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Impact of COVID-19 Pandemic on Cost of Chronic Diseases Treatment and Care at Public Hospitals in Wallaga Zones, Oromia Regional State, Ethiopia: Hospital Based Cross-Sectional Study

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3 **1 Impact of COVID-19 Pandemic on Cost of Chronic Diseases Treatment and**
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5 **2 Care at Public Hospitals in Wallaga Zones, Oromia Regional State, Ethiopia:**
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7 **3 Hospital Based Cross-Sectional Study**
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9

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5 31 **Abstract**

6 32 **Objective:** Aimed to determine the impact of COVID-19 pandemic on cost of chronic
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8 33 diseases treatment and care at public hospitals in Wallaga Zones, Oromia Regional
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10 34 State, Ethiopia, from August 01 to 31, 2020.

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13 35 **Methods:** An institutional based cross-sectional study design was used and the
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15 36 sample size for the study (n = 642) was determined using a single population mean
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17 37 formula. Data was collected using interviews and analyzed using SPSS version 25.
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19 38 Descriptive statistics were performed and the cost of follow-up care before and after
20
21 39 the pandemic was compared using a Related-samples Wilcoxon signed-rank test,
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23 40 declaring the level of significance of the median cost difference at $P < 0.05$.

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28 41 **Results:** A total of 642 patients were included in the study, among whom 605 (94.2%)
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30 42 of them responded to the interviews. There was a significant median cost difference (n
31
32 43 = 593, $Z = 5.05$, $p = 0.001$) between the cost of chronic diseases among follow-up
33
34 44 patients during the pandemic compared to the costs incurred by these patients before
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36 45 the pandemic.

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40 46 **Conclusion:** The cost of follow-up care among chronic disease patients during the
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42 47 COVID-19 pandemic was significantly higher compared to before the pandemic era.
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44 48 Therefore, healthcare providers should arrange special fee waiver mechanisms for
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46 49 chronic disease healthcare costs during such types of pandemics and provide the
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48 50 services at proximal health facilities.

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51 51 **Keywords:** COVID-19 Pandemic, Chronic Disease, Cost of Illness, Follow up Care,
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55 52 Ethiopia
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53 **Background**

54 Globally, chronic diseases (CDs) are major public health problems that account for
55 60% of all deaths and are the cause of 35% of deaths in low and 40% of deaths
56 occurring in middle income countries.¹⁻³ Many low- and middle-income countries
57 (LMICs) are undergoing a gradual epidemiologic transition as the disease burden shifts
58 from infectious to non-communicable diseases .⁴⁻⁶

59 Healthcare systems in LMICs are mostly unprepared to handle the increasing burden
60 of non-communicable diseases (NCDs), resulting in no or limited access to affordable
61 prevention and diagnosis of NCDs.⁷ These add up to higher NCD treatment costs, the
62 financing of which mostly comes from households' out-of-pocket (OOP) spending .⁸

63 COVID-19 originated first in China, in Wuhan, Hubei province, in late December 2019,
64 as a health crisis that struck the global community, causing dismal repercussions.

65 SARS-CoV-2 has spread fast all over the world to involve over 200 countries, making it
66 a pandemic. The World Health Organization (WHO) notified COVID-19 as a pandemic
67 on March 12, 2020. ^{9, 10}

68 The COVID-19 pandemic disrupts entire societies, including the routine health care
69 systems. The comprehensive effort to contain the pandemic and minimize the
70 subsequent morbidity and mortality has affected both the continuity and quality of care
71 for patients with CDs.¹¹

72 During the pandemic, most global healthcare resources are focused on COVID-19
73 control and prevention. This resource reallocation could disrupt the continuum of care
74 for patients with CDs. Diabetes, chronic obstructive pulmonary disease, hypertension,
75 heart disease, asthma, cancer, and depression were the conditions reported to be
76 most impacted by the reduction in healthcare resources due to the pandemic.¹²

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3 77 Resources at all levels have shifted away from CDs management and prevention
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5 78 during the outbreak, and the lock-down of many services has translated into reduced
6
7 79 access, a decrease in referrals, and reduced hospitalizations of patients with non-
8
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10 80 COVID-19 pathology.¹³
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12 81 As the pandemic continues to rapidly spread, our attention often focuses on the
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14 82 numbers of confirmed and probable cases, hospitalizations, and deaths, which can be
15
16 83 called the "direct" effects of the pandemic. However, these numbers do not capture the
17
18 84 full extent of the pandemic because it has also generated important spillover (indirect)
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20 85 effects by decreasing the supply of and altering patient demand for non-COVID-19-
21
22 86 related medical care. ¹⁴
23
24
25 87 A lock-down, self-isolation, and social distancing are some of the measures taken by
26
27 88 governments of different countries aimed at decelerating the pandemic spread. The
28
29 89 pandemic influenced everyone around the globe, but it can cause more concerns for
30
31 90 people living with chronic illnesses .¹⁵
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34 91 Ethiopia had the first COVID-19 positive case confirmed on March 13th, 2020.¹⁶ At this
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36 92 time, the government declared a state of emergency, labeling the pandemic as a
37
38 93 national threat and launching overall preventive measures, including advising the
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40 94 community to stay at home, practicing strict and frequent hand washing, and wearing a
41
42 95 face mask. The government also restricted the movement of its people from place to
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44 96 place and laid temporary restrictions on market places, restaurants, shops, cinema
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46 97 houses, religious, and cities.¹⁷ During this time, the number of hospital visits dropped
47
48 98 sharply to utilize health services, including CD follow-up. ¹⁸
49
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51 99 Many studies have revealed the direct impact of COVID-19 on health care provision
52
53 100 and utilization. But none of them reported the impact of the pandemic on illness costs
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55 101 of chronic disease follow-up care from a patient perspective. So, the study aimed to
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3 102 determine the impact of the COVID-19 pandemic on the cost of follow-up care among
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5 103 chronic disease patients at public hospitals.
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8 104 **Methods and Materials**

9 10 105 **Study Setting**

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12 106 This study was conducted from August 01 to 31, 2020 in East Wallaga, West
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14 107 Wallaga, and Horro Guduru Wallaga zones of Oromia National Regional State,
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16 108 Ethiopia.
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19 109 **Study Design and Costing Method**

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21 110 A cross-sectional institutional-based study design was used. The bottom-up costing
22
23 111 approach was used. To analyze the cost of the treatment during the follow-up visit
24
25 112 with respect to patient perspective and the indirect costs(income lost due to
26
27 113 productive time lost) that were estimated using earnings lost.¹⁹
28
29

30
31 114 The time foregone and productive time lost were converted into indirect costs based
32
33 115 on the daily wage rate and then multiplied by the number of working days lost. The
34
35 116 daily wage rate for patients was estimated by dividing their monthly income by 30
36
37 117 days for both patients and caregivers.¹⁹
38
39

40 118 All costs included in the analysis were measured in terms of Ethiopian Birr (ETB) and
41
42 119 were converted to US\$(US dollar) during the analysis, and the average currency
43
44 120 exchange rate was (August 2020; 1 US\$ = 35.99 ETB).
45
46

47 121 **Study Participants**

48
49 122 All chronic disease patients who visited public hospitals in the Wallaga Zones were
50
51 123 the source population, and all patients who visited the three Wallaga Zones' selected
52
53 124 study hospitals during the study period were the study population.
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125 **Inclusion and Exclusion Criteria**

126 All patients of the selected CDs in the study area who visited the study hospitals
 127 were included in the study. Patients whose age was less than 15 years old and
 128 without accompanying patients who were seriously ill and unable to respond to the
 129 interviews were excluded from the study.

130 **Sample Size and Sampling Procedures**

131 The sample size was determined by using the single population mean formula,
 132 applying the following assumptions: two-sided alpha error (ϵ) set at 0.05, 95%
 133 confidence level, and mean cost of DM (μ) = 48.99 ETB, and standard deviation
 134 (SD)= 30.89 ETB²⁰, adding 5% non-response rate.

135 Using the formula, $n = \frac{(z - \frac{\alpha}{2})^2 * \sigma^2}{\epsilon^2 \mu^2}$ [21], n= 642.

136 Among thirteen public hospitals in the study area, data was collected from the
 137 selected CDs of follow-up care patients from Nekemte specialized hospitals, Sire
 138 hospital, Gida hospital, Arjo hospital, Shambu hospital, Guduru hospital, Gimbi
 139 hospital, and Nedjo hospital.

140 The determined sample size was allocated to each study hospital proportionally
 141 based on the proportion of each CDS patient who attended follow-up care. Wollega
 142 University referral hospital was purposely excluded from the study, which was an
 143 isolation and treatment center for COVID-19 during the study period, and four other
 144 hospitals were excluded due to their low CDS patient flow.

145 A total of 642 participants were selected by using a systematic sampling method at
 146 each study hospital. A simple random sampling technique was employed to select
 147 the first participant from the registration book.

148 **Data Collection Procedures**

149 The structured questionnaire was developed in English after reviewing relevant
150 literature, and it was translated into Afan Oromo. Data collection and supervision
151 were carried out by eight data collectors, with four supervisors assigned. These data
152 collectors and supervisors were trained before the pre-test and actual data collection
153 started. The questionnaires were pre-tested in Bedele Hospital using 32(5%) of the
154 determined sample size. It was collected by face-to-face interview. Patients who
155 completed their chronic outpatient services and returned to leave the study hospitals
156 were interviewed.

157 **Study Variables**

158 **Socio-demographic and economic characteristics, health service costs**
159 **(non-medical costs; transportation, food, accommodation, and income**
160 **lost, and medical costs; registration, consultation, laboratory, radiology,**
161 **and drugs) were assessed and determined.**

162 **Operational Definitions**

163 **Before COVID-19:** The period before March 13, 2020, when Ethiopia had the first
164 confirmed COVID-19 positive case.

165 **Chronic disease follow up patients:** A patient visited the study hospital for the
166 follow-up care of one of; hypertension (HTN), diabetic's mellitus (DM), heart failure
167 (HF), mental illness, HIV (Human immune virus), stroke, epilepsy, and asthma.

168 **Chronic disease:** Any of the following illnesses that persist over time, can gradually
169 progress, do not resolve spontaneously, and may not be cured, like HTN, DM. HF,
170 mental illness, HIV, stroke, epilepsy, and asthma.

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3 171 **Direct costs:** The expenditures in ETB spent by chronic disease patients and their
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5 172 families on the diagnosis and treatment of chronic illness per prescription of
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8 173 physicians in the study hospitals.

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10 174 **During COVID-19:** The period after March 13, 2020, when Ethiopia had the first
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12 175 confirmed COVID-19 positive case.

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14 176 Indirect costs: the number of productive days lost by patients and their families as a
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17 177 result of chronic illness care and treatment.

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19 178 Medical cost: The cost component of chronic disease patients' follow-up visits at
20
21 179 study hospitals that includes registration, laboratory, radiology, and drug costs.

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24 180 **Non-medical cost:** The cost component that includes transportation, food,
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26 181 accommodation, and income lost among chronic disease patients during
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29 182 follow-up visits at study hospitals.

30 31 183 **Data Management and Analysis**

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33 184 Data was entered in to Epi-data version 3.1 and exported to SPSS version 25
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36 185 software for analysis. Descriptive statistics and median were performed for all study
37
38 186 variables based on their characteristics. Finally, the normality distribution of
39
40 187 treatment cost data was checked, and it was not normally distributed. As a result,
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43 188 non-parametric tests were used to analyze the median cost for each cost category,
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45 189 as well as a 2-paired sample Wilcoxon sign rank test to compare the costs incurred
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47 190 before and during the pandemic lock-down, with the level of significance of the
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49 191 median cost difference set at $p < 0.05$.

50 51 192 **Patient and Public Involvement**

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194 Results

195 Socio-demographic Characteristics

196 A total of 642 patients were included in the study, among whom 605 responded to
 197 the interview, making a 94.2% response rate. An almost equal number of male and
 198 female participants participated in the study. More than half of the participants, 352
 199 (58.2%), were from urban areas, and the majority of them, 421 (69.6%), were
 200 married.

201 Regarding the educational status of the participants, 137 (22.6%) were illiterates who
 202 were unable to read and write (Table 1). The average participant age was 43.29
 203 (16.5%) years, the average monthly income was 84.32 (± 70.65) US dollars, and the
 204 average household size was 4.46 (± 3.43).

205 Table 1: Socio-demographic and economic characteristics of chronic diseases
 206 patients visited public hospitals in the three Wallaga zones, Oromia National Regional
 207 State, Ethiopia 2020 (N= 605)

Socio-demographic Characteristics (N= 605)		Frequency (n)	Percentage (%)
Sex	Male	302	49.9
	Female	303	50.1
Residence place	Urban	352	58.2
	Rural	253	41.8
Marital status	Single	130	21.5
	Married	421	69.6
	Separated	7	1.2
	Divorced	2	0.3
	Widowed	45	7.4

Religion	Orthodox	165	27.3
	Muslim	59	9.8
	Protestant	373	61.7
	Others	8	1.3
Ethnic group	Oromo	552	91.2
	Amhara	48	7.9
	Gurage	4	0.7
	Tigre	1	0.2
Educational status	Illiterate	137	22.6
	Read & Write	102	16.9
	Grade 1-8	99	16.4
	Grade 9-8	151	25.0
	Diploma and above	116	19.2
Employment status	Government employee	93	15.4
	NGO* employee	89	14.7
	Merchant	100	16.5
	Housewife	114	18.8
	Farmer	107	17.7
	Others**	102	16.9

208 *NGO= non-governmental organization, ** Daily laborer, students

209 **Costs of Follow up Care**

210 The total cost for the treatment of CDs before the COVID-19 pandemic among
 211 patients who incurred any one or more types of cost was on average 10.70(±10.50)
 212 US dollars, with the median cost of 8.04 US dollars among 600 patients before the
 213 pandemic. The total cost of the treatment of the diseases per follow-up visit during

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3 214 the pandemic among 597 patients was 13.40(\pm 11.54) US dollars and the median cost
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5 215 was 10.41 US dollars.
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8 216 The median income lost due to productivity time lost for the treatment of CDs before
9
10 217 the pandemic was 1.48 US dollars among 501 participants who had income, which
11
12 218 was almost similar to the income lost when visiting the study hospitals during the
13
14 219 pandemic, which was 1.40 US dollars.
15

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17 220 The total median non-medical cost incurred for the follow-up care was 2.57 US
18
19 221 dollars before the pandemic among 463 patients and 5.49 US dollars among the
20
21 222 same number of patients during the pandemic.
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24 223 The total median transportation cost to travel to hospitals and travel back to their
25
26 224 homes, the participants incurred 1.14 US dollars before the pandemic and 2.29 US
27
28 225 dollars during the pandemic among 430 patients who paid for transportation.
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31 226 The total median cost incurred for the accommodation and food during the follow-up
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33 227 visit was 3.43 US dollars before the pandemic and 4.29 US dollars during the
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35 228 pandemic among 199 participants.
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38 229 The total median medical cost was 3.71 US dollars before the pandemic, whereas it
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40 230 was 4.29 US dollars during the pandemic hospital visit among 425 participants who
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42 231 paid for the prescribed drugs (Table 2).
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236 Table 2: Chronic diseases follow-up treatment and care cost categories among
 237 chronic diseases patients at public hospitals in the three Wallaga zones, Oromia
 238 National Regional state, Ethiopia 2020(N= 605)

Cost Categories	Era of COVID-19 Pandemic	Observation (N)	Median (US\$)	Significance level of median cost difference (During- Before covid-19)
(a) Income lost	Before	501	1.48	Z = 1.780, p = 0.075
	During	501	1.40	
(b) Transportation	Before	430	1.14	Z = 8.028, p = 0.001
	During	430	2.29	
Food and accommodation c	Before	199	3.43	Z = 1.189, p = 0.169
	During	199	4.29	
Total nonmedical cost (a+b+c) = (d)	Before	463	2.57	Z = 4.903, p = 0.001
	During	463	5.49	
(e) Total medical cost	Before	425	3.71	Z = 2.382, p = 0.017
	During	425	4.29	
Total cost per patient per visit (d+e)	Before	600	8.04	Z = 5.05, p=0.001
	During	593	10.41	

239 Note: 1US\$ = 35.99 ETB, August, 2020

240 Cost Difference Based on COVID-19 Pandemic

241 Patients were categorized according to the type of chronic disease for which they
 242 visited study hospitals (Table 3). There was a significant median cost difference (n =
 243 593, Z = 5.05, p = 0.001) between the cost of follow-up care during the COVID-19
 244 pandemic lock-down compared to the costs incurred before the pandemic (Table 4).

