals and the

182   heads of the health centers. The study's purpose was presented to the research participants, and

183   they were given the opportunity to participate and explain why the data were collected. The

184   interviewees who accepted the research aims and signed a written informed consent were

185   interviewed. This study was approved by the Institutional Review Board of Hawassa University

186   (IRB), Ethiopia, and Number IRB 072/13.

187   The above-mentioned domains and indicators were drawn from the guidelines of the Ethiopian

188   NCD clinical management manual for NCDs(30).

189   **DATA PROCESSING AND ANALYSIS**

190   The Primary Investigator processed the data by using SPSS version 24. Descriptive statistics

191   like; frequency and percentage, inferential statistics like; the chi-square test, and a logistic

192   regression model was used to analyze the data.

193   The PI provided two days of training to the selected data collectors, which focused on data

194   collection techniques, tools, and research ethics. Supervisors with at least an MSc in Public

195   Health are trained to supervise the data collection process and the investigator.

196   ## Result

197   ### Background characteristics of surveyed health facilities
198

199   This section presents results from the facility inventory assessed by SARA. Two main categories

200   of results are presented. These are: 1) the descriptive part for the availability of basic amenities,

201   guidelines, and staff trained, diagnostic materials and medicines for both DM and HPN

202   management; 2) the association between the availability of guidelines, staff trained, diagnostic

203   materials, and medicines with the readiness of the PHCU to manage both DM and HPN.

204

205

206   As can be seen in table 2, the majority of the 82 healthcare facilities included in the survey, 63

207   (76.8%), were health centers, comprising 46 (56%) situated in rural areas and 17 (23%) in urban

208   areas. More than half of the primary hospitals, 8 (9.7%) were located in the woreda towns. In

209   comparison, only 5(6%) of the primary hospitals were located in a rural setting. Two of the three

210   general public hospitals were located in rural, and only one was in urban.

211

212   As presented in figure 2 above, basic amenities, sanitation facilities, communication equipment,

213   consultation room, improved water source, electric power source, emergency transportation

214   (ambulance), and computer with internet access were assessed for availability and functionality.

215   Figure 2 shows that 62 (75.6%) of the facilities had a sanitation facility, 48 (58.5%) had

216   communication equipment, 32 (38.9%) had a consultation room, 45 (54.9%) had improved water

217   source, 54(65.8%) had any concept of electrical power, 74(90.2%) had emergency transportation

218   at the nearby woreda office, and 42 (51.2%) of the facilities had a functioning computer with

219   internet connectivity.

220   As clearly shown in figure 3 above, of the total health facilities (n=82), only 19% of the facilities

221   had NCD guidelines. Besides, 54% of the PHCU had a trained staff for the management of HPN,

222   whereas only 27% of them had a trained staff for the management of DM. The existence of

223   guidelines for diabetes mellitus and HPN varied greatly depending on the kind of facility, with

224   health centers having lower availability than hospitals. The proportion of facilities with at least

225   one staff who had received refresher training on NCDs was low across all facilities. Furthermore,

226   the availability of these trained staff was significantly higher in hospitals than in health centers

227   located in the rural.($p < 0.05$).

228 As explained in figure 4; regardless of the facility type, the availability of a functioning adult

229 weight scale and height scale was consistently high across all facilities at 87.3% and 84.2%,

230 respectively. At the same time, measuring tape was significantly lower in all types of health

231 facilities and their location.

232 As described in figure 5, the availability of blood glucose tests was relatively good. The test kit

233 was more available in primary and general hospitals with a significantly lower proportion of

234 functioning glucometers with testing strips found in rural health centers than urban facilities.

235

236 **Essential medicines and commodities for the management of HPN and DM**

237 We evaluated the availability of medicines and commodities to manage both HPN and DM based

238 on SARA (figure 6a and 6b). Consequently, the availability of Angiotensin-converting enzyme

239 (ACE) inhibitor was relatively higher 41(50%) than thiazide diuretic 35(42.7%), Beta-blocker

240 15(18.3%) calcium channel blockers 34 (41.4%). The availability of antihypertensive medicines

241 was consistently lower at the rural health facilities than urban. Hence, considering the above

242 description in figure 3, only 29% and 28% of the PHCU were identified as ready to manage HPN

243 and DM, respectively. The overall availability of anti-diabetic agents was, Metformin tab/cap 30

244 (36.5%), Glibenclamide tablet 32(39%), regular insulin 25(30.5%) Glucose 40%, 49 (59.8%) and

245 minimal health facilities 3(3.6%) do have Gliclazide or Glipizide tabs. The availability of

246 Metformin, glibenclamide, and regular insulin was consistently higher in hospitals and urban

247 health centers than in facilities located in rural.

