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Perceived quality of care among households ever enrolled in a community-based health insurance scheme in two districts of northeast Ethiopia: a multilevel analysis

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ABSTRACT

Objectives: The purpose of this study was to examine how clients perceived about the quality of health care they received and to identify associated factors at the individual and facility-level.

Design: A community-based, cross-sectional study

Setting: Health centers in two districts

Participants: 1081 rural households who had ever been enrolled in a community-based health insurance and had visited a health center at least once in the previous 12 months, as well as 194 health care providers working in 12 health centers.

Outcome measures: The outcome variable of interest was the perceived quality of care, which was measured using a 17-item scale. Respondents were asked to rate the degree to which they agreed on 5-point response items relating to their experiences with health care in the outpatient departments of nearby health centers. A multilevel linear regression analysis was used to identify predictors of perceived quality of care.

Results: The mean perceived quality of care was 70.28 (SD=8.39). Five dimensions of perceived quality of care were extracted from the factor analysis, with the patient-provider communication dimension having the highest mean score (M=77.84, SD=10.12), and information provision having the lowest (M=64.67, SD=13.87). Wealth status, current insurance status, perceived health status, presence of chronic illness, time since the most recent health center visit, work experience of health care providers and patient volume were the factors significantly associated with perceived quality of care. An interaction term between patient volume and staff job satisfaction also showed significant association.

Conclusions: Much work remains to improve the quality of care, especially on information provision and access to care quality dimensions. A range of individual and cluster-level characteristics influence the perceived quality of care. For a better quality of care, it is vital to optimize the patient-provider ratio, and enhance staff job satisfaction.

Strengths and limitations of this study

- The study tried to assess the quality of care from the clients' point of view using a validated multidimensional scale.
- This is the first cross-sectional study in Ethiopia, which considered health center (cluster) level variables that have association with perceived quality of care.
- We tested for the existence of endogeneity between current insurance status and quality of care. Although the results indicated no evidence of endogeneity, it is still possible due to omitted variables. Active insurance members may report a higher perception score quality of care as a result of their desire to stay in the scheme.
- Because of the cross-sectional nature of the study, it is impossible to establish a cause-and-effect relationship.

INTRODUCTION

Health care providers and patients define quality of care differently and attach varying levels of importance to its attributes. When assessing the quality of care, health care professionals tend to prioritize technical competence, while patients place a high value on patient-centeredness, amenities, and reputation.[1] The emphasis on health care quality measurement has shifted away from the viewpoints of health care providers to people-centered approaches that rely on patient perceptions.[2-4] Patients' perception of health care quality has become an essential element of quality measurement due to its link with health service utilization. It is based on a mix of patient

experiences, processed information and rumors.[5] Patient experience surveys elicit data on the transactional components of care, which are process-related, as well as the interpersonal interactions that occur over the course of care.[6] Individuals receiving care are asked about their experiences of health facility encounters to report if particular processes or events occurred.[7] Patient experience measurements have received increased attention and are widely employed to inform quality improvement, and pay-for-performance.[8] Patient experience is consistently and positively associated with patient safety and clinical effectiveness, adherence to prevention and treatment recommendations, and technical quality of care.[9 10]

Quality of health care is vital to the success of universal health coverage (UHC) initiatives, like community-based health insurance (CBHI). The development of CBHI schemes must be accompanied by improvements in the quality of care.[11 12] To build sustainable CBHI schemes, members must believe that the benefits of health care provided via health insurance coverage outweigh the benefits of not being insured.[13] Patients' positive experiences with the quality of care provided under insurance schemes increase their trust in the health system and insurance schemes.[14 15] As a result, they are more likely to use health care services and participate in health insurance plans.[16] If insured clients are unable to access high quality services, they lose trust in service providers and seek care elsewhere,[17] making them less likely to pay premiums.[18 19]

The ultimate goal of UHC is to ensure that all people who need health services receive high quality care without financial strain.[20] Although increased health care coverage is promising with the implementation of CBHI, quality of care remains a key impediment to achieving UHC.[20 21] Increasing access to essential health services without improving their quality would not bring the intended health outcomes.[2 4] For example, more than eight million deaths amenable to a high

quality of care occurred in low- and middle-income countries, making poor-quality of care a bigger obstacle to mortality reduction than lack of access to care.[21]

Poor quality of care is also a major issue that jeopardizes the long-term viability of many CBHI schemes.[11 22] Findings of systematic reviews revealed that the quality of care was a key factor that influenced enrollment and renewal decisions of CBHI membership.[23 24] Some quality concerns include 'unavailability and perceived poor quality of prescribed medicines, misbehavior of health professionals, and the differential treatment of the insured in favor of the uninsured patients, unclean hospital environment, long queues, lack of diagnostic equipment, and long waiting hours to obtain health care'.[24]

To promote optimal utilization, stable finance, and better outcomes, the quality of health care must be monitored on a regular basis.[17] Previous studies in Ethiopia focused on surveys of client satisfaction and did not employ multidimensional measurement scales.[25 26] To our knowledge, the quality of care delivered under the CBHI in Ethiopia has never been investigated using multidimensional metrics from the perspective of service users at the community level. There is also a paucity of literature on facility-level variables that influence the quality of care. Therefore, the purpose of this study was to examine the perceived quality of care (PQoC) from the perspective of clients, and identify associated factors at the individual and facility-level.

Improving quality of care and CBHI are among Ethiopia's top priorities in its health sector strategic plan.[27] The findings of this study will inform relevant stakeholders on the current state of clients' perceptions of the quality of care, and will be an essential input for quality improvement initiatives.

It will also provide useful information for decision-makers to address challenges in the country's endeavors to establish higher-level insurance pools.

METHODS

Study setting and population

A community-based cross-sectional study was conducted in rural parts of two neighboring districts in northeast Ethiopia, Tehulederie and Kallu. Tehulederie is divided into 20 rural and seven urban *Kebeles* (subdistricts) with a population of 145,625, of which 87.5% reside in rural areas. There are five health centers and one primary hospital in the district. It was one of the 13 districts in Ethiopia where CBHI was piloted in 2011. The scheme was introduced in Kallu district after two years, in July 2013. Kallu is divided into 36 rural and four urban *Kebeles,* and has nine health centers. It is the most populous district in the zone, with a population of 234,624, of which 89.11% live in the rural area.[28]

The study population of interest were rural households who had ever been enrolled in the CBHI scheme before January 2020. To minimize recall bias, households who had not used health care in the 12-month period before data collection were excluded from the study. The sample size was calculated using MedCalc software by assuming a mean difference of two independent groups. A previous study on PQoC reported mean scores of 5.2 and 5.4 with standard deviations (SD) of 0.8 and 0.7 among insured and uninsured respondents, respectively.[29] Using this output and assuming an 80% power, 95% confidence level and equally sized groups, a sample size of 446 was calculated. Considering a design effect of 1.5 attributable to multi-stage sampling and a potential

non-response rate of 10%, the effective sample size was estimated to be 736 households. Alternative sample sizes were calculated for a PhD study on the sustainability of CBHI with 1257 being the largest estimated sample size. Among those, 1081 eligible households participated in this study. Furthermore, 194 health care providers from 12 health centers participated in the study to provide cluster-level data.

Data collection and measurement

The data were collected from 04 February to 21 March 2021. The study participants were recruited using a three-level multistage sampling approach. First, 12 clusters of *Kebeles* organized under a health center catchment area were selected. Then, 14 rural *Kebeles* were drawn randomly using a lottery method proportional to the number of *Kebeles* under each cluster. Accordingly, five *Kebeles* from Tehulederie and nine from Kallu were included. A list of households who have ever been enrolled in the CBHI was obtained from the membership registration logbook of each *Kebele*. The required sample was generated at random from each Kebele, proportional to the number of households who have ever enrolled in the scheme, using random number generator software.

Individual-level data was collected through face-to-face interviews with household heads at their homes using a structured questionnaire via an electronic data collection platform. The data collectors submit the completed forms to a data aggregating server on a daily basis, which allowed us to review the submissions and streamline the supervision process.

The PQoC, which is the outcome variable of interest, was measured using a 17-item scale designed after a thorough review of validated tools. [29-33] Respondents were asked to rate the extent to which they agreed on a set of items relating to their experiences with the health care they received in the

outpatient departments of nearby health centers. Each item was designed on a 5-point response format, with 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree. The summary scores for the PQoC and its dimensions were calculated for individual respondents by adding the scores for each item. This gives a scale ranging from 17 (1 ×17) to 85 (5 × 17) for the overall PQoC score. When reporting the results, the scores were arithmetically transformed to a scale of 20 to 100.[34] This allows the comparison of mean scores of PQoC with its dimensions, and measurement items on a common scale.

Wealth index was generated using the principal component analysis method. The scores for 15 types of assets were translated into latent factors, and a wealth index was created based on the first factor that explained most of the variation. The study households were grouped into wealth tertile – lower, medium and higher based on the index. Perceived health status was measured based on a household head's subjective assessment of the health status of the household, and was rated as "poor, fair, good, very-good, or excellent". However, for analysis purpose, it was recategorized into "fair, good, and very-good", by merging the two extreme response categories to the next option due to fewer replies.

Before the data collection, the questionnaire was pre-tested on a sample of 84 randomly selected participants in one *Kebele*. As part of the pre-test, a cognitive interview was conducted on selected items using the verbal probe technique among eight respondents to determine if the items and response categories were understood, and interpreted by the potential respondents as intended. Accordingly, the phrasing of some items and response options were modified, and some items were omitted.

Cluster-level data were collected from 12 health centers that provide health care for the population in the sampled *Kebeles*. Patient volume data were obtained by reviewing the monthly service delivery reports of health centers, while data related to work experience, affective commitment and job satisfaction were collected through a self-administered questionnaire among health care providers who worked more than one year in the current facility.

Patient volume was measured using the daily average number of patients managed by a health care provider in the outpatient department. It was calculated by dividing the number of patients who visited the health center in the last six months before the study by the number of working days, and then by the number of consultation rooms in each health center. Affective commitment and job satisfaction were composite variables which were assessed using a 5-point Likert scale. Affective commitment was measured with a seven-item questionnaire based on a modified version of the Meyer et al. scale, which had previously been used in a hospital setup.[35] Staff job satisfaction was measured using a 10-item scale, which was adapted from a previous study among health care workers in Ethiopia.[36] Average affective commitment and job satisfaction scores were computed for each health center.

Data analysis

The data were analyzed using Stata version 17.0. Exploratory factor analysis was performed to assess the validity of the quality measurement scale. The Bartlett's test of Sphericity and Kaiser-Mayer-Olkin's (KMO) measure of sampling adequacy were performed to assess the appropriateness of the data for factor analysis. The principal component factor method of extraction and Promax rotation with Kaiser Normalization was used. The Eigenvalue greater than

one decision rule was used to determine the appropriate number of factors to be extracted. Items with loadings below 0.40 were removed from the analysis.[37] Correlation coefficients were used to test construct validity. Item-total score correlation, dimension-total score correlation and dimension intercorrelation were computed. The total score was the mean score of the ratings for all items of the scale, and the dimension score was the factor scores. A questionnaire has good construct validity when the item-total score correlations are higher than 0.40, dimension intercorrelations are less than 0.80, and dimension-total score correlations are higher than dimension intercorrelations.[31] Cronbach's alpha coefficients were generated for each dimension to assess the internal consistency. Reliability of the scale was considered acceptable if Cronbach's alpha coefficient was 0.60 or higher.[37]

To compare mean scores of PQoC and its dimensions among subgroups, an independent t-test and a one-way analysis of variance (ANOVA) with Tukey's post-hoc test were used. Because the outcome variable was considered as a continuous variable, a multilevel linear regression model was fitted to identify its predictors. The Restricted Maximum Likelihood estimation approach was used because it is appropriate for smaller cluster sizes.[38] The PQoC was assumed to be influenced by the characteristics of households (individual-level variables) as well as the characteristics of health centers (cluster-level variables). Cluster-level data were linked to individual-level data based on the usual source of health care for each study participant. Considering the hierarchical structure of the data, where patients are nested within health centers, a two-level linear regression model was applied. Four models were estimated to choose the one that best fits the data. The first model, or the null model (a model without predictors) is given by:

$$Y_{ij} = \gamma_{00} + u_{0j} + \varepsilon_{ij} \quad (1)$$

The null model estimates three parameters: the average intercept (Y_{00}), the between health center error, or deviation, from the average intercept (u_{0j}), and the individual-level residual, or variation in individual scores within health centers (ε_{ij}). The second model estimated PQoC (Y_{ij}) for individual household i at health center j. We treat PQoC as a function of a matrix of individual-level variables (X_{ij}) which include age, gender, education and marital status of the household head; wealth status; household size; current health insurance status; presence of chronic illness in the household; perceived health status, and time since the most recent visit to a health center, and expressed as:

$$Y_{ij} = \gamma_{00} + \gamma_{10}X_{1ij} + \gamma_{20}X_{2ij} + u_{1j}X_{1ij} + u_{2j}X_{2ij} + \ldots + \gamma_{n0}X_{nij} + u_{nj}X_{nij} + u_{0j} + \varepsilon ij \quad (2)$$

where $u_{1j,}\, u_{2j\ldots}u_{nj}$ indicate the random error terms connected to each X_{ij}.

The third model estimated the PQoC as a function of cluster-level variables (Z_j) that include work experience, affective commitment and job satisfaction of health care providers, and patient volume. The model takes into account the differences between health centers and explains these differences in terms of these characteristics. It is given by:

$$Y_{ij} = \gamma_{00} + \gamma_{01}Z_{1j} + \gamma_{02}Z_{2j} + \ldots + \gamma_{0n}Z_{nj} + \gamma_{11}PV_j * JS_j + u_{0j} + \varepsilon ij \quad (3)$$

where PV_j*JS_j indicates an interaction term between patient volume and job satisfaction in which job satisfaction was assumed to moderate the effect between patient volume and PQoC. The interaction effect was tested by plotting the marginal effects of interaction terms. The two variables were centered towards the grand mean to facilitate the interpretation of the coefficients.

By combining model II and III, the fourth model estimated the PQoC as a function of both individual and cluster-level variables, and can be written as:

$$Y_{ij} = \gamma_{00} + \gamma'_{10}X_{ij} + \gamma'_{01}Z_j + \gamma_{11}PV_j * JS_j + u'_jX_{ij} + u_{0j} + \varepsilon ij \quad (4)$$

where γ_{10} and γ_{01} are the vector of coefficients of n explanatory variables whose values are at X_{1ij}, $X_{2ij}, \ldots, X_{nij}$ for the i^{th} individual within the j^{th} cluster, and $Z_{1j}, Z_{2j}, \ldots, Z_{nj}$ for the j^{th} cluster, respectively. The intercept γ_{00} and slopes γ_{01}, γ_{10} and γ_{11} are fixed effects, while u_{0j}, u_j and ε_{ij} are random effects.

This multilevel regression decomposes the total variances into two independent components: σ_e^2, which is the variance of individual-level errors ε_{ij}, and σ_{u0}^2, which is the variance of cluster-level errors u_{0j}. From this model we can define the intraclass correlation (ICC) by the equation:[39]

$$ICC = \sigma_{u0}^2 / \left(\sigma_{u0}^2 + \sigma_e^2\right)$$

The ICC and proportional change in variance (PCV) were used to report the measures of variation (random effects). The need for multilevel analysis, which considers cluster-level factors, was tested using the ICC. The ICC shows the variation in PQoC accounted for cluster-level characteristics. Statistically significant variability between health centers justifies the need to consider cluster-level factors.[40] The PCV expresses the change in the cluster-level variance between the empty model and models with more terms, and is calculated by PCV = $(V_A - V_B)/V_A$, where V_A = variance of the null model, and V_B = variance of the model with more terms. It measures the total variation explained by individual and cluster-level factors.

The measures of association (fixed-effects) estimate the association between the PQoC score and various explanatory variables. The existence of a statistically significant association was determined at p-values of <0.05. The degree of the association was assessed using regression

coefficients, and their statistical significance was determined at a 95% confidence interval. Models were compared using the Deviance Information Criteria (DIC) and Akaike Information Criteria (AIC). The best fit model was determined to have the lowest DIC and AIC values. The preliminary analysis confirmed no violation of the assumptions of normality, linearity, homoscedasticity, and multicollinearity. The presence of multicollinearity was determined using Variance Inflation Factor with a cutoff point of 5.

Patient and Public Involvement

No patient involved

RESULTS

Background characteristics of the study population

The household survey included 1081 respondents who had visited a health center at least once in the previous 12 months prior to the study. The average age of the study participants was 49.25 years (SD=12.07), with slightly more than half (51.34%) were between the age ranges of 45 and 64, and 12.67% being 65 and older. Of the total household heads, 938 (86.77%) were men, and 1003 (92.78%) were currently married. One-fifth of the study participants (20.91%) attended formal education, and 62.72% had a household size of five or above.

Nearly ninety percent of the households (87.14%) were active members of the CBHI scheme at the time of the study. A quarter of households (25.72%) had one or more individuals with a known chronic illness informed by a healthcare provider. One-third of respondents (33.58%) rated their

household health status as very-good, while 207 (19.15%) and 511 (47.27%) rated it as fair and good, respectively. Nearly half of the households (46.16%) had visited a health center within three months prior to the study, while 31.73% and 22.11% had their most recent visit to a health center before 6-12 and 3-6 months, respectively (Table 1).

The median work experience of health care providers involved in this study ranges from three to ten years. The mean scores of affective commitment and job satisfaction were 29.00 and 30.95 (SD=2.08 and 3.17), respectively. The average patient volume was 32.17 per day per care provider, with a range of 19 to 43 (SD=7.83).

Factor analysis

Sampling was adequate as measured by the KMO (0.83), and Bartlett's test of sphericity was significant ($p<0.001$). Two items were removed from further analysis due to loadings below 0.40, and one item was removed due to low communality. The factor analysis extracted five dimensions that explained 59.25% of the total variation (online supplemental file 1). The item-total score correlations ranged from 0.268 to 0.622, four items had correlations less than 0.40. The dimension intercorrelations varied from 0.031 to 0.434, all of which were less than the 0.80 criterion, indicating that each dimension was distinct enough to be considered an independent measure. Dimension-total score correlation ranged between 0.463 and 0.743, all significant at a p-value of 0.001, and were higher than dimension intercorrelation. The scale was tested for reliability and had an overall Cronbach's alpha coefficient of 0.804. The Cronbach's alpha coefficients for the five dimensions exceeded 0.60, except for the access to care subscale, which had an alpha coefficient of 0.531.

Table 1: Independent t-test and one-way ANOVA comparing mean scores of the PQoC (20-100 scale) across respondent characteristics in two districts of northeast Ethiopia, 2021

Variable	Categories	N=1081	%	PQoC score		t/F-test
				M	SD	
Age in years	25 – 44	389	35.99	69.97	7.78	1.08
	45 – 64	555	51.34	70.26	8.52	
	65+	137	12.67	71.20	9.49	
Gender	Men	938	86.77	70.15	8.21	-1.31
	Women	143	13.23	71.13	9.51	
Marital status	Divorced/widowed	78	7.22	71.61	10.95	1.46
	Married	1003	92.78	70.17	8.16	
Attend formal education	No	855	79.09	70.29	8.48	0.07
	Yes	226	20.91	70.24	8.05	
Household size	< Five	403	37.28	70.85	8.63	1.73
	≥ Five	678	62.72	69.94	8.25	
Wealth tertile	Lowest	361	33.40	71.77	9.15	8.83#
	Medium	360	33.30	69.36[b]	8.16	
	Highest	360	33.30	69.70[b]	7.62	
Current insurance status	Ex-member	139	12.86	67.66	9.65	-3.96#
	Active-member	942	87.14	70.66	8.13	
Perceived health status	Fair	207	19.15	72.28	8.84	8.04#
	Good	511	47.27	70.08[b]	7.83	
	Very-good	363	33.58	69.41[b]	8.73	
Chronic illness	No	803	74.28	69.54	8.29	-4.96#
	Yes	278	25.72	72.40	8.33	
Last health center visit	< 3 months	499	46.16	70.75[b]	8.99	4.78§
	3-6 months	239	22.11	70.94[b]	7.60	
	6-12 months	343	31.73	69.13	7.92	
Total		1081	100	70.28	70.28	

Statistical significance for t-test/F-test is indicated by §p<0.01, and #p<0.001. Based on Tukey's post-hoc test, mean values sharing letter 'b' are not significantly different in the group at the 5% level.