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3 245 This showed that 348 out of 593 (58.7%) patients incurred significantly higher costs
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5 246 during the pandemic compared to before the pandemic. The median cost of follow-
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7 247 up care during the pandemic was 10.41 US dollars compared to 8.04 US dollars
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9 248 before the COVID-19 pandemic.

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12 249 The study showed that there was no significant median difference in income lost
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14 250 among patients who had income during and before the pandemic ($n = 501$, $Z =$
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16 251 1.780 , $p = 0.075$). The median income lost during the pandemic was 1.48 US dollars
17
18 252 compared to the income lost before the pandemic, which was 1.40 US dollars.

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21 253 There was a significant median cost difference in non-medical costs per patient
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23 254 during and before the pandemic ($n = 463$, $Z = 4.903$, $p = 0.001$). This showed
24
25 255 significantly higher costs have been incurred by more than half of the patients, 276
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27 256 (59.61%), during the pandemic compared to before the pandemic. The median non-
28
29 257 medical cost observed among the patients was 5.49 and 2.57 US dollars per follow-
30
31 258 up visit during and before the pandemic, respectively.

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34 259 The study revealed that there was no statistical significance in the median cost
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36 260 difference of food and accommodation incurred during and before the pandemic ($n =$
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38 261 199 , $Z = 1.189$, $p = 0.169$), and the median of this cost category was 4.29 and 3.13
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40 262 US dollars during and before the pandemic lock-down, respectively.

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43 263 The majority of the patients, 289 (67.2%), paid higher transportation fees when they
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45 264 visited hospitals during the pandemic compared to before the pandemic. There was
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47 265 a significant median cost difference in transportation costs during and before the
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49 266 pandemic ($n = 430$, $Z = 8.028$, $p = 0.00$), which was explained by the fact that the
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51 267 median transportation cost was 1.14 US dollars and 2.29 US dollars during and
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53 268 before the pandemic, respectively.
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3 269 More than half of the patients, 236 (55.5%), incurred higher costs for medical
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5 270 services during the pandemic compared to before the pandemic. There was a
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7 271 significant median cost difference during and before the pandemic ($n = 425$, $Z =$
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9 272 2.382 , $p = 0.017$) in which the median cost was 4.29 and 3.71 US dollars during and
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11 273 before the pandemic lock-down.

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14 274 The study showed that the majority of the HTN patients, 128 (60.7%), paid a high
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16 275 amount of money during the pandemic compared to before the pandemic among 211
17
18 276 patients who paid for the services. There was a significant median cost difference
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20 277 per visit during and before the pandemic ($n = 211$, $Z = 3.632$, $p = 0.00$). The median
21
22 278 cost observed among these patients was 7.58 and 10.14 US per follow-up visit
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24 279 before and during the pandemic, respectively.

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27 280 More than half of DM patients (59.17%) paid higher costs for the services during the
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29 281 pandemic compared to before the pandemic. The total cost incurred by these
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31 282 patients was significantly higher during the pandemic compared to before the
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33 283 pandemic ($n = 169$, $Z = 3.095$, $p = 0.002$). The median cost was 11.39 and 8.11 US
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35 284 dollars during and before the pandemic lock-down, respectively.

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38 285 The study revealed that there was no statistical significance in the median difference
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40 286 in total cost incurred by HF patients during and before the pandemic era ($n = 61$, $Z =$
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42 287 -0.055 , $p = 0.956$). Among 61 HF patients, only 31(50.82%) paid a higher amount of
43
44 288 money during the pandemic compared to before the pandemic.

45
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47 289 Similarly, there was no statistical significance in the median difference of total cost
48
49 290 incurred by patients who visited the hospitals for mental health follow up for the
50
51 291 treatment of diseases during and before the pandemic era ($n = 41$, $Z = -1.497$, $p =$
52
53 292 0.134). Among 41 patients, only 20(40.82%) paid a higher amount of money during
54
55 293 the pandemic.

294 The study also showed that there was a statistically significant median difference in
 295 total cost incurred by HIV patients during and before the pandemic lock-down (n =
 296 49, Z = 3.356, p = 0.00). Among 49 patients, the majority of them 34(69.39%)
 297 incurred a higher cost per visit during the pandemic compared to before the
 298 pandemic lock-down.

299 There was no statistical significance in the median difference of total cost incurred by
 300 asthma patients during and before the pandemic era (n = 28, Z = 1.731, p = 0.184).
 301 Similarly, there was no statistically significant median difference in total cost incurred
 302 by epilepsy patients during and before the pandemic lock-down (n = 18, Z = 1.328, p
 303 = 0.184)(Table 4).

304 Table 3: Types of chronic diseases among chronic diseases patients at public
 305 hospitals in the three Wallaga zones, Oromia National Regional state, Ethiopia
 306 2020(N= 605)

Types of Chronic diseases	Frequency(n)	Percentage (%)
Hypertension	214	35.4
Diabetic mellitus	173	28.6
Heart failure	62	10.2
Mental disease	51	8.4
HIV/AIDS	50	8.3
Asthma	29	4.8
Epilepsy	18	3.0
Stroke	3	0.5

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308

309 Table 4: Chronic diseases follow up visit for the treatment and care cost among
 310 chronic disease patients at public hospitals in the three Wallaga zones, Oromia
 311 National Regional state, Ethiopia 2020(N= 605)

Types of CD	Era of COVID-19 Pandemic	Observation (N)	Median (US\$)	Significance level of median cost difference (During- Before covid-19)
HTN	Before	211	7.58	$Z = 3.632, p = 0.001$
	During	211	10.14	
DM	Before	169	8.12	$Z = 3.095, p = 0.002$
	During	169	11.39	
HF	Before	61	9.06	$Z = -0.055, p = 0.956$
	During	61	8.2	
Mental disease	Before	49	11.63	$Z = -1.497, p = 0.134$
	During	49	8.86	
HIV	Before	49	6.12	$Z = 3.356, p = 0.000$
	During	49	12.24	
Asthma	Before	28	7.33	$Z = 1.731, p = 0.184$
	During	28	10.34	
Epilepsy	Before	18	5.70	$Z = 1.328, p = 0.184$
	During	18	10.00	

Note: 1US\$ = 35.99 ETB, August, 2020

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313 Discussion

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3 314 The study evaluated the illness cost of chronic diseases before and during the
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5 315 COVID-19 pandemic lock-down. Accordingly, more than half of the chronic patients
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7 316 (58.7%) incurred a significantly higher total cost during the pandemic lock-down
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9 317 compared to before the pandemic. This is explained by the median cost that was
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11 318 increased by 29.39% (Table 4).

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13
14 319 This finding supports the study's findings that chronic illness costs account for more
15
16 320 than 75% of total healthcare costs in high-income countries.^{22, 23} During the
17
18 321 pandemic, most global healthcare resources are focused on COVID-19, and this
19
20 322 resource reallocation could disrupt the continuum of care for patients with CDs.^{11, 12,}
21
22 323 ²⁴ This could be explained by the fact that the global pandemic's disruption of the
23
24 324 health-care system may impose additional costs on CD patients.

25
26 325 The study revealed that the non-medical cost during the follow-up visit per patient
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28 326 during the era of COVID-19 was significantly higher than the cost incurred before the
29
30 327 pandemic era by the same patients, which was doubled during the pandemic. This
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32 328 significant difference probably might be due to a strict lock-down that could affect
33
34 329 these patients adversely as they require regular follow-up visits that lead to further
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36 330 health consequences and additional costs.^{25, 26}

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38 331 Transportation costs were one of the cost categories that doubled during the
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40 332 pandemic compared to before the pandemic. The median cost per patient per visit of
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42 333 this cost category during the pandemic era was significantly increased by two folds.
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44 334 This could be due to the fact that the government restricted the movement of its
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46 335 people from place to place and laid a temporary restriction on public transport
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48 336 across-regions and cities.^{17, 25}

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50 337 The study discovered a significant median cost difference in medical costs, with the
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52 338 median of this cost category increasing by 15.6% during the pandemic. This finding
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3 339 is in line with the study report that revealed that before the pandemic, one in three
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5 340 Americans did not take their medications as prescribed because of high costs, but
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7 341 during a global pandemic, forgoing medications involves even more risks for chronic
8
9 342 care patients and incurs even higher costs in the long run. ²⁷

10 343 The study also evaluated the illness cost of each selected chronic disease.
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12 344 Accordingly, for the follow-up care of HTN patients, the patients incurred significantly
13
14 345 higher costs during the pandemic compared to before the pandemic, which was
15
16 346 raised by 33.76% during the pandemic. The cost incurred before the COVID-
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18 347 pandemic was almost comparable with other study reports, but the cost incurred
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20 348 during the pandemic was higher than the study report on the cost of hypertension
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22 349 before the COVID-19 lockdown in Ethiopia. ²⁸

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24 350 Again, the study showed that the cost of DM follow-up visit per patient during the
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26 351 pandemic lock-down was significantly higher than the cost incurred before the
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28 352 pandemic, which was increased by 40.53%. However, before and during the COVID-
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30 353 19 lock-down, the cost of DM in this study was lower than the study reports in
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32 354 Ethiopia. ^{20, 29} This variation could be attributed to differences in DM complications
33
34 355 and treatment among study participants.

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36 356 Despite HIV care and treatment being an exempted service in Ethiopia, patients
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38 357 incurred nonmedical costs. The study revealed that the cost incurred by HIV patients
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40 358 for follow-up treatment and care per visit per patient during the pandemic lock-down
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42 359 was significantly higher than the cost incurred before the pandemic, which was
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44 360 increased by two folds. The cost of HIV treatment and care reported in the study was
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46 361 higher than in other Ethiopian studies. ^{30, 31}

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3 362 However, there was no significant statistical median cost difference for the follow-up
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5 363 care of HF, mental illness, asthma, and epilepsy during and before the pandemic; a
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7
8 364 slight median cost difference was observed during and before the pandemic.
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10 365 **Limitation of the Study**

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12 366 The cost findings in the study could be underestimated for the reason that the
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14 367 income loss of unemployed patients and unemployed caregivers due to productivity
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16 368 time lost were not included in the cost estimation. However, the cost of illness
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18 369 analysis was limited to the patients' perspective and did not incorporate other
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20 370 intangible costs (stigma and discrimination, pain) associated with chronic illness,
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22 371 which were not also estimated in the current study.
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25

26 372 **Conclusion**

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29 373 This study revealed that the total cost of follow-up care among chronic disease
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31 374 patients during the COVID-19 pandemic lock-down was significantly higher
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33 375 compared to before the pandemic era among the same patients. A comprehensive
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35 376 package of chronic disease treatment and care is demanded at different levels of
36
37 377 health facilities in the health system of the country. Therefore, healthcare providers
38
39 378 should arrange special fee waiver mechanisms for chronic disease healthcare costs
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41 379 during such types of pandemics and provide the services at proximal health facilities.
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45 380 **Declarations**

46 381 **Ethical Approval and Consent to Participate**

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48
49 382 An appropriate research ethical approval was obtained from the ethical review board
50
51 383 of Wallaga University, Institute of health sciences (Reference number:
52
53 384 IRB/233/2020). The study was conducted in accordance with the Declaration of
54
55 385 Helsinki. The questionnaire was designed to be anonymous, and the result did not
56
57 386 identify the personalities of the respondents; rather, it was presented in the
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3 387 aggregated statistics. The data was kept in protected and safe locations. Paper-
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5 388 based data was kept in a locked cabinet, and computer-based data was password
6
7 389 secured. Data sharing was enacted based on the consent and permission of
8
9
10 390 research participants and the ethical and legal rules of data sharing, and it was not
11
12 391 accessed by a third person, except the research teams.

14 392 **Authors Contribution and Conflict of interests**

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16
17 393 All authors made substantial contributions to conception and design, acquisition of
18
19 394 data, or analysis and interpretation of data; took part in drafting the article or revising
20
21 395 it critically for important intellectual content; gave final approval of the version to be
22
23 396 published; and agreed to be accountable for all aspects of the work.

24
25
26
27 397 All authors declared that they have no conflicts of interest related to this work.

28 29 398 **Consent for Publication**

30
31 399 NA

32 33 400 **Availability of Data and Materials**

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35
36
37 401 All the data supporting the study's findings are within the manuscript. Additional
38
39 402 detailed information and raw data will be shared upon request addressed to the
40
41 403 corresponding author.

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44
45
46
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48
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52
53
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55
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57 58 410 **Acronyms**

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2
3 411 ETB: Ethiopian Birr, HF: Heart Failure, HIV: Human Immune Virus, HTN:
4
5 412 Hypertension, LMICs: Low-and-middle-income countries, NCDs: Non-communicable
6
7 413 diseases, OOP: Out-of-pocket, TB: Tuberculosis, WHO: World Health Organization
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20 442 [the-mission-briefing-on-covid-19---12-march-2020](https://www.who.int/dg/speeches/detail/whodirector-generals-opening-remarks-at-the-mission-briefing-on-covid-19---12-march-2020)
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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	2
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	-
Bias	9	Describe any efforts to address potential sources of bias	-
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	8
		(b) Describe any methods used to examine subgroups and interactions	-
		(c) Explain how missing data were addressed	8
		(d) If applicable, describe analytical methods taking account of sampling strategy	-
		(e) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest	8
Outcome data	15*	Report numbers of outcome events or summary measures	-
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	12-14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	-
Generalisability	21	Discuss the generalisability (external validity) of the study results	-
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Impact of COVID-19 Pandemic on Cost of Chronic Diseases Treatment and Care at Public Hospitals in Wallaga Zones, Oromia Regional State, Ethiopia: Hospital Based Cross-Sectional Study

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Primary Subject Heading:	Health policy
Secondary Subject Heading:	Health economics, Health policy, Health services research, Infectious diseases, Public health
Keywords:	Health Equity, Decision Making, EPIDEMIOLOGY, Health Services Accessibility, HEALTH SERVICES ADMINISTRATION & MANAGEMENT

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3 **1 Impact of COVID-19 Pandemic on Cost of Chronic Diseases Treatment and**
4 **Care at Public Hospitals in Wallaga Zones, Oromia Regional State, Ethiopia:**
5 **2**
6 **3 Hospital Based Cross-Sectional Study**
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14 31 **Abstract**