248

249 **Determinants of the readiness of the health facilities to manage DM and HPN cases**

250 In this topic, we tried to see 1) the association of facility type and location, with the availability

251 of guidelines and at least one staff trained to manage type II DM and HPN. 2) the association of

252 basic diagnostic equipment, essential medicines, and commodities needed for the management of

253 HPN and DM with the readiness of the PHCU.

254 The readiness of the PHCU was evaluated based on the criteria developed by the WHO-SARA.

255 Therefore, their readiness was assessed based on three attributes, availability of treatment

256 guidelines and availability of at least one staff trained in the management of DM and HPN,

257 availability of basic diagnostic materials, and the availability of essential medicines for each

258 disease. Therefore, we considered the availability of guidelines and at least one staff trained and

259 the availability of functioning BP apparatus and stethoscope for HPN and blood glucose test with

260 an unexpired test strip for type 2 DM as mandatory. Considering the availability of at least one

261 type of medicine from each group (ACA inhibitors, thiazide groups, Beta-blockers, and calcium

262 channel blockers) is compulsory for HPN management. In contrast, the availability of Metformin

263 for non-obese and glibenclamide for obese patients, insulin, and 40% glucose is deemed

264 obligatory for the management of DM. We considered the above-mentioned operational

265 definition; the PHCUs were either 'ready' or 'not ready to manage type 2 DM or HPN.

266 **Readiness of the facilities for the management of HPN with the independent variables**

267 The following bivariate tables will discuss the association of facility type and location with the

268 availability of trained staff and the guidelines to manage DM and HPN. Table 3

269

270 As described in table below, stethoscopes and BP apparatus availability at the facilities was

271 relatively high compared to primary and general hospitals, 80(94.5%) and 81(97.5%),

272 respectively. In comparison, we identified only 23 (28.0%) of the facilities with stethoscopes and

273   BP apparatus ready for the screening and management of HPN. Due to the availability of BP

274   apparatus and stethoscope in the majority of the health facilities, the test statistics were

275   insignificant at p>0.05 (1.000). The researcher also tried to triangulate the availability of the

276   adult weight scale, stadiometer, measuring tape, blood glucose test, and urine dipstick protein

277   and ketones with the readiness of the health facility to manage DM.

278   Only 24(29.3%), 24(29.3%), 17(20.7%), 23(28.0%), and 23(28%) of the facilities had adult

279   weight scale, stadiometer, measuring tape, blood glucose test, and urine dipstick protein and

280   ketones respectively were ready to manage DM and HPN. The diagnostic equipment for DM,

281   stadiometer, measuring tape, blood glucose test, and urine dipstick protein and ketones were

282   significantly associated with the readiness of the PHCU with a P<0.05. Because of vast

283   availability, the adult weight scale was not associated with the readiness of the PHCU at a

284   P>0.348.

285   The following table (table 4) describes the availability of diagnostic equipment to manage HPN

286   and DM.

287   **Readiness of the facilities to manage HPN**

288   The following tables describe the basic medicines and commodities used to determine the

289   readiness of the PHCU to manage HPN and DM, respectively.

290

291   These were medicines and commodities to manage HPN; at least one type of ACA inhibitor,

292   thiazide diuretics, beta-blockers, and calcium channel blockers) and Metformine, glibenclamide,

293   insulin, glucose 40%, and Gliczaide for the management of DM (table 5).

294   Of the total health facilities, only 17 (20.7%), 22(26.8%), 12(14.6%), and 22(26.8%) had at least

295   one type of ACE inhibitor, a thiazide diuretic, beta-blockers, and calcium channel blockers,

296 respectively were ready to manage HPN. The association between the availability of

297 antihypertensive drugs and the readiness of the health facility to manage HPN was strongly

298 significant at P<0.05.

299 The researchers assessed the availability of basic DM medicines with the readiness of health

300 facilities to manage DM (table 6). Therefore, facilities that had 23(28.0%) metformin, 23(28.0%)

301 glibenclamide 20(24.4%), insulin regular injectable 40% 24(29.3%), glucose, and Gliclazide or

302 Glipizide tablet2(2.4%), was found ready to manage DM.. Moreover, the availability of medicine

303 and the facility's readiness was strongly associated with the first four medicines at a p-value

304 =0.00 (<0.05). While the availability of gliclazide tablets was almost nil at all health facilities

305 except general hospitals. Thus the readiness of the PHCU to manage DM was not significantly

306 associated at P>0.05

307

308   **Predictors of health facilities' readiness for HPN management**

309 Based on table 7 below, the variables facility type, facility location, availability of guidelines,

310 staff trained, ACE inhibitor Thiazide groups, and Beta-blockers had a significant impact

311 (P<0.05) on the readiness of the PHCU to manage HPN at a 0.05 level of significance.