Perceived quality of care

The minimum and maximum PQoC scores were 37.65 and 97.65, respectively. The mean score was 70.28 (95% CI: 69.77, 70.78) with an SD of 8.39. The aggregated mean score at the health

center-level ranges from 64.94 to 74.06. Patient-provider communication had the highest mean score (M=77.84, SD=10.12) of the five quality dimensions, while information provision had the lowest score (M=64.67, SD=13.87). The mean score for each measurement item is summarized by online supplemental file 2.

An independent t-test and a one-way ANOVA were performed to compare the mean scores of PQoC and its dimensions between subgroups. As shown under Table 1, there was a significant difference in the PQoC mean score for wealth tertile at $p<0.05$ (F=8.83, $p=0.001$). Tukey's post-hoc test indicated that the mean score of PQoC for the lowest wealth tertile (M=71.77, SD=9.15) was significantly different from both the medium (M=69.36, SD=8.16) and highest (M=69.70, SD=7.62) wealth tertile. However, no significant difference was seen between medium and high wealth tertile. The ANOVA test also showed that the PQoC mean score showed significant differences based on the respondents perceived health status and most recent visit to a health center, with (F=8.04, $p<0.001$) and (F=4.78, $p<0.01$), respectively. There was a significant difference in the mean score of PQoC between active insurance members (M=3.53, SD=0.41) and ex-members (M=3.38, SD=0.48); t = 3.96, $p<0.001$. The mean PQoC score of households with chronic illness (M=3.62, SD=0.42) was also significantly higher compared to those who did not have chronic illness (M=3.48, SD=0.42); t = 4.95, $p<0.001$. The results of an independent t-test and a one-way ANOVA that compare the differences in mean scores of the five dimensions between subgroups is displayed by Table 2.

Table 2: Independent t-test and one-way ANOVA comparing mean scores of PQoC dimensions (20-100 scale) across respondent characteristics in two districts of northeast Ethiopia, 2021

Variables	N	Technical care		Communication		Information provision		Access to care		Trust in providers	
		M	SD	M	SD	M	SD	M	SD	M	SD

Age in years											
25 – 44	389	68.33	15.61	77.60	9.89	62.75[b]	13.73	69.99	11.64	73.59[b]	10.11
45 – 64	555	68.14	15.19	77.71	10.01	64.60[b]	14.03	69.41	12.04	73.61[b]	10.96
65+	137	69.15	14.44	79.03	11.19	70.36[#]	12.09	68.25	10.97	70.46[§]	13.21
Gender											
Men	938	68.36	15.15	77.67	10.17	64.40	13.80	69.34	11.67	73.18	10.80
Women	143	68.48	16.00	78.93	9.81	66.40	14.27	70.31	12.42	73.38	12.37
Marital status											
Divorced/widowed	78	70.77	14.74	78.80	12.10	70.77[#]	13.58	67.18	13.03	72.31	14.01
Married	1003	68.15	15.27	77.76	9.96	64.19	13.79	69.65	11.65	73.27	10.75
Formal education											
No	855	68.37	15.41	77.78	10.29	64.43	13.98	69.63	11.64	73.39	11.13
Yes	226	68.20	14.62	78.05	9.54	65.55	13.46	68.89	12.24	72.51	10.56
Household size											
< Five	403	69.10	15.21	78.51	10.07	65.14	14.31	70.37	11.25	73.18	11.94
≥ Five	678	67.89	15.25	77.43	10.14	64.39	13.61	68.94	12.04	73.22	10.44
Wealth tertile											
Lowest	361	69.64	14.42	79.56[#]	9.94	70.21[a#]	12.84	68.70	11.49	72.13[a]	13.07
Medium	360	67.11	15.28	76.80[b]	10.57	63.08[a]	14.40	69.00	11.82	73.02[*]	10.45
Highest	360	68.26	15.93	77.13[b]	9.65	60.69[a]	12.54	70.63	11.94	74.46[a]	9.04
Insurance status											
Ex-member	139	64.75[§]	15.73	74.29[§]	12.91	63.13	14.46	67.05[§]	13.56	70.79[§]	13.07
Active-member	942	68.87	15.10	78.36	9.54	64.89	13.78	69.83	11.44	73.56	10.64
Self-rated health											
Fair	207	71.76[b]	13.73	80.35[#]	9.55	70.02[#]	12.87	68.62	11.51	72.59[*]	11.83
Good	511	68.85[b]	14.73	76.73[b]	10.06	63.86[b]	13.95	69.18	11.14	74.16[a]	9.83
Very-good	363	65.67[#]	16.31	77.96[b]	10.29	62.74[b]	13.59	70.37	12.71	72.21[a]	11.99
Chronic illness											
No	803	67.39[#]	15.58	77.30[§]	10.35	63.09[#]	13.74	69.13	11.90	73.07	10.94
Yes	278	71.08	13.90	79.38	9.29	69.21	13.26	70.47	11.33	73.60	11.25
Last health center visit											
< 3 months	499	68.08	15.10	78.46	10.25	68.07[#]	13.95	68.88[b]	11.49	71.77[#]	12.20
3-6 months	239	69.71	14.79	77.68	9.97	62.97[b]	12.90	71.67[§]	11.28	75.06[b]	9.31
6-12 months	343	67.76	15.74	77.03	10.02	60.90[b]	13.26	68.80[b]	12.34	73.99[b]	10.01
Total	1081	68.34	15.24	77.84	10.12	64.67	13.87	69.47	11.77	73.20	11.02

Statistical significance for t-test/F-test is indicated by $^{*}p<0.05$, $^{\S}p<0.01$, and $^{\#}p<0.001$. Based on Tukey's post-hoc test, mean values sharing letter 'a' are significantly different; while mean values sharing letter 'b' are not significantly different in the group at the 5% level.

The mean PQoC score was significantly different among health centers (F=11.85, $p<0.001$). The mean scores for the five dimensions were also significantly different among health centers at $p<0.001$ level: technical care (F=8.66), patient-provider communication (F=6.65), information

provision (F=47.42), access to care (F=36.87) and trust in care providers (F=6.98). The mean scores of the PQoC and its dimensions across the 12 health centers are depicted using a radar chart (Figure 1). The chart shows a comparison of mean scores on a scale of 10 to 90. For example, respondents from 11 health centers had a higher perception score on patient-provider communication than other dimensions with less variation, while the information provision dimension was mostly ranked lowest with more variability.

Figure 1: Summary of the mean scores of the PQoC and its dimensions across 12 health centers in two districts of northeast Ethiopia, 2021

Predictors of perceived quality of care: Multilevel analysis

The fixed effects (measures of association) and the random effects (measures of variation) for the multilevel linear regression model are depicted in Table 3. In the null model, 8.5% of the total variance in PQoC was attributed to cluster-level variables. The variability between clusters was statistically significant (τ=5.90, p<0.001). Furthermore, the null model shows a significant improvement in fit relative to a standard linear model, demonstrating the importance of developing a multilevel model. The cluster-level variation in Model II remained significant (τ=6.33, p<0.001), with 9.31% of the total variability attributed to differences across clusters. The PCV was negative in this model, indicating that individual-level characteristics did not play a role in explaining the between cluster variation. In Model III, cluster-level variables accounted for just 1.33% of the variation in PQoC across clusters. The PCV showed that cluster-level variables explained 85.42% of the between health centers variation, indicating the importance of including cluster-level

characteristics to build a more robust explanatory model. We interpreted the results of the regression analysis using Model IV, which has the lowest DIC and AIC.

After adjusting for other individual and cluster-level factors, the mean PQoC score for households with higher wealth tertile increased by 1.79 points compared to those with lower wealth tertile (b=1.79; 95% CI: 0.37, 3.21). Households who were active members of CBHI at the time of the study had a 2.70-point higher PQoC score than ex-members (b=2.70; 95% CI: 1.25, 4.14). The PQoC score of households who rated their health status as very-good was 1.80 points lower compared to those who rated it as fair (b=-1.80; 95% CI: -3.31, -0.29). Compared to households without a chronic illness, those with one or more family members with a chronic illness had a 1.42 point higher perception score (b=1.42; 95% CI: 0.22, 2.63). Time since the most recent visit to a health center was also significantly associated with PQoC score. The mean score for households who had their most recent visit to a health center before 3-6 months was 1.89 points higher compared to those whose recent visit was within 3-months prior to the study (b=1.89; 95% CI: 0.61, 3.17).

Regarding cluster-level variables, the work experience of health care providers and patient volume had statistically significant associations with PQoC. A 1.07-point improvement in the average PQoC score of health centers was noted for every year increase in the median work experience of health care providers (b=1.07; 95% CI: 0.74, 1.40). An interaction term between patient volume and job satisfaction was positively associated with PQoC, implying that increasing staff job satisfaction would buffer or lessen the effect between patient volume and PQoC. At an average staff job satisfaction, a 0.42-point drop in the average PQoC score of health centers was observed for a unit increase in patient volume (b=-0.42; 95% CI: -0.50, -0.33). A one-unit increase in patient

volume would only result in a 26% fall in average PQoC if the average job satisfaction is set one SD above the mean. This prediction was substantiated by the fact that the margins graph for patient volume showed the flattest slope for high job satisfaction. However, the buffering role is observed in health centers with an average patient volume of 30.75 or higher.

DISCUSSIONS

In this study, the mean PQoC score was 70.28 from a scale of 20-100 with an SD of 8.39. The patient-provider communication received the highest score (M=77.84, SD=10.12) among the five quality dimensions. In 2015, the Ethiopian government incorporated the development of caring, respectful and compassionate health care providers as one of the main transformation agendas in its five-year strategic plan.[27] Our finding may be attributed partly to the government's ongoing training initiative aimed at producing caring, respectful and compassionate health care providers. The perception score for the information provision dimension, on the other hand, was the lowest (M=64.67, SD=13.87). This could be attributed to an increase in patient volume following the implementation of CBHI.[26] Items loaded under this dimension appear less practical in the presence of a larger patient load. If health care providers are required to treat a large number of patients, consultation times will be reduced. They are unlikely to provide the necessary information to their clients if they are under time constraints. Regarding item level observations, waiting time and medicine availability received the lowest perception scores (62.96 and 63.50, respectively), which could also be related to increased patient load. This is consistent with previous studies in Ethiopia, which showed insured clients frequently complain about a lack of medicine and long wait times at CBHI-affiliated health facilities.[41 42]

Table 3: Multilevel linear regression analysis of factors associated with PQoC among households ever enrolled in a CBHI scheme in two districts of northeast Ethiopia, 2021

Variables		Model I	Model II	Model III	Model IV
	Category		b (95% CI)	b (95% CI)	b (95% CI)
Fixed effects					
Age			-0.02 (-0.06, 0.03)		-0.03 (-0.07, 0.02)
Gender	Women		0.64 (-1.06, 2.34)		0.80 (-0.88, 2.49)
Marital status	Married		-0.14 (-2.42, 2.15)		0.18 (-2.09, 2.45)
Modern education	Yes		-0.07 (-1.34, 1.19)		-0.25 (-1.49, 1.00)
Wealth tertile	Medium		-0.57 (-1.89, 0.74)		-0.16 (-1.40, 1.09)
	High		0.73 (-0.87, 2.34)		1.79 (0.37, 3.21)*
Household size	Large (≥ 5)		-0.28 (-1.28, 0.72)		-0.31 (-1.31, 0.68)
Insurance status	Active member		2.65 (1.20, 4.11)#		2.70 (1.25, 4.14)#
Perceived health status	Good		-0.75 (-2.16, 0.66)		-0.73 (-2.14, 0.67)
	Very-good		-1.78 (-3.29, -0.26)*		-1.80 (-3.31, -0.29)*
Chronic illness	Yes		1.55 (0.34, 2.76)*		1.42 (0.22, 2.63)*
Last health center visit	3-6 months		1.64 (0.35, 2.94)*		1.89 (0.61, 3.17)§
	6-12 months		0.77 (-0.45, 1.99)		1.02 (-0.18, 2.21)
Work experience				0.75 (0.33, 1.17)§	1.07 (0.74, 1.40)#
Affective commitment				0.48 (0.04, 1.00)	0.27 (-0.10, 0.65)
Patient volume				-0.33 (-0.45, -0.21)#	-0.42 (-0.50, -0.33)#
Job satisfaction				0.01 (-0.24, 0.27)	0.07 (-0.10, 0.24)
Patient volume x Job satisfaction				0.06 (0.02, 0.11)§	0.05 (0.02, 0.08)§
Random effect					
τ (SE)		5.90 (2.78)#	6.33 (3.10)#	0.86 (0.94)	≈ 0.00
ICC (%)		8.50	9.31	1.33	≈ 0.00
PCV (%)		Reference	-7.29	85.42	≈ 100
Model fitness					
DIC		7578.01	7528.89	7572.79	7516.90
AIC		7584.01	7560.89	7588.79	7558.90

*p<0.05; §p<0.01; # p<0.001; τ - Cluster-level variance, ICC - Intraclass Correlation; PCV - Proportional Change in Variance; DIC - Deviance Information Criterion; AIC - Akaike Information Criterion; SE – standard error; b - regression coefficient; CI – Confidence Interval.

Results of the regression analysis revealed that households with higher wealth tertile had a higher PQoC score than those with lower wealth tertile. This is in contrast to other studies,[15 43] whereby

the richest group had a lower perception score. This discrepancy could be attributed to the use of different metrics to assess quality of care. People with higher economic status may be more aware of health issues and able to bargain with health care providers to obtain the best possible care. Furthermore, if prescribed medicines are not available in CBHI-affiliated health facilities (which is one of the lowest-rated items in this study), they can afford to buy from private pharmacies. On the contrary, it may be irritating for people with lower economic status to buy medicines with limited money or to forgo treatment due to lack of money. In this regard, they may develop a negative perception of the quality of care.

Households who were active members of CBHI at the time of the study had a higher rating of PQoC compared to ex-members. Contrary to our finding, a study in Ghana showed that previously insured clients had a higher perception of quality of care compared to actively insured clients (statistical significance is not reported). The authors argue this was due to the more time-consuming nature of the service delivery processes for insured clients.[44] At least three possible explanations exist for the relationship between CBHI status and PQoC. First, because they do not have to pay for health care, active members have better access to and enjoy its benefits, resulting in a favorable perception of its quality. Second, the relationship could be due to an endogeneity issue. It is plausible that higher quality score reported by active members is due to their desire to stay in the scheme, which could be influenced by unobserved variables. We tested for endogeneity between current insurance status and PQoC using the Durbin–Wu–Hausman test, and the results showed no evidence of endogeneity. However, there is still the possibility of endogeneity due to omitted variables. Third, ex-members of CBHI may have had negative experiences with health services, which led to the decision to discontinue their membership. As a result, they would be

418 critical in rating the quality of care provided. In support of the latter argument, it was evidenced
419 that poor quality of care was a major reason for insurance members to leave the scheme.[24 45] A
420 statistically significant association was also reported between dropout and low quality of care.[45-47]

421 This study verified that the PQoC score of households who rated their health status as very-good
422 was significantly lower compared to those who rated it as fair. The households' chronic illness
423 experiences also influence the PQoC rating. The PQoC score of households with a chronic illness
424 was higher compared to those without a chronic illness. This may be true for people who perceive
425 their health as fair or who live with chronic conditions to appreciate the gains or benefits of the
426 health care they received. In this respect, they may be more likely than their counterparts to rate
427 quality of care higher.

428 The results also indicated that households who had their most recent visit to a health center before
429 3-6 months had higher PQoC scores compared to those whose recent visit was within 3-months
430 prior to the study. Patients may experience varying levels of emotional highs and lows, depending
431 on the length of the most recent facility visit. Although patients' perceptions of quality may
432 develop over time,[5] patients who recently visited a health facility may be more critical of the
433 quality of care due to strong emotions attached to negative events or health services that fall short
434 of their expectations.

435 Our findings revealed that the work experience of health care providers was positively associated
436 with PQoC. Work experience is linked to task specialization, which can lead to a faster work pace,
437 more output in less time, and higher quality.[48] This could be more pronounced in Ethiopia, where
438 the number of outpatient visits to CBHI-affiliated health centers had increased dramatically.[26]

Providers with more experience take less time to make diagnoses and treatment decisions, while still providing recommended practical aspects of care, such as good communication, physical examination, and provision of relevant health information.[48] As a result, they can reduce waiting times, and their management outcomes may be more effective than inexperienced providers.

Conditional on the average staff job satisfaction, patient volume has a negative association with PQoC. A study in Ethiopia identified a non-linear significant association (an inverted U-shape) between patient volume and quality. Quality decreased with increasing patient volume in health facilities that treated 90.6 or more patients per day, while quality increased with increasing patient volume in health facilities that treated less than 90.6 patients per day in the outpatient departments.[49] Our finding is consistent with a study at public hospitals in China,[30] where overcrowding was negatively associated with clients' perception of quality of care. There are two possible explanations for the observed relationship between patient volume and PQoC. First, increased patient volume would put a great deal of pressure on health care providers to treat a large number of patients in a short time. This may result in shorter consultation time and the omission of important practical aspects of care. Second, an increase in patient volume would mean longer waiting times at various service delivery points. Both these factors could have contributed to a negative patient experience and influenced their perception on overall quality of care. Some studies reported a positive relationship between patient volume and quality of basic maternal care, and postoperative infections.[50 51] The alternative direction of this relationship, in which quality drives patient volume, is based on the assumption that the provision of high quality care will attract more patients. This may be true in areas where patients have access to competitive health care facilities, and health care providers are incentivized for providing higher quality care. This is not the case in

low-income countries, like Ethiopia, where health care facilities are hard to reach for most rural populations. Members of CBHI are further limited to use health services only in public health facilities affiliated with the scheme.

This study found no relationship between staff job satisfaction and PQoC. This contrasts with the findings of Kvist et al,[52] which reported a positive relationship between job satisfaction among nursing staff and patients' perceptions of quality of care. Despite this, it moderates the relationship between patient volume and PQoC in a nonlinear fashion. Increased job satisfaction buffers the negative relationship between patient volume and PQoC in health centers with an average patient volume of 30.75 or higher. When the average patient volume is less than 30.75, however, an increase in job satisfaction enhances the effect between patient volume and PQoC. It is plausible that the buffering role of provider job satisfaction as patient volume rises indicates that provider job satisfaction is a result of the intrinsic rewards of higher work performance. Providers may also be fully available during working hours at the health facility due to the increased number of clients. On the other hand, the moderating role of enhancing the relationship as patient volume decreases could suggest that a low workload is one source of job satisfaction. Because clients are in small numbers, providers may not be fully engaged during working hours. They may have the freedom to do other businesses outside the health facility, leaving patients unattended and dissatisfied.