15
16 32 **Introduction:** Globally, around one third of the population has at least one long-term
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18 33 health condition that could be affected by the COVID-19 pandemic. Despite, studies
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20 34 have revealed the direct impact of COVID-19 on health care provision and utilization,
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22 35 the impact of the pandemic on cost of chronic disease treatment and care from a
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24 36 patient perspective was scanty. So, the study aimed to determine the impact of
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26 37 COVID-19 pandemic on cost of chronic diseases treatment and care at public
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28 38 hospitals in Wallaga Zones, Oromia Regional State, Ethiopia, from August 01 to 31,
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30 39 2020.
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34 40 **Methods:** An institutional based cross-sectional study design was used and the
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36 41 sample size for the study (n = 642) was determined using a single population mean
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38 42 formula. Data was collected using interviews and analyzed using SPSS version 25.
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40 43 Descriptive statistics were performed and the cost of follow-up care before and after
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42 44 the pandemic was compared using a Related-samples Wilcoxon signed-rank test,
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44 45 declaring the level of significance of the median cost difference at $P < 0.05$.
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50 46 **Results:** A total of 642 patients were included in the study, among whom 605
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52 47 (94.2%) of them responded to the interviews. There was a significant median cost
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54 48 difference (n = 593, $Z = 5.05$, $p = 0.001$) between the cost of chronic diseases among
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56 49 follow-up patients during the pandemic compared to the costs incurred by these
57
58 50 patients before the pandemic.
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3 51 **Conclusion:** The cost of follow-up care among chronic disease patients during the
4
5 52 COVID-19 pandemic was significantly higher compared to before the pandemic era.
6
7 53 Therefore, healthcare providers should arrange special fee waiver mechanisms for
8
9 54 chronic disease healthcare costs during such types of pandemics and provide the
10
11 55 services at proximal health facilities.
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15 56 **Keywords:** COVID-19 Pandemic, Chronic Disease, Cost of Illness, Follow up Care,
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17 57 Ethiopia
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20 58 **Strengths and Limitations of the Study**

- 21
22 59 • The cost findings in the study could be underestimated due to; the income loss of
23
24 60 unemployed patients and their companions due to productivity time lost were not
25
26 61 included in the cost estimation,
27
28 62 • The cost of illness analysis was limited to the patients' perspective and did not
29
30 63 incorporate the intangible costs,
31
32 64 • Also, children (<15 years) and elderly (greater than 65 years) were not included in
33
34 65 the valuation of lost work days.
35
36 66 • Finally, there might be a recall bias.
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40 67 **Background**

41
42 68 Globally, chronic diseases (CDs) are the major public health problems that account
43
44 69 for 60% of all deaths(35% in low and 40% in middle income countries).¹⁻³ Including
45
46 70 Ethiopia many low and middle-income countries (LMICs) are undergoing a gradual
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48 71 epidemiologic transition as the disease burden shifts from infectious to non-
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50 72 communicable diseases(NCDs).⁴⁻⁶Healthcare systems in these countries are mostly
51
52 73 unprepared to handle the increasing burden of these diseases, resulting in no or
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54 74 limited access to affordable prevention and diagnosis of NCDs.⁷ These challenges
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3 75 add up to higher NCDs treatment costs and even the financing of which mostly
4
5 76 comes from households' out-of-pocket (OOP) spending.⁸
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7
8 77 COVID-19 pandemic was also another challenge which disrupts entire societies,
9
10 78 including the routine health care systems in Ethiopia. The comprehensive effort to
11
12 79 contain the pandemic and minimize the subsequent morbidity and mortality has
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14 80 affected both the continuity and quality of care.⁹ During the pandemic, most global
15
16 81 healthcare resources are focused on COVID-19 prevention and control. This
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18 82 resource reallocation could disrupt the continuum of care for patients with CDs in this
19
20 83 era. Diabetes, chronic obstructive pulmonary disease, hypertension, heart disease,
21
22 84 asthma, cancer, and depression were some of the conditions reported to be most
23
24 85 impacted by the reduction in healthcare resources due to the pandemic.¹⁰ Resources
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26 86 at all levels have shifted away from CDs management and prevention during the
27
28 87 outbreak, and the lock-down of many services has translated into reduced access, a
29
30 88 decrease in referrals, and reduced hospitalizations of patients with non-COVID-19
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32 89 pathology.¹¹ As the pandemic continues to rapidly spread, attentions often focuses on
33
34 90 the numbers of confirmed and probable cases, hospitalizations, and deaths, which
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36 91 can be called the "direct" effects of the pandemic. However, these numbers do not
37
38 92 capture the full extent of the pandemic because it has also generated important
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40 93 spillover (indirect) effects by decreasing the supply of and altering patient demand for
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42 94 non-COVID-19-related medical care.¹²
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49 95 In Ethiopia, the government declared a state of emergency, labeling the pandemic as
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51 96 a national threat and launching overall preventive measures, including advising the
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53 97 community to stay at home, practicing strict and frequent hand washing, and wearing
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55 98 a face mask. Also, restricted the movement of its people from place to place and laid
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57 99 temporary restrictions on market places, restaurants, shops, cinema houses,
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3 100 religious, and cities.¹³ During this time, the number of hospital visits dropped sharply
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5 101 to utilize health services, including CDs follow-up.¹⁴ Many studies have revealed the
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7 102 direct impact of COVID-19 on health care provision and utilization. But, there has
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9
10 103 been little emphasis on the impact of the pandemic on illness costs of chronic
11
12 104 disease follow-up care from a patient perspective. So, the study aimed to determine
13
14 105 the impact of the COVID-19 pandemic on the cost of follow-up care among chronic
15
16 106 disease patients at public hospitals.

19 107 **Methods and Materials**

21 108 **Study Design and Setting**

23
24 109 An institutional-based cross-sectional study design was used to conduct this study. It
25
26 110 was conducted from August 01 to 31, 2020 in the three wallaga zones namely; East
27
28 111 Wallaga, West Wallaga, and Horro Guduru Wallaga zones of Oromia Regional State,
29
30 112 Ethiopia. These three Wallaga zones are among the twenty one zones of Oromia
31
32 113 region and were found in the western direction of the region, Oromia. The capital
33
34 114 town of east Wallaga zone, Nekemte town; west Wallaga zone, Gimbi town and
35
36 115 Horro Guduru Wallaga zone, shambu town were located 333km, 441km, and 314km
37
38 116 west direction of Addis Ababa, capital city of Ethiopia, respectively.

42 117 **Study Participants**

44 118 All chronic disease patients who visited public hospitals in the Wallaga Zones were
45
46 119 the source population, and all patients who visited the three Wallaga Zones' selected
47
48 120 study hospitals during the study period were the study population.

51 121 **Inclusion and Exclusion Criteria**

53 122 All patients of the selected CDs in the study area who visited the study hospitals were
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55 123 included in the study. Patients whose age was less than 15 years old and without
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124 accompanying parents who were seriously ill and unable to respond to the interviews
125 were excluded from the study.

126 **Sample Size and Sampling Methods**

127 The sample size was determined by using the single population mean formula,
128 applying the following assumptions: two-sided alpha error (ϵ) set at 0.05, 95%
129 confidence level, and mean cost of DM (μ) = 48.99 ETB, and standard deviation
130 (SD)= 30.89 ETB¹⁵, adding 5% non-response rate.

131 Using the formula, $n = \frac{(z - \frac{\alpha}{2})^2 * \sigma^2}{\epsilon^2 \mu^2}$ [16], n= 642.

132 Among thirteen public hospitals in the study area, data was collected from the
133 selected CDs of follow-up care patients from Nekemte specialized hospitals, Sire
134 hospital, Gida hospital, Arjo hospital, Shambu hospital, Guduru hospital, Gimbi
135 hospital, and Nedjo hospital which were selected using simple random sampling
136 technique.

137 The determined sample size was allocated to each study hospital proportionally
138 based on the proportion of each CD patients who attended follow-up care. Wallaga
139 University referral hospital was purposely excluded from the study, which was an
140 isolation and treatment center for COVID-19 during the study period, and four other
141 hospitals were excluded due to their low CD patients flow.

142 Finally, to sample patients at each study hospital, systematic random sampling
143 technique was used to select 642 participants. A simple random sampling technique
144 was employed to select the first participant from the registration book.

145 **Data Collection**

146 The structured questionnaire was developed in English after reviewing relevant
147 literatures, and it was translated into Afan Oromo. Data collection and supervision
148 were carried out by eight data collectors, with four supervisors assigned. These data

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3 149 collectors and supervisors were trained before the pre-test and actual data collection
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5 150 started. The questionnaires were pre-tested in Bedele hospital using 32(5%) of the
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7
8 151 determined sample size. It was collected by face-to-face interview. Patients who
9
10 152 completed their chronic outpatient services and returned to leave the study hospitals
11
12 153 were interviewed.

14 154 **Study Variables**

15 155 **Socio-demographic and economic characteristics, health service costs (non-**
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17 156 **medical costs; transportation, food, accommodation, and income lost, and**
18
19 157 **medical costs; registration, consultation, laboratory, radiology, and drugs)**
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21
22 158 **were assessed and determined.**
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26 **Operational Definitions**

27
28 Before COVID-19: The period before March 13, 2020, when Ethiopia had the first
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30 confirmed COVID-19 positive case.

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33 Chronic disease follow up patients: A patient visited the study hospital for the
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35 follow-up care of one of; hypertension (HTN), diabetic's mellitus (DM), heart failure
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37 (HF), mental illness, HIV (Human immune virus), stroke, epilepsy, and asthma.

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40 Chronic disease: Any of the following illnesses that persist over time, can gradually
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42 progress, do not resolve spontaneously, and may not be cured, like HTN, DM, HF,
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44 mental illness, HIV, stroke, epilepsy, and asthma.

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47 Direct costs: The expenditures in ETB spent by chronic disease patients and their
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49 families on the diagnosis and treatment of chronic illness per prescription of
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51 physicians in the study hospitals.

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54 During COVID-19: The period after March 13, 2020, when Ethiopia had the first
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56 confirmed COVID-19 positive case.

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58 Indirect costs: the number of productive days lost by patients and their families as
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a result of chronic illness treatment and care.

Medical cost: The cost component of chronic disease patients' follow-up visits at study hospitals that includes registration, laboratory, radiology, and drug costs.

Non-medical cost: The cost component that includes transportation, food, accommodation, and income lost among chronic disease patients during follow-up visits at study hospitals.

159 **Data Analysis**

160 Data was entered in to Epi-data version 3.1 and exported to SPSS version 25
161 software for analysis. Descriptive statistics were performed for all study variables
162 based on their characteristics. The bottom-up costing approach was used to
163 estimate the direct cost for the follow-up visit with respect to patient perspective and
164 the indirect costs (income lost due to productive time lost) were estimated using
165 earnings lost both before and during COVID-19 pandemic.¹⁷ The time foregone and
166 productive time lost were converted into indirect costs based on the daily wage rate
167 and then multiplied by the number of working days lost. The daily wage rate for
168 patients was estimated by dividing their monthly income by 30 days for both patients
169 and caregivers.¹⁷ All costs included in the analysis were measured in terms of
170 Ethiopian Birr (ETB) and were converted to US\$(US dollar) during the analysis, and
171 the average currency exchange rate was (August 2020; 1 US\$ = 35.99 ETB).

172 Finally, the normality distribution of treatment cost data was checked, and it was not
173 normally distributed. AS a result, non-parametric tests were used to analyze the
174 median cost for each cost category, as well as a 2-paired sample Wilcoxon sign rank
175 test to compare the costs incurred before and during the pandemic lock-down, with
176 the level of significance of the median cost difference set at $p < 0.05$.

177 **Ethical consideration**

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3 178 An appropriate research ethical approval was obtained from the ethical review board
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5 179 of Wallaga University, Institute of health sciences (Reference number:
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7
8 180 IRB/233/2020). The study was conducted in accordance with the Declaration of
9
10 181 Helsinki. The questionnaire was designed to be anonymous, and the result did not
11
12 182 identify the personalities of the respondents; rather, it was presented in the
13
14 183 aggregated statistics. Written consent was obtained from the study participants. The
15
16 184 data was kept in protected and safe locations. Paper-based data was kept in a
17
18 185 locked cabinet, and computer-based data was password secured. Data sharing was
19
20 186 enacted based the ethical and legal rules of data sharing, and it was not accessed
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22 187 by a third person, except the research teams.
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26 188 **Patient and Public Involvement**

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29 189 None
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31 190 **Results**

32 33 191 **Socio-demographic Characteristics**

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36 192 A total of 642 patients were included in the study, among whom 605 responded to
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38 193 the interview, yielding 94.2% response rate. An almost equal number of male and
39
40 194 female participated in the study. More than half of the participants, 352 (58.2%),
41
42 195 were from urban areas, and the majority of them, 421 (69.6%), were married.

43
44 196 Regarding the educational status of the participants, 137 (22.6%) were illiterates
45
46 197 (Table 1).The average participant's age was 43.29 (SD=16.5) years, the average
47
48 198 monthly income was 84.32 (SD=70.65) US dollars, and the average household size
49
50 199 was 4.46 (SD=3.43).
51

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53
54 200 Table 1: Socio-demographic characteristics and classification of study participants by
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56 201 chronic diseases conditions in the public hospitals of the three Wallaga zones,
57
58 202 Oromia National Regional State, Ethiopia 2020 (N= 605)
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203

Characteristics (N= 605)		Frequency (n)	Percentage (%)
Sex	Male	302	49.9
	Female	303	50.1
Residence place	Urban	352	58.2
	Rural	253	41.8
Marital status	Single	130	21.5
	Married	421	69.6
	Separated	7	1.2
	Divorced	2	0.3
	Widowed	45	7.4
Religion	Orthodox	165	27.3
	Muslim	59	9.8
	Protestant	373	61.7
	Others	8	1.3
Ethnic group	Oromo	552	91.2
	Amhara	48	7.9
	Gurage	4	0.7
	Tigre	1	0.2
Educational status	Illiterate	137	22.6
	Read & Write	102	16.9
	Grade 1-8	99	16.4
	Grade 9-8	151	25.0
	Diploma and above	116	19.2

Employment status	Government employee	93	15.4
	NGO* employee	89	14.7
	Merchant	100	16.5
	Housewife	114	18.8
	Farmer	107	17.7
	Others**	102	16.9
Types of Chronic diseases	Hypertension	214	35.4
	Diabetic mellitus	173	28.6
	Heart failure	62	10.2
	Mental disease	51	8.4
	HIV/AIDS	50	8.3
	Asthma	29	4.8
	Epilepsy	18	3.0
	Stroke	3	0.5

204 *NGO= non-governmental organization, ** Daily laborer, students

205 **The Overall Cost of CD Follow-up Care before and during the Pandemic**

206 The total cost for the treatment of CDs before the COVID-19 pandemic among
 207 patients who incurred any one or more types of cost was on average
 208 10.41(SD=10.19) US dollars, with the median cost of 9.76(IQR=8.64) US dollars
 209 among 600 patients before the pandemic. The total cost of the treatment of the
 210 diseases per follow-up visit during the pandemic among 593 patients was
 211 13.02(SD=11.22) US dollars and the median cost was 12.27(IQR=10.40) US dollars.
 212 The median income lost due to productivity time lost for the treatment of CDs before
 213 the pandemic was 1.48(IQR=2.71) US dollars among 501 participants who had

214 income, which was almost similar to the income lost when visiting the study hospitals
215 during the pandemic, which was 1.40 (IQR=2.85)US dollars.

216 The total median non-medical cost incurred for the follow-up care was
217 6.05(IQR=5.55) US dollars before the pandemic among 463 patients and
218 7.98(IQR=7.50) US dollars among the same number of patients during the pandemic.

219 The total median transportation cost to travel to hospitals and travel back to their
220 homes, the participants incurred 1.141 (IQR=1.94) US dollars before the pandemic
221 and 2.29(IQR=3.05) US dollars during the pandemic among 430 patients who paid
222 for transportation.

223 The total median cost incurred for the accommodation and food during the follow-up
224 visit was 3.43(IQR=4.91) US dollars before the pandemic and 4.29(IQR=633) US
225 dollars during the pandemic among 199 participants.

226 The total median medical cost was 3.71(IQR=5.22) US dollars before the pandemic,
227 whereas it was 4.29 (IQR=5.91) US dollars during the pandemic hospital visit among
228 425 participants who paid for the prescribed drugs (Table 2).