312 Facilities located in urban were 8.2 times more likely to be ready to provide HPN management

313 than facilities located in rural [AOR=8.2, 95%CI; 2.4-28.5]. PHCU, which had no guidelines,

314 trained staff, antihypertensive medicines such as ACE inhibitors, thiazide groups, and beta-

315 blockers, were 0.005, 0.066, 0.095, 0.012, and 0.011 times less likely to get ready in the

316 management of manage HPN than those who had guidelines, trained staffs, and at least one type

317 of medicines from the group of medicines respectively. [AOR=0.005, 95% CI; 0.000-0.09,

318   AOR= 0.066, 95%CI; 0.008-0.564, AOR= 0.095, 95% CI; 0.016-0.57, AOR= 0.012, 95%CI

319   0.001-0.135, AOR= 0.011, 95%CI .001-.149] at a P<0.01.

320   **Predictors of health facilities' readiness for DM management**

321   As displayed in table 8 below, most of the binary logistic regression results showed a clear link

322   between the availability of the trained staff and guidelines on NCD with the dependent variable,

323   'readiness to screen and manage DM' at P<0.05. In the meantime, the availability of some

324   diagnostic equipment like measuring tape, blood glucose test, urine dipstick-protein, and ketones

325   is strongly associated with the readiness of the PHCU. Moreover, the availability of antidiabetic

326   medications like Metformin cap/tab, Glibenclamide, cap/tab, Insulin regular injectable were

327   strongly associated with the readiness of the health facility too. In comparison, the type of the

328   facility, availability of adult weight scale, BP apparatus, stadiometer, glucose 50% injectable,

329   gliclazide tablet, or glipizide tablet was not associated with the readiness of the PHCU at P>0.05

330   and CI of 95%.

331

332

333   **Discussion**

334   This study assessed the readiness of PHCUs found in Sidama regional states to manage DM and

335   HPN. The study identified significant gaps in the availability of basic amenities, staff training

336   and guidelines, diagnostic equipment and materials, medicines, and commodities. Although,

337   there is variability among the different types of health facilities and where the facilities are

338   located to manage DM and HPN.

339   Overall, the study found disparities in the readiness between the type of health facilities and their

340   service. Hospitals provide a higher level of service for their communities than health centers.

341   When looking at individual categories of the WHO-SARA (availability of trained personnel and

342   guidelines, basic diagnostic materials, and basic medicines and commodities) according to the

343   type of the facility, health centers had lower availability of guidelines and trained staff to manage

344   DM HPN. This finding is consistent with research undertaken in Uganda and Tanzania(31,32).

345   The unavailability of guidelines in the health centers and low availability in the primary and

346   general hospitals is evidence of the problems related to early detection of DM and HPN (30,31).

347   The study also revealed that the lower proportion of health care providers trained for DM and

348   HPN in all types of health facilities, and the problem is serious at the rural health facility level.

349   This finding is consistent with previous research conducted in Uganda, Nigeria, sub-Saharan

350   countries and Bangladesh (31-33, 54). The similarity could be the financial problem that the

351   countries are facing, the attention given to NCDs, or the country's policy toward NCD. (34,35).

352   The availability of basic diagnostic materials for all types of DM and HPN significantly impacts

353   the early identification and management of the problems (36). This study revealed a significant

354   difference in the availability of diagnostic materials between health facilities. Concerning the

355   availability of essential risk factor screening tools for DM, the availability of weight scale and

356   height scale among the health facilities were high. Our finding is consistent with research

357   conducted in Tanzania and Cambodia (37,38). The reason for the availability of the material in

358   the facilities may be elucidated because the weight and height scales are attached and used for

359   other purposes like maternal and child care (MCH). Besides, facility type had an excellent

360   contribution to the availability of glucometers with their testing strips. We found that similar

361   studies conducted in Tanzania and Uganda have identified a higher proportion of glucometer

362   with its strip found in hospitals than in health centers and dispensaries (31, 37). The present

363   study also revealed that a high proportion of blood pressure measuring apparatus and

364 stethoscopes as essential diagnostic equipment for HPN screening and management was

365 available in the majority of the health facility. The study also confirmed no significant difference

366 in the availability of the machine and stethoscope in facility type. Studies conducted in Ethiopia,

367 Nigeria, and Uganda confirmed similarities between the results (37,39,40). This finding may be

368 because BP machines and stethoscopes are considered basic materials to take the patient's vital

369 signs at the triage unit. It can use for antenatal, laboring, and postnatal periods to screen pre-

370 eclampsia, eclampsia, and postnatal complications.

