ORIGINAL RESEARCH

Community-Based Health Insurance Enrollment and Child Health Service Utilization in Northwest Ethiopia: A Cross-Sectional Case Comparison Study

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Purpose: Utilization of primary healthcare services in the rural communities of Ethiopia is very low. The Ethiopian government has introduced community-based health insurance (CBHI) to improve the health service utilization of the rural community. Thus, this study was conducted to examine the association between CBHI enrollment and child health service utilization in northwest Ethiopia.

Patients and Methods: A cross-sectional case comparison study among CBHI enrolled and unenrolled households was conducted. A total of 226 sick children from 2008 surveyed households were included in the study. Bivariate-probit regression analysis was employed to account the endogenous nature of insurance enrollment and child health services utilization.

Results: The results showed that the overall sick child healthcare visit in the CBHI enrolled group was about 0.44 (44%) point more compared to those unenrolled households. CBHI enrolled households in the poorest wealth group have a higher probability of visiting healthcare facilities for their sick children (coefficient: 0.13, SD: 0.07, 95% CI: −0.01, 0.27), whereas CBHI enrolled households with older age household head have a lower probability of visiting healthcare facilities for their sick children (coefficient: −0.16, SD: 0.08, 95% CI: −0.32, 0.01).

Conclusion: A promising positive effect on sick children's health services utilization among CBHI enrolled was noticed. Moreover, households in the poorest wealth status and older age head affect the use of sick children's healthcare services among those CBHI enrolled. Therefore, policy measures to expand benefit packages and supply-side interventions are essential to enhance the effects of CBHI on different health service utilization.

Keywords: health insurance, child health services utilization, bivariate-probit regression, northwest Ethiopia

Introduction

Many low- and middle-income countries (LMICs) are seeking ways to attain the goal of universal health coverage (UHC) by securing access to adequate healthcare for all at an affordable price.[1] Recently, the Ethiopian government has introduced various measures to implement community-based health insurance (CBHI) to reach and cover the vast agricultural sector and urban informal sector, to improve access to health services and to reduce health-related out-of-pocket payments (OOPs).[2–4] However, empirical evidence on the association between CBHI enrollment and

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child health service utilization is insufficient. Treatment seeking behaviors for a sick child is relatively low in Ethiopia.[5]

Many healthcare financing related studies in Africa have attempted to assess whether and to what extent CBHI schemes facilitate healthcare services utilization. Findings showed inconsistencies with the association between CBHI enrollment and different health service utilization; some revealed CBHI improves health services utilization[1,6-10] and others revealed no effect.[11]

Study findings from Burkina Faso and India suggested that CBHI increase use of health service for the members.[12,13] Moreover, a study in Ethiopia during the pilot CBHI implementation showed that participation improved outpatient health services utilization.[4] Studies among mutual health insurances in Rwanda identified that membership in joint health insurances is significantly associated with the increased use of health services and a higher degree of financial risk protection.[14,15] Another study in Burkina Faso revealed that there was no difference in healthcare utilization between members and non-members if they are living far from health facilities.[11]

Many of the existing studies about the effect of CBHI on health services utilization face significant limitation that most of them mainly examine its effect either with inpatient or outpatient healthcare utilization and largely neglecting its impact on sick children's healthcare use.[14–16] Therefore, this study was aimed to assess the association between CBHI enrollment and the utilization healthcare services for those sick children in northwest Ethiopia.

Patients and Methods
Study Design and Setting

A cross-sectional case comparison design with quantitative (household survey linked with health facility survey) method was employed to examine the association between CBHI enrollment and sick children health services utilization in north Gondar zone, northwest Ethiopia from December 2016 to March 2017. North Gondar zone consists of 23 districts which consist of 610 kebeles (the smallest administrative unit) with a total population of 3,514,247 and more than 80% of them were dwell in rural areas. Of those, more than 50% were under five children. Of the total population, almost 9.5% of the households enrolled in CBHI.

The comparisons were CBHI enrolled households and unenrolled (control) households both from districts where CBHI has been implemented. Initially, five districts were selected using lottery method and the survey included all the households in the districts. The household survey covered 2008 households across 15 clusters in the selected five districts. Out of a total of 2008 surveyed households, 226 households with at least one sick child four weeks before the sample collection period were included in the sample of analysis for a sick child's healthcare services visit. Moreover, if there were more than one sick child in the household, a child with a recent disease occurrence was selected and included in the study.