229 Table 2: The overall cost of chronic diseases follow-up treatment and care before and
230 during the pandemic among chronic diseases patients at public hospitals in the three
231 Wallaga zones, Oromia National Regional state, Ethiopia 2020(N= 605)

Cost Categories	Era of COVID-19 Pandemic	Observa tion-on (N)	Mean(SD)	Median (IQR)	Significance level of median cost difference (During-Before covid-19)
Income lost (a)	Before	501	2.27(2.75)	1.48(2.71)	Z = 1.780, p = 0.075
	During	501	2.25(2.72)	1.40(2.85)	
Transportation	Before	430	1.91(2.13)	1.14(1.94)	Z = 8.028,

(b)	During	430	3.43(4.42)	2.29(3.05)	p = 0.001
Food and accommodation (c)	Before	199	4.67(5.05)	3.43(4.91)	Z = 1.189,
	During	199	5.6(5.94)	4.29(6.33)	p = 0.169
Total nonmedical cost (a+b+c) = (d)	Before	463	4.58(5.35)	6.05(5.55)	Z = 4.903,
	During	463	6.81(7.58)	7.98(7.50)	p = 0.001
Total medical cost (e)	Before	425	5.51(8.43)	3.71(5.22)	Z = 2.382,
	During	425	5.93(7.81)	4.29(5.91)	p = 0.017
Total cost per patient per visit (d+e)	Before	600	10.41(10.19)	9.76(8.64)	Z = 5.05,
	During	593	13.02(11.22)	12.27(10.40)	p=0.001

Note: 1US\$ = 35.99 ETB, August, 2020; SD: Standard Deviation; IQR: Interquartile

Range

Cost Difference Based on COVID-19 Pandemic

There was a significant median cost difference (n = 593, Z = 5.05, p = 0.001) between the cost of follow-up care during the COVID-19 pandemic lock-down compared to the costs incurred before the pandemic (Table 3). This showed that 348 out of 593 (58.7%) patients incurred significantly higher costs during the pandemic compared to before the pandemic. The median cost of follow-up care during the pandemic was 12.27(IQR=10.40) US dollars compared to 9.76(IQR=8.64) US dollars before the COVID-19 pandemic.

The study showed that there was no significant median difference in income lost among patients who had income during and before the pandemic (n = 501, Z = 1.780, p = 0.075). The median income lost during the pandemic was 1.48(IQR=2.71) US dollars compared to the income lost before the pandemic, which was 1.40(IQR=2.85) US dollars.

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3 247 There was a significant median cost difference in non-medical costs per patient
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5 248 during and before the pandemic (n = 463, Z = 4.903, p = 0.001). This showed
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7 249 significantly higher costs have been incurred by more than half of the patients, 276
8
9 250 (59.61%), during the pandemic compared to before the pandemic. The median non-
10
11 251 medical cost observed among the patients was 7.98(IQR=7.50) and 6.05(IQR=5.55)
12
13 252 US dollars per follow-up visit during and before the pandemic, respectively.
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17 253 The study revealed that there was no statistical significance in the median cost
18
19 254 difference of food and accommodation incurred during and before the pandemic (n =
20
21 255 199, Z = 1.189, p = 0.169), and the median of this cost category was 4.29(IQR=6.33)
22
23 256 and 3.13(IQR=4.91) US dollars during and before the pandemic lock-down,
24
25 257 respectively.
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29 258 The majority of the patients, 289 (67.2%), paid higher transportation fees when they
30
31 259 visited hospitals during the pandemic compared to before the pandemic. There was
32
33 260 a significant median cost difference in transportation costs during and before the
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35 261 pandemic (n = 430, Z = 8.028, p = 0.00), which was explained by the fact that the
36
37 262 median transportation cost was 1.14 (IQR=1.94) US dollars and 2.29 (IQR=3.05) US
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39 263 dollars during and before the pandemic, respectively.
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43 264 More than half of the patients, 236 (55.5%), incurred higher costs for medical
44
45 265 services during the pandemic compared to before the pandemic. There was a
46
47 266 significant median cost difference during and before the pandemic (n = 425, Z =
48
49 267 2.382, p = 0.017) in which the median cost was 4.29 (IQR=5.91) and 3.71(IQR=5.22)
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51 268 US dollars during and before the pandemic lock-down.
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54 269 The study showed that the majority of the hypertensive (HTN) patients, 128 (60.7%),
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56 270 paid a high amount of money during the pandemic compared to before the pandemic
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58 271 among 211 patients who paid for the services. There was a significant median cost
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3 272 difference per visit during and before the pandemic (n = 211, Z = 3.632, p = 0.00).
4

5 273 The median cost observed among these patients was 7.58 (IQR=7.53) and 10.14
6
7 274 (IQR=8.74) US per follow-up visit before and during the pandemic, respectively.
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9
10 275 More than half of diabetes mellitus (DM) patients (59.17%) paid higher costs for the
11
12 276 services during the pandemic compared to before the pandemic. The total cost
13
14 277 incurred by these patients was significantly higher during the pandemic compared to
15
16 278 before the pandemic (n = 169, Z = 3.095, p = 0.002). The median cost was 11.39
17
18 279 (IQR=10.87) and 8.11(IQR=9.26) US dollars during and before the pandemic lock-
19
20
21 280 down, respectively.
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23
24 281 The study revealed that there was no statistical significance in the median difference
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26 282 in total cost incurred by heart failure (HF) patients during and before the pandemic
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28 283 era (n = 61, Z = -0.055, p = 0.956). Among 61 HF patients, only 31(50.82%) paid a
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30 284 higher amount of money during the pandemic compared to before the pandemic.
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33 285 Similarly, there was no statistical significance in the median difference of total cost
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35 286 incurred by patients who visited the hospitals for mental health follow up for the
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37 287 treatment of diseases during and before the pandemic era (n = 41, Z = -1.497, p =
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39 288 0.134). Among 41 patients, only 20(40.82%) paid a higher amount of money during
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41 289 the pandemic.
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44 290 The study also showed that there was a statistically significant median difference in
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46 291 total cost incurred by HIV patients during and before the pandemic lock-down (n =
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48 292 49, Z = 3.356, p = 0.00). Among 49 patients, the majority of them 34(69.39%)
49
50 293 incurred a higher cost per visit during the pandemic compared to before the
51
52 294 pandemic lock-down.
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55
56 295 There was no statistical significance in the median difference of total cost incurred by
57
58 296 asthma patients during and before the pandemic era (n = 28, Z = 1.731, p = 0.184).
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297 Similarly, there was no statistically significant median difference in total cost incurred
 298 by epilepsy patients during and before the pandemic lock-down ($n = 18$, $Z = 1.328$, p
 299 $= 0.184$) (Table 3).

300 Table 3: Cost of chronic diseases follow-up treatment and care by disease types
 301 among chronic disease patients at public hospitals in the three Wallaga zones,
 302 Oromia National Regional state, Ethiopia 2020(N= 605)

Types of CDs	Era of COVID-19 Pandemic	Observation (N)	Mean(SD)	Median (IQR)	Significance level of median cost difference(During- Before covid-19)
HTN	Before	211	10.03(11.86)	7.58(7.53)	$Z = 3.632$, $p = 0.001$
	During	211	12.65(10.42)	10.14(8.74)	
DM	Before	169	10.64(8.42)	8.12(9.26)	$Z = 3.095$, $p = 0.002$
	During	169	13.56(10.49)	11.39(10.87)	
HF	Before	61	12.64(12.85)	9.06(8.53)	$Z = -0.055$, $p = 0.956$
	During	61	12.51(11.34)	8.2(12.52)	
Mental disease	Before	49	13.08(8.97)	11.63(10.10)	$Z = -1.497$, $p = 0.134$
	During	49	10.91(8.45)	8.86(10.24)	
HIV	Before	49	7.37(6.65)	6.12(6.76)	$Z = 3.356$, $p = 0.000$
	During	49	16.58(18.32)	12.24(14.25)	
Asthma	Before	28	8.95(6.40)	7.33(10.68)	$Z = 1.731$, $p = 0.184$
	During	28	12.92(12.34)	10.34(8.18)	

Epilepsy	Before	18	7.70(7.01)	5.70(11.18)	Z = 1.328, p = 0.184
	During	18	10.44(5.74)	10.00(9.84)	

303 *Note: 1US\$ = 35.99 ETB, August, 2020; SD: Standard Deviation; IQR: Interquartile*

304 *Range*

305 Discussion

306 This study was aimed to determine the impact of COVID-19 pandemic on cost of
307 chronic diseases treatment and care at public hospitals in Wallaga Zones, Oromia
308 Regional State, Ethiopia. The study found that, the cost of follow-up treatment and
309 care among chronic disease patients during COVID-19 pandemic was significantly
310 higher compared to before the pandemic era.

311 This indicated that, more than half of the chronic patients, 58.7%, incurred a
312 significantly higher total cost during the pandemic lock-down compared to before the
313 pandemic. This finding supports the study's findings that chronic illness costs
314 account for more than 75% of total healthcare costs in high-income countries.^{18, 19}
315 During the pandemic, most global healthcare resources are focused on COVID-19,
316 and this resource reallocation could disrupt the continuum of care for patients with
317 CDs.^{9, 10, 20} This could be explained by the fact that the global pandemic's disruption
318 of the health-care system may impose additional costs on CD patients.

319 The study revealed that the non-medical cost during the follow-up visit per patient
320 during the era of COVID-19 was significantly higher than the cost incurred before the
321 pandemic era by the same patients, which was doubled during the pandemic. This
322 significant difference probably might be due to a strict lock-down that could affect
323 these patients adversely as they require regular follow-up visits that lead to further
324 health consequences and additional costs.^{21,22}

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3 325 Transportation costs were one of the cost categories that doubled during the
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5 326 pandemic compared to before the pandemic. The median cost per patient per visit of
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7 327 this cost category during the pandemic era was significantly increased by two folds.
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10 328 This could be due to the fact that the government restricted the movement of its
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12 329 people from place to place and laid a temporary restriction on public transport
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14 330 across-regions and cities.^{13, 21}
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17 331 The study discovered a significant median cost difference in medical costs, with the
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19 332 median of this cost category increasing by 15.6% during the pandemic. This finding
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21 333 is in line with the study report that revealed that before the pandemic, one in three
22
23 334 Americans did not take their medications as prescribed because of high costs, but
24
25 335 during a global pandemic, forgoing medications involves even more risks for chronic
26
27 336 care patients and incurs even higher costs in the long run.²³
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29
30 337 The study also evaluated the illness cost of each selected chronic disease.
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32 338 Accordingly, for the follow-up care of HTN patients, the patients incurred significantly
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34 339 higher costs during the pandemic compared to before the pandemic, which was
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36 340 raised by 33.76% during the pandemic. The cost incurred before the COVID-
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38 341 pandemic was almost comparable with other study reports, but the cost incurred
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40 342 during the pandemic was higher than the study report on the cost of hypertension
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42 343 before the COVID-19 lockdown in Ethiopia.²⁴
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45 344 Again, the study showed that the cost of DM follow-up visit per patient during the
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47 345 pandemic lock-down was significantly higher than the cost incurred before the
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49 346 pandemic, which was increased by 40.53%. However, before and during the COVID-
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51 347 19 lock-down, the cost of DM in this study was lower than the study reports in
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53 348 Ethiopia.^{15, 25} This variation could be attributed to differences in DM complications
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55 349 and treatment among study participants.
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3 350 Despite HIV care and treatment being an exempted service in Ethiopia, patients
4
5 351 incurred nonmedical costs. The study revealed that the cost incurred by HIV patients
6
7 352 for follow-up treatment and care per visit per patient during the pandemic lock-down
8
9 353 was significantly higher than the cost incurred before the pandemic, which was
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11 354 increased by two folds. The cost of HIV treatment and care reported in the study was
12
13 355 higher than in other Ethiopian studies.^{26, 27}

14
15
16 356 However, there was no significant statistical median cost difference for the follow-up
17
18 357 care of heart failure, mental illness, asthma, and epilepsy during and before the
19
20 358 pandemic; a slight median cost difference was observed during and before the
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22 359 pandemic.

23 24 25 26 360 **Conclusion**

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28
29 361 This study revealed that the total cost of follow-up care among chronic disease
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31 362 patients during the COVID-19 pandemic lock-down was significantly higher
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33 363 compared to before the pandemic era among the same patients. A comprehensive
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35 364 package of chronic disease treatment and care is demanded at different levels of
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37 365 health facilities in the health system of the country. Therefore, healthcare providers,
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39 366 hospital administrators and the local government should arrange special fee waiver
40
41 367 mechanisms for chronic disease healthcare costs during such types of pandemics
42
43 368 and provide the services at proximal health facilities.

44 45 46 47 369 **Declarations**

48 49 370 **Authors Contribution and Conflict of interests**

50
51 371 All authors made substantial contributions to conception and design, acquisition of
52
53 372 data, or analysis and interpretation of data; took part in drafting the article or revising
54
55 373 it critically for important intellectual content; gave final approval of the version to be
56
57 374 published; and agreed to be accountable for all aspects of the work.

1
2
3 375 All authors declared that they have no conflicts of interest related to this work.
4

5 376 **Consent for Publication**

7 377 NA

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10 378 **Availability of Data and Materials**

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12
13 379 All the data supporting the study's findings are within the manuscript. Additional
14
15 380 detailed information and raw data will be shared upon request addressed to the
16
17 381 corresponding author.
18

19
20
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22
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24
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26

27
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29
30 386 Researchers would like to acknowledge all participants in the study and respective
31
32 387 administrative bodies from top to bottom for their due cooperation and involvement.
33

34
35 388 **Acronyms**

36
37 389 ETB: Ethiopian Birr, HF: Heart Failure, HIV: Human Immune Virus, HTN:
38
39 390 Hypertension, LMICs: Low-and-middle-income countries, NCDs: Non-communicable
40
41 391 diseases, OOP: Out-of-pocket, WHO: World Health Organization
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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	2
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	-
Bias	9	Describe any efforts to address potential sources of bias	-
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	8
		(b) Describe any methods used to examine subgroups and interactions	-
		(c) Explain how missing data were addressed	8
		(d) If applicable, describe analytical methods taking account of sampling strategy	-
		(e) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	-
		(b) Give reasons for non-participation at each stage	-
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	-
Outcome data	15*	Report numbers of outcome events or summary measures	-
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	-
		(b) Report category boundaries when continuous variables were categorized	-
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	12-14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	-
Generalisability	21	Discuss the generalisability (external validity) of the study results	-
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Impact of the COVID-19 pandemic on the cost of chronic diseases treatment and care at public hospitals in Wallaga zones, Oromia Regional State, Ethiopia: A hospital-based, cross-sectional study

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5 2 care at public hospitals in Wallaga zones, Oromia Regional State, Ethiopia: A
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7 3 hospital-based, cross-sectional study
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14 31 **Abstract**

15
16 32 **Introduction:** Globally, around one third of the population has at least one long-term
17
18 33 health condition that could be affected by the COVID-19 pandemic. Despite, studies
19
20 34 have revealed the direct impact of COVID-19 on health care provision and utilization,
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22 35 the impact of the pandemic on cost of chronic disease treatment and care from a
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24 36 patient perspective was scanty. So, the study aimed to determine the impact of the
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26 37 COVID-19 pandemic on cost of chronic diseases treatment and care at public
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28 38 hospitals in Wallaga Zones, Oromia Regional State, Ethiopia, from August 1 to 31,
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30 39 2020.
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34 40 Globally, around one-third of the population has at least one long-term health
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36 41 condition that could be affected by the COVID-19 pandemic. Despite studies
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38 42 revealing the direct impact of COVID-19 on health care provision and utilization, the
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40 43 impact of the pandemic on the cost of chronic disease treatment and care from a
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42 44 patient perspective was scanty. So, the study aimed to determine the impact of the
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44 45 COVID-19 pandemic on the cost of chronic disease treatment and care at public
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46 46 hospitals in Wallaga Zones, Oromia Regional State, Ethiopia, from August 1 to 31,
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48 47 2020.
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52 53 **Methods:** An institutional-based cross-sectional study design was used, and the
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54 54 sample size for the study (n = 642) was determined using a single population mean
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56 55 formula. Data was collected using interviews and analyzed using SPSS version 25.
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3 51 Descriptive statistics were performed, and the cost of follow-up care before and after
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5 52 the pandemic was compared using a related-samples Wilcoxon signed-rank test,
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8 53 declaring the level of significance of the median cost difference at $P < 0.05$.