371 Access to effective treatment for NCDs is a vital step in reducing the risk and burden of the

372 disease (40). However, services remained lower according to the type of facilities in many LMIC

373 (43,11). Overall, the availability of Metformin, glibenclamide, and injectable insulin reported in

374 this study was consistently higher in hospitals than in health centers. Similar investigations have

375 been carried out in various parts of the world. This study was in line with studies conducted by

376 different researchers (37, 39, 41). In addition, relatively half of the health facilities have ACE

377 inhibitors. However, a lower proportion of facilities have at least one type of

378 Hydrochlorothiazide, beta-blockers, and calcium channel blockers at the lower levels of the

379 health facilities (Health centers). This finding agrees with other African countries' reports like

380 Cameroon, Tanzania, Zambia, Uganda, and Nigeria (45, 46 47, 31).

381 The disparities in the availability of basic screening/diagnostic materials and treatment medicines

382 and commodities among facility types in the current study may be due to several problems like

383 lack of trained health care providers, especially at the lower levels of health facilities (health

384 centers), the unavailability of medicines and commodities at the official distributor, a complex

385 procurement process arranged by the government (45). Inadequate budget allocation and

386 insufficient ordering of the NCD medicines by the health care facility, and lack of appropriate

387 knowledge of the healthcare providers found in the rural health centers worsened the problem(2).

388 Health centers are expected to provide NCD services for their community members. In contrast,

389 medicines and medical commodities essential for NCD screening and treatment were not

390 available at the health center level.

391 Therefore, we recommend that essential NCD screening and management medicines and

392 commodities be available at the lower and rural health centers to consider the rural communities.

393 The differences in the availability of diagnostic and treatment commodities have a significant

394 impact on the readiness of the health facility to provide early detection of DM and HPN. The

395 variations in availability of services based on; the availability of trained staff and guidelines, the

396 availability of basic diagnostic materials for both DM and HPN, and the availability of essential

397 medicines and commodities have a significant impact on the readiness of facilities to provide

398 early detection and management of NCD services. At the same time, Ethiopian health policies

399 and guidelines necessitate all facilities, including health centers, to screen for major NCDs(50).

400 Whereas this study identified that facilities located in rural are less ready than those found in

401 urban. Lesser readiness is identified at health centers than in hospitals (primary and general).

402 This may be because of the lower requesting ability of the health care providers at the health

403 centers than hospitals and the lower level of the academic background of the health care

404 providers at the health center level than hospitals.

405 According to our study, facilities located in urban were 8.2 times more likely to be ready to

406 provide HPN management than facilities located in rural. This outcome is consistent with

407 findings from earlier Tanzanian (46), Zambian, and Malawian investigations (47). The good

408 reason for not providing DM and HPN at the rural health facilities could be improper supportive

409   supervision from the nearby health offices, a little concern for NCDs, and a lack of political

410   commitment (48-50).

411   The study also found that primary hospitals and NGO clinics were 3.6 and 22.3 times more likely

412   to handle HPN and DM than health centers. This finding is consistent with recent studies

413   conducted in Tanzania(46) and Ethiopia (48). The projected reason for this could be lack of

414   trained and skilled health care providers, lack of diagnostic equipment and materials at the health

415   centers, lack of political and leadership commitment (48, 50, 51).

416   PHCUs that do not have guidelines, trained personnel, and antihypertensive and anti-diabetic

417   drugs were 0.005, 0.066, 0.095, 0.012, and 0.011 times less likely to manage HPN than those

418   with guidelines, trained staff, and at least one type of medicine from the category of medicines.

419   Our result is also in-line with studies conducted in other LMIC and sub-Saharan African

420   countries (46,51,52). The predicted cause for this could be a lack of political will and leadership,

421   loose policy implementation on NCD prevention, and a lack of knowledge on the severity of the

422   disease (34,48,50).

423   This study offers valuable policy inferences to progress NCD services at all facilities regardless

424   of their location. The recommendations include an improved country-wide obligation to offer

425   NCD services in all facilities as stipulated in the existing policies and guidelines. In addition,

426   tactics must be developed to facilitate better policy results incorporating local context factors

427   such as political will, allocating resources, and so forth, and assignment of qualified health care

428   providers (at least a health officer or BSc nurse) at the rural health centers. MoH should revise

429   policies for procurement of medicines and medical supplies to strengthen lower-level facilities,

430   particularly health centers located in the rural areas serving the majority of the Ethiopian

431   population. Also, efforts should be made to meet the voluntary target set by the Global Action

432 Plan on NCDs of an 80% availability of affordable basic technologies and medicines required to

433 treat major NCDs in both public and private facilities (53). Through this, we can reduce

434 premature disabilities and death in the country.

435 The main strength of this study is the use of primary data directly from the study setting and

436 investigating the current availability and functionality of the screening equipment, medicines,

437 and commodities. The researchers created the outcome variables based on indicators identified

438 from the WHO- SARA manual, which desired to be available in the national guidelines of

439 Ethiopia for the prevention and treatment of NCDs.

440 **Limitation of the study**

441 The drawback of this study was its cross-sectional nature. Service availability and readiness

442 measures may not detect the quality and experience of service delivery, which has usually

443 become a higher contributor to health loss in LMICs related to service availability alone.