Variables and Measurements

The dependent variable of the study was the utilization of child health services. It was measured based on the child health services uptake/visits during the recent illness. Accordingly, if a sick child visited the health facility at least once, we considered them as "utilized" the child health services; if a sick child did not have any visit, we considered as "non-utilized". The child health services included all preventive and curative outpatients and impatient services except for the few chronic diseases; hemodialysis, transplantation and others which were not included under the benefit packages of community-based health insurance in Ethiopia.[17] Whereas the independent variables were sociodemographic and economic characteristics (wealth index), perceived health status, history of chronic disease, child characteristics, perceived quality of health services, being a membership in the local credit and religious group, and presence of essential drugs which includes Oral Rehydration salt (ORS), and equipment's that could be used for laboratory analysis and other (laboratory chemistry analyzer, thermometer, and others) for child service provision in the healthcare facility.

Wealth index is based on the assumption that wealth or economic status is a latent variable. We assume that economic status is the common factor behind the ownership of the assets, such that household economic status explains the maximum variance and covariance in the asset variables. It was calculated as an index based on the consumer goods and household characteristics. These scores were derived using principal component analysis and ranked into five (poorest, poorer, middle, richer, and richest). The wealth quintiles are expressed in terms of quintiles of individuals in the population rather than quintiles of individuals at risk for anyone's health or population indicator.

Perceived health status was assessed by asking the respondents and they rated their health status as poor, medium or good, whereas perceived quality of health services was assessed by asking the respondents and they were rate the quality of health services as poor, medium or good.

Data Collection Tools and Procedures

An interviewer-administered standardized structured questionnaire was adapted and used after reviewing different studies and guidelines.[12,14,15,18–22] The tool was initially adapted in English and then translated into the local language (Amharic) and finally back to English to ensure its consistency. Eight trained degree Nurses and five Public Health Officers were recruited as data collectors and supervisors, respectively, from the University of Gondar specialized hospital. During the data collection process, supervisors have checked the data accuracy, consistency, and completeness daily.

Data Quality Control

Before data collection, a day training for data collectors and supervisors was given on the study objectives, data collection instruments, techniques, and producers. Data collectors were supervised daily, and every night, the consistency and completeness of data were checked by the principal investigator (PI). A pretest was conducted on 100 households in South Gondar zone (which is one of the neighbour zones and having almost similar characteristics). Finally, all findings from the pretest were incorporated into the final questionnaire, and necessary amendments were done before the survey.

Data Analysis and Modelling

After appropriate data cleaning and coding, the data were entered to Epi-Data version 3.1 and exported to STATA version 14 for analysis. The level of analysis for this study was households as enrollment in CBHI is at household level in Ethiopia. Sick children's healthcare visits were treated as a binary outcome variable ("1 for healthcare visit" and "0 otherwise").

Regarding the association between health insurance enrollment and healthcare use, studies[9] reflect the potential endogenous nature of the choice of insurance and healthcare use as the main problem, leading to the potential selection bias. Individuals who self-select them to the insurance program may have unobservable characteristics related to preference or health status (adverse selection)

that makes it more likely for them to join the program and also influence their decision to use healthcare services. Therefore, an observed association between health insurance status and healthcare use may not be due to insurance, but due to an underlying unobservable characteristic. Hence, classical logit/probit regression analysis may provide over/underestimated insurance effect.

Therefore, in this study, bivariate probit regression analysis was employed to account for the endogenous nature of insurance enrollment. The model provides a convenient setting for estimating the effect of an endogenous binary regressor on a binary outcome variable in non-experimental empirical studies.[23,24] In the case of bivariate probit regression, two binary response variables are varying jointly, and we want estimated coefficients to account for the joint distribution. In this analysis, insurance enrollment and healthcare visits were an endogenous binary regressor and outcome variables, respectively. So, applying classical logistic/probit regression analysis may provide biased estimates and will end up with the wrong conclusion. In the case of continuous outcome and predictor variable: instrumental (IV) variable and regression discontinuity (RD) methods can be applied to deal with endogeneity problems.[25] However, a regression with a binary outcome and binary regressor presents particular difficulties and instrumental variables solution may not be apparent, mainly when the endogenous regressor is binary.[25] The bivariate probit model is recommended in health economics studies when one wants to estimate the effect of treatment on a binary healthcare use[23,26-32] Therefore, in this study, we applied the bivariate probit model to predict the effect of CBHI enrollment on child health services utilization. First, the model assessed the households' CBHI enrollment status and self-rated health and socioeconomic predictor variables used as a control. Second, the conditional probability of the enrolment to CBH and different supply and demand-side factors that affect CBHI enrolment, and finally, the model determined the marginal effect of the binary endogenous regressor after bivariate-probit regression using margins in Stata. The percent of marginal effects as an average treatment effect with a 95% CI and a p-value of less than 0.05 were used to determine statistically significant association between healthcare utilization and the independent variables.