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11 54 **Results:** A total of 642 patients were included in the study, of whom 605 (94.2%)
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13 55 responded to the interviews. There was a significant median cost difference ($n = 593$,
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15 56 $Z = 5.05$, $p = 0.001$) between the cost of chronic diseases among follow-up patients
16
17 57 during the pandemic and the costs incurred by these patients before the pandemic.

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21 58 **Conclusion:** The cost of follow-up care among chronic disease patients during the
22
23 59 COVID-19 pandemic was significantly higher compared to before the pandemic era.
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25 60 Therefore, healthcare providers should arrange special fee waiver mechanisms for
26
27 61 chronic disease healthcare costs during such types of pandemics and provide the
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29 62 services at proximal health facilities.

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33 63 **Keywords:** COVID-19 Pandemic, Chronic Disease, Cost of Illness, Follow up care,
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35 64 Ethiopia

36 37 38 65 **Strengths and Limitations of the Study**

- 39
40 66 • A less costly and time-consuming retrospective costing approach was used.
41
42 67 • The cost of illness analysis in this study was limited to the patients' perspective.
43
44 68 • The study did not include the costs experienced by patients who were employed
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46 69 before the pandemic but then lost their jobs.
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48 70 • Children less than 15 years of age and the elderly greater than 65 years of age
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50 71 were not included in the valuation of lost work days in the cost estimation.
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52 72 • There might also be a recall bias.
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73 **Background**

74 Chronic diseases (CDs) are the major public health problems that account for 60% of
75 all deaths (35% in low- and middle-income countries). [1-3] including Ethiopia, many
76 low and middle-income countries (LMICs) are undergoing a gradual epidemiologic
77 transition as the disease burden shifts from infectious to non-communicable
78 diseases (NCDs). [4–6] Healthcare systems in these countries are mostly
79 unprepared to handle the increasing burden of these diseases, resulting in no or
80 limited access to affordable prevention and diagnosis of NCDs. [7] These challenges
81 add up to higher NCD treatment costs, whose financing mostly comes from
82 households' out-of-pocket (OOP) spending. [8]

83 The COVID-19 pandemic was also another challenge that disrupted entire societies,
84 including the routine health care systems in Ethiopia. The comprehensive effort to
85 contain the pandemic and minimize the subsequent morbidity and mortality has
86 affected both the continuity and quality of care. [9] During the pandemic, most global
87 healthcare resources were focused on COVID-19 prevention and control. This
88 resource reallocation could disrupt the continuum of care for patients with CDs in this
89 era. Diabetes, chronic obstructive pulmonary disease, hypertension, heart disease,
90 asthma, cancer, and depression were some of the conditions reported to be most
91 impacted by the reduction in healthcare resources due to the pandemic. [10]
92 Resources at all levels have shifted away from CDs management and prevention
93 during the outbreak, and the lockdown of many services has translated into reduced
94 access, a decrease in referrals, and reduced hospitalizations of patients with non-
95 COVID-19 pathology. [11] As the pandemic continues to rapidly spread, attention
96 often focuses on the numbers of confirmed and probable cases, hospitalizations, and
97 deaths, which can be called the "direct" effects of the pandemic. However, these

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3 98 numbers do not capture the full extent of the pandemic because it has also generated
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5 99 important spillover (indirect) effects by decreasing the supply of and altering patient
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8 100 demand for non-COVID-19-related medical care. [12]
9

10 101 In Ethiopia, the government declared a state of emergency, labeling the pandemic a
11
12 102 national threat and launching overall preventive measures, including advising the
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14 103 community to stay at home, practicing strict and frequent hand washing, and wearing
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16 104 a face mask. Also, it restricted the movement of its people from place to place and
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18 105 laid temporary restrictions on market places, restaurants, shops, cinema houses,
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20 106 religious institutions, and cities. [13] During this time, the number of hospital visits
21
22 107 dropped sharply to utilize health services, including CD follow-up. [14] Many studies
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24 108 have revealed the direct impact of COVID-19 on health care provision and utilization.
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26 109 But there has been little emphasis on the impact of the pandemic on the costs of
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28 110 chronic disease follow-up care from a patient perspective. So, the study aimed to
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30 111 determine the impact of the COVID-19 pandemic on the cost of follow-up care among
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32 112 chronic disease patients at public hospitals.
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37 113 **Methods and Materials**

38 114 **Study Design and Setting**

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40 115 An institutional-based cross-sectional study design was used to conduct this study. It
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42 116 was conducted from August 1 to 31, 2020, in the three wallaga zones, namely, East
43
44 117 Wallaga, West Wallaga, and Horro Guduru Wallaga zones, of Oromia Regional State,
45
46 118 Ethiopia. These three Wallaga zones are among the twenty-one zones of the Oromia
47
48 119 region and were found in the western direction of the region, Oromia. The capital
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50 120 towns of east Wallaga zone, Nekemte town; west Wallaga zone, Gimbi town; and
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52 121 Horro Guduru Wallaga zone, Shambu town, were located 333km, 441km, and 314km
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54 122 west of Addis Ababa, the capital city of Ethiopia, respectively.
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123 **Study Participants**

124 All chronic disease patients who visited public hospitals in the Wallaga Zones were
125 the source population, and all patients who visited the three Wallaga Zones' selected
126 study hospitals during the study period were the study population.

127 **Inclusion and Exclusion Criteria**

128 All patients from the selected CDs in the study area who visited the study hospitals
129 were included in the study. Patients whose age was less than 15 years old and
130 without accompanying parents who were seriously ill and unable to respond to the
131 interviews were excluded from the study.

132 **Sample Size and Sampling Methods**

133 The sample size was determined by using the single population mean formula,
134 applying the following assumptions: two-sided alpha error (ϵ) set at 0.05, 95%
135 confidence level, mean cost of DM (μ) = 48.99 ETB, and standard deviation (SD) =
136 30.89 ETB[15], adding a 5% non-response rate.

137 Using the formula, $n = \frac{(z - \alpha/2)^2 * \sigma^2}{\epsilon^2 \mu^2}$ [16], $n = 642$.

138 Among thirteen public hospitals in the study area, data was collected from the
139 selected CDs of follow-up care patients from Nekemte specialized hospitals, Sire
140 hospital, Gida hospital, Arjo hospital, Shambu hospital, Guduru hospital, Gimbi
141 hospital, and Nedjo hospital, which were selected using a simple random sampling
142 technique.

143 The determined sample size was allocated to each study hospital proportionally
144 based on the proportion of CD patients who attended follow-up care. Wallaga
145 University referral hospital was purposely excluded from the study, which was an
146 isolation and treatment center for COVID-19 during the study period, and four other
147 hospitals were excluded due to their low CD patient flow.

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3 148 Finally, a simple random sampling technique was used from the registration book to
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5 149 sample patients at each study hospital as per their proportion to select 642
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7
8 150 participants.

10 151 **Data Collection**

12 152 The structured questionnaire was developed in English after reviewing relevant
13
14 153 literature, and it was translated into Afan Oromo. Data collection and supervision
15
16
17 154 were carried out by eight data collectors, with four supervisors assigned. These data
18
19 155 collectors and supervisors were trained before the pre-test and actual data collection
20
21 156 started. The questionnaires were pre-tested in Bedele Hospital using 32 (5%) of the
22
23
24 157 determined sample size. It was collected through a face-to-face interview. Patients
25
26 158 who completed their chronic outpatient services and returned to leave the study
27
28 159 hospitals were interviewed.

30 160 **Study Variables**

32
33 161 **Socio-demographic and economic characteristics, health service costs (non-**
34
35 162 **medical costs; transportation, food, accommodation, and income lost, and**
36
37 163 **medical costs; registration, consultation, laboratory, radiology, and drugs)**
38
39
40 164 **were assessed and determined.**

42 **Operational Definitions**

43
44
45 Before COVID-19: The period before March 13, 2020, when Ethiopia had the first
46
47 confirmed COVID-19 positive case.

48
49 Chronic disease follow-up patients: A patient visited the study hospital for the
50
51 follow-up care of one of the following: hypertension (HTN), diabetes mellitus (DM),
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53 heart failure (HF), mental illness, HIV (Human Immune Virus), stroke, epilepsy,
54
55 and asthma.

56
57
58 Chronic disease: any of the following illnesses that persist over time, can gradually
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4 progress, do not resolve spontaneously, and may not be cured: HTN, DM, HF,
5
6 mental illness, HIV, stroke, epilepsy, and asthma.[14]
7

8 Direct costs: the expenditures in ETB spent by chronic disease patients and their
9
10 families on the diagnosis and treatment of chronic illness per prescription of
11
12 physicians in the study hospitals.
13

14 During COVID-19: the period after March 13, 2020, when Ethiopia had the first
15
16 confirmed COVID-19 positive case.
17

18 Indirect costs: the number of productive days lost by patients and their families as
19
20 a result of chronic illness treatment and care.
21
22

23 Medical cost: the cost component of chronic disease patients' follow-up visits at
24
25 study hospitals that includes registration, laboratory, radiology, and drug costs.
26
27

28 **Non-medical cost:** the cost component that includes transportation, food,
29
30 accommodation, and income lost among chronic disease patients during
31
32 follow-up visits at study hospitals.
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34
35

36 37 165 **Data Analysis**

38
39 166 Data was entered into Epi-data version 3.1 and exported to SPSS version 25
40
41 167 software for analysis. Descriptive statistics were performed for all study variables
42
43 168 based on their characteristics. The bottom-up costing approach was used to
44
45 169 estimate the direct cost of the follow-up visit with respect to the patient's perspective,
46
47 170 and the indirect costs (income lost due to productive time lost) were estimated using
48
49 171 earnings lost both before and during the COVID-19 pandemic. [17] The time
50
51 172 foregone and productive time lost were converted into indirect costs based on the
52
53 173 daily wage rate and then multiplied by the number of working days lost. The daily
54
55 174 wage rate for patients was estimated by dividing their monthly income by 30 days for
56
57
58
59 175 both patients and caregivers. [17] All costs included in the analysis were measured in
60

1
2
3 176 terms of Ethiopian Birr (ETB) and were converted to US\$(US dollar) during the
4
5 177 analysis, and the average currency exchange rate was (August 2020; 1 US\$ = 35.99
6
7
8 178 *ETB*).

9
10 179 Finally, the normality distribution of treatment cost data was checked, and it was not
11
12 180 normally distributed. As a result, non-parametric tests were used to analyze the
13
14 181 median cost for each cost category, as well as a 2-paired sample Wilcoxon sign rank
15
16 182 test to compare the costs incurred before and during the pandemic lockdown, with
17
18
19 183 the level of significance of the median cost difference set at $p < 0.05$.

21 184 **Ethical consideration**

22
23
24 185 An appropriate research ethical approval was obtained from the ethical review board
25
26 186 of Wallaga University, Institute of Health Sciences (Reference number:
27
28 187 IRB/233/2020). The study was conducted in accordance with the Declaration of
29
30
31 188 Helsinki. The questionnaire was designed to be anonymous, and the result did not
32
33 189 identify the personalities of the respondents; rather, it was presented in the
34
35 190 aggregated statistics. Written consent was obtained from the study participants. The
36
37
38 191 data was kept in protected and safe locations. Paper-based data was kept in a
39
40 192 locked cabinet, and computer-based data was password-secured. Data sharing was
41
42 193 enacted based on the ethical and legal rules of data sharing, and it was not
43
44
45 194 accessed by a third party except the research teams.

47 195 **Patient and Public Involvement**

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49 196 None
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197 Results

198 Socio-demographic Characteristics

199 A total of 642 patients were included in the study, among whom 605 responded to
 200 the interview, yielding a 94.2% response rate. An almost equal number of males and
 201 females participated in the study. More than half of the participants, 352 (58.2%),
 202 were from urban areas, and the majority of them, 421 (69.6%), were married.

203 Regarding the educational status of the participants, 137 (22.6%) were illiterates
 204 (Table 1). The average participant's age was 43.29 (SD=16.5) years, the average
 205 monthly income was 84.32 (SD=70.65) US dollars, and the average household size
 206 was 4.46 (SD=3.43).

207 Table 1: Socio-demographic characteristics and classification of study participants by
 208 chronic diseases conditions in the public hospitals of the three Wallaga zones,
 209 Oromia National Regional State, Ethiopia 2020 (N= 605)

Characteristics (N= 605)		Frequency (n)	Percentage (%)
Sex	Male	302	49.9
	Female	303	50.1
Residence place	Urban	352	58.2
	Rural	253	41.8
Marital status	Single	130	21.5
	Married	421	69.6
	Separated	7	1.2
	Divorced	2	0.3
	Widowed	45	7.4
Religion	Orthodox	165	27.3

	Muslim	59	9.8
	Protestant	373	61.7
	Others	8	1.3
Ethnic group	Oromo	552	91.2
	Amhara	48	7.9
	Gurage	4	0.7
	Tigre	1	0.2
Educational status	Illiterate	137	22.6
	Read & Write	102	16.9
	Grade 1-8	99	16.4
	Grade 9-8	151	25.0
	Diploma and above	116	19.2
Employment status	Government employee	93	15.4
	NGO* employee	89	14.7
	Merchant	100	16.5
	Housewife	114	18.8
	Farmer	107	17.7
	Others**	102	16.9
Types of Chronic diseases	Hypertension	214	35.4
	Diabetic mellitus	173	28.6
	Heart failure	62	10.2
	Mental disease	51	8.4
	HIV/AIDS	50	8.3
	Asthma	29	4.8

	Epilepsy	18	3.0
	Stroke	3	0.5

210 *NGO= non-governmental organization, ** Daily laborer, students

211 **The Overall Cost of CD Follow-up Care before and during the Pandemic**

212 The total cost for the treatment of CDs before the COVID-19 pandemic among
 213 patients who incurred any one or more types of cost was on average 10.41 (SD =
 214 10.19) US dollars, with the median cost of 9.76 (IQR = 8.64) US dollars among 600
 215 patients before the pandemic. The total cost of the treatment of the diseases per
 216 follow-up visit during the pandemic among 593 patients was 13.02 (SD = 11.22) US
 217 dollars, and the median cost was 12.27 (IQR = 10.40) US dollars.

218 The median income lost due to productivity time lost for the treatment of CDs before
 219 the pandemic was 1.48 (IQR = 2.71 US dollars) among the 501 participants who had
 220 income, which was almost similar to the income lost when visiting the study hospitals
 221 during the pandemic, which was 1.40 (IQR = 2.85 US dollars).

222 The total median non-medical cost incurred for the follow-up care was 6.05 (IQR =
 223 5.55) US dollars before the pandemic among 463 patients and 7.98 (IQR = 7.50) US
 224 dollars among the same number of patients during the pandemic.

225 The total median transportation cost to travel to hospitals and travel back to their
 226 homes was 1.141 (IQR = 1.94) US dollars before the pandemic and 2.29 (IQR =
 227 3.05) US dollars during the pandemic among the 430 patients who paid for
 228 transportation.

229 The total median cost incurred for the accommodation and food during the follow-up
 230 visit was 3.43 (IQR = 4.91) US dollars before the pandemic and 4.29 (IQR = 633) US
 231 dollars during the pandemic among 199 participants.

232 The total median medical cost was 3.71 (IQR = 5.22) US dollars before the
 233 pandemic, whereas it was 4.29 (IQR = 5.91) US dollars during the pandemic hospital
 234 visit among the 425 participants who paid for the prescribed drugs (Table 2).