The findings of this study will be an essential input for quality improvement initiatives as well as addressing challenges in the country's efforts to establish higher-level insurance pools. This is the first study of its kind to consider cluster-level variables associated with PQoC in Ethiopia. It gives an important lesson to health care managers and other relevant stakeholders to consider cluster-level characteristics in healthcare quality improvement efforts. It also pointed out quality

dimensions that require special consideration in managerial decisions. Despite the significant findings of the current study, some caution should be taken in interpreting the findings. One noteworthy limitation of this study is the cross-sectional nature of the data. The study's analysis was conducted to identify for associations rather than prove causation. Second, the association between current insurance status and PQoC could be due to the possibility of endogeneity. Third, patient volume data based on secondary data may not reflect the true figure due to the possibility of under or over reporting.

CONCLUSIONS

Despite encouraging findings on patient-provider communication, much work remains to be done to improve information provision and access to care quality dimensions. According to the findings, people's perceptions of quality of care varied depending on a variety of individual and cluster-level factors. The household's wealth status, current insurance membership, perceived health status, presence of chronic illness in the household, and time since the most recent visit to a health center were individual-level predictors of PQoC. At the cluster-level, patient volume and work experience of health care providers were associated with PQoC. A lower patient volume allows the health care provider to devote more time and attention to each patient, address their patients' individual needs, and have more time to improve communication with and provide behavior change counseling, which has an impact on quality of care.[53] Therefore, to ensure that patients have access to a better quality of care, it is critical to determine an appropriate patient volume per care provider. Staff job satisfaction was an important factor that buffers the effect between patient volume and PQoC. Hence, it is vital to devise mechanisms to improve staff job satisfaction,

especially in health facilities with higher patient volume. More importantly, health centers should go to great lengths to ensure that every patient has access to the necessary medications. This will boost clients' trust in health care providers, which will be critical for health insurance schemes to retain and attract members.

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Contributors

MH conceptualized the study, designed the study, collected the data, analyzed and interpreted the data, and drafted the manuscript. MA and NBB contributed to survey design, data collection and statistical analysis, and reviewed the manuscript. All authors read and approved the final manuscript.

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Ethics approval Ethical approval was obtained from the Institutional Review Board (IRB) of College of Medicine and Health Science, Bahir Dar University with protocol number 001/2021. A support letter was communicated to the district health offices to gain entry permission into the community where the research was conducted. Before the interview, oral informed consent was secured from each of the study participants. Confidentiality was assured through collecting

anonymous information and informing the participants that personal identifiers would not be revealed to a third party.

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Figure 2: Summary of the mean scores of the PQoC and its dimensions across 12 health centers in two districts of northeast Ethiopia, 2021

Responses to Reviewers

Dear editor, we are enclosing herewith the revised version on the manuscript # **bmjopen-2021-058499** entitled "**Perceived quality of care among households ever enrolled in a community-based health insurance scheme in two districts of northeast Ethiopia: a multilevel analysis**"

We thank the editor and reviewers for the time they spent reviewing our manuscript. Our responses to the concerns raised during the review process are presented below.

Reviewers' comments are in bold and numbered

- Authors' responses in normal typeface and bulleted

Reviewer #1 Evaluation

Major comments

1. **The empirical approach presented under your "Data analysis" section does not seem to correspond to your research topic and objectives. Looking at your title "… Health centers affiliated with CBHI…", I was expecting your analysis to follow the direction of comparison between "Affiliated" and "Non-affiliated" health centers. However, what you carry out is a comparison between "current" and "previous" enrolment of individual households. Are all the health centers affiliated with the CBHI scheme?**
   - Thank you for raising these important issues, that could create confusion for readers. Now we modify the title as " Perceived quality of care among households ever enrolled in a community-based health insurance scheme in two districts of northeast Ethiopia: a multilevel analysis". Here it should be understood that our study is **not comparative.** The term *"households ever enrolled in CBHI"* is mentioned to indicate the specific population participated in the study. We aim to assess the experiences of people who received health care under CBHI, on quality of care. We classify the population in to previous and current members as an independent variable. Just it is one independent variable. Some similar clarifications are provided under the 4th comment. We believe the data analysis is in line with the objectives (1. Assessing perceived quality, 2. Identify individual and health center level factors associated with perceived quality). Currently, all health centers in the study districts are affiliated with CBHI.
2. **The authors propose multilevel analysis as the major line of econometric technique and analysis in their study. However, the findings presented from the data analysis are very**

shallow and rushed. From the onset, the authors need to present a model showing what has been done in the different specifications with a clear motivation. These are key in evaluating what has gone to the analysis and evaluating whether the methods and results support or fail to support the conclusions made in the manuscript.

- Thank you. We prepared the manuscript based on a standardized reporting format for cross-sectional studies (STROBE Guide). Based on the guide presenting the analysis model is not a requirement. It is also less common in public health research to specify analysis models. That is why we fail to include the model. Now we tried to show the multilevel linear regression analysis models that we employed **(line 207 – 234).** Regarding presentation of the result, we believe it describes and include all important findings in line with the objectives. It seems "**shallow and rushed"**, but we don't think that is so. Rather we tried to present the result concisely, without missing important findings. Further the main findings are more elaborated under the discussion part. Now, although we tried to add some more details under the results part (**line 303-317, 366.374 –** we are not sure this is up to the expectation of the reviewer) we prefer to make it more concise. In addition, even with the previous version, we pass the journals word limit of 4000 words. The journal recommends that exceeding this limit will impact upon the paper's 'readability', and we were guided in part by this recommendation.

3. **I also have a major concern on the appropriateness of the linear definition that you applied in converting your discrete outcome variable to a continuous outcome unless this was explicitly communicated to the respondents during data collection. Alternatively, the authors might consider estimating marginal effects using an ordered-probit model or creating dummy variables from the categorical variable and estimating a linear probability model. The descriptive statistics provided in Table 1 should also include the descriptive statistics on your outcome variable.**

- Thank you for raising this important issue. We converted the discrete outcome variable to a continuous outcome based on recommendations of a validated tool by Benson and Potts 2014, http://www.biomedcentral.com/1472-6963/14/499. But your concern **"unless this was explicitly communicated to the respondents during data collection"** is acceptable as the option "0" (zero) was not available during the interview. This was what we missed out and fail to understand the approach suggested by the tool. They included the option (0) during their data collection. Now we modify the approach based on recommendations of the above tool (Benson and Potts 2014), and now it reads as "The summary scores for the PQoC and its dimensions were calculated for

individual respondents by adding the scores for each item. This gives a scale ranging from 17 (1 ×17) to 85 (5 × 17) for the overall PQoC score. When reporting the results, the scores were arithmetically transformed to a scale of 20 to 100. This allows the comparison of mean scores of PQoC with its dimensions, and measurement items on a common scale." Accordingly, we did the whole analysis again. One more change we made on the analysis is the estimation method. We change the Maximum Likelihood estimation method to Restricted Maximum Likelihood method, because it is more appropriate for smaller cluster sizes. Regarding alternative analysis approaches, still there is a great debate whether to treat a Likert scale data as a continuous or a categorical ordinal data. Initially we considered to do multilevel ordinal regression analysis. Accordingly, we created a five level categorical data by performing factor analysis, and divide the index into quintiles (with no literature supporting the approach). We compared the two models (the multilevel linear VS ordinal) using AIC, and found the linear approach better fits the data. Furthermore, it is recommended that, if the measurement items are more than 8, it is better to add the scores of each item and treat as a continuous variable. On the other hand (as to our search) there is no agreed up on method of converting multidimensional Likert scale data to ordinal categories. As a result, we opted to create a continuous variable from the sum of all the 17 item scores and do multilevel linear regression analysis. The approaches you suggested may also be other alternatives, but we public health researchers conventionally apply biostatistics approaches. Our primary readers are also oriented towards biostatical approaches. The outcome variable is included as part of the descriptive statistics under table 1, based on your suggestion. What we

4. **Previous works, also discussed in your literature review, identify quality in health care (including perceived quality of care) as a major factor in insurance uptake and dropout from voluntary insurance schemes such as community-based health insurance schemes. However, you use the variable capturing past versus current enrolment as your main regressor. It is highly likely for your outcome to suffer from contamination from past experience than perceived quality of care in the period you identified for the analysis. This concern is partially founded on the fact that you only consider households enrolled in the scheme in the past or present. Was there any specific reason why you chose to focus on ever enrolment than the conventional choice between insured vs non-insured?**

- Thank you again. Let us give some clarifications on this concern. The main intention of this study was to identify the different variables that influence the perceived quality of care, with special interest to facility level factors which are not assessed so far. “Past versus current enrolment” **was not our main regressor**. Just it was treated as one independent variable (covariate). We did not indicate it as a main regressor, either.
- The interest was what do people “perceive” about the quality of care in general, not in a specified time, which is based on their past experience. The period (use of health care in the last one year) was identified for the sake of minimizing recall bias for some questions that need their recall. This is why the title was framed as *“Perceived quality of care” rather than* patient satisfaction which is based on the service received at a point in time. Contamination due to past experience works for both active and ex-members. But this is more evident among ex-members. As we stated in the introduction part **(line 62),** *perceived quality is shaped by past experience, and even with rumors.* In addition, three possible explanations were given for the observed association between insurance status and PQoC, one of which is (line 419), *“ex-members of CBHI may have had negative experiences with health services, which led to the decision to discontinue their membership.”* In fact, perceived quality of care is a “patient experience study”. One more point is that it is not only in our study that contamination is an issue (if it is). We could not control it in cross-sectional studies. Narrowing the study population to a specific group may minimize this bias, as we did, since one group may have more contamination than the other.
- As mentioned above, our aim is not **comparative**. Rather to assess the perceived quality with the eyes of people who have health insurance membership experience. Rather than doing the study on the general population, we prefer a specific population, that is “ever insured”. In addition, the advantage of choosing this group helps to assess the role of health care quality on membership retention. We have no other reason to focus on ever enrolment.

Minor comments

1. **The manuscript needs some reorganization in the structure, presentation, formatting and coherence. Some (sub-) sections be made more concise by combining sub-sections and removing repetitions with no added value. For example, sub-sections “Study setting” up to “Data collection” can be combined in a maximum of two sub-sections. Table 2 can be divided in to two Tables. The same applies to Table 3. You write the caption for Figure 1 without the figure. Either remove it or bring the Figure inside the text.**

- These are all important comments and we tried to revise the paper accordingly.
- The methods part is restructured, some subsections merged together, hence duplications are avoided
- Table 2 is reformatted and its size is minimized, some part was splinted and included under table one (description of the outcome variable).
- Table 3 show the final regression output, better to display all models together for comparison purpose, we keep as it is, but we remove the reference category, as it is specified in table two.
- It is the journal's requirement to upload figures as separate files rather than embedding them in the manuscript. We upload it separately and attached at the end of the manuscript.

2. **Although language is not a major issue, the manuscript will benefit from an editorial work.**
   - Yes, it is. We go through in detail and made many corrections on the editorials.
3. **There is no point in including the reference categories in the results Table, Table 3 since you have already presented them in the previous Tables.**
   - We remove it accordingly.

Reviewer #2 Evaluation

1. **In the introduction section, authors are interchangeably using terms "perceived quality of care" and "quality of care". This are two different things. Terminology must be accurate. Please check the text.**
2. **There are few typos in the text, proof-reading recommended**.
   - Thank you for your comments. We try to check and edit to avoid interchangeable use of the two terms. But we use "quality of care" in some places to indicate the relationship between the two.
   - We found this issue and go through in detail and made many corrections on the editorials.

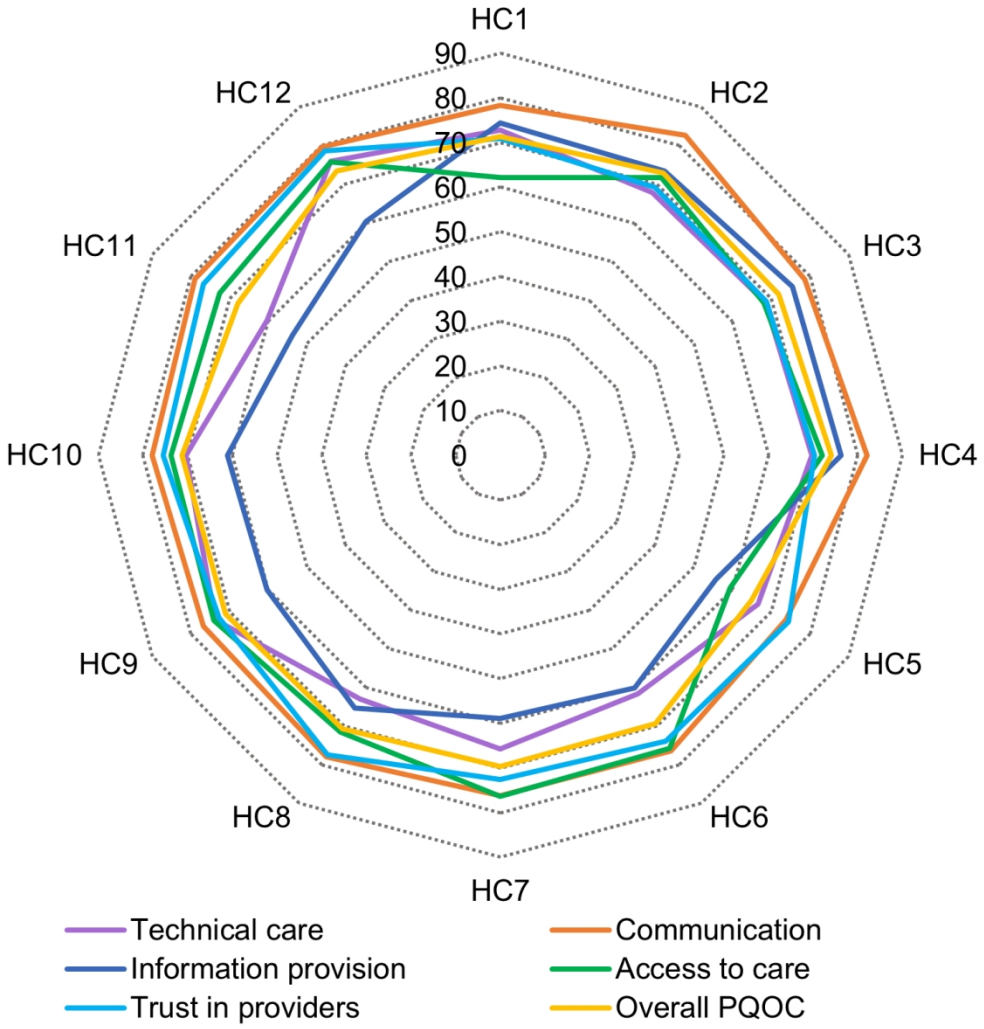

Figure 1: Summary of the mean scores of the PQoC and its dimensions across 12 health centers in two districts of northeast Ethiopia, 2021

130x135mm (300 x 300 DPI)

Supplementary file 1: Factor analysis of the measurement scale to assess the perceived quality of care among households enrolled in a CBHI in two districts of northeast Ethiopia, 2021

Dimensions and items	Loadings under each dimension				
	1	2	3	4	5
Technical care					
The necessary Laboratory tests were performed	0.911				
Health care providers perform the necessary physical examinations	0.818				
Health care providers make a good diagnosis	0.740				
Patient-provider communication					
Health care providers actively ask questions to understand your situation		0.846			
Health care providers listened to you carefully what you had to say		0.845			
Health care providers treated you with courtesy and respect		0.542			
Information provision					
Health care providers clearly explained the use and side effects of medicines			0.787		
Health care providers clearly explained the results of tests and examination			0.760		
Health care providers explain things in a way you could understand			0.672		
Health care providers spent sufficient time examining patients			0.510		
Access to care					
Patients do not wait long in the health center to receive treatment				0.799	
All prescribed medicines are available on the spot				0.624	
Facility assistants are friendly and helpful to patients				0.559	
The health facility serves all patients fairly				0.463	
Trust in care providers					
Treatment is effective for recovery and cure					0.754
Health care providers prescribe appropriate medicines for patients					0.672
You have confidence in the competence of health care providers					0.662

Supplementary file 2: Mean score of each measurement item of the perceived quality of care (20-100 scale) among households enrolled in a CBHI in two districts of northeast Ethiopia, 2021

Factors and items			95% CI	
	Mean	SD	LCI	UCI
Technical care	**68.34**	**15.24**	**67.43**	**69.25**
The necessary Laboratory tests were performed	69.20	18.36	68.10	70.29
Health care providers perform the necessary physical examinations	68.23	18.89	67.11	69.36
Health care providers make good diagnosis	67.59	17.69	66.53	68.64
Patient-provider communication	**77.84**	**10.12**	**77.23**	**78.44**
Health care providers actively ask questions to understand your situation	80.39	11.68	79.69	81.09
Health care providers listened to you carefully what you had to say	79.61	10.93	78.96	80.26
Health care providers treated you with courtesy and respect	73.51	16.72	72.51	74.50
Information provision	**64.67**	**13.87**	**63.84**	**65.49**
Health care providers clearly explained the use and side effects of medicines	62.90	19.87	61.72	64.09
Health care providers clearly explained the results of tests and examination	62.50	19.48	61.34	63.66
Health care providers explain things in a way you could understand	69.36	17.42	68.32	70.40
Health care providers spent sufficient time to examine patients	63.90	20.18	62.70	65.11
Access to care	**69.47**	**11.77**	**68.77**	**70.17**
Patients do not wait long in the health center to receive treatment	62.96	20.17	61.76	64.16
All prescribed medicines are available on the spot	63.50	20.37	62.28	64.71
Facility assistants are friendly and helpful to patients	73.38	16.07	72.42	74.34
The health facility serves all patients fairly	78.06	15.90	77.11	79.01
Trust in care providers	**73.20**	**11.02**	**72.55**	**73.86**
Treatment is effective for recovery and cure	72.47	14.78	71.59	73.35
Health care providers prescribe appropriate medicines for patients	75.47	12.90	74.70	76.24
You have confidence in the competence of health care providers	71.67	14.36	70.82	72.53
Overall perceived quality of care (PQoC)	**70.28**	**8.39**	**69.77**	**70.78**

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	2
		(*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	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6, 7
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	11, 12
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	7, 8
Bias	9	Describe any efforts to address potential sources of bias	*6*
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	9, 10
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9, 10
		(*b*) Describe any methods used to examine subgroups and interactions	11
		(*c*) Explain how missing data were addressed	NA
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	10
		(*e*) Describe any sensitivity analyses	NA
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	13
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	13, 15
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	15
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	16, 17
		(*b*) Report category boundaries when continuous variables were categorized	NA
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	20
Discussion			
Key results	18	Summarise key results with reference to study objectives	20, 21-26
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	26
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	21-26
Generalisability	21	Discuss the generalisability (external validity) of the study results	26
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	27

*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.

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Perceived quality of care among households ever enrolled in a community-based health insurance scheme in two districts of northeast Ethiopia: A community-based, cross-sectional study

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Perceived quality of care among households ever enrolled in a community-based health insurance scheme in two districts of northeast Ethiopia: A community-based, cross-sectional study

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ABSTRACT

Objectives: The purpose of this study was to examine how clients perceived the quality of health care they received and to identify associated factors both at the individual and facility levels.

Design: A community-based, cross-sectional study.

Setting: Two rural districts of northeast Ethiopia, Tehulederie and Kallu.

Participants: 1081 rural households who had ever been enrolled in community-based health insurance and visited a health center at least once in the previous 12 months. Furthermore, 194 health care providers participated in the study to provide cluster-level data.

Outcome measures: The outcome variable of interest was the perceived quality of care, which was measured using a 17-item scale. Respondents were asked to rate the degree to which they agreed on 5-point response items relating to their experiences with health care in the outpatient departments of nearby health centers. A multilevel linear regression analysis was used to identify predictors of perceived quality of care.