444 **Implications of the result**

445 The outcome of this study has broad implications for the NCD response in Ethiopia. First, this

446 study adds to the body of knowledge relating to primary health care units' readiness to manage

447 diabetes and Hypertension in particular and NCDs in general. This study adds depth to the

448 understanding of the policymakers how to address communities who reside in the rural setting.

449 Also, it is beneficial to mitigate the risk of undiagnosed NCD to ensure readiness for NCD

450 services. Facilities in rural settings lack trained staff, guidelines, screening and diagnostic

451 materials, and medicines and medical commodities to manage DM and HPN. The probability of

452 early detection will deteriorate so that the possibility of getting severe complications such as

453 macro and microvascular damage will be higher. The health costs will put the patient into an

454   unbearable economic burden. Therefore, making PHCU ready to manage DM and HPN should

455   be the primary focus of the government of Ethiopian government.

456   **Conclusion**

457   In summary, this study provided tangible evidence of the disparities in readiness of the PHCU in

458   the early detection and management of DM and HPN. The current results identified a gap in the

459   availability of trained staff members and treatment guidelines, essential diagnostic equipment,

460   and medicines; the researchers observed comparatively poor and deprived readiness to offer

461   HPN and DM services at the lower level health facilities (health centers).

462   **Recommendations**

463   Equipping the lower-level health facilities with all the required will improve the quality of

464   service provided for NCD patients. The higher levels of health care are overloaded with the

465   management of routine cases. There should be improvements to be geared towards six main

466   areas: (i) provision of refresher training for the health care providers at the rural health centers,

467   ii) provision of standard guidelines, iii) procurement and re-filling of essential diagnostic

468   equipment and drugs; iv) critical follow-up schedule should be arranged for NCDs by the woreda

469   health offices; v) professionals with at least first degree in public health or nursing should be

470   assigned; vi) nearby primary hospitals should schedule an outreach program, and they should

471   provide on-site training for the health care providers of the rural health centers.

472

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665

. Domains and indicators used for assessing the readiness of Primary Health Care Units to manage Diabetes and Hypertension

1   Table1. Domains and indicators used for assessing the readiness of Primary Health Care Units to

2   manage Diabetes and Hypertension

Domain	Indicator	Data collection and description
1. Basic amenities	Sanitation facilities Communication equipment's Consultation room Water source, power source, emergency transportation and computer with internet	Observed availability of functioning Sanitation facilities Communication equipment's Consultation room Water source, power source, emergency transportation and computer with internet
2. Staff training and guidelines	Guidelines for the diagnosis and management of DM and HPN	Observed availability of National Standard Treatment hard copy of Guidelines for DM and HPN .
	Staff trained in the diagnosis and management of DM and HPN	Observed availability of at least one trained staff providing DM, HPN services who had completed refresher courses for the diagnosis and management of DM, HPN.
3. Basic diagnostic equipment	DM: weight scale, height scale and measuring tape and glucometer.	Observed availability of functioning weight scale, height scale and glucometer with test strips and urine dipstick protein and ketone
	HPN: stethoscope and blood pressure (BP) apparatus	Observed availability of functioning digital or manual BP apparatus in the facility
4. Basic medicines	DM: metformin, glibenclamide and insulin injection.	Observed availability of a first- line regimen that had not expired; metformin (for obese patients), glibenclamide (for non- obese patients) and insulin injection for DM
	HPN: thiazide diuretics, ACE inhibitors, beta blockers and furosemide	Observed availability of at least one type of thiazide diuretics as a first-line regimen for hypertension atleast one type of (ACE inhibitor+beta blocker furosemide).

Study facilities and their location

1   Table 2: Study facilities and their location

Facility type	Rural facilities		Urban facilities		Total	
	n	%	n	%	n	%
Health centers	46	56	17	23	63	76.8
Primary hospital	5	6	8	9.7	13	16
General hospital	2	2.4	1	1.2	3	2.4
NGO clinics	3	3.6	0	0%	3	3.6
Total	**56**	**68.3**	**26**	**31.7**	**82**	**100**

Association of facility type and location guidelines and availability of trained staff with
HPN and DM

1   Table 3; Association of facility type and location guidelines and availability of trained staff with

2   HPN and DM

Variables	Categories	HPN management and treatment		P-Value	DM management and treatment		P-value
		Ready	Not ready		Ready	not ready	
Facility type	Health center	1152	52		12	51	
	Primary Hospital	76	6		7	6	
	General Hospital	3	0	.001**	3	0	
	Others	2	1		2	1	0.001**
	Total	**23**	**59**		**24**	**58**	
Facilities location	Rural	47	9		48	8	
	Urban	12	14	.001**	10	16	
	Total	59	23		**58**	**24**	0.00**
Availability of Guideline for NCD	Yes	1	14		3	12	
	No	58	9	.000**	55	12	
	Total	**59**	**23**		**15**	**67**	0.00**
Staff trained for NCD	Yes	21	22		3	18	
	No	38	1	.000**	55	6	
	Total	**59**	**23**		**21**	**61**	0.00**