235 Table 2: The overall cost of chronic diseases follow-up treatment and care before and
 236 during the pandemic among chronic diseases patients at public hospitals in the three
 237 Wallaga zones, Oromia National Regional state, Ethiopia 2020(N= 605)

Cost Categories	Era of COVID-19 Pandemic	Observation-on (N)	Mean(SD)	Median (IQR)	Significance level of median cost difference (During-Before covid-19)
(a) Income lost	Before	501	2.27(2.75)	1.48(2.71)	Z = 1.780, p = 0.075
	During	501	2.25(2.72)	1.40(2.85)	
(b) Transportation	Before	430	1.91(2.13)	1.14(1.94)	Z = 8.028, p = 0.001
	During	430	3.43(4.42)	2.29(3.05)	
(c) Food and accommodation	Before	199	4.67(5.05)	3.43(4.91)	Z = 1.189, p = 0.169
	During	199	5.6(5.94)	4.29(6.33)	
Total nonmedical cost (a+b+c) = (d)	Before	463	4.58(5.35)	6.05(5.55)	Z = 4.903, p = 0.001
	During	463	6.81(7.58)	7.98(7.50)	
Total medical cost (e)	Before	425	5.51(8.43)	3.71(5.22)	Z = 2.382, p = 0.017
	During	425	5.93(7.81)	4.29(5.91)	
Total cost per patient per visit (d+e)	Before	600	10.41(10.19)	9.76(8.64)	Z = 5.05, p=0.001
	During	593	13.02(11.22)	12.27(10.40)	

238 Note: 1US\$ = 35.99 ETB, August, 2020; SD: Standard Deviation; IQR: Interquartile
 239 Range

240 **Cost Difference Based on COVID-19 Pandemic**

241 There was a significant median cost difference (n = 593, Z = 5.05, p = 0.001)
242 between the cost of follow-up care during the COVID-19 pandemic lockdown and the
243 costs incurred before the pandemic (Table 3). This showed that 348 out of 593
244 (58.7%) patients incurred significantly higher costs during the pandemic compared to
245 before the pandemic. The median cost of follow-up care during the pandemic was
246 12.27 (IQR = 10.40) US dollars, compared to 9.76 (IQR = 8.64) US dollars before the
247 COVID-19 pandemic.

248 The study showed that there was no significant median difference in income lost
249 among patients who had income during and before the pandemic (n = 501, Z =
250 1.780, p = 0.075). The median income lost during the pandemic was 1.48 (IQR =
251 2.71 US dollars) compared to the income lost before the pandemic, which was 1.40
252 (IQR = 2.85 US dollars).

253 There was a significant median cost difference in non-medical costs per patient
254 during and before the pandemic (n = 463, Z = 4.903, p = 0.001). This showed
255 significantly higher costs were incurred by more than half of the patients, 276
256 (59.61%), during the pandemic compared to before the pandemic. The median non-
257 medical cost observed among the patients was 7.98 (IQR = 7.50) and 6.05 (IQR =
258 5.55) US dollars per follow-up visit during and before the pandemic, respectively.

259 The study revealed that there was no statistical significance in the median cost
260 difference of food and accommodation incurred during and before the pandemic (n =
261 199, Z = 1.189, p = 0.169), and the median of this cost category was 4.29 (IQR =
262 6.33) and 3.13 (IQR = 4.91) US dollars during and before the pandemic lock-down,
263 respectively.

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3 264 The majority of the patients, 289 (67.2%), paid higher transportation fees when they
4
5 265 visited hospitals during the pandemic compared to before the pandemic. There was
6
7
8 266 a significant median cost difference in transportation costs during and before the
9
10 267 pandemic ($n = 430$, $Z = 8.028$, $p = 0.00$), which was explained by the fact that the
11
12 268 median transportation cost was 1.14 (IQR = 1.94) US dollars and 2.29 (IQR = 3.05)
13
14 269 US dollars during and before the pandemic, respectively.

16
17 270 More than half of the patients, 236 (55.5%), incurred higher costs for medical
18
19 271 services during the pandemic compared to before the pandemic. There was a
20
21 272 significant median cost difference during and before the pandemic ($n = 425$, $Z =$
22
23 273 2.382 , $p = 0.017$), in which the median cost was 4.29 (IQR = 5.91) and 3.71 (IQR =
24
25 274 5.22) US dollars during and before the pandemic lockdown.

26
27
28 275 The study showed that the majority of the hypertensive (HTN) patients, 128 (60.7%),
29
30 276 paid a high amount of money during the pandemic compared to before the pandemic
31
32 277 among the 211 patients who paid for the services. There was a significant median
33
34 278 cost difference per visit during and before the pandemic ($n = 211$, $Z = 3.632$, $p =$
35
36 279 0.00). The median cost observed among these patients was 7.58 (IQR = 7.53) and
37
38 280 10.14 (IQR = 8.74) US per follow-up visit before and during the pandemic,
39
40 281 respectively.

41
42
43 282 More than half of diabetes mellitus (DM) patients (59.17%) paid higher costs for
44
45 283 services during the pandemic compared to before the pandemic. The total cost
46
47 284 incurred by these patients was significantly higher during the pandemic compared to
48
49 285 before the pandemic ($n = 169$, $Z = 3.095$, $p = 0.002$). The median cost was 11.39
50
51 286 (IQR = 10.87) and 8.11 (IQR = 9.26) US dollars during and before the pandemic
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53 287 lockdown, respectively.
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3 288 The study revealed that there was no statistical significance in the median difference
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5 289 in total cost incurred by heart failure (HF) patients during and before the pandemic
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7
8 290 era (n = 61, Z = -0.055, p = 0.956). Among 61 HF patients, only 31 (50.82%) paid a
9
10 291 higher amount of money during the pandemic compared to before the pandemic.

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12 292 Similarly, there was no statistical significance in the median difference in total cost
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14 293 incurred by patients who visited the hospitals for mental health follow-up for the
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16
17 294 treatment of diseases during and before the pandemic era (n = 41, Z = -1.497, p =
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19 295 0.134). Among 41 patients, only 20 (40.82%) paid a higher amount of money during
20
21 296 the pandemic.

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24 297 The study also showed that there was a statistically significant median difference in
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26 298 total cost incurred by HIV patients during and before the pandemic lockdown (n = 49,
27
28 299 Z = 3.356, p = 0.00). Among 49 patients, the majority of them 34(69.39%) incurred a
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30 300 higher cost per visit during the pandemic compared to before the pandemic
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32 301 lockdown.

33
34
35 302 There was no statistical significance in the median difference in total cost incurred by
36
37 303 asthma patients during and before the pandemic era (n = 28, Z = 1.731, p = 0.184).

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39 304 Similarly, there was no statistically significant median difference in total cost incurred
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42 305 by epilepsy patients during and before the pandemic lockdown (n = 18, Z = 1.328, p
43
44 306 = 0.184) (Table 3).

45
46
47 307 Table 3: Cost of chronic diseases follow-up treatment and care by disease types
48
49 308 among chronic disease patients at public hospitals in the three Wallaga zones,
50
51 309 Oromia National Regional state, Ethiopia 2020(N= 605)

Types of CDs	Era of COVID-19 Pandemic	Observation (N)	Mean(SD)	Median (IQR)	Significance level of median cost difference(During- Before covid-19)
HTN	Before	211	10.03(11.86)	7.58(7.53)	$Z = 3.632,$ $p = 0.001$
	During	211	12.65(10.42)	10.14(8.74)	
DM	Before	169	10.64(8.42)	8.12(9.26)	$Z = 3.095,$ $p = 0.002$
	During	169	13.56(10.49)	11.39(10.87)	
HF	Before	61	12.64(12.85)	9.06(8.53)	$Z = -0.055,$ $p = 0.956$
	During	61	12.51(11.34)	8.2(12.52)	
Mental disease	Before	49	13.08(8.97)	11.63(10.10)	$Z = -1.497,$ $p = 0.134$
	During	49	10.91(8.45)	8.86(10.24)	
HIV	Before	49	7.37(6.65)	6.12(6.76)	$Z = 3.356,$ $p = 0.000$
	During	49	16.58(18.32)	12.24(14.25)	
Asthma	Before	28	8.95(6.40)	7.33(10.68)	$Z = 1.731,$ $p = 0.184$
	During	28	12.92(12.34)	10.34(8.18)	
Epilepsy	Before	18	7.70(7.01)	5.70(11.18)	$Z = 1.328,$ $p = 0.184$
	During	18	10.44(5.74)	10.00(9.84)	

310 Note: 1US\$ = 35.99 ETB, August, 2020; SD: Standard Deviation; IQR: Interquartile
311 Range

312 Discussion

313 This study was aimed at determining the impact of the COVID-19 pandemic on the
314 cost of chronic disease treatment and care at public hospitals in Wallaga Zones,

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3 315 Oromia Regional State, Ethiopia. The study found that the cost of follow-up
4
5 316 treatment and care among chronic disease patients during the COVID-19 pandemic
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8 317 was significantly higher compared to before the pandemic era.

9
10 318 This indicated that more than half of the chronic patients, 58.7%, incurred a
11
12 319 significantly higher total cost during the pandemic lockdown compared to before the
13
14 320 pandemic. This finding supports the study's findings that chronic illness costs
15
16 321 account for more than 75% of total healthcare costs in high-income countries. [18,
17
18 322 19] However, this study was conducted during the COVID-19 pandemic and in a low-
19
20 323 income country, but these studies were not conducted at the time of the pandemic
21
22 324 and were also conducted in high-income countries. During the pandemic, most
23
24 325 global healthcare resources are focused on COVID-19, and this resource
25
26 326 reallocation could disrupt the continuum of care for patients with CDs. [9, 10, 20]
27
28 327 This could be explained by the fact that the global pandemic's disruption of the
29
30 328 health care system may impose additional costs on CD patients.

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32
33 329 The study revealed that the non-medical cost during the follow-up visit per patient
34
35 330 during the era of COVID-19 was significantly higher than the cost incurred before the
36
37 331 pandemic era by the same patients, which was doubled during the pandemic. This
38
39 332 significant difference might be due to a strict lockdown that could affect these
40
41 333 patients adversely as they require regular follow-up visits that lead to further health
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43 334 consequences and additional costs. [21,22]

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45 335 Transportation costs were one of the cost categories that doubled during the
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47 336 pandemic compared to before the pandemic. The median cost per patient per visit of
48
49 337 this cost category during the pandemic era was significantly increased by two folds.
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51 338 This could be due to the fact that the government restricted the movement of its
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3 339 people from place to place and laid a temporary restriction on public transport across
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5 340 regions and cities. [13, 21]
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7
8 341 The study discovered a significant median cost difference in medical costs, with the
9
10 342 median of this cost category increasing by 15.6% during the pandemic. This finding
11
12 343 is in line with the study report that revealed that before the pandemic, one in three
13
14 344 Americans did not take their medications as prescribed because of high costs, but
15
16 345 during a global pandemic, forgoing medications involves even more risks for chronic
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18 346 care patients and incurs even higher costs in the long run. [23] However, comparing
19
20 347 study findings in this study setting with those in a high-resource setting is taken as a
21
22 348 weakness of this study.
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25
26 349 The study also evaluated the cost of each selected chronic disease. Accordingly, for
27
28 350 the follow-up care of HTN patients, the patients incurred significantly higher costs
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30 351 during the pandemic compared to before the pandemic, which were raised by
31
32 352 33.76% during the pandemic. The cost incurred before the COVID pandemic was
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34 353 almost comparable with other study reports, but the cost incurred during the
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36 354 pandemic was higher than the study report on the cost of hypertension before the
37
38 355 COVID-19 lockdown in Ethiopia. [24]
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42 356 Again, the study showed that the cost of DM follow-up visits per patient during the
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44 357 pandemic lockdown was significantly higher than the cost incurred before the
45
46 358 pandemic, which was increased by 40.53%. However, before and during the COVID-
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48 359 19 lockdown, the cost of DM in this study was lower than the study reported in
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50 360 Ethiopia. [15, 25] This variation could be attributed to differences in DM
51
52 361 complications and treatment among study participants.
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56 362 Despite HIV care and treatment being an exempted service in Ethiopia, patients
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58 363 incurred nonmedical costs. The study revealed that the cost incurred by HIV patients
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3 364 for follow-up treatment and care per visit per patient during the pandemic lock-down
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5 365 was significantly higher than the cost incurred before the pandemic, which was
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7
8 366 increased by two folds. The cost of HIV treatment and care reported in the study was
9
10 367 higher than in other Ethiopian studies. [26, 27]

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12 368 However, there was no significant statistical median cost difference for the follow-up
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14 369 care of heart failure, mental illness, asthma, and epilepsy during and before the
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16
17 370 pandemic; a slight median cost difference was observed during and before the
18
19 371 pandemic.

21 372 **Conclusion**

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23
24 373 This study revealed that the total cost of follow-up care among chronic disease
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26 374 patients during the COVID-19 pandemic lockdown was significantly higher compared
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28
29 375 to before the pandemic era among the same patients. In this study, hypertensive
30
31 376 patients had the greatest impact on the cost of ongoing care as a result of the
32
33 377 COVID-19 pandemic. A comprehensive package of chronic disease treatment and
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35 378 care is demanded at different levels of health facilities in the country's health system.
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38 379 Therefore, healthcare providers, hospital administrators, and the local government
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40 380 should arrange special fee waiver mechanisms for chronic disease healthcare costs
41
42 381 during such types of pandemics and provide the services at proximal health facilities.

44 382 **Declarations**

46 383 **Author's Contribution Statement**

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48
49 384 All authors made substantial contributions to conception and design, acquisition of
50
51 385 data, or analysis and interpretation of data; took part in drafting the article or revising
52
53 386 it critically for important intellectual content; gave final approval of the version to be
54
55
56 387 published; and agreed to be accountable for all aspects of the work.