Results: The mean perceived quality of care was 70.28 (SD=8.39). Five dimensions of perceived quality of care were extracted from the factor analysis, with the patient-provider communication dimension having the highest mean score (M=77.84, SD=10.12), and information provision having the lowest (M=64.67, SD=13.87). Wealth status, current insurance status, perceived health status, presence of chronic illness, time to a recent health center visit, work experience of health care providers, and patient volume were the factors significantly associated with perceived quality of care. An interaction term between patient volume and staff job satisfaction also showed a significant association.

Conclusions: Much work remains to improve the quality of care, especially on information provision and access to care quality dimensions. A range of individual and cluster-level characteristics influence the perceived quality of care. For a better quality of care, it is vital to optimize the patient-provider ratio and enhance staff job satisfaction.

Strengths and limitations of this study

- The study tried to assess the quality of care from the clients' point of view using a validated multidimensional scale.
- This is the first cross-sectional study in Ethiopia, which considered health center (cluster) level variables that have an association with perceived quality of care.
- A statistically significant association was observed between current insurance status and perceived quality of care. The relationship could be due to an endogeneity issue created by omitted variables. It is plausible that higher quality score reported by active members is due to such variables, as the desire to continue their membership.
- Because of the cross-sectional nature of the study, it is impossible to establish a cause-and-effect relationship.

INTRODUCTION

Health care providers and patients define the quality of care differently and attach varying levels of importance to its attributes. When assessing the quality of care, health care professionals tend to prioritize technical competence, while patients place a high value on patient-centeredness, amenities, and reputation.[1] The emphasis on health care quality measurement has shifted away from the viewpoints of health care providers to people-centered approaches that rely on patient perceptions.[2-4] Patients' perception of health care quality has become an essential element of

quality measurement due to its link with health service utilization. It is based on a mix of patient experiences, processed information and rumors.[5]

Patient experience surveys elicit data on the transactional components of care, which are process-related, as well as the interpersonal interactions that occur over the course of care.[6] Individuals receiving care are asked about their experiences of health facility encounters to report if particular processes or events occurred.[7] Patient experience measurements have received increased attention and are widely employed to inform quality improvement, and pay-for-performance.[8] Patient experience is consistently and positively associated with patient safety and clinical effectiveness, adherence to prevention and treatment recommendations, and technical quality of care.[9 10]

Patient experience is a reflection of the patient journey, which consists of the myriad interactions patients have with health care providers and the healthcare system over time and in a variety of settings. It is shaped by the health care team, the organization, and the surrounding policy and regulatory environment. A negative patient experience is a proxy for a larger health system failure, underscoring the need to apply a systems approach to improving health care quality.[4]

Quality of health care is vital to the success of universal health coverage (UHC) initiatives, like community-based health insurance (CBHI). To achieve the desired outcomes, the development of CBHI schemes must be accompanied by improvements in health care quality.[2 4 11-13] To build sustainable CBHI schemes, members must believe that the benefits of health care provided via health insurance coverage outweigh the benefits of not being insured.[14] Patients' positive

experiences with the quality of care provided under insurance schemes increase their trust in the health system and insurance schemes.[15 16] As a result, they are more likely to use health care services and participate in health insurance plans.[17] If insured clients are unable to access high-quality services, they lose trust in service providers and seek care elsewhere,[18] making them less likely to pay premiums.[19 20] Low perception of health care quality further deters people from interacting with the health system in the future.[4]

Although increased health care coverage is promising with the implementation of CBHI initiatives, quality of care remains a key impediment to achieving UHC.[13 21] For example, more than eight million deaths amenable to a high quality of care occurred in low- and middle-income countries, making the poor quality of care a bigger obstacle to mortality reduction than lack of access to care.[21] Poor quality of care is also a major issue that jeopardizes the long-term viability of many CBHI schemes.[11 22] Findings of systematic reviews revealed that the quality of care was a key factor that influenced enrollment and renewal decisions of CBHI membership.[23 24] Some quality concerns include 'unavailability and perceived poor quality of prescribed medicines, misbehavior of health professionals, and the differential treatment of the insured in favor of the uninsured patients, unclean hospital environment, long queues, lack of diagnostic equipment, and long waiting hours to obtain health care.[24]

To promote optimal utilization, stable finance, and better outcomes, the quality of health care must be monitored on a regular basis.[18] Previous studies in Ethiopia focused on surveys of client satisfaction and did not employ multidimensional measurement scales.[25 26] To our knowledge, the quality of care delivered under the CBHI in Ethiopia has never been investigated using

multidimensional metrics from the perspective of service users at the community level. There is also a paucity of literature on facility-level variables that influence the quality of care. Therefore, the purpose of this study was to examine the perceived quality of care (PQoC) from the perspective of clients and identify associated factors at the individual and facility level.

Improving the quality of care under the CBHI is among Ethiopia's top priorities in its health sector strategic plan.[27] The findings of this study will inform relevant stakeholders on the current state of clients' perceptions of the quality of care and will be an essential input for quality improvement initiatives. It will also provide useful information for decision-makers to address challenges in the country's endeavors to establish higher-level insurance pools.

METHODS

Study setting and population

A community-based cross-sectional study was conducted in rural parts of two neighboring districts in northeast Ethiopia, Tehulederie and Kallu. Tehulederie is divided into 20 rural and seven urban *Kebeles* (subdistricts) with a population of 145,625, of which 87.5% reside in rural areas. There are five health centers and one primary hospital in the district. It was one of the 13 districts in Ethiopia where CBHI was piloted in 2011. The scheme was introduced in Kallu district after two years, in July 2013. Kallu is divided into 36 rural and four urban *Kebeles* and has nine health centers. It is the most populous district in the zone, with a population of 234,624, of which 89.11% live in rural areas.[28]

The study population of interest was rural households who had been ever enrolled in the CBHI scheme before January 2020. To minimize recall bias, households who had not used health care in the 12 months before data collection were excluded from the study.

Sample size and sampling procedure

The sample size was calculated using MedCalc software by assuming a mean difference of two independent groups. A previous study on PQoC reported mean scores of 5.2 and 5.4 with standard deviations (SD) of 0.8 and 0.7 among insured and uninsured respondents, respectively.[29] Using this output and assuming an 80% power, 95% confidence level and equally sized groups, a sample size of 446 was calculated. Considering a design effect of 1.5 attributable to multi-stage sampling and a potential non-response rate of 10%, the effective sample size was estimated to be 736 households. An alternative sample size of 1257 was calculated for a companion article as part of a research project examining the sustainability of a CBHI in Ethiopia.[30] Among those, 1081 eligible households participated in this study. Furthermore, 194 health care providers from 12 health centers participated in the study to provide cluster-level data.

The study participants were recruited using a three-level multistage sampling approach. First, 12 clusters of *Kebeles* organized under a health center catchment area were selected. Then, 14 rural *Kebeles* were drawn randomly using a lottery method proportional to the number of *Kebeles* under each cluster. Accordingly, five *Kebeles* from Tehulederie and nine from Kallu were included. A list of households who have ever been enrolled in the CBHI was obtained from the

membership registration logbook of each *Kebele*. The required sample was generated at random from each *Kebele*, proportional to the number of households who have ever been enrolled in the scheme, using random number generator software.

Data collection and measurement

The data were collected from 04 February to 21 March 2021. Individual-level data were collected through face-to-face interviews with household heads at their homes or workplace using a structured questionnaire via an electronic data collection platform. The data collectors submit the completed forms to a data aggregating server daily, which allowed us to review the submissions and streamline the supervision process.

The PQoC, which is the outcome variable of interest, was measured using a 17-item scale designed after a thorough review of validated tools.[29 31-34] Respondents were asked to rate the extent to which they agreed on a set of items relating to their experiences with the health care they received in the outpatient departments of nearby health centers. Each item was designed on a 5-point response format, with 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree. The summary scores for the PQoC and its dimensions were calculated for individual respondents by adding the scores of each item. This gives a scale ranging from 17 (1×17) to 85 (5×17) for the overall PQoC score. For quality dimensions consisting of three and four items, the scale ranges from 3 to 15 and 4 to 20, respectively. When reporting the results, the scores were arithmetically transformed to a scale of 20 to 100.[35] This allows the comparison of mean scores of PQoC, its dimensions, and each measurement item on a common scale.

Wealth index was generated using the principal component analysis method. The scores for 15 types of assets were translated into latent factors, and a wealth index was created based on the first factor that explained most of the variation. The study households were grouped into wealth tertile – lower, medium, and higher based on the index. Perceived health status was measured based on a household head's subjective assessment of the health status of the household, and was rated as "poor, fair, good, very good, or excellent". However, for analysis purposes, it was recategorized into "fair, good, and very-good", by merging the two extreme response categories to the next option due to fewer replies.

Before the data collection, the questionnaire was pre-tested on a sample of 84 randomly selected participants in one *Kebele*. As part of the pre-test, a cognitive interview was conducted on selected items using the verbal probe technique among eight respondents to determine if the items and response categories were understood, and interpreted by the potential respondents as intended. Accordingly, the phrasing of some items and response options were modified, and some items were omitted.

Cluster-level data were collected from 12 health centers that provide health care for the population in the sampled *Kebeles*. Patient volume data were obtained by reviewing the monthly service delivery reports of health centers, while data related to work experience, affective commitment, and job satisfaction were collected through a self-administered questionnaire among health care providers who worked more than one year in the current facility.

Patient volume was measured using the daily average number of patients managed by a health care provider in the outpatient department. It was calculated by dividing the number of patients who visited the health center in the last six months before the study by the number of working days, and then by the number of consultation rooms in each health center.[36] Affective commitment and job satisfaction were composite variables that were assessed using a 5-point Likert scale. Affective commitment was measured with a seven-item questionnaire based on a modified version of the Meyer et al. scale, which had previously been used in a hospital setup.[37] Staff job satisfaction was measured using a 10-item scale, which was adapted from a previous study among health care workers in Ethiopia.[38] Average affective commitment and job satisfaction scores were computed for each health center.

Data analysis

The data were analyzed using Stata version 17.0. Exploratory factor analysis was performed to assess the validity of the quality measurement scale. Bartlett's test of Sphericity and Kaiser-Mayer-Olkin's (KMO) measure of sampling adequacy were performed to assess the appropriateness of the data for factor analysis. The principal component factor method of extraction and Promax rotation with Kaiser Normalization was used. The Eigenvalue greater than one decision rule was used to determine the appropriate number of factors to be extracted. Items with both loadings and communalities below 0.40 were removed from the analysis.[39] Correlation coefficients were used to test construct validity. Item-total score correlation, dimension-total score correlation, and dimension intercorrelation were computed. The total

score was the mean score of the ratings for all items of the scale, and the dimension score was the factor score. A questionnaire has good construct validity when the item-total score correlations are higher than 0.40, dimension intercorrelations are less than 0.80, and dimension-total score correlations are higher than dimension intercorrelations.[32] Cronbach's alpha coefficients were generated for each dimension to assess the internal consistency. The reliability of the scale was considered acceptable if Cronbach's alpha coefficient was 0.60 or higher.[39]

To compare mean scores of PQoC and its dimensions among subgroups, an independent t-test and a one-way analysis of variance (ANOVA) with Tukey's post-hoc test were used. Because the outcome variable was considered a continuous variable, a multilevel linear regression model was fitted to identify its predictors. The PQoC was assumed to be influenced by the characteristics of households (individual-level variables) as well as the characteristics of health centers (cluster-level variables). Cluster-level data were linked to individual-level data based on the usual source of health care for each study participant. Considering the hierarchical structure of the data, where patients are nested within health centers, a two-level linear regression model was applied. In this study, there were 12 health centers, hence the Restricted Maximum Likelihood estimation approach was employed because it is appropriate for smaller cluster sizes.[40] Four models were estimated to choose the one that best fits the data. The first model or the null model (a model without predictors) is given by:

$$Y_{ij} = \gamma_{00} + u_{0j} + \varepsilon ij \qquad (1)$$

The null model estimates three parameters: the average intercept (Y_{00}), the between health center error, or deviation, from the average intercept (u_{0j}), and the individual-level residual, or variation in individual scores within health centers (ε_{ij}). The second model estimated PQoC (Y_{ij}) for individual household *i* at health center *j*. We treat PQoC as a function of a matrix of individual-level variables (X_{ij}) which include age, gender, education, and marital status of the household head; wealth status; household size; current health insurance status; the presence of chronic illness in the household; perceived health status, and time to a recent visit to a health center, and expressed as:

$$Y_{ij} = \gamma_{00} + \gamma_{10}X_{1ij} + \gamma_{20}X_{2ij} + u_{1j}X_{1ij} + u_{2j}X_{2ij} + \ldots + \gamma_{n0}X_{nij} + u_{nj}X_{nij} + u_{0j} + \varepsilon ij \quad (2)$$

where $u_{1j,}\ u_{2j\ldots}u_{nj}$ indicate the random error terms connected to each X_{ij}.

The third model estimated the PQoC as a function of cluster-level variables (Z_j) that include average work experience, affective commitment and job satisfaction of health care providers, and patient volume. The model takes into account the differences between health centers and explains these differences in terms of these characteristics. It is given by:

$$Y_{ij} = \gamma_{00} + \gamma_{01}Z_{1j} + \gamma_{02}Z_{2j} + \ldots + \gamma_{0n}Z_{nj} + \gamma_{11}PV_j * JS_j + u_{0j} + \varepsilon ij \quad (3)$$

where PV_j*JS_j indicates an interaction term between patient volume and job satisfaction in which job satisfaction was assumed to moderate the effect between patient volume and PQoC. The interaction effect was tested by plotting the marginal effects of interaction terms. The two variables were centered toward the grand mean to facilitate the interpretation of the

coefficients. By combining models II and III, the fourth model estimated the PQoC as a function of both individual and cluster-level variables, and can be written as:

$$Y_{ij} = \gamma_{00} + \gamma_{10}X_{1ij} + \gamma_{20}X_{2ij} + u_{1j}X_{1ij} + u_{2j}X_{2ij} + \ldots + \gamma_{n0}X_{nij} + u_{nj}X_{nij} + \gamma_{01}Z_{1j} + \gamma_{02}Z_{2j} + \ldots + \gamma_{0n}Z_{nj} + \gamma_{11}PV_j * JS_j + u_{0j} + \varepsilon ij \quad (4)$$

where γ_{10} and γ_{01} are the vector of coefficients of *n* explanatory variables whose values are at X_{1ij}, X_{2ij}, . . . , X_{nij} for the i^{th} individual within the j^{th} cluster, and Z_{1j}, Z_{2j}, . . . , Z_{nj} for the j^{th} cluster, respectively. The intercept γ_{00} and slopes γ_{01}, γ_{10} and γ_{11} are fixed effects, while u_{0j}, u_j, and ε_{ij} are random effects.

This multilevel regression decomposes the total variances into two independent components: σ_e^2, which is the variance of individual-level errors ε_{ij}, and σ_{u0}^2, which is the variance of cluster-level errors u_{0j}. From this model, we can define the intraclass correlation (ICC) by the equation:[41]

$$ICC = \sigma_{u0}^2 / \left(\sigma_{u0}^2 + \sigma_e^2\right)$$

The ICC and proportional change in variance (PCV) were used to report the measures of variation (random effects). The need for multilevel analysis, which considers cluster-level factors, was tested using the ICC. The ICC shows the variation in PQoC accounted for cluster-level characteristics. Statistically significant variability between health centers justifies the need to consider cluster-level factors.[42] The PCV expresses the change in the cluster-level variance between the empty model and models with more terms and is calculated by PCV = (V_A - V_B)/V_A, where V_A = variance of the null model, and V_B = variance of the model with more terms. It measures the total variation explained by individual and cluster-level factors.

The measures of association (fixed-effects) estimate the association between the PQoC score and various explanatory variables. The existence of a statistically significant association was determined at p-values of <0.05. The degree of the association was assessed using regression coefficients, and their statistical significance was determined at a 95% confidence interval. Models were compared using the Deviance Information Criteria (DIC) and Akaike Information Criteria (AIC). The best fit model was determined to have the lowest DIC and AIC values. The preliminary analysis confirmed no violation of the assumptions of normality, linearity, homoscedasticity, and multicollinearity. The presence of multicollinearity was determined using the Variance Inflation Factor with a cutoff point of 5.

Patient and Public Involvement

No patient involved

RESULTS

Background characteristics of the study participants

The household survey included 1081 respondents who had visited a health center at least once in the previous 12 months prior to the study. The average age of the study participants was 49.25 years (SD=12.07), with slightly more than half (51.34%) between the age ranges of 45 and 64, and 12.67% being 65 and older. Of the total study participants, 938 (86.77%) were men, and 1003 (92.78%) were currently married. One-fifth of the study participants (20.91%) attended formal education, and 62.72% had a household size of five or above.

Nearly ninety percent of the households (87.14%) were active members of the CBHI scheme at the time of the study. A quarter of households (25.72%) had one or more individuals with a known chronic illness informed by a healthcare provider. One-third of respondents (33.58%) rated their household health status as very good, while 207 (19.15%) and 511 (47.27%) rated it as fair and good, respectively. Nearly half of the households (46.16%) had visited a health center within three months prior to the study, while 31.73% and 22.11% had their most recent visit to a health center before 6-12 and 3-6 months, respectively (Table 1).

The median work experience of health care providers involved in this study ranges from three to ten years. The mean scores of affective commitment and job satisfaction were 29.00 and 30.95 (SD=2.08 and 3.17), respectively. The average patient volume was 32.17 per day per care provider, with a range of 19 to 43 (SD=7.83).

Factor analysis

Sampling was adequate as measured by the KMO (0.83), and Bartlett's test of sphericity was significant (p<0.001). Two items were removed from further analysis due to loadings below 0.40, and one item was removed due to low communality. The factor analysis extracted five dimensions that explained 59.25% of the total variation (online supplemental file 1). The item-total score correlations ranged from 0.268 to 0.622, four items had correlations less than 0.40. The dimension intercorrelations varied from 0.031 to 0.434, all of which were less than the 0.80 criterion, indicating that each dimension was distinct enough to be considered an independent measure. Dimension-total score correlation ranged from 0.417 to 0.772, all significant at a p-value of 0.001, and are higher than dimension intercorrelations. The scale was tested for

reliability and had an overall Cronbach's alpha coefficient of 0.804. The Cronbach's alpha coefficients for the five dimensions exceeded 0.60, except for the access to care subscale, which had an alpha coefficient of 0.531.

Table 1: Independent t-test and one-way ANOVA comparing mean scores of the PQoC (20-100 scale) across respondent characteristics in two districts of northeast Ethiopia, 2021

Variable	Categories	N=1081	%	PQoC score		t/F-test
				M	SD	
Age in years	25 – 44	389	35.99	69.97	7.78	1.08
	45 – 64	555	51.34	70.26	8.52	
	65+	137	12.67	71.20	9.49	
Gender	Men	938	86.77	70.15	8.21	-1.31
	Women	143	13.23	71.13	9.51	
Marital status	Divorced/widowed	78	7.22	71.61	10.95	1.46
	Married	1003	92.78	70.17	8.16	
Attend formal education	No	855	79.09	70.29	8.48	0.07
	Yes	226	20.91	70.24	8.05	
Household size	< Five	403	37.28	70.85	8.63	1.73
	≥ Five	678	62.72	69.94	8.25	
Wealth tertile	Lowest	361	33.40	71.77	9.15	8.83#
	Medium	360	33.30	69.36b	8.16	
	Highest	360	33.30	69.70b	7.62	
Current insurance status	Ex-member	139	12.86	67.66	9.65	-3.96#
	Active-member	942	87.14	70.66	8.13	
Perceived health status	Fair	207	19.15	72.28	8.84	8.04#
	Good	511	47.27	70.08b	7.83	
	Very good	363	33.58	69.41b	8.73	
Chronic illness	No	803	74.28	69.54	8.29	-4.96#
	Yes	278	25.72	72.40	8.33	
Last health center visit	< 3 months	499	46.16	70.75b	8.99	4.78§
	3-6 months	239	22.11	70.94b	7.60	
	6-12 months	343	31.73	69.13	7.92	
Total		1081	100	70.28	70.28	

Statistical significance for t-test/F-test is indicated by §p<0.01, and #p<0.001. Based on Tukey's post-hoc test, mean values sharing letter 'b' are not significantly different in the group at the 5% level.