Availability of diagnostic equipment's for HPN and DM

1   **Table 4; Availability of Diagnostic equipment's for HPN and DM**

Diagnostic equipment's for HPN management and treatment				
Equipment	Category	HPN management and treatment		P-Value
		Ready	not ready	
Stethoscope	Yes	23	57	1.000
	No	0	2	
	Total	**23**	59	
Blood pressure apparatus	Yes	23	58	1.000
	No	0	1	
	Total	**23**	**59**	
Diagnostic equipment's for DM management and treatment				
Measuring tape	Yes	17	7	
	No	7	51	.000**
	Total	**24**	**58**	
Adult weight scale	Yes	24	55	0.348
	No	0	3	
	Total	**24**	**58**	
Stadio-metere	Yes	24	45	0.008*
	No	0	13	
	Total	**24**	**58**	
Blood glucose test	Yes	23	18	
	No	1	40	.000**
	Total	**24**	**58**	
Urine dipstick-protein and ketone	Yes	23	20	
	No	138	38	.000**
	Total	**24**	**24**	

the bivariate analysis of basic medicines for the management of HPN with readiness of the PHCU

2   **Table 5:** the bivariate analysis of basic medicines for the management of HPN with readiness of

3   the PHCU

Variables	Categories	HPN management and treatment Ready	Not Ready	P-value
At least one type of ACE inhibitor	Yes	17	13	.013*
	No	6	46	
	Total	**23**	**59**	
At least one type of thiazide diuretic	Yes	22	13	.000**
	No	1	146	
	Total	**23**	**59**	
At least one type of Beta blocker	Yes	12	3	.000**
	No	11	56	
	Total	**23**	**59**	
At least one type of calcium channel blockers (e.g. amlodipine)	Yes	22	12	.000**
	No	1	48	
	Total	**1**	**59**	

The bivariate analysis of basic medicines for the management of DM with readiness of the PHCU

1 Table 6: the bivariate analysis of basic medicines for the management of DM with readiness of

2 the PHCU

Variables	DM management and treatment		P-value
	Ready	not ready	
Metformin cap/tab	23	7	.000
	1	51	
	24	**58**	
Glibenclamide cap/tab	23	6	.000
	1	49	
	24	**58**	
Insulin regular injectable	20	5	.000
	4	3	
	24	**58**	
Glucose 50% injectable	24	25	.000
	0	33	
	24	**58**	
Gliclazide tablet or Glipizide tablet	2	1	.0204
	22	57	
	24	**24**	

Factors associated with the readiness of the facilities to provide HPN management at the PHCU adjusted for confounding variables

4   **Table 7;** Factors associated with the readiness of the facilities to provide HPN management at

5   the PHCU adjusted for confounding variables

Variables	COR [95% CI]	AOR [95% CI]
Facility type		1.0 3.6[0.9-14.9]
health centre	1.0	-
Primary Hospital	5.5[1.5-19.6]*	22.2[1.7-297.9]*
General Hospital	7636790166	
Others	9.5[0.8-0.113	
Location of the Facilities		
Rural	1.0	1.0
Urban	6.0[2.1-17.4]**	8.2[2.4-28.5]*
Guideline for CVD		
Not available	1.0	1.0
Available	0.011[0.001-0.095]**	.005[.000-.091]**
Staff trained for HPN management	1.0	1.0
Not trained	.025 [.003-0.20]**	0.066[0.008-0.564]*
Trained		
Stethoscope		
Available	1.0	1.0
Not available	0.000	-
BP apparatus		
Available	1.0	1.0
Not available	0.000	-
Groups of medicine		
ACE inhibitor	1.0	1.0
Thiazide groups	.242[.083-0.703]*	.095[.016-.570]*
Beta blockers	.013[.002-.105]**	.012[.001-.135]**
Calcium channel blocker	.049[.012-.203]**	.011[.001-.149]**

6   Note *=P value≤0.05   **=P value≤0.01

Factors associated with the readiness of the facilities to provide DM management at the PHCU adjusted for confounding variables

1   **Table 8;** Factors associated with the readiness of the facilities to provide DM management at the
2   PHCU adjusted for confounding variables