58 59 388 **Conflict of Interest Statement**

1
2
3 389 All authors declared that they have no conflicts of interest related to this work.
4

5 390 **Consent for Publication**

6
7 391 NA
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9

10 392 **Availability of Data and Materials**

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12 393 All the data supporting the study's findings are within the manuscript. Additional
13
14 394 detailed information and raw data will be shared upon request addressed to the
15
16 395 corresponding author.
17
18

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20
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22
23 398 commercial, or not-for-profit sectors.
24
25

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27
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29
30 401 administrative bodies from top to bottom for their due cooperation and involvement.
31
32

33 402 **Acronyms**

34
35 403 ETB: Ethiopian Birr, HF: Heart Failure, HIV: Human Immune Virus, HTN:
36
37 404 Hypertension, LMICs: Low-and-middle-income countries, NCDs: Non-communicable
38
39 405 diseases, OOP: Out-of-pocket, WHO: World Health Organization
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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	2
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	-
Bias	9	Describe any efforts to address potential sources of bias	-
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	8
		(b) Describe any methods used to examine subgroups and interactions	-
		(c) Explain how missing data were addressed	8
		(d) If applicable, describe analytical methods taking account of sampling strategy	-
		(e) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	-
		(b) Give reasons for non-participation at each stage	-
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	-
Outcome data	15*	Report numbers of outcome events or summary measures	-
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	-
		(b) Report category boundaries when continuous variables were categorized	-
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	12-14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	-
Generalisability	21	Discuss the generalisability (external validity) of the study results	-
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Impact of the COVID-19 pandemic on the cost of chronic diseases treatment and care at public hospitals in Wallaga zones, Oromia Regional State, Ethiopia: A hospital-based, cross-sectional study

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3 1 Impact of the COVID-19 pandemic on the cost of chronic diseases treatment and
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5 2 care at public hospitals in Wallaga zones, Oromia Regional State, Ethiopia: A
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7 3 hospital-based, cross-sectional study
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16 32 **Abstract**

17
18 33 **Objective:** Globally, around one third of the population has at least one long-term
19
20 34 health condition that could be affected by the COVID-19 pandemic. Despite the fact
21
22 35 that studies have revealed the direct impact of COVID-19 on health care provision
23
24 36 and utilization, the impact of the pandemic on the cost of chronic disease treatment
25
26 37 and care from a patient perspective was scanty. So, the study aimed to determine
27
28 38 the impact of the COVID-19 pandemic on cost of chronic diseases treatment and
29
30 39 care at public hospitals in Wallaga Zones, Oromia Regional State, Ethiopia, from
31
32 40 August 1 to 31, 2020.
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36 41 **Methods:** An institutional-based cross-sectional study design was used, and the
37
38 42 sample size for the study (n = 642) was determined using a single population mean
39
40 43 formula. Data was collected using interviews and analyzed using SPSS version 25.
41
42 44 Descriptive statistics were performed, and the cost of follow-up care before and after
43
44 45 the pandemic was compared using a related-samples Wilcoxon signed-rank test,
45
46 46 declaring the level of significance of the median cost difference at $P < 0.05$.
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52 47 **Results:** A total of 642 patients were included in the study, of whom 605 (94.2%)
53
54 48 responded to the interviews. There was a significant median cost difference (n = 593,
55
56 49 $Z = 5.05$, $p = 0.001$) between the cost of chronic diseases among follow-up patients
57
58 50 during the pandemic and the costs incurred by these patients before the pandemic.
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3 51 **Conclusion:** The cost of follow-up care among chronic disease patients during the
4
5 52 COVID-19 pandemic was significantly higher compared to before the pandemic era.
6
7 53 Therefore, healthcare providers should arrange special fee waiver mechanisms for
8
9 54 chronic disease healthcare costs during such types of pandemics and provide the
10
11 55 services at proximal health facilities.
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14

15 56 **Keywords:** COVID-19 Pandemic, Chronic Disease, Cost of Illness, Follow up care,
16
17 57 Ethiopia
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19

20 58 **Strengths and Limitations of the Study**

- 21
22 59 • A less costly and time-consuming retrospective costing approach was used.
- 23
24 60 • The cost of illness analysis in this study was limited to the patients' perspective.
- 25
26 61 • The study did not include the costs experienced by patients who were employed
27
28 62 before the pandemic but then lost their jobs.
- 29
30 63 • Children less than 15 years of age and the elderly greater than 65 years of age
31
32 64 were not included in the valuation of lost work days in the cost estimation.
- 33
34 65 • There might also be a recall bias.
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40 66 **Background**

41
42 67 Chronic diseases (CDs) are the major public health problems that account for 60% of
43
44 68 all deaths (35% in low- and middle-income countries). [1-3] including Ethiopia, many
45
46 69 low and middle-income countries (LMICs) are undergoing a gradual epidemiologic
47
48 70 transition as the disease burden shifts from infectious to non-communicable
49
50 71 diseases (NCDs). [4–6] Healthcare systems in these countries are mostly
51
52 72 unprepared to handle the increasing burden of these diseases, resulting in no or
53
54 73 limited access to affordable prevention and diagnosis of NCDs. [7] These challenges
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3 74 add up to higher NCD treatment costs, whose financing mostly comes from
4
5 75 households' out-of-pocket (OOP) spending. [8]
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7
8 76 The COVID-19 pandemic was also another challenge that disrupted entire societies,
9
10 77 including the routine health care systems in Ethiopia. The comprehensive effort to
11
12 78 contain the pandemic and minimize the subsequent morbidity and mortality has
13
14 79 affected both the continuity and quality of care. [9] During the pandemic, most global
15
16 80 healthcare resources were focused on COVID-19 prevention and control. This
17
18 81 resource reallocation could disrupt the continuum of care for patients with CDs in this
19
20 82 era. Diabetes, chronic obstructive pulmonary disease, hypertension, heart disease,
21
22 83 asthma, cancer, and depression were some of the conditions reported to be most
23
24 84 impacted by the reduction in healthcare resources due to the pandemic. [10]
25
26 85 Resources at all levels have shifted away from CDs management and prevention
27
28 86 during the outbreak, and the lockdown of many services has translated into reduced
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30 87 access, a decrease in referrals, and reduced hospitalizations of patients with non-
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32 88 COVID-19 pathology. [11] As the pandemic continues to rapidly spread, attention
33
34 89 often focuses on the numbers of confirmed and probable cases, hospitalizations, and
35
36 90 deaths, which can be called the "direct" effects of the pandemic. However, these
37
38 91 numbers do not capture the full extent of the pandemic because it has also generated
39
40 92 important spillover (indirect) effects by decreasing the supply of and altering patient
41
42 93 demand for non-COVID-19-related medical care. [12]
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49 94 In Ethiopia, the government declared a state of emergency, labeling the pandemic a
50
51 95 national threat and launching overall preventive measures, including advising the
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53 96 community to stay at home, practicing strict and frequent hand washing, and wearing
54
55 97 a face mask. Also, it restricted the movement of its people from place to place and
56
57 98 laid temporary restrictions on market places, restaurants, shops, cinema houses,
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3 99 religious institutions, and cities. [13] During this time, the number of hospital visits
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6 100 dropped sharply to utilize health services, including CD follow-up. [14] Many studies
7
8 101 have revealed the direct impact of COVID-19 on health care provision and utilization.
9
10 102 But there has been little emphasis on the impact of the pandemic on the costs of
11
12 103 chronic disease follow-up care from a patient perspective. So, the study aimed to
13
14 104 determine the impact of the COVID-19 pandemic on the cost of follow-up care among
15
16 105 chronic disease patients at public hospitals.

106 **Methods and Materials**

107 **Study Design and Setting**

108 An institutional-based cross-sectional study design was used to conduct this study. It
109 was conducted from August 1 to 31, 2020, in the three wallaga zones, namely, East
110 Wallaga, West Wallaga, and Horro Guduru Wallaga zones, of Oromia Regional State,
111 Ethiopia. These three Wallaga zones are among the twenty-one zones of the Oromia
112 region and were found in the western direction of the region, Oromia. The capital
113 towns of east Wallaga zone, Nekemte town; west Wallaga zone, Gimbi town; and
114 Horro Guduru Wallaga zone, Shambu town, were located 333km, 441km, and 314km
115 west of Addis Ababa, the capital city of Ethiopia, respectively.

116 **Study Participants**

117 All chronic disease patients who visited public hospitals in the Wallaga Zones were
118 the source population, and all patients who visited the three Wallaga Zones' selected
119 study hospitals during the study period were the study population.

120 **Inclusion and Exclusion Criteria**

121 All patients from the selected CDs in the study area who visited the study hospitals
122 were included in the study. Patients whose age was less than 15 years old and

1
2
3 123 without accompanying parents who were seriously ill and unable to respond to the
4
5 124 interviews were excluded from the study.
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7

8 125 **Sample Size and Sampling Methods**

9
10 126 The sample size was determined by using the single population mean formula,
11
12 127 applying the following assumptions: two-sided alpha error (ϵ) set at 0.05, 95%
13
14 128 confidence level, mean cost of DM (μ) = 48.99 ETB, and standard deviation (SD) =
15
16
17 129 30.89 ETB[15], adding a 5% non-response rate.
18

19
20 130 Using the formula, $n = \frac{(z - \alpha/2)^2 * \sigma^2}{\epsilon^2 \mu^2}$ [16], $n = 642$.
21
22

23 131 Among thirteen public hospitals in the study area, data was collected from the
24
25 132 selected CDs of follow-up care patients from Nekemte specialized hospitals, Sire
26
27 133 hospital, Gida hospital, Arjo hospital, Shambu hospital, Guduru hospital, Gimbi
28
29 134 hospital, and Nedjo hospital, which were selected using a simple random sampling
30
31
32 135 technique.
33

34 136 The determined sample size was allocated to each study hospital proportionally
35
36 137 based on the proportion of CD patients who attended follow-up care. Wallaga
37
38 138 University referral hospital was purposely excluded from the study, which was an
39
40 139 isolation and treatment center for COVID-19 during the study period, and four other
41
42
43 140 hospitals were excluded due to their low CD patient flow.
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3 141 Finally, a simple random sampling technique was used from the registration book to
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5 142 sample patients at each study hospital as per their proportion to select 642
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7
8 143 participants.

10 144 **Data Collection**

12 145 The structured questionnaire was developed in English after reviewing relevant
13
14 146 literature, and it was translated into Afan Oromo. Data collection and supervision
15
16
17 147 were carried out by eight data collectors, with four supervisors assigned. These data
18
19 148 collectors and supervisors were trained before the pre-test and actual data collection
20
21 149 started. The questionnaires were pre-tested in Bedele Hospital using 32 (5%) of the
22
23
24 150 determined sample size. It was collected through a face-to-face interview. Patients
25
26 151 who completed their chronic outpatient services and returned to leave the study
27
28 152 hospitals were interviewed.

30 153 **Study Variables**

32
33 154 **Socio-demographic and economic characteristics, health service costs (non-**
34
35 155 **medical costs; transportation, food, accommodation, and income lost, and**
36
37 156 **medical costs; registration, consultation, laboratory, radiology, and drugs)**
38
39
40 157 **were assessed and determined.**

42 **Operational Definitions**

43
44
45 Before COVID-19: The period before March 13, 2020, when Ethiopia had the first
46
47 confirmed COVID-19 positive case.

48
49 Chronic disease follow-up patients: A patient visited the study hospital for the
50
51 follow-up care of one of the following: hypertension (HTN), diabetes mellitus (DM),
52
53 heart failure (HF), mental illness, HIV (Human Immune Virus), stroke, epilepsy,
54
55 and asthma.

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58 Chronic disease: any of the following illnesses that persist over time, can gradually
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4 progress, do not resolve spontaneously, and may not be cured: HTN, DM, HF,
5
6 mental illness, HIV, stroke, epilepsy, and asthma.[14]
7

8 Direct costs: the expenditures in ETB spent by chronic disease patients and their
9
10 families on the diagnosis and treatment of chronic illness per prescription of
11
12 physicians in the study hospitals.
13

14 During COVID-19: the period after March 13, 2020, when Ethiopia had the first
15
16 confirmed COVID-19 positive case.
17

18 Indirect costs: the number of productive days lost by patients and their families as
19
20 a result of chronic illness treatment and care.
21
22

23 Medical cost: the cost component of chronic disease patients' follow-up visits at
24
25 study hospitals that includes registration, laboratory, radiology, and drug costs.
26
27

28 **Non-medical cost:** the cost component that includes transportation, food,
29
30 accommodation, and income lost among chronic disease patients during
31
32 follow-up visits at study hospitals.
33
34
35

36 37 158 **Data Analysis**

38
39 159 Data was entered into Epi-data version 3.1 and exported to SPSS version 25
40
41 160 software for analysis. Descriptive statistics were performed for all study variables
42
43 161 based on their characteristics. The bottom-up costing approach was used to
44
45 162 estimate the direct cost of the follow-up visit with respect to the patient's perspective,
46
47 163 and the indirect costs (income lost due to productive time lost) were estimated using
48
49 164 earnings lost both before and during the COVID-19 pandemic. [17] The time
50
51 165 foregone and productive time lost were converted into indirect costs based on the
52
53 166 daily wage rate and then multiplied by the number of working days lost. The daily
54
55 167 wage rate for patients was estimated by dividing their monthly income by 30 days for
56
57 168 both patients and caregivers. [17] All costs included in the analysis were measured in
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3 169 terms of Ethiopian Birr (ETB) and were converted to US\$(US dollar) during the
4
5 170 analysis, and the average currency exchange rate was (August 2020; 1 US\$ = 35.99
6
7 171 *ETB*). The cost data was converted to real terms by adjusting market prices to reflect
8
9 172 true costs using Ethiopian inflation data.

10
11
12 173 Finally, the normality distribution of treatment cost data was checked, and it was not
13
14 174 normally distributed. As a result, non-parametric tests were used to analyze the
15
16 175 median cost for each cost category, as well as a 2-paired sample Wilcoxon sign rank
17
18 176 test to compare the costs incurred before and during the pandemic lockdown, with
19
20 177 the level of significance of the median cost difference set at $p < 0.05$.

21 22 178 **Ethical consideration**

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24
25 179 An appropriate research ethical approval was obtained from the ethical review board
26
27 180 of Wallaga University, Institute of Health Sciences (Reference number:
28
29 181 IRB/233/2020). The study was conducted in accordance with the Declaration of
30
31 182 Helsinki. The questionnaire was designed to be anonymous, and the result did not
32
33 183 identify the personalities of the respondents; rather, it was presented in the
34
35 184 aggregated statistics. Written consent was obtained from the study participants. The
36
37 185 data was kept in protected and safe locations. Paper-based data was kept in a
38
39 186 locked cabinet, and computer-based data was password-secured. Data sharing was
40
41 187 enacted based on the ethical and legal rules of data sharing, and it was not
42
43 188 accessed by a third party except the research teams.

44 45 189 **Patient and Public Involvement**

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47 190 None
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191 Results

192 Socio-demographic Characteristics

193 A total of 642 patients were included in the study, among whom 605 responded to
 194 the interview, yielding a 94.2% response rate. An almost equal number of males and
 195 females participated in the study. More than half of the participants, 352 (58.2%),
 196 were from urban areas, and the majority of them, 421 (69.6%), were married.

197 Regarding the educational status of the participants, 137 (22.6%) were illiterates
 198 (Table 1). The average participant's age was 43.29 (SD=16.5) years, the average
 199 monthly income was 84.32 (SD=70.65) US dollars, and the average household size
 200 was 4.46 (SD=3.43).

201 Table 1: Socio-demographic characteristics and classification of study participants by
 202 chronic diseases conditions in the public hospitals of the three Wallaga zones,
 203 Oromia National Regional State, Ethiopia 2020 (N= 605)

Characteristics (N= 605)		Frequency (n)	Percentage (%)
Sex	Male	302	49.9
	Female	303	50.1
Residence place	Urban	352	58.2
	Rural	253	41.8
Marital status	Single	130	21.5
	Married	421	69.6
	Separated	7	1.2
	Divorced	2	0.3
	Widowed	45	7.4
Religion	Orthodox	165	27.3

	Muslim	59	9.8
	Protestant	373	61.7
	Others	8	1.3
Ethnic group	Oromo	552	91.2
	Amhara	48	7.9
	Gurage	4	0.7
	Tigre	1	0.2
Educational status	Illiterate	137	22.6
	Read & Write	102	16.9
	Grade 1-8	99	16.4
	Grade 9-8	151	25.0
	Diploma and above	116	19.2
Employment status	Government employee	93	15.4
	NGO* employee	89	14.7
	Merchant	100	16.5
	Housewife	114	18.8
	Farmer	107	17.7
	Others**	102	16.9
Types of Chronic diseases	Hypertension	214	35.4
	Diabetic mellitus	173	28.6
	Heart failure	62	10.2
	Mental disease	51	8.4
	HIV/AIDS	50	8.3
	Asthma	29	4.8

	Epilepsy	18	3.0
	Stroke	3	0.5

204 *NGO= non-governmental organization, ** Daily laborer, students

205 **The Overall Cost of CD Follow-up Care before and during the Pandemic**

206 The total cost for the treatment of CDs before the COVID-19 pandemic among
 207 patients who incurred any one or more types of cost was on average 10.41 (SD =
 208 10.19) US dollars, with the median cost of 9.76 (IQR = 8.64) US dollars among 600
 209 patients before the pandemic. The total cost of the treatment of the diseases per
 210 follow-up visit during the pandemic among 593 patients was 13.02 (SD = 11.22) US
 211 dollars, and the median cost was 12.27 (IQR = 10.40) US dollars.

212 The median income lost due to productivity time lost for the treatment of CDs before
 213 the pandemic was 1.48 (IQR = 2.71 US dollars) among the 501 participants who had
 214 income, which was almost similar to the income lost when visiting the study hospitals
 215 during the pandemic, which was 1.40 (IQR = 2.85 US dollars).