Perceived quality of care

The minimum and maximum PQoC scores were 37.65 and 97.65, respectively. The mean score was 70.28 (95% CI: 69.77, 70.78) with an SD of 8.39. The aggregated mean score at the health center level ranges from 64.94 to 74.06. Patient-provider communication had the highest mean score (M=77.84, SD=10.12) of the five quality dimensions, while information provision had the lowest score (M=64.67, SD=13.87). The mean score for each measurement item is summarized in the online supplemental file 2.

An independent t-test and a one-way ANOVA were performed to compare the mean scores of PQoC and its dimensions between subgroups. As shown in Table 1, there was a significant difference in the PQoC mean score for wealth tertile at $p<0.05$ (F=8.83, $p=0.001$). Tukey's post-hoc test indicated that the mean score of PQoC for the lowest wealth tertile (M=71.77, SD=9.15) was significantly different from both the medium (M=69.36, SD=8.16) and highest (M=69.70, SD=7.62) wealth tertile. However, no significant difference was seen between medium and high wealth tertile. The ANOVA test also showed that the PQoC mean score showed significant differences based on the respondents' perceived health status and time to a recent visit to a health center, with (F=8.04, $p<0.001$) and (F=4.78, p<0.01), respectively. There was a significant difference in the mean score of PQoC between active insurance members (M=3.53, SD=0.41) and ex-members (M=3.38, SD=0.48); t = 3.96, $p<0.001$. The mean PQoC score of households with chronic illness (M=3.62, SD=0.42) was also significantly higher compared to those who did not have a chronic illness (M=3.48, SD=0.42); t = 4.95, $p<0.001$. The results of an independent t-test and a one-way ANOVA that compare the differences in mean scores of the five dimensions between subgroups are displayed in Table 2.

Table 2: Independent t-test and one-way ANOVA comparing mean scores of PQoC dimensions (20-100 scale) across respondent characteristics in two districts of northeast Ethiopia, 2021

Variables	N	Technical care		Communication		Information provision		Access to care		Trust in providers	
		M	SD	M	SD	M	SD	M	SD	M	SD
Age in years											
25 – 44	389	68.33	15.61	77.60	9.89	62.75[b]	13.73	69.99	11.64	73.59[b]	10.11
45 – 64	555	68.14	15.19	77.71	10.01	64.60[b]	14.03	69.41	12.04	73.61[b]	10.96
65+	137	69.15	14.44	79.03	11.19	70.36[#]	12.09	68.25	10.97	70.46[§]	13.21
Gender											
Men	938	68.36	15.15	77.67	10.17	64.40	13.80	69.34	11.67	73.18	10.80
Women	143	68.48	16.00	78.93	9.81	66.40	14.27	70.31	12.42	73.38	12.37
Marital status											
Divorced/widowed	78	70.77	14.74	78.80	12.10	70.77[#]	13.58	67.18	13.03	72.31	14.01
Married	1003	68.15	15.27	77.76	9.96	64.19	13.79	69.65	11.65	73.27	10.75
Formal education											
No	855	68.37	15.41	77.78	10.29	64.43	13.98	69.63	11.64	73.39	11.13
Yes	226	68.20	14.62	78.05	9.54	65.55	13.46	68.89	12.24	72.51	10.56
Household size											
< Five	403	69.10	15.21	78.51	10.07	65.14	14.31	70.37	11.25	73.18	11.94
≥ Five	678	67.89	15.25	77.43	10.14	64.39	13.61	68.94	12.04	73.22	10.44
Wealth tertile											
Lowest	361	69.64	14.42	79.56[#]	9.94	70.21[a#]	12.84	68.70	11.49	72.13[a]	13.07
Medium	360	67.11	15.28	76.80[b]	10.57	63.08[a]	14.40	69.00	11.82	73.02[*]	10.45
Highest	360	68.26	15.93	77.13[b]	9.65	60.69[a]	12.54	70.63	11.94	74.46[a]	9.04
Insurance status											
Ex-member	139	64.75[§]	15.73	74.29[§]	12.91	63.13	14.46	67.05[§]	13.56	70.79[§]	13.07
Active-member	942	68.87	15.10	78.36	9.54	64.89	13.78	69.83	11.44	73.56	10.64
Self-rated health											
Fair	207	71.76[b]	13.73	80.35[#]	9.55	70.02[#]	12.87	68.62	11.51	72.59[*]	11.83
Good	511	68.85[b]	14.73	76.73[b]	10.06	63.86[b]	13.95	69.18	11.14	74.16[a]	9.83
Very good	363	65.67[#]	16.31	77.96[b]	10.29	62.74[b]	13.59	70.37	12.71	72.21[a]	11.99
Chronic illness											
No	803	67.39[#]	15.58	77.30[§]	10.35	63.09[#]	13.74	69.13	11.90	73.07	10.94
Yes	278	71.08	13.90	79.38	9.29	69.21	13.26	70.47	11.33	73.60	11.25
Last health center visit											
< 3 months	499	68.08	15.10	78.46	10.25	68.07[#]	13.95	68.88[b]	11.49	71.77[#]	12.20
3-6 months	239	69.71	14.79	77.68	9.97	62.97[b]	12.90	71.67[§]	11.28	75.06[b]	9.31
6-12 months	343	67.76	15.74	77.03	10.02	60.90[b]	13.26	68.80[b]	12.34	73.99[b]	10.01
Total	1081	68.34	15.24	77.84	10.12	64.67	13.87	69.47	11.77	73.20	11.02

Statistical significance for t-test/F-test is indicated by $^{*}p<0.05$, $^{§}p<0.01$, and $^{\#}p<0.001$. Based on Tukey's post-hoc test, mean values sharing letter 'a' are significantly different; while mean values sharing letter 'b' are not significantly different in the group at the 5% level.

The mean PQoC score was significantly different among health centers (F=11.85, p<0.001). The mean scores for the five dimensions were also significantly different among health centers at p<0.001 level: technical care (F=8.66), patient-provider communication (F=6.65), information provision (F=47.42), access to care (F=36.87) and trust in care providers (F=6.98). The mean scores of the PQoC and its dimensions across the 12 health centers are depicted using a radar chart (Figure 1). The chart shows a comparison of mean scores on a scale of 10 to 90. For example, respondents from 11 health centers had a higher perception score on patient-provider communication than other dimensions with less variation, while the information provision dimension was mostly ranked lowest with more variability.

Figure 1: Summary of the mean scores of the PQoC and its dimensions across 12 health centers in two districts of northeast Ethiopia, 2021

Predictors of perceived quality of care: Multilevel analysis

The fixed effects (measures of association) and the random effects (measures of variation) for the multilevel linear regression model are depicted in Table 3. In the null model, 8.5% of the total variance in PQoC was attributed to cluster-level variables. The variability between clusters was statistically significant (τ=5.90, p<0.001). Furthermore, the null model showed a significant improvement in fit relative to a standard linear model, demonstrating the importance of developing a multilevel model. The cluster-level variation in Model II remained significant (τ=6.33, p<0.001), with 9.31% of the total variability attributed to differences across clusters. The

PCV was negative in this model, indicating that individual-level characteristics did not play a role in explaining the variation between clusters. In Model III, cluster-level variables accounted for just 1.33% of the variation in PQoC across clusters. The PCV showed that cluster-level variables explained 85.42% of the variation between health centers, indicating the importance of including cluster-level characteristics to build a more robust explanatory model. We interpreted the results of the regression analysis using Model IV, which has the lowest DIC and AIC.

After adjusting for other individual and cluster-level factors, the mean PQoC score for households with higher wealth tertile increased by 1.79 points compared to those with lower wealth tertile (b=1.79; 95% CI: 0.37, 3.21). Households who were active members of CBHI at the time of the study had a 2.70-point higher PQoC score than ex-members (b=2.70; 95% CI: 1.25, 4.14). The PQoC score of households who rated their health status as very good was 1.80 points lower compared to those who rated it as fair (b=-1.80; 95% CI: -3.31, -0.29). Compared to households without a chronic illness, those with one or more family members with a chronic illness had a 1.42-point higher perception score (b=1.42; 95% CI: 0.22, 2.63). Time to a recent visit to a health center was also significantly associated with PQoC score. The mean score for households who had their most recent visit to a health center before 3-6 months was 1.89 points higher compared to those whose recent visit was within 3 months prior to the study (b=1.89; 95% CI: 0.61, 3.17).

Regarding cluster-level variables, the average work experience of health care providers and patient volume had statistically significant associations with PQoC. A 1.07-point improvement in the average PQoC score of health centers was noted for every year's increase in the median work

experience of health care providers (b=1.07; 95% CI: 0.74, 1.40). An interaction term between patient volume and job satisfaction was positively associated with PQoC, implying that improving staff job satisfaction would buffer or lessen the effect between patient volume and PQoC. At an average staff job satisfaction, a 0.42-point drop in the average PQoC score of health centers was observed for a unit increase in patient volume (b=-0.42; 95% CI: -0.50, -0.33). A one-unit increase in patient volume would only result in a 26% fall in average PQoC if the average job satisfaction is set one SD above the mean. This prediction was substantiated by the fact that the margins graph for patient volume showed the flattest slope for higher job satisfaction. However, the buffering role is observed in health centers with an average patient volume of 30.75 or higher.

Table 3: Multilevel linear regression analysis of factors associated with PQoC among households ever enrolled in a CBHI scheme in two districts of northeast Ethiopia, 2021

Variables		Model I	Model II	Model III	Model IV
	Category		b (95% CI)	b (95% CI)	b (95% CI)
Fixed effects					
Age			-0.02 (-0.06, 0.03)		-0.03 (-0.07, 0.02)
Gender	Women		0.64 (-1.06, 2.34)		0.80 (-0.88, 2.49)
Marital status	Married		-0.14 (-2.42, 2.15)		0.18 (-2.09, 2.45)
Modern education	Yes		-0.07 (-1.34, 1.19)		-0.25 (-1.49, 1.00)
Wealth tertile	Medium		-0.57 (-1.89, 0.74)		-0.16 (-1.40, 1.09)
	High		0.73 (-0.87, 2.34)		1.79 (0.37, 3.21)*
Household size	Large (≥ 5)		-0.28 (-1.28, 0.72)		-0.31 (-1.31, 0.68)
Insurance status	Active member		2.65 (1.20, 4.11)#		2.70 (1.25, 4.14)#
Perceived health	Good		-0.75 (-2.16, 0.66)		-0.73 (-2.14, 0.67)
status	Very good		-1.78 (-3.29, -0.26)*		-1.80 (-3.31, -0.29)*
Chronic illness	Yes		1.55 (0.34, 2.76)*		1.42 (0.22, 2.63)*
Last health center	3-6 months		1.64 (0.35, 2.94)*		1.89 (0.61, 3.17)§
visit	6-12 months		0.77 (-0.45, 1.99)		1.02 (-0.18, 2.21)
Work experience				0.75 (0.33, 1.17)§	1.07 (0.74, 1.40)#
Affective commitment				0.48 (0.04, 1.00)	0.27 (-0.10, 0.65)
Patient volume				-0.33 (-0.45, -0.21)#	-0.42 (-0.50, -0.33)#
Job satisfaction				0.01 (-0.24, 0.27)	0.07 (-0.10, 0.24)
Patient volume x Job satisfaction				0.06 (0.02, 0.11)§	0.05 (0.02, 0.08)§
Random effect					
τ (SE)		5.90 (2.78)#	6.33 (3.10)#	0.86 (0.94)	≈ 0.00
ICC (%)		8.50	9.31	1.33	≈ 0.00
PCV (%)		Reference	-7.29	85.42	≈ 100
Model fitness					
DIC		7578.01	7528.89	7572.79	7516.90
AIC		7584.01	7560.89	7588.79	7558.90

*p<0.05; §p<0.01; #p<0.001; τ - Cluster-level variance, ICC - Intraclass Correlation; PCV - Proportional Change in Variance; DIC - Deviance Information Criterion; AIC - Akaike Information Criterion; SE – standard error; b - regression coefficient; CI – Confidence Interval.

DISCUSSIONS

Individuals with health insurance will continue to be members if they believe they are receiving the highest possible quality of health care. [19 20] In this study, the mean PQoC score was 70.28 on a scale of 20-100 with an SD of 8.39. The patient-provider communication received the highest score (M=77.84, SD=10.12) among the five quality dimensions. In 2015, the Ethiopian government incorporated the development of caring, respectful, and compassionate health care providers as one of the main transformation agendas in its five-year health sector strategic plan, and movements were created around it.[27] Our finding may be attributed partly to the government's ongoing training initiatives aimed at producing health care providers who are competent in this aspect. The perception score for the information provision dimension, on the other hand, was the lowest (M=64.67, SD=13.87). This could be attributed to an increase in patient volume following the implementation of CBHI.[26] Items loaded under this dimension appear less practical in the presence of a larger patient load. If health care providers are required to treat a large number of patients, consultation times will be reduced. They are unlikely to provide the necessary information to their clients if they are under time constraints. Regarding item level observations, waiting time and medicine availability received the lowest perception scores (62.96 and 63.50, respectively), which could also be related to increased patient load. This is in line with earlier studies in Ethiopia, which revealed that clients with health insurance frequently complain about a lack of medicine and long wait times at CBHI-affiliated health facilities.[43 44]

Results of the regression analysis revealed that households with higher wealth tertile had a higher PQoC score than those with lower wealth tertile. This is in contrast to other studies whereby the richest group had a lower perception score.[16 45] This discrepancy could be partly attributed to the use of different metrics to assess the quality of care. People with higher economic status may be more aware of health issues and able to bargain with health care providers to obtain the best possible care. Furthermore, if prescribed medicines are not available in CBHI-affiliated health facilities, for instance, they can afford to buy from private pharmacies. On the contrary, it may be irritating for people with lower economic status to buy medicines with limited money or to forgo treatment due to lack of money. In this regard, they may develop a negative perception of the quality of care.

Households who were active members of CBHI at the time of the study had a higher rating of PQoC compared to ex-members. Contrary to our finding, a study in Ghana showed that previously insured clients had a higher perception of quality of care compared to actively insured clients (statistical significance is not reported). The authors argue this was due to the more time-consuming nature of the service delivery processes for insured clients.[46] At least three possible explanations exist for the relationship between CBHI status and PQoC. First, because they do not have to pay for health care, active members have better access to and enjoyment of its benefits, resulting in a favorable perception of its quality. Second, the relationship could be due to an endogeneity issue created by omitted variables. It is plausible that higher quality score reported by active members is due to such variables, as the desire to continue their membership. Third, ex-members of CBHI may have had negative experiences with health services, which led to the

decision to discontinue their membership. As a result, they would be critical in rating the quality of care provided. In support of the latter argument, it was evidenced that poor quality of care was a major reason for insurance members to leave the scheme.[24 47] Elsewhere, a statistically significant association was also reported between dropout and low quality of care.[48 49]

This study verified that the PQoC score of households who rated their health status as very good was significantly lower compared to those who rated it as fair. The households' chronic illness experiences also influence the PQoC rating. The PQoC score of households with a chronic illness was higher compared to those without a chronic illness. This may be true for people who perceive their health as fair or who live with chronic conditions to appreciate the gains or benefits of the health care they received. In this respect, they may be more likely to rate the quality of care higher than their counterparts.

The results also indicated that households who had their most recent visit to a health center before 3-6 months had higher PQoC scores compared to those whose recent visit was within 3-months prior to the study. Patients may experience varying levels of emotional highs and lows, depending on the length of the most recent facility visit. Although patients' perceptions of quality may develop over time,[5] patients who recently visited a health facility may be more critical of the quality of care due to strong emotions attached to negative events or health services that fall short of their expectations.

Our findings revealed that the average work experience of health care providers was positively associated with PQoC. Work experience is linked to task specialization, which can lead to a faster

work pace, more output in less time, and higher quality. Providers with more experience take less time to make diagnoses and treatment decisions, while still providing recommended practical aspects of care, such as good communication, physical examination, and provision of relevant health information.[50] As a result, they can reduce waiting times, and their management outcomes may be more effective than inexperienced providers. This could be more pronounced in Ethiopia, where the number of outpatient visits to CBHI-affiliated health centers had increased dramatically.[26]

Conditional to the average staff job satisfaction, patient volume is negatively correlated with PQoC. A study in Ethiopia identified a non-linear significant association (an inverted U-shape) between patient volume and quality. Quality decreased with increasing patient volume in health facilities that treated 90.6 or more patients per day, while quality increased with increasing patient volume in health facilities that treated less than 90.6 patients per day in the outpatient departments.[51] Our finding is consistent with a study at public hospitals in China where overcrowding was negatively associated with clients' perception of quality of care.[31] The apparent correlation between patient volume and PQoC could be explained by factors such as increased demand for health care providers and longer wait times. An increased patient volume would put a great deal of pressure on health care providers to treat a large number of patients in a short time. This may result in shorter consultation time and the omission of important practical aspects of care. On top of that, an increase in patient volume would mean longer waiting times at various service delivery points. Both these factors could have contributed to a negative patient experience and influenced their perception of overall quality of care. Some studies

reported a positive relationship between patient volume and quality of basic maternal care, and postoperative infections.[52 53] The alternative direction of this relationship, in which quality drives patient volume, is based on the assumption that the provision of high-quality care will attract more patients. This may be true in areas where patients have access to competitive health facilities, and health care providers are incentivized for providing higher quality care. This is not the case in low-income countries, like Ethiopia, where health care facilities are hard to reach for most rural populations. Members of CBHI are further limited to using health services only in public health facilities affiliated with the scheme.

This study found no relationship between staff job satisfaction and PQoC. This contrasts with the findings of Kvist et al. 2014, which reported a positive relationship between job satisfaction among the nursing staff and patients' perceptions of quality of care.[54] Despite this, it moderates the relationship between patient volume and PQoC in a nonlinear fashion. Improved job satisfaction buffers the negative relationship between patient volume and PQoC in health centers with an average patient volume of 30.75 or higher. When the average patient volume is less than 30.75, however, improving job satisfaction enhances the effect between patient volume and PQoC. It is plausible that the buffering role of provider job satisfaction as patient volume rises indicates that service provider job satisfaction is a result of the intrinsic rewards of higher work performance. Providers may also be fully available during working hours at the health facility due to the increased number of clients. On the other hand, the moderating role of enhancing the relationship as patient volume decreases could suggest that a low workload is one source of job satisfaction. Because clients are in small numbers, providers may not be fully engaged during

working hours. They may have the freedom to do other businesses outside the health facility, leaving patients unattended and dissatisfied.

The findings of this study will be an essential input for quality improvement initiatives as well as addressing challenges in the country's efforts to establish higher-level insurance pools. This is the first study of its kind to consider cluster-level variables associated with PQoC in Ethiopia. It gives an important lesson to healthcare managers and other relevant stakeholders to consider cluster-level characteristics in healthcare quality improvement efforts. It also pointed out quality dimensions that require special consideration in managerial decisions. Despite the significant findings of the current study, some caution should be taken in interpreting the findings. One noteworthy limitation of this study is the cross-sectional nature of the data. The study's analysis was conducted to identify associations rather than prove causation. Second, the association between current insurance status and PQoC could be due to the possibility of endogeneity. Third, patient volume data based on secondary data may not reflect the true figure due to the possibility of under or over-reporting.