Ethical Considerations

Ethical clearance was obtained from the Ethical Review Board of the University of Gondar. Support letters were

obtained from the Amhara regional state health bureau. Permission was sought from the clusters/kebele administration before conducting the study. A brief explanation of the risk and benefit of the study was given to the study participants and they had the right to withdrawal at any time. Then, written consent was obtained from each participant before the actual data collection. Confidentiality and anonymity of study participants were safeguarded throughout the entire study by using a non-personal identifier and finally, the study was conducted in accordance with the declaration of Helsinki.

Results
Descriptive Results
Out of 2008 surveyed households, there were 226 (11.3%) sick children one month before the survey period. Out of 226 children, 194 (86%) sought healthcare service at a public facility, and the rest 32 (14%) did not visit. Out of 194 sick children who visited a health facility, 106 (54%) were from CBHI enrolled households and the remaining 88 (46%) were from CBHI unenrolled households. Around 45% of the sick children were from illiterate families, and majority (91.6%) were from rural. More than 60% of service user were from middle and above household wealth status. The mean household size of the sick children's healthcare users was lower compared to non-users 5.1 (SD: 1.82) and 5.6 (SD: 1.89), respectively (Table 1).

CBHI Enrollment and Child Health Services Utilization
Community-based health insurance enrollment showed a positive association with sick children's healthcare visits. Perceived healthcare quality also indicates a positive probability of association with sick children's healthcare visits. However, the older the household age shows a negative correlation with sick children's healthcare visits. In this table, the final line shows, the correlation coefficient (ρ) of the joint distribution of equation one and two is different from zero and statistically significant, which is an indication of the presence of endogeneity in the joint distribution (Table 2). Therefore, the application of classical probit/logit regression analysis would have introduced bias and ended up with the wrong conclusions.

Marginal Effects of Predictor Variables on Sick Children's Healthcare Visit
Community-based health insurance enrollment increases the probability of a household's healthcare facility visit for sick children by 0.44 (44%) points controlled for other predictor variables. Moreover, when the age of the household head is above 50 years, the probability of visiting a healthcare facility for their sick children is decreased by 0.16 (16%) points compared to the younger household head in the age of 18 to 30 years. Moreover, households in the poorest wealth group have a 0.13 (13%) point higher probability of visiting healthcare facilities for their sick children than the richest one (Table 3).

Summary of the Effect of CBHI Enrollment on Sick Children's Healthcare Visits
Community-based health insurance enrollment in the study area showed a promising positive association with sick children's healthcare visits with marginal effect of 0.44 (44%) point (SD: 0.05, p-value <0.001, and 95% CI: 0.29–0.58). Therefore, the extent of the impact on health services utilization for sick children's health services is high that should include all other CBHI unenrolled households in the study area.

Discussion
This study used bivariate probit regression analysis and revealed the correlation between CBHI enrollment and sick child healthcare utilization in northwest Ethiopia. The result demonstrated that CBHI enrollment has a positive association with sick children's healthcare visits. This finding is similar to different studies that indicate participation in insurances improves utilization of child health services. A study in Burkina Faso showed that there was a strong positive effect of community-based health insurance enrollment of parents and reduction in child mortality as a result of increased utilization of health services.[33] Another study conducted in the Philippines also revealed that child health outcomes and insurance coverage have a positive relation.[34]

Our finding showed that children from the poorest wealth status of households were more likely to visit the healthcare compared to the richest. This finding is in disagreement with different study findings that revealed wealth status as an indirect measure of the relative income of the households, which positively correlates with various healthcare utilization and health outcome measures.[35–37] Our finding may be justified, in the rural Ethiopian context, public health posts and health centers are the primary healthcare service providers. The services at the public health posts and health centers are accused of low quality, but the service charges are minimal. Therefore, even