216 The total median non-medical cost incurred for the follow-up care was 6.05 (IQR =
 217 5.55) US dollars before the pandemic among 463 patients and 7.98 (IQR = 7.50) US
 218 dollars among the same number of patients during the pandemic.

219 The total median transportation cost to travel to hospitals and travel back to their
 220 homes was 1.141 (IQR = 1.94) US dollars before the pandemic and 2.29 (IQR =
 221 3.05) US dollars during the pandemic among the 430 patients who paid for
 222 transportation.

223 The total median cost incurred for the accommodation and food during the follow-up
 224 visit was 3.43 (IQR = 4.91) US dollars before the pandemic and 4.29 (IQR = 633) US
 225 dollars during the pandemic among 199 participants.

226 The total median medical cost was 3.71 (IQR = 5.22) US dollars before the
 227 pandemic, whereas it was 4.29 (IQR = 5.91) US dollars during the pandemic hospital
 228 visit among the 425 participants who paid for the prescribed drugs (Table 2).

229 Table 2: The overall cost of chronic diseases follow-up treatment and care before and
 230 during the pandemic among chronic diseases patients at public hospitals in the three
 231 Wallaga zones, Oromia National Regional state, Ethiopia 2020(N= 605)

Cost Categories	Era of COVID-19 Pandemic	Observation-on (N)	Mean(SD)	Median (IQR)	Significance level of median cost difference (During-Before covid-19)
(a) Income lost	Before	501	2.27(2.75)	1.48(2.71)	Z = 1.780, p = 0.075
	During	501	2.25(2.72)	1.40(2.85)	
(b) Transportation	Before	430	1.91(2.13)	1.14(1.94)	Z = 8.028, p = 0.001
	During	430	3.43(4.42)	2.29(3.05)	
(c) Food and accommodation	Before	199	4.67(5.05)	3.43(4.91)	Z = 1.189, p = 0.169
	During	199	5.6(5.94)	4.29(6.33)	
Total nonmedical cost (a+b+c) = (d)	Before	463	4.58(5.35)	6.05(5.55)	Z = 4.903, p = 0.001
	During	463	6.81(7.58)	7.98(7.50)	
Total medical cost (e)	Before	425	5.51(8.43)	3.71(5.22)	Z = 2.382, p = 0.017
	During	425	5.93(7.81)	4.29(5.91)	
Total cost per patient per visit (d+e)	Before	600	10.41(10.19)	9.76(8.64)	Z = 5.05, p=0.001
	During	593	13.02(11.22)	12.27(10.40)	

232 Note: 1US\$ = 35.99 ETB, August, 2020; SD: Standard Deviation; IQR: Interquartile
 233 Range

234 **Cost Difference Based on COVID-19 Pandemic**

235 There was a significant median cost difference (n = 593, Z = 5.05, p = 0.001)
236 between the cost of follow-up care during the COVID-19 pandemic lockdown and the
237 costs incurred before the pandemic (Table 3). This showed that 348 out of 593
238 (58.7%) patients incurred significantly higher costs during the pandemic compared to
239 before the pandemic. The median cost of follow-up care during the pandemic was
240 12.27 (IQR = 10.40) US dollars, compared to 9.76 (IQR = 8.64) US dollars before the
241 COVID-19 pandemic.

242 The study showed that there was no significant median difference in income lost
243 among patients who had income during and before the pandemic (n = 501, Z =
244 1.780, p = 0.075). The median income lost during the pandemic was 1.48 (IQR =
245 2.71 US dollars) compared to the income lost before the pandemic, which was 1.40
246 (IQR = 2.85 US dollars).

247 There was a significant median cost difference in non-medical costs per patient
248 during and before the pandemic (n = 463, Z = 4.903, p = 0.001). This showed
249 significantly higher costs were incurred by more than half of the patients, 276
250 (59.61%), during the pandemic compared to before the pandemic. The median non-
251 medical cost observed among the patients was 7.98 (IQR = 7.50) and 6.05 (IQR =
252 5.55) US dollars per follow-up visit during and before the pandemic, respectively.

253 The study revealed that there was no statistical significance in the median cost
254 difference of food and accommodation incurred during and before the pandemic (n =
255 199, Z = 1.189, p = 0.169), and the median of this cost category was 4.29 (IQR =
256 6.33) and 3.13 (IQR = 4.91) US dollars during and before the pandemic lock-down,
257 respectively.

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3 258 The majority of the patients, 289 (67.2%), paid higher transportation fees when they
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5 259 visited hospitals during the pandemic compared to before the pandemic. There was
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8 260 a significant median cost difference in transportation costs during and before the
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10 261 pandemic ($n = 430$, $Z = 8.028$, $p = 0.00$), which was explained by the fact that the
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12 262 median transportation cost was 1.14 (IQR = 1.94) US dollars and 2.29 (IQR = 3.05)
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14 263 US dollars during and before the pandemic, respectively.

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17 264 More than half of the patients, 236 (55.5%), incurred higher costs for medical
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19 265 services during the pandemic compared to before the pandemic. There was a
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21 266 significant median cost difference during and before the pandemic ($n = 425$, $Z =$
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23 267 2.382 , $p = 0.017$), in which the median cost was 4.29 (IQR = 5.91) and 3.71 (IQR =
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25 268 5.22) US dollars during and before the pandemic lockdown.

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28 269 The study showed that the majority of the hypertensive (HTN) patients, 128 (60.7%),
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30 270 paid a high amount of money during the pandemic compared to before the pandemic
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32 271 among the 211 patients who paid for the services. There was a significant median
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34 272 cost difference per visit during and before the pandemic ($n = 211$, $Z = 3.632$, $p =$
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36 273 0.00). The median cost observed among these patients was 7.58 (IQR = 7.53) and
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38 274 10.14 (IQR = 8.74) US per follow-up visit before and during the pandemic,
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40 275 respectively.

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43 276 More than half of diabetes mellitus (DM) patients (59.17%) paid higher costs for
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45 277 services during the pandemic compared to before the pandemic. The total cost
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47 278 incurred by these patients was significantly higher during the pandemic compared to
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49 279 before the pandemic ($n = 169$, $Z = 3.095$, $p = 0.002$). The median cost was 11.39
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51 280 (IQR = 10.87) and 8.11 (IQR = 9.26) US dollars during and before the pandemic
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53 281 lockdown, respectively.
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3 282 The study revealed that there was no statistical significance in the median difference
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5 283 in total cost incurred by heart failure (HF) patients during and before the pandemic
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8 284 era (n = 61, Z = -0.055, p = 0.956). Among 61 HF patients, only 31 (50.82%) paid a
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10 285 higher amount of money during the pandemic compared to before the pandemic.

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12 286 Similarly, there was no statistical significance in the median difference in total cost
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14 287 incurred by patients who visited the hospitals for mental health follow-up for the
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17 288 treatment of diseases during and before the pandemic era (n = 41, Z = -1.497, p =
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19 289 0.134). Among 41 patients, only 20 (40.82%) paid a higher amount of money during
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21 290 the pandemic.

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24 291 The study also showed that there was a statistically significant median difference in
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26 292 total cost incurred by HIV patients during and before the pandemic lockdown (n = 49,
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28 293 Z = 3.356, p = 0.00). Among 49 patients, the majority of them 34(69.39%) incurred a
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30 294 higher cost per visit during the pandemic compared to before the pandemic
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32 295 lockdown.

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35 296 There was no statistical significance in the median difference in total cost incurred by
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37 297 asthma patients during and before the pandemic era (n = 28, Z = 1.731, p = 0.184).

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40 298 Similarly, there was no statistically significant median difference in total cost incurred
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42 299 by epilepsy patients during and before the pandemic lockdown (n = 18, Z = 1.328, p
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44 300 = 0.184) (Table 3).

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46
47 301 Table 3: Cost of chronic diseases follow-up treatment and care by disease types
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49 302 among chronic disease patients at public hospitals in the three Wallaga zones,
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51 303 Oromia National Regional state, Ethiopia 2020(N= 605)

Types of CDs	Era of COVID-19 Pandemic	Observation (N)	Mean(SD)	Median (IQR)	Significance level of median cost difference(During- Before covid-19)
HTN	Before	211	10.03(11.86)	7.58(7.53)	$Z = 3.632,$ $p = 0.001$
	During	211	12.65(10.42)	10.14(8.74)	
DM	Before	169	10.64(8.42)	8.12(9.26)	$Z = 3.095,$ $p = 0.002$
	During	169	13.56(10.49)	11.39(10.87)	
HF	Before	61	12.64(12.85)	9.06(8.53)	$Z = -0.055,$ $p = 0.956$
	During	61	12.51(11.34)	8.2(12.52)	
Mental disease	Before	49	13.08(8.97)	11.63(10.10)	$Z = -1.497,$ $p = 0.134$
	During	49	10.91(8.45)	8.86(10.24)	
HIV	Before	49	7.37(6.65)	6.12(6.76)	$Z = 3.356,$ $p = 0.000$
	During	49	16.58(18.32)	12.24(14.25)	
Asthma	Before	28	8.95(6.40)	7.33(10.68)	$Z = 1.731,$ $p = 0.184$
	During	28	12.92(12.34)	10.34(8.18)	
Epilepsy	Before	18	7.70(7.01)	5.70(11.18)	$Z = 1.328,$ $p = 0.184$
	During	18	10.44(5.74)	10.00(9.84)	

Note: 1US\$ = 35.99 ETB, August, 2020; SD: Standard Deviation; IQR: Interquartile Range

Discussion

This study was aimed at determining the impact of the COVID-19 pandemic on the cost of chronic disease treatment and care at public hospitals in Wallaga Zones,

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3 309 Oromia Regional State, Ethiopia. The study found that the cost of follow-up
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5 310 treatment and care among chronic disease patients during the COVID-19 pandemic
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8 311 was significantly higher compared to before the pandemic era.

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10 312 This indicated that more than half of the chronic patients, 58.7%, incurred a
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12 313 significantly higher total cost during the pandemic lockdown compared to before the
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14 314 pandemic. This finding supports the study's findings that chronic illness costs
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16 315 account for more than 75% of total healthcare costs in high-income countries. [18,
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18 316 19] However, this study was conducted during the COVID-19 pandemic and in a low-
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20 317 income country, but these studies were not conducted at the time of the pandemic
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22 318 and were also conducted in high-income countries. During the pandemic, most
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24 319 global healthcare resources are focused on COVID-19, and this resource
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26 320 reallocation could disrupt the continuum of care for patients with CDs. [9, 10, 20]
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28 321 This could be explained by the fact that the global pandemic's disruption of the
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30 322 health care system may impose additional costs on CD patients.

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33 323 The study revealed that the non-medical cost during the follow-up visit per patient
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35 324 during the era of COVID-19 was significantly higher than the cost incurred before the
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37 325 pandemic era by the same patients, which was doubled during the pandemic. This
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39 326 significant difference might be due to a strict lockdown that could affect these
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41 327 patients adversely as they require regular follow-up visits that lead to further health
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43 328 consequences and additional costs. [21,22]

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45 329 Transportation costs were one of the cost categories that doubled during the
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47 330 pandemic compared to before the pandemic. The median cost per patient per visit of
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49 331 this cost category during the pandemic era was significantly increased by two folds.
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51 332 This could be due to the fact that the government restricted the movement of its
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3 333 people from place to place and laid a temporary restriction on public transport across
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5 334 regions and cities. [13, 21]
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8 335 The study discovered a significant median cost difference in medical costs, with the
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10 336 median of this cost category increasing by 15.6% during the pandemic. This finding
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12 337 is in line with the study report that revealed that before the pandemic, one in three
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14 338 Americans did not take their medications as prescribed because of high costs, but
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16 339 during a global pandemic, forgoing medications involves even more risks for chronic
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18 340 care patients and incurs even higher costs in the long run. [23] However, comparing
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20 341 study findings in this study setting with those in a high-resource setting is taken as a
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22 342 weakness of this study.
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26 343 The study also evaluated the cost of each selected chronic disease. Accordingly, for
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28 344 the follow-up care of HTN patients, the patients incurred significantly higher costs
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30 345 during the pandemic compared to before the pandemic, which were raised by
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32 346 33.76% during the pandemic. The cost incurred before the COVID pandemic was
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34 347 almost comparable with other study reports, but the cost incurred during the
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36 348 pandemic was higher than the study report on the cost of hypertension before the
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38 349 COVID-19 lockdown in Ethiopia. [24]
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42 350 Again, the study showed that the cost of DM follow-up visits per patient during the
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44 351 pandemic lockdown was significantly higher than the cost incurred before the
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46 352 pandemic, which was increased by 40.53%. However, before and during the COVID-
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48 353 19 lockdown, the cost of DM in this study was lower than the study reported in
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50 354 Ethiopia. [15, 25] This variation could be attributed to differences in DM
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52 355 complications and treatment among study participants.
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56 356 Despite HIV care and treatment being an exempt service in Ethiopia, patients
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58 357 incurred nonmedical costs. The study revealed that the cost incurred by HIV patients
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3 358 for follow-up treatment and care per visit per patient during the pandemic lockdown
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5 359 was significantly higher than the cost incurred before the pandemic, which was
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8 360 increased by twofold. The cost of HIV treatment and care reported in the study was
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10 361 higher than in other Ethiopian studies. [26, 27]

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12 362 However, there was no significant statistical median cost difference for the follow-up
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14 363 care of heart failure, mental illness, asthma, and epilepsy during and before the
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16 364 pandemic; a slight median cost difference was observed during and before the
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19 365 pandemic.

21 366 **Conclusion**

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24 367 This study revealed that the total cost of follow-up care among chronic disease
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26 368 patients during the COVID-19 pandemic lockdown was significantly higher compared
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28 369 to before the pandemic era among the same patients. In this study, hypertensive
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30 370 patients had the greatest impact on the cost of ongoing care as a result of the
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32 371 COVID-19 pandemic. A comprehensive package of chronic disease treatment and
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34 372 care is demanded at different levels of health facilities in the country's health system.
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36 373 Therefore, healthcare providers, hospital administrators, and the local government
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38 374 should arrange special fee waiver mechanisms for chronic disease healthcare costs
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40 375 during such types of pandemics and provide the services at proximal health facilities.
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45 376 **Declarations**

46 377 **Author's Contribution Statement**

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48
49 378 All authors made substantial contributions to conception and design, acquisition of
50
51 379 data, or analysis and interpretation of data; took part in drafting the article or revising
52
53 380 it critically for important intellectual content; gave final approval of the version to be
54
55 381 published; and agreed to be accountable for all aspects of the work.
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59 382 **Conflict of Interest Statement**

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3 383 All authors declared that they have no conflicts of interest related to this work.
4

5 384 **Consent for Publication**

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8 385 NA
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10 386 **Availability of Data and Materials**

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12 387 All the data supporting the study's findings are within the manuscript. Additional
13
14 388 detailed information and raw data will be shared upon request addressed to the
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16 389 corresponding author.
17
18

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22
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24
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29
30 395 administrative bodies from top to bottom for their due cooperation and involvement.
31
32

33 396 **Acronyms**

34
35 397 ETB: Ethiopian Birr, HF: Heart Failure, HIV: Human Immune Virus, HTN:
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37 398 Hypertension, LMICs: Low-and-middle-income countries, NCDs: Non-communicable
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39 399 diseases, OOP: Out-of-pocket, WHO: World Health Organization
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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	2
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	-
Bias	9	Describe any efforts to address potential sources of bias	-
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	8
		(b) Describe any methods used to examine subgroups and interactions	-
		(c) Explain how missing data were addressed	8
		(d) If applicable, describe analytical methods taking account of sampling strategy	-
		(e) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest	8
Outcome data	15*	Report numbers of outcome events or summary measures	-
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
Discussion			
Key results	18	Summarise key results with reference to study objectives	12-14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	-
Generalisability	21	Discuss the generalisability (external validity) of the study results	-
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.