CONCLUSIONS

Despite encouraging findings on patient-provider communication, much work remains to be done to improve information provision and access to care quality dimensions. According to the findings, people's perceptions of quality of care varied depending on a variety of individual and cluster-level factors. The household's wealth status, current insurance membership, perceived health status, presence of chronic illness in the household, and time to a recent visit to a health

center were individual-level predictors of PQoC. At the cluster level, patient volume and work experience of health care providers were associated with PQoC. A lower patient volume allows the health care provider to devote more time and attention to each patient, address the individual patient's needs, and have more time to improve communication with and provide behavior change counseling, which has an impact on the quality of care.[55] Therefore, to ensure that patients have access to a better quality of care, it is critical to determine an appropriate patient volume per care provider. Staff job satisfaction was an important factor that buffers the effect between patient volume and PQoC. Hence, it is vital to devise mechanisms to improve staff job satisfaction, especially in health facilities with higher patient volumes. More importantly, health centers should go to great lengths to ensure that every patient has access to the necessary medications. This will boost clients' trust in health care providers, which will be critical for health insurance schemes to retain and attract members.

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Contributors

MH conceptualized the study, designed the study, collected the data, analyzed and interpreted the data, and drafted the manuscript. MA and NBB contributed to survey design, data collection,

and statistical analysis and reviewed the manuscript. All authors read and approved the final manuscript.

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Competing interests None declared.

Patient consent for publication Not required.

Ethics approval Ethical approval was obtained from the Institutional Review Board (IRB) of the College of Medicine and Health Science, Bahir Dar University with protocol number 001/2021. A support letter was communicated to the district health offices to gain entry permission into the community where the research was conducted. Before the interview, verbal informed consent was secured from each of the study participants. Confidentiality was assured by collecting anonymous information and informing the participants that personal identifiers would not be revealed to a third party.

Provenance and peer review Not commissioned; externally peer-reviewed.

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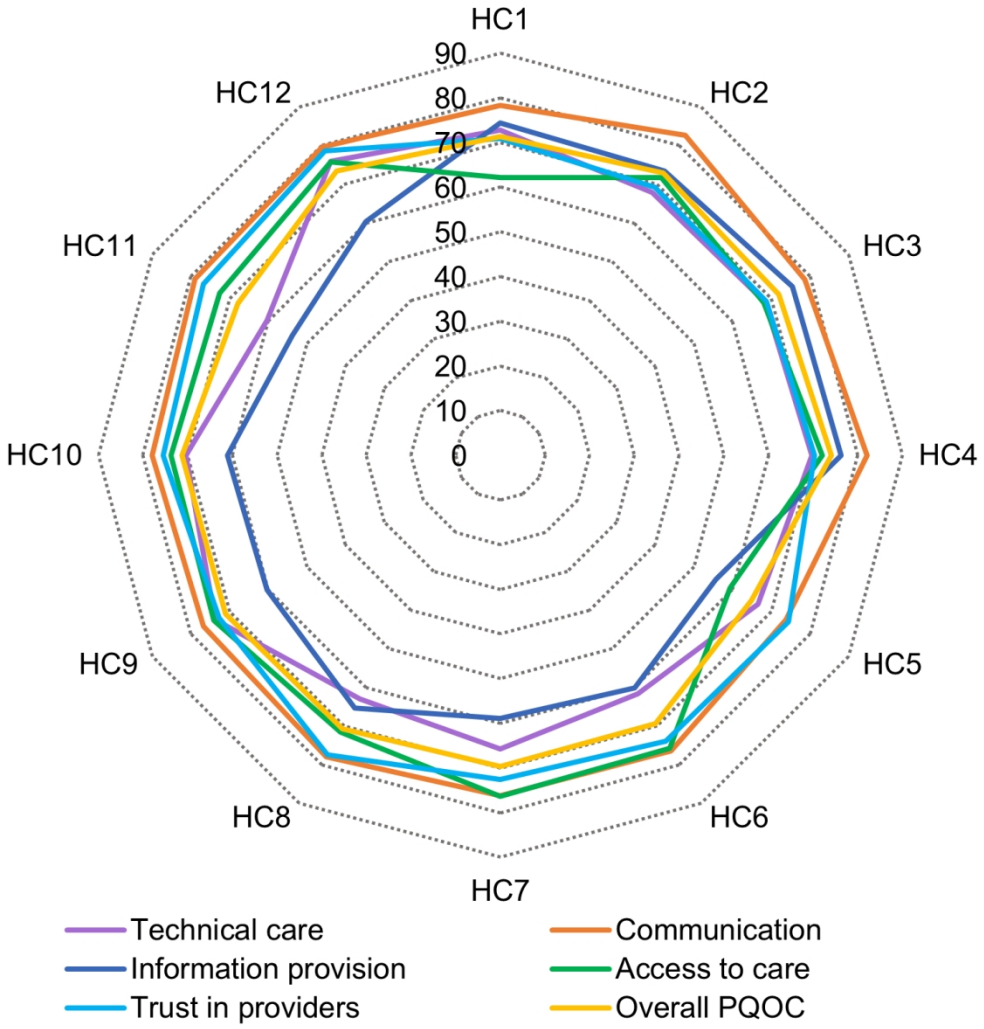

Figure 1: Summary of the mean scores of the PQoC and its dimensions across 12 health centers in two districts of northeast Ethiopia, 2021

130x135mm (300 x 300 DPI)

Supplementary file 1: Factor analysis of the measurement scale to assess the perceived quality of care among households ever enrolled in a CBHI in two districts of northeast Ethiopia, 2021

Dimensions and items	Loadings under each dimension				
	1	2	3	4	5
Technical care					
The necessary Laboratory tests were performed	0.911				
Health care providers perform the necessary physical examinations	0.818				
Health care providers make a good diagnosis	0.740				
Patient-provider communication					
Health care providers actively ask questions to understand your situation		0.846			
Health care providers listened to you carefully what you had to say		0.845			
Health care providers treated you with courtesy and respect		0.542			
Information provision					
Health care providers clearly explained the use and side effects of medicines			0.787		
Health care providers clearly explained the results of tests and examination			0.760		
Health care providers explain things in a way you could understand			0.672		
Health care providers spent sufficient time examining patients			0.510		
Access to care					
Patients do not wait long in the health center to receive treatment				0.799	
All prescribed medicines are available on the spot				0.624	
Facility assistants are friendly and helpful to patients				0.559	
The health facility serves all patients fairly				0.463	
Trust in care providers					
Treatment is effective for recovery and cure					0.754
Health care providers prescribe appropriate medicines for patients					0.672
You have confidence in the competence of health care providers					0.662

Supplementary file 2: Mean score of each measurement item of the perceived quality of care (20-100 scale) among households ever enrolled in a CBHI in two districts of northeast Ethiopia, 2021

Factors and items			95% CI	
	Mean	SD	LCI	UCI
Technical care	**68.34**	**15.24**	**67.43**	**69.25**
The necessary Laboratory tests were performed	69.20	18.36	68.10	70.29
Health care providers perform the necessary physical examinations	68.23	18.89	67.11	69.36
Health care providers make a good diagnosis	67.59	17.69	66.53	68.64
Patient-provider communication	**77.84**	**10.12**	**77.23**	**78.44**
Health care providers actively ask questions to understand your situation	80.39	11.68	79.69	81.09
Health care providers listened to you carefully what you had to say	79.61	10.93	78.96	80.26
Health care providers treated you with courtesy and respect	73.51	16.72	72.51	74.50
Information provision	**64.67**	**13.87**	**63.84**	**65.49**
Health care providers clearly explained the use and side effects of medicines	62.90	19.87	61.72	64.09
Health care providers clearly explained the results of tests and examination	62.50	19.48	61.34	63.66
Health care providers explain things in a way you could understand	69.36	17.42	68.32	70.40
Health care providers spent sufficient time to examining patients	63.90	20.18	62.70	65.11
Access to care	**69.47**	**11.77**	**68.77**	**70.17**
Patients do not wait long in the health center to receive treatment	62.96	20.17	61.76	64.16
All prescribed medicines are available on the spot	63.50	20.37	62.28	64.71
Facility assistants are friendly and helpful to patients	73.38	16.07	72.42	74.34
The health facility serves all patients fairly	78.06	15.90	77.11	79.01
Trust in care providers	**73.20**	**11.02**	**72.55**	**73.86**
Treatment is effective for recovery and cure	72.47	14.78	71.59	73.35
Health care providers prescribe appropriate medicines for patients	75.47	12.90	74.70	76.24
You have confidence in the competence of health care providers	71.67	14.36	70.82	72.53
Overall perceived quality of care (PQoC)	**70.28**	**8.39**	**69.77**	**70.78**

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	2
		(*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	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6, 7
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	11, 12
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	7, 8
Bias	9	Describe any efforts to address potential sources of bias	*6*
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	9, 10
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9, 10
		(*b*) Describe any methods used to examine subgroups and interactions	11
		(*c*) Explain how missing data were addressed	NA
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	10
		(*e*) Describe any sensitivity analyses	NA
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	13
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	13, 15
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	15
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	16, 17
		(*b*) Report category boundaries when continuous variables were categorized	NA
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	20
Discussion			
Key results	18	Summarise key results with reference to study objectives	20, 21-26
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	26
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	21-26
Generalisability	21	Discuss the generalisability (external validity) of the study results	26
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	27

*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.

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Perceived quality of care among households ever enrolled in a community-based health insurance scheme in two districts of northeast Ethiopia: A community-based, cross-sectional study

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ABSTRACT

Objectives: To examine how clients perceived the quality of health care they received and identify associated factors both at the individual and facility levels.

Design: A community-based, cross-sectional study.

Setting: Two rural districts of northeast Ethiopia, Tehulederie and Kallu.

Participants: 1081 rural households who had ever been enrolled in community-based health insurance and visited a health center at least once in the previous 12 months. Furthermore, 194 health care providers participated in the study to provide cluster-level data.

Outcome measures: The outcome variable of interest was the perceived quality of care, which was measured using a 17-item scale. Respondents were asked to rate the degree to which they agreed on 5-point response items relating to their experiences with health care in the outpatient departments of nearby health centers. A multilevel linear regression analysis was used to identify predictors of perceived quality of care.

Results: The mean perceived quality of care was 70.28 (SD=8.39). Five dimensions of perceived quality of care were extracted from the factor analysis, with the patient-provider communication dimension having the highest mean score (M=77.84, SD=10.12), and information provision having the lowest (M=64.67, SD=13.87). Wealth status, current insurance status, perceived health status, presence of chronic illness, and time to a recent health center visit were individual level variables that showed a significant association with the outcome variable. At the cluster

level, the work experience of health care providers, patient volume, and an interaction term between patient volume and staff job satisfaction also showed a significant association.

Conclusions: Much work remains to improve the quality of care, especially on information provision and access to care quality dimensions. A range of individual and cluster-level characteristics influence the perceived quality of care. For a better quality of care, it is vital to optimize the patient-provider ratio and enhance staff job satisfaction.

Strengths and limitations of this study

- The study tried to assess the quality of care from the clients' point of view using a validated multidimensional scale.
- This is the first cross-sectional study in Ethiopia, which considered health center (cluster) level variables that have an association with perceived quality of care.
- The observed association between current insurance status and perceived quality of care could be due to an endogeneity issue created by omitted variables.
- The use of a relatively small cluster sample size in this study may limit the accuracy of the estimates in the multilevel modeling.
- Because of the cross-sectional nature of the study, it is impossible to establish a cause-and-effect relationship.

INTRODUCTION

Health care providers and patients define the quality of care differently and attach varying levels of importance to its attributes. When assessing the quality of care, health care professionals tend to prioritize technical competence, while patients place a high value on patient-centeredness, amenities, and reputation.[1] The emphasis on health care quality measurement has shifted away

from the viewpoints of health care providers to people-centered approaches that rely on patient perceptions.[2-4] Patients' perception of health care quality has become an essential element of quality measurement due to its link with health service utilization. It is based on a mix of patient experiences, processed information and rumors.[5]

Patient experience surveys elicit data on the transactional components of care, which are process-related, as well as the interpersonal interactions that occur over the course of care.[6] Individuals receiving care are asked about their experiences of health facility encounters to report if particular processes or events occurred.[7] Patient experience measurements have received increased attention and are widely employed to inform quality improvement, and pay-for-performance.[8] Patient experience is consistently and positively associated with patient safety and clinical effectiveness, adherence to prevention and treatment recommendations, and technical quality of care.[9 10]

Patient experience is a reflection of the patient journey, which consists of the myriad interactions patients have with health care providers and the healthcare system over time and in a variety of settings. It is shaped by the health care team, the organization, and the surrounding policy and regulatory environment. A negative patient experience is a proxy for a larger health system failure, underscoring the need to apply a systems approach to improving health care quality.[4]

Quality of health care is vital to the success of universal health coverage (UHC) initiatives, like community-based health insurance (CBHI). To achieve the desired outcomes, the development of CBHI schemes must be accompanied by improvements in health care quality.[2 4 11-13] To build

sustainable CBHI schemes, members must believe that the benefits of health care provided via health insurance coverage outweigh the benefits of not being insured.[14] Patients' positive experiences with the quality of care provided under insurance schemes increase their trust in the health system and insurance schemes.[15 16] As a result, they are more likely to use health care services and participate in health insurance plans.[17] If insured clients are unable to access high-quality services, they lose trust in service providers and seek care elsewhere,[18] making them less likely to pay premiums.[19 20] Low perception of health care quality further deters people from interacting with the health system in the future.[4]

Although increased health care coverage is promising with the implementation of CBHI initiatives, quality of care remains a key impediment to achieving UHC.[13 21] For example, more than eight million deaths amenable to a high quality of care occurred in low- and middle-income countries, making the poor quality of care a bigger obstacle to mortality reduction than lack of access to care.[21] Poor quality of care is also a major issue that jeopardizes the long-term viability of many CBHI schemes.[11 22] Findings of systematic reviews revealed that the quality of care was a key factor that influenced enrollment and renewal decisions of CBHI membership.[23 24] Some quality concerns include 'unavailability and perceived poor quality of prescribed medicines, misbehavior of health professionals, and the differential treatment of the insured in favor of the uninsured patients, unclean hospital environment, long queues, lack of diagnostic equipment, and long waiting hours to obtain health care.[24]

To promote optimal utilization, stable finance, and better outcomes, the quality of health care must be monitored on a regular basis.[18] Previous studies in Ethiopia focused on surveys of client

satisfaction and did not employ multidimensional measurement scales.[25 26] To our knowledge, the quality of care delivered under the CBHI in Ethiopia has never been investigated using multidimensional metrics from the perspective of service users at the community level. There is also a paucity of literature on facility-level variables that influence the quality of care. Therefore, the purpose of this study was to examine the perceived quality of care (PQoC) from the perspective of clients and identify associated factors at the individual and facility level.

Improving the quality of care under the CBHI is among Ethiopia's top priorities in its health sector strategic plan.[27] The findings of this study will inform relevant stakeholders on the current state of clients' perceptions of the quality of care and will be an essential input for quality improvement initiatives. It will also provide useful information for decision-makers to address challenges in the country's endeavors to establish higher-level insurance pools.

METHODS

Study setting and population

A community-based cross-sectional study was conducted in rural parts of two neighboring districts in northeast Ethiopia, Tehulederie and Kallu. Tehulederie is divided into 20 rural and seven urban *Kebeles* (subdistricts) with a population of 145,625, of which 87.5% reside in rural areas. There are five health centers and one primary hospital in the district. It was one of the 13 districts in Ethiopia where CBHI was piloted in 2011. The scheme was introduced in Kallu district after two years, in July 2013. Kallu is divided into 36 rural and four urban *Kebeles* and has nine

health centers. It is the most populous district in the zone, with a population of 234,624, of which 89.11% live in rural areas.[28]

The study population of interest was rural households who had been ever enrolled in the CBHI scheme before January 2020. To minimize recall bias, households who had not used health care in the 12 months before data collection were excluded from the study.

Sample size and sampling procedure

The sample size was calculated using MedCalc software by assuming a mean difference of two independent groups. A previous study on PQoC reported mean scores of 5.2 and 5.4 with standard deviations (SD) of 0.8 and 0.7 among insured and uninsured respondents, respectively.[29] Using this output and assuming an 80% power, 95% confidence level and equally sized groups, a sample size of 446 was calculated. Considering a design effect of 1.5 attributable to multi-stage sampling and a potential non-response rate of 10%, the effective sample size was estimated to be 736 households. An alternative sample size of 1257 was calculated for a companion article as part of a research project examining the sustainability of a CBHI in Ethiopia.[30] Among those, 1081 eligible households participated in this study. Furthermore, 194 health care providers from 12 health centers participated in the study to provide cluster-level data.

The study participants were recruited using a three-level multistage sampling approach. First, 12 clusters of *Kebeles* organized under a health center catchment area were selected. Then, 14 rural *Kebeles* were drawn randomly using a lottery method proportional to the number of *Kebeles*

under each cluster. Accordingly, five *Kebeles* from Tehulederie and nine from Kallu were included. A list of households who have ever been enrolled in the CBHI was obtained from the membership registration logbook of each *Kebele*. The required sample was generated at random from each *Kebele*, proportional to the number of households who have ever been enrolled in the scheme, using random number generator software.

Data collection and measurement

The data were collected from 04 February to 21 March 2021. Individual-level data were collected through face-to-face interviews with household heads at their homes or workplace using a structured questionnaire via an electronic data collection platform. The data collectors submit the completed forms to a data aggregating server daily, which allowed us to review the submissions and streamline the supervision process.

The PQoC, which is the outcome variable of interest, was measured using a 17-item scale designed after a thorough review of validated tools.[29 31-34] Respondents were asked to rate the extent to which they agreed on a set of items relating to their experiences with the health care they received in the outpatient departments of nearby health centers. Each item was designed on a 5-point response format with 1 - strongly disagree, 2 - disagree, 3 - neutral, 4 - agree and 5 - strongly agree. The summary scores for the PQoC and its dimensions were calculated for individual respondents by adding the scores of each item. This gives a scale ranging from 17 (1×17) to 85 (5×17) for the overall PQoC score. For quality dimensions consisting of three and four items, the scale ranges from 3 to 15 and 4 to 20, respectively. When reporting the results,

the scores were arithmetically transformed to a scale of 20 to 100.[35] This allows the comparison of mean scores of PQoC, its dimensions, and each measurement item on a common scale.

Wealth index was generated using the principal component analysis method. The scores for 15 types of assets were translated into latent factors, and a wealth index was created based on the first factor that explained most of the variation. The study households were grouped into wealth tertile – lower, medium, and higher based on the index. Perceived health status was measured based on a household head's subjective assessment of the health status of the household, and was rated as "poor, fair, good, very good, or excellent". However, for analysis purposes, it was recategorized into "fair, good, and very-good", by merging the two extreme response categories to the next option due to fewer replies.

Before the data collection, the questionnaire was pre-tested on a sample of 84 randomly selected participants in one *Kebele*. As part of the pre-test, a cognitive interview was conducted on selected items using the verbal probe technique among eight respondents to determine if the items and response categories were understood, and interpreted by the potential respondents as intended. Accordingly, the phrasing of some items and response options were modified, and some items were omitted.

Cluster-level data were collected from 12 health centers that provide health care for the population in the sampled *Kebeles*. Patient volume data were obtained by reviewing the monthly service delivery reports of health centers, while data related to work experience, affective

commitment, and job satisfaction were collected through a self-administered questionnaire among health care providers who worked more than one year in the current facility.

Patient volume was measured using the daily average number of patients managed by a health care provider in the outpatient department. It was calculated by dividing the number of patients who visited the health center in the last six months before the study by the number of working days, and then by the number of consultation rooms in each health center.[36] Affective commitment and job satisfaction were composite variables that were assessed using a 5-point Likert scale. Affective commitment was measured with a seven-item questionnaire based on a modified version of the Meyer et al. scale, which had previously been used in a hospital setup.[37] Staff job satisfaction was measured using a 10-item scale, which was adapted from a previous study among health care workers in Ethiopia.[38] Average affective commitment and job satisfaction scores were computed for each health center.