Table 1 Descriptive Statistics on CBHI Enrollment and Sick Child Health Service Utilization in Northwest Ethiopia, 2017 (n=226)

Explanatory Variables	Categories	Child Health Service Utilization		Total
		Yes	No	
		n (%)	n (%)	
CBHI	Yes No	106 (95.5) 88 (76.5)	5 (4.5) 27 (23.5)	111 115
Sex	Male Female	134 (84.8) 60 (88.2)	24 (15.2) 8 (11.8)	158 68
Age of household head in years	18–30 31–40 41–50 50+	65 (91.5) 61 (87.1) 41 (82.0) 27 (77.1)	6 (8.5) 9 (12.9) 9 (18.0) 8 (22.9)	71 70 50 35
Residence	Rural Urban	177 (85.5) 17 (89.5)	30 (14.5) 2 (10.5)	207 19
Education	Illiterate/No education Read and write Elementary school (grade 1–4) Elementary school (grade 5–8) Secondary school (grade 9–12)	91 (90.0) 61 (81.3) 17 (85.0) 18 (85.7) 7 (77.8)	10 (10.0) 14 (18.7) 3 (15.0) 3 (14.3) 2 (22.2)	101 75 20 21 9
Marital status	Single Married Divorced Widowed	4 (80.0) 178 (87.3) 9 (81.8) 3 (50.0)	1 (20.0) 26 (12.7) 2 (18.2) 3 (50.0)	5 204 11 6
Occupation	Farmer Merchant Day laborer Petty trader	169 (87.1) 8 (66.7) 7 (87.5) 10 (83.3)	25 (12.9) 4 (33.3) 1 (12.5) 2 (16.7)	194 12 8 12
Self-rated health status	Poor Medium Good	13 (68.4) 119 (90.8) 62 (81.6)	6 (31.6) 12 (9.2) 14 (18.4)	19 131 76
Perceived quality of health service	Poor Medium Good	32 (84.2) 62 (83.8) 100 (87.7)	6 (15.8) 12 (16.2) 14 (12.3)	38 74 114
Family size (mean)	5.6 (SD: 1.89)			
Chronic disease	No Yes	129 (87.2) 65 (83.3)	19 (12.8) 13 (16.7)	148 78
Elderly above 65 years	No Yes	182 (86.7) 12 (75.0)	28 (13.3) 4 (25.0)	210 16
Wealth index	Poorest Poorer Middle Richer Richest	31 (91.2) 43 (91.5) 36 (85.7) 39 (84.8) 45 (78.9)	3 (8.8) 4 (8.5) 6 (14.3) 7 (15.2) 12 (21.1)	34 47 42 46 57

Abbreviations: CBHI, community-based health insurance; SD, standard deviation.

Table 2 Bi-Probit Regression Result of Sick Children's Healthcare Visit and CBHI Enrollment in Northwest Ethiopia, 2017 (n=226)

Explanatory Variables			Coef.	Std. Err.	P-value	[95% CI]
	Equation 1: Sick Children Healthcare Visit					
CBHI2	No	Ref.				
	Yes		2.11	0.26	0.00*	1.59, 2.63
Wealth index	Poorest		0.65	0.36	0.12	−0.05, 1.36
	Poorer		0.24	0.34	0.53	−0.42, 0.89
	Middle		−0.22	0.31	0.54	−0.83, 0.39
	Rich		−0.42	0.32	0.23	−1.04, 0.19
	Richest	Ref.				
Radio	No	Ref.				
	Yes		0.43	0.29	0.12	−0.14, 1.03
Perceived quality of health service	Poor	Ref.				
	Medium		0.04	0.28	0.11	0.55, 0.56
	Good		0.15	0.28	0.63	0.69, 0.39
Family size	<5	Ref.				
	≥5		−0.33	0.23	0.21	−0.78, 0.13
Educational status	Unable to read and write	Ref.				
	Able to read and write		−0.15	0.26	0.62	−0.65, 0.35
	Elementary school (1–4)		0.19	0.38	0.65	−0.55, 0.93
	Elementary school (5–8)		−0.31	0.37	0.43	−1.03, 0.40
Age in years	18–30	Ref.				
	31–40		−0.37	0.27	0.24	−0.89, 0.16
	41–50		−0.4	0.31	0.22	−1.02, 0.21
	50+		−0.68	0.34	0.00*	−1.34, 0.02
_cons			0.41	0.37	0.33	−0.32, 1.14
CBHI2	**Equation 2: CBHI Enrollment**					
Age in years	18–30	Ref.				
	31–40		0.42	0.27	0.12	−0.11, 0.94
	41–50		0.32	0.33	0.33	−0.33, 0.97
	50+		0.18	0.35	0.61	−0.51, 0.86
Sex	Male	Ref.				
	Female		−0.34	0.24	0.20	−0.81, 0.14
Educational status	Unable to read and write	Ref.				
	Able to read and write		−0.08	0.23	0.70	−0.53, 0.38
	Elementary school (1–4)		−0.52	0.37	0.20	−1.26, 0.21
	Elementary school (5–8)		0.07	0.36	0.90	−0.64, 0.78
	Secondary school (9–12)		−0.88	0.65	0.21	−2.15, 0.39
Wealth index	Poorest		−0.35	0.37	0.32	−1.08, 0.38
	Poorer		0.21	0.31	0.51	−0.40, 0.82
	Middle		0.26	0.31	0.40	−0.36, 0.87
	Rich		0.65	0.29	0.00	0.07, 1.22
	Richest	Ref.				
Family size	<5	Ref.				
	≥5		−0.11	0.2	0.60	−0.49, 0.29