Variables	COR[95%CI]	AOR[95%CI]
Facility type		
Health centre	1.0	1.0
Primary Hospital	4.958[1.4-17.5]*	2.2[0.5-9.5]
General Hospital	-	-
Others	8.5[0.7-101.6]	11.9[.8-.186.0]
Facilities location		
Rural	1.0	1.0
Urban	9.6[3.2-28.5]**	11.1[3.13-39.36] **
Guideline for NCD		
Not available	1.0	1.0
Available	.055[.013-.22]**	0.31[.004-.231]**
Staff trained for DM management		
Trained	1.0	1.0
Not trained	0.18[.004 -.08]**	0.055[.009-.0336]*
Adult weight scale		
Not available	1	1
Available	0.000	-
Measuring tape(ref.		
Not available	1.0	1.0
Available	.057[.017-.18]**	.055[.009-.336]**
Stadio-meter		
Available)	1	1
Not available	-	-
Blood glucose test		
Not available)	1	1
Available	0.04[.002-.156]**	.044 [0.005-.339]**
Urine protein and ketone		
Not available	1	1
Available	0.023[0.003-.182]**	054[.006-.472]**
Metformin		
Available	1	1
Not available	.006[.001-.051]**	.003[.000-.066]**
Glibenclamid		
Not available)	1	1
Available	.008[0.001-0.67]	.008[.001-.091]
Insulin		
Not available)	1	1
Available	0.19[.005-0.77]	.018[.003-.121]**
Glucose 40%		

Not available	1	1
Available	-	-
Gliclazide/ Glipizide		
Not available	1	1
Available	.193[.017-2.237]	.459[.011-19.545]

Figure 1

Sample facilities recruited for SARA
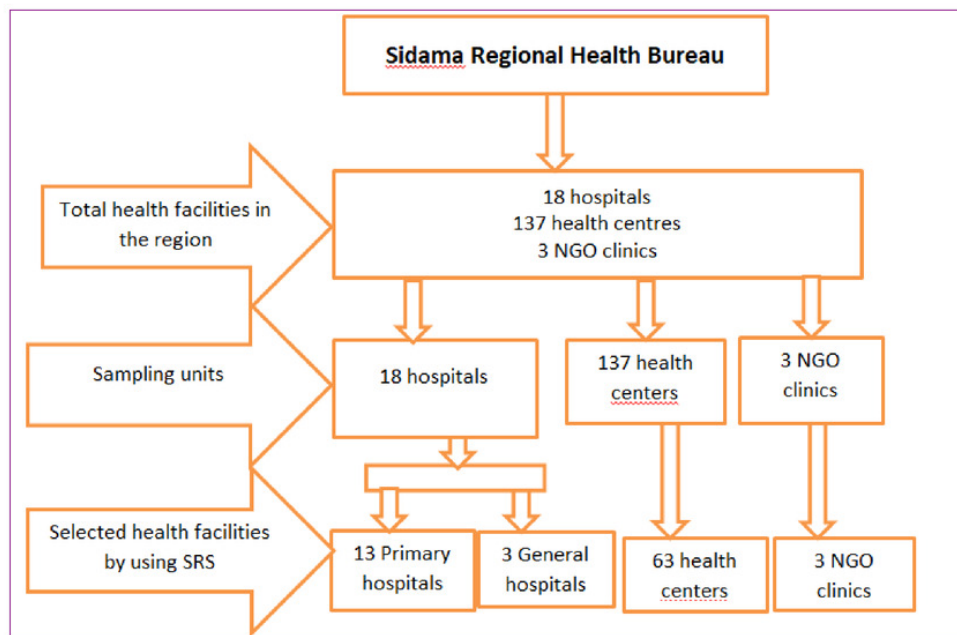
Figure1: Sample facilities recruited for SARA

Figure 2

The availability of basic amenities in the sampled health facilities
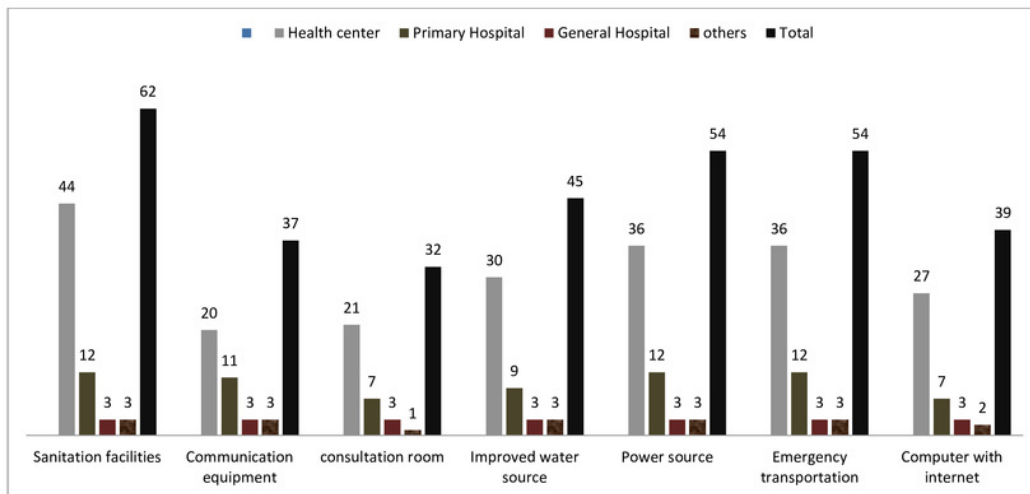
Figure 3