Data analysis

The data were analyzed using Stata version 17.0. Exploratory factor analysis was performed to assess the validity of the quality measurement scale. Bartlett's test of Sphericity and Kaiser-Mayer-Olkin's (KMO) measure of sampling adequacy were performed to assess the appropriateness of the data for factor analysis. The principal component factor method of extraction and Promax rotation with Kaiser Normalization was used. The Eigenvalue greater than one decision rule was used to determine the appropriate number of factors to be extracted. Items with both loadings and communalities below 0.40 were removed from the analysis.[39]

Correlation coefficients were used to test construct validity. Item-total score correlation, dimension-total score correlation, and dimension intercorrelation were computed. The total score was the mean score of the ratings for all items of the scale, and the dimension score was the factor score. A questionnaire has good construct validity when the item-total score correlations are higher than 0.40, dimension intercorrelations are less than 0.80, and dimension-total score correlations are higher than dimension intercorrelations.[32] Cronbach's alpha coefficients were generated for each dimension to assess the internal consistency. The reliability of the scale was considered acceptable if Cronbach's alpha coefficient was 0.60 or higher.[39]

To compare mean scores of PQoC and its dimensions among subgroups, an independent t-test and a one-way analysis of variance (ANOVA) with Tukey's post-hoc test were used. Because the outcome variable was considered a continuous variable, a multilevel linear regression model was fitted to identify its predictors. The PQoC was assumed to be influenced by the characteristics of households (individual-level variables) as well as the characteristics of health centers (cluster-level variables). Cluster-level data were linked to individual-level data based on the usual source of health care for each study participant. Considering the hierarchical structure of the data, where patients are nested within health centers, a two-level linear regression model was applied. In this study, there were 12 health centers (level-two units), hence the Restricted Maximum Likelihood estimation approach was employed because it is appropriate for smaller cluster sizes.[40] Four models were estimated to choose the one that best fits the data. The first model or the null model (a model without predictors) is given by:

$$Y_{ij} = \gamma_{00} + u_{0j} + \varepsilon ij \quad (1)$$

The null model estimates three parameters: the average intercept (Y_{00}), the between health center error, or deviation, from the average intercept (u_{0j}), and the individual-level residual, or variation in individual scores within health centers (ε_{ij}). The second model estimated PQoC (Y_{ij}) for individual household *i* at health center *j*. We treat PQoC as a function of a matrix of individual-level variables (X_{ij}) which include age, gender, education, and marital status of the household head; wealth status; household size; current health insurance status; the presence of chronic illness in the household; perceived health status, and time to a recent visit to a health center, and expressed as:

$$Y_{ij} = \gamma_{00} + \gamma_{10}X_{1ij} + \gamma_{20}X_{2ij} + u_{1j}X_{1ij} + u_{2j}X_{2ij} + \ldots + \gamma_{n0}X_{nij} + u_{nj}X_{nij} + u_{0j} + \varepsilon ij \quad (2)$$

where $u_{1j,}\ u_{2j\ldots}u_{nj}$ indicate the random error terms connected to each X_{ij}.

The third model estimated the PQoC as a function of cluster-level variables (Z_j) that include average work experience, affective commitment and job satisfaction of health care providers, and patient volume. The model accounts for the variation amongst health centers and explains it in terms of these characteristics. It is given by:

$$Y_{ij} = \gamma_{00} + \gamma_{01}Z_{1j} + \gamma_{02}Z_{2j} + \ldots + \gamma_{0n}Z_{nj} + \gamma_{11}PV_j * JS_j + u_{0j} + \varepsilon ij \quad (3)$$

where PV_j*JS_j indicates an interaction term between patient volume and job satisfaction in which job satisfaction was assumed to moderate the effect between patient volume and PQoC. The interaction effect was tested by plotting the marginal effects of interaction terms. The two

variables were centered toward the grand mean to facilitate the interpretation of the coefficients. By combining models II and III, the fourth model estimated the PQoC as a function of both individual and cluster-level variables, and can be written as:

$$Y_{ij} = \gamma_{00} + \gamma_{10}X_{1ij} + \gamma_{20}X_{2ij} + u_{1j}X_{1ij} + u_{2j}X_{2ij} + \ldots + \gamma_{n0}X_{nij} + u_{nj}X_{nij} + \gamma_{01}Z_{1j} + \gamma_{02}Z_{2j} + \ldots + \gamma_{0n}Z_{nj} + \gamma_{11}PV_j * JS_j + u_{0j} + \varepsilon ij \quad (4)$$

where γ_{10} and γ_{01} are the vector of coefficients of *n* explanatory variables whose values are at X_{1ij}, X_{2ij}, . . . , X_{nij} for the i^{th} individual within the j^{th} cluster, and Z_{1j}, Z_{2j}, . . . , Z_{nj} for the j^{th} cluster, respectively. The intercept γ_{00} and slopes γ_{01}, γ_{10} and γ_{11} are fixed effects, while u_{0j}, $u_{j,}$ and ε_{ij} are random effects.

This multilevel regression decomposes the total variances into two independent components: σ_e^2, which is the variance of individual-level errors ε_{ij}, and σ_{u0}^2, which is the variance of cluster-level errors u_{0j}. From this model, we can define the intraclass correlation (ICC) by the equation:[41]

$$ICC = \sigma_{u0}^2 / \left(\sigma_{u0}^2 + \sigma_e^2\right)$$

The ICC and proportional change in variance (PCV) were used to report the measures of variation (random effects). The need for multilevel analysis, which considers cluster-level factors, was tested using the ICC. The ICC shows the variation in PQoC accounted for cluster-level characteristics. Statistically significant variability between health centers justifies the need to consider cluster-level factors.[42] The PCV expresses the change in the cluster-level variance between the empty model and models with more terms and is calculated by PCV = $(V_A - V_B)/V_A$,

where V_A is the variance of the null model, and V_B is the variance of the model with more terms. It measures the total variation explained by individual and cluster-level factors.

The measures of association (fixed-effects) estimate the association between the PQoC score and various explanatory variables. The existence of a statistically significant association was determined at p-values of <0.05. The degree of the association was assessed using regression coefficients, and their statistical significance was determined at a 95% confidence interval. Models were compared using the Deviance Information Criteria (DIC) and Akaike Information Criteria (AIC). The best fit model was determined to have the lowest DIC and AIC values. The preliminary analysis confirmed no violation of the assumptions of normality, linearity, homoscedasticity, and multicollinearity. The presence of multicollinearity was determined using the Variance Inflation Factor with a cutoff point of 5.

Patient and Public Involvement

No patient involved

RESULTS

Background characteristics of the study participants

The household survey included 1081 respondents who had visited a health center at least once in the previous 12 months prior to the study. The average age of the study participants was 49.25 years (SD=12.07), with slightly more than half (51.34%) between the age ranges of 45 and 64, and 12.67% being 65 and older. Of the total study participants, 938 (86.77%) were men, and 1003

(92.78%) were currently married. One-fifth of the study participants (20.91%) attended formal education, and 62.72% had a household size of five or above.

Nearly ninety percent of the households (87.14%) were active members of the CBHI scheme at the time of the study. A quarter of households (25.72%) had one or more individuals with a known chronic illness informed by a healthcare provider. One-third of respondents (33.58%) rated their household health status as very good, while 207 (19.15%) and 511 (47.27%) rated it as fair and good, respectively. Nearly half of the households (46.16%) had visited a health center within three months prior to the study, while 31.73% and 22.11% had their most recent visit to a health center before 6-12 and 3-6 months, respectively (Table 1).

The median work experience of health care providers involved in this study ranges from three to ten years. The mean scores of affective commitment and job satisfaction were 29.00 and 30.95 (SD=2.08 and 3.17), respectively. The average patient volume was 32.17 per day per care provider, with a range of 19 to 43 (SD=7.83).

Factor analysis

Sampling was adequate as measured by the KMO (0.83), and Bartlett's test of sphericity was significant (p<0.001). Two items were removed from further analysis due to loadings below 0.40, and one item was removed due to low communality. The factor analysis extracted five dimensions that explained 59.25% of the total variation (online supplemental file 1). The item-total score correlations ranged from 0.268 to 0.622, four items had correlations less than 0.40. The dimension intercorrelations ranged from 0.031 to 0.434, all of which were less than the 0.80 criterion, indicating that each dimension was distinct enough to be considered an independent

measure. Dimension-total score correlation ranged from 0.417 to 0.772, all significant at a p-value of 0.001, and are higher than dimension intercorrelations. The scale was tested for reliability and had an overall Cronbach's alpha coefficient of 0.804. The Cronbach's alpha coefficients for the five dimensions exceeded 0.60, except for the access to care subscale, which had an alpha coefficient of 0.531.

Table 1: Independent t-test and one-way ANOVA comparing mean scores of the PQoC (20-100 scale) across respondent characteristics in two districts of northeast Ethiopia, 2021

Variable	Categories	N=1081	%	PQoC score		t/F-test
				M	SD	
Age in years	25 – 44	389	35.99	69.97	7.78	1.08
	45 – 64	555	51.34	70.26	8.52	
	65+	137	12.67	71.20	9.49	
Gender	Men	938	86.77	70.15	8.21	-1.31
	Women	143	13.23	71.13	9.51	
Marital status	Divorced/widowed	78	7.22	71.61	10.95	1.46
	Married	1003	92.78	70.17	8.16	
Attend formal education	No	855	79.09	70.29	8.48	0.07
	Yes	226	20.91	70.24	8.05	
Household size	< Five	403	37.28	70.85	8.63	1.73
	≥ Five	678	62.72	69.94	8.25	
Wealth tertile	Lowest	361	33.40	71.77	9.15	8.83[#]
	Medium	360	33.30	69.36[b]	8.16	
	Highest	360	33.30	69.70[b]	7.62	
Current insurance status	Ex-member	139	12.86	67.66	9.65	-3.96[#]
	Active-member	942	87.14	70.66	8.13	
Perceived health status	Fair	207	19.15	72.28	8.84	8.04[#]
	Good	511	47.27	70.08[b]	7.83	
	Very good	363	33.58	69.41[b]	8.73	
Chronic illness	No	803	74.28	69.54	8.29	-4.96[#]
	Yes	278	25.72	72.40	8.33	
Last health center visit	< 3 months	499	46.16	70.75[b]	8.99	4.78[§]
	3-6 months	239	22.11	70.94[b]	7.60	
	6-12 months	343	31.73	69.13	7.92	

Total	1081	100	70.28	70.28

Statistical significance for t-test/F-test is indicated by $^{\S}p<0.01$, and $^{\#}p<0.001$. Based on Tukey's post-hoc test, mean values sharing letter 'b' are not significantly different in the group at the 5% level.

Perceptions of the quality of care

The minimum and maximum PQoC scores were 37.65 and 97.65, respectively. The mean score was 70.28 (95% CI: 69.77, 70.78) with an SD of 8.39. The aggregated mean score at the health center level ranges from 64.94 to 74.06. Patient-provider communication had the highest mean score (M=77.84, SD=10.12) of the five quality dimensions, while information provision had the lowest score (M=64.67, SD=13.87). The mean score for each measurement item is summarized in the online supplemental file 2.

An independent t-test and a one-way ANOVA were performed to compare the mean scores of PQoC and its dimensions between subgroups. As shown in Table 1, there was a significant difference in the PQoC mean score for wealth tertile at $p<0.05$ (F=8.83, $p=0.001$). Tukey's post-hoc test indicated that the mean score of PQoC for the lowest wealth tertile (M=71.77, SD=9.15) was significantly different from both the medium (M=69.36, SD=8.16) and highest (M=69.70, SD=7.62) wealth tertile. However, no significant difference was seen between medium and high wealth tertile. The ANOVA test also showed that the PQoC mean score showed significant differences based on the respondents' perceived health status and time to a recent visit to a health center, with (F=8.04, $p<0.001$) and (F=4.78, $p<0.01$), respectively. There was a significant difference in the mean score of PQoC between active insurance members (M=3.53, SD=0.41) and ex-members (M=3.38, SD=0.48); t=3.96, $p<0.001$. The mean PQoC score of households with chronic illness (M=3.62, SD=0.42) was also significantly higher compared to those who did not have a chronic illness (M=3.48, SD=0.42); t=4.95, $p<0.001$. The results of an independent t-test

and a one-way ANOVA that compare the differences in mean scores of the five dimensions between subgroups are displayed in Table 2.

Table 2: Independent t-test and one-way ANOVA comparing mean scores of PQoC dimensions (20-100 scale) across respondent characteristics in two districts of northeast Ethiopia, 2021

Variables	N	Technical care		Communication		Information provision		Access to care		Trust in providers	
		M	SD	M	SD	M	SD	M	SD	M	SD
Age in years											
25 – 44	389	68.33	15.61	77.60	9.89	62.75[b]	13.73	69.99	11.64	73.59[b]	10.11
45 – 64	555	68.14	15.19	77.71	10.01	64.60[b]	14.03	69.41	12.04	73.61[b]	10.96
65+	137	69.15	14.44	79.03	11.19	70.36[#]	12.09	68.25	10.97	70.46[§]	13.21
Gender											
Men	938	68.36	15.15	77.67	10.17	64.40	13.80	69.34	11.67	73.18	10.80
Women	143	68.48	16.00	78.93	9.81	66.40	14.27	70.31	12.42	73.38	12.37
Marital status											
Divorced/widowed	78	70.77	14.74	78.80	12.10	70.77[#]	13.58	67.18	13.03	72.31	14.01
Married	1003	68.15	15.27	77.76	9.96	64.19	13.79	69.65	11.65	73.27	10.75
Formal education											
No	855	68.37	15.41	77.78	10.29	64.43	13.98	69.63	11.64	73.39	11.13
Yes	226	68.20	14.62	78.05	9.54	65.55	13.46	68.89	12.24	72.51	10.56
Household size											
< Five	403	69.10	15.21	78.51	10.07	65.14	14.31	70.37	11.25	73.18	11.94
≥ Five	678	67.89	15.25	77.43	10.14	64.39	13.61	68.94	12.04	73.22	10.44
Wealth tertile											
Lowest	361	69.64	14.42	79.56[#]	9.94	70.21[a#]	12.84	68.70	11.49	72.13[a]	13.07
Medium	360	67.11	15.28	76.80[b]	10.57	63.08[a]	14.40	69.00	11.82	73.02[*]	10.45
Highest	360	68.26	15.93	77.13[b]	9.65	60.69[a]	12.54	70.63	11.94	74.46[a]	9.04
Insurance status											
Ex-member	139	64.75[§]	15.73	74.29[§]	12.91	63.13	14.46	67.05[§]	13.56	70.79[§]	13.07
Active-member	942	68.87	15.10	78.36	9.54	64.89	13.78	69.83	11.44	73.56	10.64
Self-rated health											
Fair	207	71.76[b]	13.73	80.35[#]	9.55	70.02[#]	12.87	68.62	11.51	72.59[*]	11.83
Good	511	68.85[b]	14.73	76.73[b]	10.06	63.86[b]	13.95	69.18	11.14	74.16[a]	9.83
Very good	363	65.67[#]	16.31	77.96[b]	10.29	62.74[b]	13.59	70.37	12.71	72.21[a]	11.99
Chronic illness											
No	803	67.39[#]	15.58	77.30[§]	10.35	63.09[#]	13.74	69.13	11.90	73.07	10.94
Yes	278	71.08	13.90	79.38	9.29	69.21	13.26	70.47	11.33	73.60	11.25
Last health center visit											
< 3 months	499	68.08	15.10	78.46	10.25	68.07[#]	13.95	68.88[b]	11.49	71.77[#]	12.20
3-6 months	239	69.71	14.79	77.68	9.97	62.97[b]	12.90	71.67[§]	11.28	75.06[b]	9.31

6-12 months	343	67.76	15.74	77.03	10.02	60.90[b]	13.26	68.80[b]	12.34	73.99[b]	10.01
Total	1081	68.34	15.24	77.84	10.12	64.67	13.87	69.47	11.77	73.20	11.02

Statistical significance for t-test/F-test is indicated by $^{*}p<0.05$, $^{\S}p<0.01$, and $^{\#}p<0.001$. Based on Tukey's post-hoc test, mean values sharing letter 'a' are significantly different; while mean values sharing letter 'b' are not significantly different in the group at the 5% level.

The mean PQoC score was significantly different among health centers (F=11.85, $p<0.001$). The mean scores for the five dimensions were also significantly different among health centers at $p<0.001$ level: technical care (F=8.66), patient-provider communication (F=6.65), information provision (F=47.42), access to care (F=36.87) and trust in care providers (F=6.98). The mean scores of the PQoC and its dimensions across the 12 health centers are depicted using a radar chart (Figure 1). The chart shows a comparison of mean scores on a scale of 10 to 90. For example, respondents from 11 health centers had a higher perception score on patient-provider communication than other dimensions with less variation, while the information provision dimension was mostly ranked lowest with more variability.

Figure 1: Summary of the mean scores of the PQoC and its dimensions across 12 health centers in two districts of northeast Ethiopia, 2021

Predictors of perceived quality of care: Multilevel analysis

The fixed effects (measures of association) and the random effects (measures of variation) for the multilevel linear regression model are depicted in Table 3. In the null model, 8.5% of the total variance in PQoC was attributed to cluster-level variables. The variability between clusters was statistically significant (τ=5.90, $p<0.001$). Furthermore, the null model showed a significant improvement in fit relative to a standard linear model, demonstrating the importance of

developing a multilevel model. The cluster-level variation in Model II remained significant (τ=6.33, p<0.001), with 9.31% of the total variability attributed to differences across clusters. The PCV was negative in this model, indicating that individual-level characteristics did not play a role in explaining the variation between clusters. In Model III, cluster-level variables accounted for just 1.33% of the variation in PQoC across clusters. The PCV showed that cluster-level variables explained 85.42% of the variation between health centers, indicating the importance of including cluster-level characteristics to build a more robust explanatory model. We interpreted the results of the regression analysis using Model IV, which has the lowest DIC and AIC.

After adjusting for other individual and cluster-level factors, the mean PQoC score for households with higher wealth tertile increased by 1.79 points compared to those with lower wealth tertile (b=1.79; 95% CI: 0.37, 3.21). Households who were active members of CBHI at the time of the study had a 2.70-point higher PQoC score than ex-members (b=2.70; 95% CI: 1.25, 4.14). The PQoC score of households who rated their health status as very good was 1.80 points lower compared to those who rated it as fair (b=-1.80; 95% CI: -3.31, -0.29). Compared to households without a chronic illness, those with one or more family members with a chronic illness had a 1.42-point higher perception score (b=1.42; 95% CI: 0.22, 2.63). Time to a recent visit to a health center was also significantly associated with PQoC score. The mean score for households who had their most recent visit to a health center before 3-6 months was 1.89 points higher compared to those whose recent visit was within 3 months prior to the study (b=1.89; 95% CI: 0.61, 3.17).

Regarding cluster-level variables, the average work experience of health care providers and patient volume had statistically significant associations with PQoC. A 1.07-point improvement in the average PQoC score of health centers was noted for every year's increase in the median work experience of health care providers (b=1.07; 95% CI: 0.74, 1.40). An interaction term between patient volume and job satisfaction was positively associated with PQoC, implying that improving staff job satisfaction would buffer or lessen the effect between patient volume and PQoC. At an average staff job satisfaction, a 0.42-point drop in the average PQoC score of health centers was observed for a unit increase in patient volume (b=-0.42; 95% CI: -0.50, -0.33). A one-unit increase in patient volume would only result in a 26% fall in average PQoC if the average job satisfaction is set one SD above the mean. This prediction was substantiated by the fact that the margins graph for patient volume showed the flattest slope for higher job satisfaction. However, the buffering role is observed in health centers with an average patient volume of 30.75 or higher.