the availability of guidelines, and trained staff for DM and HPN management.
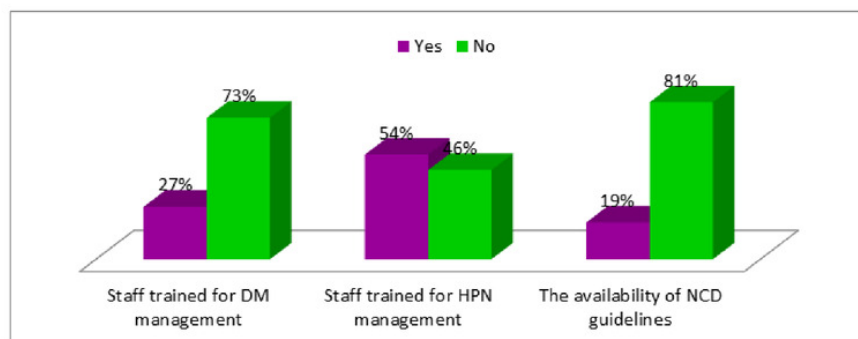
Figure 3: the availability of guidelines, and trained staff for DM and HPN management.

Figure 4

Availability of basic screening equipment for DM
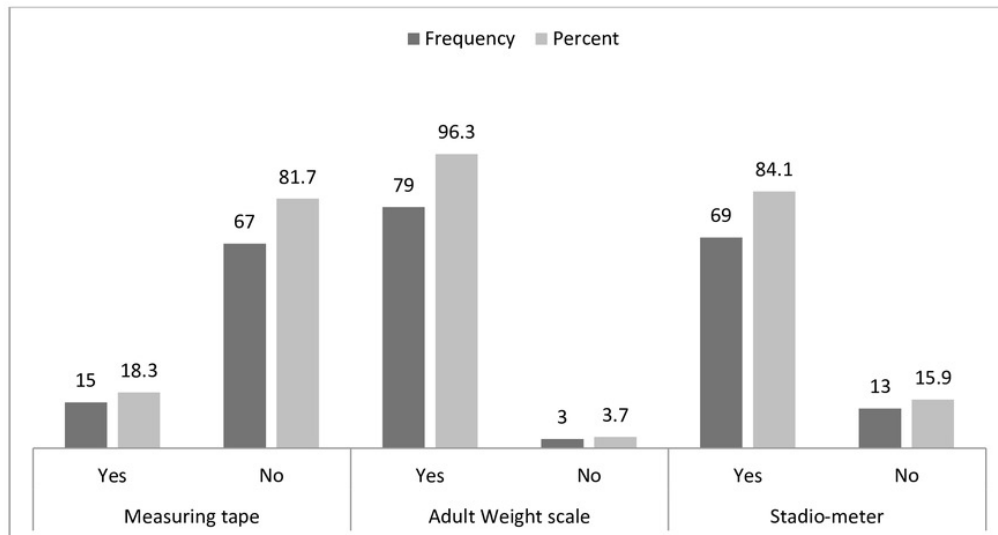
Figure 5

The availability of basic diagnostic materials for DM management
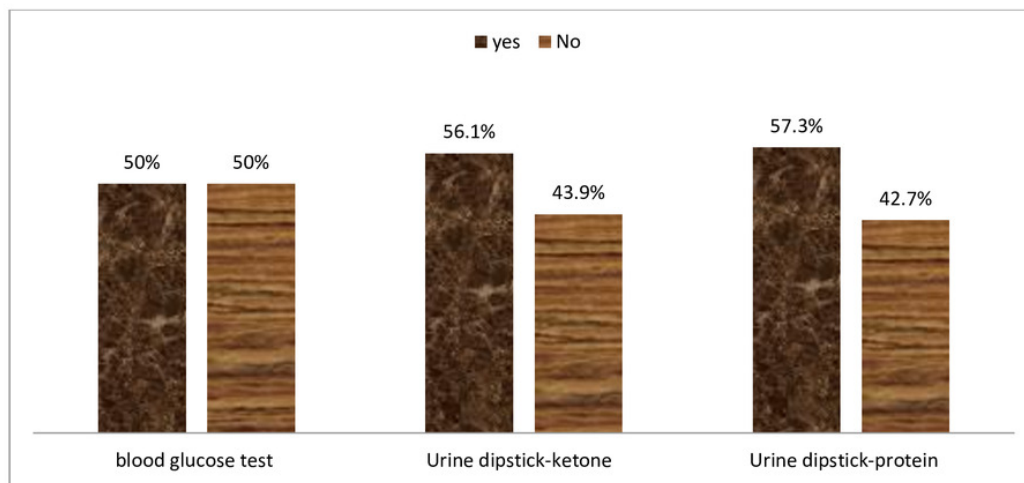
Figure 6

Figure 6 (A and B): Availability of basic medicines for HPN and DM