Table 3: Multilevel linear regression analysis of factors associated with PQoC among households ever enrolled in a CBHI scheme in two districts of northeast Ethiopia, 2021

Variables		Model I	Model II	Model III	Model IV
	Category		b (95% CI)	b (95% CI)	b (95% CI)
Fixed effects					
Age			-0.02 (-0.06, 0.03)		-0.03 (-0.07, 0.02)
Gender	Women		0.64 (-1.06, 2.34)		0.80 (-0.88, 2.49)
Marital status	Married		-0.14 (-2.42, 2.15)		0.18 (-2.09, 2.45)
Modern education	Yes		-0.07 (-1.34, 1.19)		-0.25 (-1.49, 1.00)
Wealth tertile	Medium		-0.57 (-1.89, 0.74)		-0.16 (-1.40, 1.09)
	High		0.73 (-0.87, 2.34)		1.79 (0.37, 3.21)*
Household size	Large (≥ 5)		-0.28 (-1.28, 0.72)		-0.31 (-1.31, 0.68)
Insurance status	Active member		2.65 (1.20, 4.11)#		2.70 (1.25, 4.14)#
Perceived health	Good		-0.75 (-2.16, 0.66)		-0.73 (-2.14, 0.67)
status	Very good		-1.78 (-3.29, -0.26)*		-1.80 (-3.31, -0.29)*
Chronic illness	Yes		1.55 (0.34, 2.76)*		1.42 (0.22, 2.63)*
Last health center	3-6 months		1.64 (0.35, 2.94)*		1.89 (0.61, 3.17)§
visit	6-12 months		0.77 (-0.45, 1.99)		1.02 (-0.18, 2.21)
Work experience				0.75 (0.33, 1.17)§	1.07 (0.74, 1.40)#
Affective commitment				0.48 (0.04, 1.00)	0.27 (-0.10, 0.65)
Patient volume				-0.33 (-0.45, -0.21)#	-0.42 (-0.50, -0.33)#
Job satisfaction				0.01 (-0.24, 0.27)	0.07 (-0.10, 0.24)
Patient volume x Job satisfaction				0.06 (0.02, 0.11)§	0.05 (0.02, 0.08)§
Random effect					
τ (SE)		5.90 (2.78)#	6.33 (3.10)#	0.86 (0.94)	≈ 0.00
ICC (%)		8.50	9.31	1.33	≈ 0.00
PCV (%)		Reference	-7.29	85.42	≈ 100
Model fitness					
DIC		7578.01	7528.89	7572.79	7516.90
AIC		7584.01	7560.89	7588.79	7558.90

*p<0.05; §p<0.01; #p<0.001; τ - Cluster-level variance, ICC - Intraclass Correlation; PCV - Proportional Change in Variance; DIC - Deviance Information Criterion; AIC - Akaike Information Criterion; SE – standard error; b - regression coefficient; CI – Confidence Interval.

DISCUSSIONS

Individuals with health insurance will continue to be members if they believe they are receiving the highest possible quality of health care. [19 20] In this study, the mean PQoC score was 70.28 on a scale of 20-100 with an SD of 8.39. The patient-provider communication received the highest score (M=77.84, SD=10.12) among the five quality dimensions. In 2015, the Ethiopian government incorporated the development of caring, respectful, and compassionate health care providers as one of the main transformation agendas in its five-year health sector strategic plan, and movements were created around it.[27] Our finding may be attributed partly to the government's ongoing training initiatives aimed at producing health care providers who are competent in this aspect. The perception score for the information provision dimension, on the other hand, was the lowest (M=64.67, SD=13.87). This could be attributed to an increase in patient volume following the implementation of CBHI.[26] Items loaded under this dimension appear less practical in the presence of a larger patient load. If health care providers are required to treat a large number of patients, consultation times will be reduced. They are unlikely to provide the necessary information to their clients if they are under time constraints. Regarding item level observations, waiting time and medicine availability received the lowest perception scores (62.96 and 63.50, respectively), which could also be related to increased patient load. This is in line with earlier studies in Ethiopia, which revealed that clients with health insurance

frequently complain about a lack of medicine and long wait times at CBHI-affiliated health facilities.[43 44]

Results of the regression analysis revealed that households with higher wealth tertile had a higher PQoC score than those with lower wealth tertile. This is in contrast to other studies whereby the richest group had a lower perception score.[16 45] This discrepancy could be partly attributed to the use of different metrics to assess the quality of care. People with higher economic status may be more aware of health issues and able to bargain with health care providers to obtain the best possible care. Furthermore, if prescribed medicines are not available in CBHI-affiliated health facilities, for instance, they can afford to buy from private pharmacies. On the contrary, it may be irritating for people with lower economic status to buy medicines with limited money or to forgo treatment due to lack of money. In this regard, they may develop a negative perception of the quality of care.

Households who were active members of CBHI at the time of the study had a higher rating of PQoC compared to ex-members. Contrary to our finding, a study in Ghana showed that previously insured clients had a higher perception of quality of care compared to actively insured clients (statistical significance is not reported). The authors argue this was due to the more time-consuming nature of the service delivery processes for insured clients.[46] At least three possible explanations exist for the relationship between CBHI status and PQoC. First, because they do not have to pay for health care, active members have better access to and enjoyment of its benefits, resulting in a favorable perception of its quality. Second, the relationship could be due to an

endogeneity issue created by omitted variables. It is plausible that higher quality score reported by active members is due to such variables, as the desire to continue their membership. Third, ex-members of CBHI may have had negative experiences with health services, which led to the decision to discontinue their membership. As a result, they would be critical in rating the quality of care provided. In support of the latter argument, it was evidenced that poor quality of care was a major reason for insurance members to leave the scheme.[24 47] Elsewhere, a statistically significant association was also reported between dropout and low quality of care.[48 49]

This study verified that the PQoC score of households who rated their health status as very good was significantly lower compared to those who rated it as fair. The households' chronic illness experiences also influence the PQoC rating. The PQoC score of households with a chronic illness was higher compared to those without a chronic illness. This may be true for people who perceive their health as fair or who live with chronic conditions to appreciate the gains or benefits of the health care they received. In this respect, they may be more likely to rate the quality of care higher than their counterparts.

The results also indicated that households who had their most recent visit to a health center before 3-6 months had higher PQoC scores compared to those whose recent visit was within 3-months prior to the study. Patients may experience varying levels of emotional highs and lows, depending on the length of the most recent facility visit. Although patients' perceptions of quality may develop over time,[5] patients who recently visited a health facility may be more critical of the

quality of care due to strong emotions attached to negative events or health services that fall short of their expectations.

Our findings revealed that the average work experience of health care providers was positively associated with PQoC. Work experience is linked to task specialization, which can lead to a faster work pace, more output in less time, and higher quality. Providers with more experience take less time to make diagnoses and treatment decisions, while still providing recommended practical aspects of care, such as good communication, physical examination, and provision of relevant health information.[50] As a result, they can reduce waiting times, and their management outcomes may be more effective than inexperienced providers. This could be more pronounced in Ethiopia where there has been a sharp rise in outpatient visits to CBHI-affiliated health centers.[26]

Conditional to the average staff job satisfaction, patient volume is negatively correlated with PQoC. A study in Ethiopia identified a non-linear significant association (an inverted U-shape) between patient volume and quality. Quality decreased with increasing patient volume in health facilities that treated 90.6 or more patients per day, while quality increased with increasing patient volume in health facilities that treated less than 90.6 patients per day in the outpatient departments.[51] Our finding is consistent with a study at public hospitals in China where overcrowding was negatively associated with clients' perception of quality of care.[31] The apparent correlation between patient volume and PQoC could be explained by factors such as increased demand for health care providers and longer wait times. An increased patient volume

would put a great deal of pressure on health care providers to treat a large number of patients in a short time. This may result in shorter consultation time and the omission of important practical aspects of care. On top of that, an increase in patient volume would mean longer waiting times at various service delivery points. Both these factors could have contributed to a negative patient experience and influenced their perception of overall quality of care. Some studies reported a positive relationship between patient volume and quality of basic maternal care, and postoperative infections.[52 53] The alternative direction of this relationship, in which quality drives patient volume, is based on the assumption that the provision of high-quality care will attract more patients. This may be true in areas where patients have access to competitive health facilities, and health care providers are incentivized for providing higher quality care. This is not the case in low-income countries, like Ethiopia, where health care facilities are hard to reach for most rural populations. Members of CBHI are further limited to using health services only in public health facilities affiliated with the scheme.

This study found no significant association between staff job satisfaction and PQoC. This contrasts with the findings of Kvist et al. 2014, which reported a positive relationship between job satisfaction among the nursing staff and patients' perceptions of quality of care.[54] Despite this, it moderates the relationship between patient volume and PQoC in a nonlinear fashion. Improved job satisfaction buffers the negative relationship between patient volume and PQoC in health centers with an average patient volume of 30.75 or higher. When the average patient volume is less than 30.75, however, improving job satisfaction enhances the effect between patient volume and PQoC. The buffering role of service providers' job satisfaction at higher patient volume may

indicate that job satisfaction is the result of intrinsic rewards for higher work performance. Providers may also be fully available during working hours at the health facility due to the increased number of clients. On the other hand, the moderating role in enhancing the relationship at lower patient volume may suggest that a low workload is one source of job satisfaction. Because clients are in small numbers, providers may not be fully engaged during working hours. They may have the freedom to do other businesses outside the health facility, leaving patients unattended and dissatisfied.

The findings of this study will be an essential input for quality improvement initiatives as well as addressing challenges in the country's efforts to establish higher-level insurance pools. This is the first study of its kind to consider cluster-level variables associated with PQoC in Ethiopia. It gives an important lesson to healthcare managers and other relevant stakeholders to consider cluster-level characteristics in healthcare quality improvement efforts. It also pointed out quality dimensions that require special consideration in managerial decisions. Despite the significant findings of the current study, some caution should be taken in interpreting the findings. One noteworthy limitation of this study is the use of relatively small cluster sample size. In this study, only 12 health centers (level-two units) were included to assess the role of cluster level variables on the outcome variable. Concerns have been raised about the accuracy of estimates in multilevel modelling when there is small number of clusters. However, we employed the Restricted Maximum Likelihood estimation method, which could substantially improve the accuracy of estimates.[40] Second, due to the cross-sectional nature of the data, the analysis was conducted to identify associations rather than prove causation. Third, the association between

current insurance status and PQoC could be due to the possibility of endogeneity. Fourth, patient volume data based on secondary data may not reflect the true figure due to the possibility of under or over-reporting.

CONCLUSIONS

Despite encouraging findings on patient-provider communication, much work remains to be done to improve information provision and access to care quality dimensions. According to the findings, people's perceptions of quality of care varied depending on a variety of individual and cluster-level factors. The household's wealth status, current insurance membership, perceived health status, presence of chronic illness in the household, and time to a recent visit to a health center were individual-level predictors of PQoC. At the cluster level, patient volume and work experience of health care providers were associated with PQoC. A lower patient volume allows the health care provider to devote more time and attention to each patient, address the individual patient's needs, and have more time to improve communication with and provide behavior change counseling, which has an impact on the quality of care.[55] Therefore, to ensure that patients have access to a better quality of care, it is critical to determine an appropriate patient volume per care provider. Staff job satisfaction was an important factor that buffers the effect between patient volume and PQoC. Hence, it is vital to devise mechanisms to improve staff job satisfaction, especially in health facilities with higher patient volumes. More importantly, health centers should go to great lengths to ensure that every patient has access to the necessary

medications. This will boost clients' trust in health care providers, which will be critical for health insurance schemes to retain and attract members.

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Contributors

MH conceptualized the study, designed the study, collected the data, analyzed and interpreted the data, and drafted the manuscript. MA and NBB contributed to survey design, data collection, and statistical analysis and reviewed the manuscript. All authors read and approved the final manuscript.

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Ethics approval Ethical approval was obtained from the Institutional Review Board (IRB) of the College of Medicine and Health Science, Bahir Dar University with protocol number 001/2021. A support letter was communicated to the district health offices to gain entry permission into the community where the research was conducted. Before the interview, verbal informed consent

was secured from each of the study participants. Confidentiality was assured by collecting anonymous information and informing the participants that personal identifiers would not be revealed to a third party.

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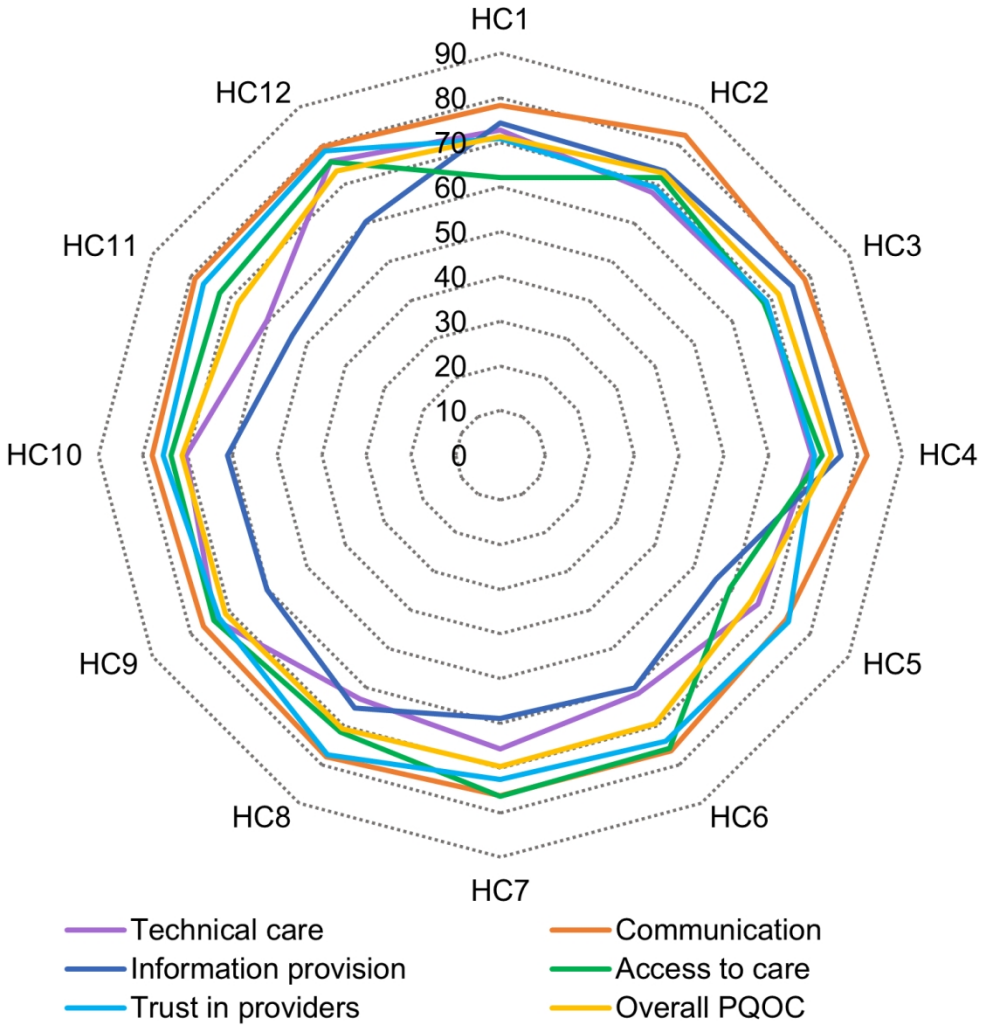

Figure 1: Summary of the mean scores of the PQoC and its dimensions across 12 health centers in two districts of northeast Ethiopia, 2021

130x135mm (300 x 300 DPI)

Supplementary file 1: Factor analysis of the measurement scale to assess the perceived quality of care among households ever enrolled in a CBHI in two districts of northeast Ethiopia, 2021

Dimensions and items	Loadings under each dimension				
	1	2	3	4	5
Technical care					
The necessary laboratory tests were performed	0.911				
Health care providers perform the necessary physical examinations	0.818				
Health care providers make a good diagnosis	0.740				
Patient-provider communication					
Health care providers actively ask questions to understand your situation		0.846			
Health care providers listened to you carefully what you had to say		0.845			
Health care providers treated you with courtesy and respect		0.542			
Information provision					
Health care providers clearly explained the use and side effects of medicines			0.787		
Health care providers clearly explained the results of tests and examination			0.760		
Health care providers explain things in a way you could understand			0.672		
Health care providers spent sufficient time examining patients			0.510		
Access to care					
Patients do not wait long in the health center to receive treatment				0.799	
All prescribed medicines are available on the spot				0.624	
Health center assistants are friendly and helpful to patients				0.559	
The health center serves all patients fairly				0.463	
Trust in care providers					
Treatment is effective for recovery and cure					0.754
Health care providers prescribe appropriate medicines for patients					0.672
You have confidence in the competence of health care providers					0.662

Supplementary file 2: Mean score of each measurement item of the perceived quality of care (20-100 scale) among households ever enrolled in a CBHI in two districts of northeast Ethiopia, 2021

Factors and items			95% CI	
	Mean	SD	LCI	UCI
Technical care	**68.34**	**15.24**	**67.43**	**69.25**
The necessary laboratory tests were performed	69.20	18.36	68.10	70.29
Health care providers perform the necessary physical examinations	68.23	18.89	67.11	69.36
Health care providers make good diagnoses	67.59	17.69	66.53	68.64
Patient-provider communication	**77.84**	**10.12**	**77.23**	**78.44**
Health care providers actively ask questions to understand your situation	80.39	11.68	79.69	81.09
Health care providers listened to you carefully what you had to say	79.61	10.93	78.96	80.26
Health care providers treated you with courtesy and respect	73.51	16.72	72.51	74.50
Information provision	**64.67**	**13.87**	**63.84**	**65.49**
Health care providers clearly explained the use and side effects of medicines	62.90	19.87	61.72	64.09
Health care providers clearly explained the results of tests and examination	62.50	19.48	61.34	63.66
Health care providers explain things in a way you could understand	69.36	17.42	68.32	70.40
Health care providers spent sufficient time examining patients	63.90	20.18	62.70	65.11
Access to care	**69.47**	**11.77**	**68.77**	**70.17**
Patients do not wait long in the health center to receive treatment	62.96	20.17	61.76	64.16
All prescribed medicines are available on the spot	63.50	20.37	62.28	64.71
Health center assistants are friendly and helpful to patients	73.38	16.07	72.42	74.34
The health center serves all patients fairly	78.06	15.90	77.11	79.01
Trust in care providers	**73.20**	**11.02**	**72.55**	**73.86**
Treatment is effective for recovery and cure	72.47	14.78	71.59	73.35
Health care providers prescribe appropriate medicines for patients	75.47	12.90	74.70	76.24
You have confidence in the competence of health care providers	71.67	14.36	70.82	72.53
Overall perceived quality of care (PQoC)	**70.28**	**8.39**	**69.77**	**70.78**

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	2
		(*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	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6, 7
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	11, 12
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	7, 8
Bias	9	Describe any efforts to address potential sources of bias	*6*
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	9, 10
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9, 10
		(*b*) Describe any methods used to examine subgroups and interactions	11
		(*c*) Explain how missing data were addressed	NA
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	10
		(*e*) Describe any sensitivity analyses	NA
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	13
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	13, 15
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	15
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	16, 17
		(*b*) Report category boundaries when continuous variables were categorized	NA
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	20
Discussion			
Key results	18	Summarise key results with reference to study objectives	20, 21-26
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	26
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	21-26
Generalisability	21	Discuss the generalisability (external validity) of the study results	26
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	27

*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.