(Continued)

Table 2 (Continued).

Explanatory Variables		Coef.	Std. Err.	P-value	[95% CI]
	Equation 1: Sick Children Healthcare Visit				
Radio	No Yes	Ref. 0.25	0.25	0.30	0.25, 0.74
Self-rated health status	Poor Medium Good	Ref. 0.57 −0.06	0.3 0.33	0.10 0.90	−0.03, 1.16 −0.71, 0.59
Perceived quality of health service	Poor Medium Good	Ref. −0.05 0.43	0.3 0.28	0.92 0.10	−0.63, 0.53 −0.12, 0.98
Thermometer health center	Yes No	Ref. −0.31	0.24	0.20	−0.78, 0.15
Local credit membership	No Yes	Ref. 0.02	0.2	0.92	−0.37, 0.40
Analyzer chemistry	Yes No	Ref. 0.67	0.28	0.00	0.12, 1.22
Religious group membership	No Yes	Ref. 0.45	0.24	0.11	−0.02, 0.92
_cons		−0.94	0.58	0.11	−2.12, 0.20
/athrho		−1.43	0.66	0.00*	−2.71, −0.14
rho		−0.89	0.14		−0.99, −0.14
Observation		226			
Wald test of rho=0 chi2(1) = 4.72223 Prob > chi2 = 0.02					

Note: *Statistically significant at p-value <0.05.
Abbreviations: Coef., coefficient; Std. Err., standard error; Ref, reference category; CI, confidence Interval.

though the better-off households have CBHI membership due to the poor quality of the service, they may prefer visiting private health facilities or travel a long distance to find a better health service provider. However, the poor without other options frequently visit public health posts and health centers. This finding could be used as an opportunity for further researches in rural Ethiopia with related to the quality of services provided by health posts and health center and healthcare use.

Moreover, in this study, those who were unable to read and write have a better chance of visiting health facilities than those who can read and write. This finding is in disagreement with a study conducted in the California community of predominantly low-income immigrant families shows a mother with non-enrolled children appeared to have informal education.[22] The possible justification in our finding might be as low quality of health

services at CBHI contracted health facilities may lead the educated households to look for other options.

Our study showed that older age of the household head has a negative association with sick children healthcare visits. This finding is in contrast with that of a study conducted at Gida Ayana district households with older age groups were utilized more healthcare services,[38] and a survey conducted in Chandranigahapur Hospital, Nepal showed that houses having greater than 60 years were found significantly associated with enrolment in CBHI scheme and services utilization.[39] This difference might be explained in our study the older household head has a lower probability of visiting healthcare facilities for their sick children, and this may be justified as elder household heads may prefer to use their life experience to treat their sick children at home rather than bringing them to a health facility. Moreover, older household heads could have

Table 3 Marginal Effects of Predictor Variables on Sick Children's Healthcare Visit in Northwest Ethiopia, 2017

Variables	Response	Healthcare Visit dy/dx	Std. Err.	P-value	[95% CI]
CBHI2	No	Ref.			
	Yes	0.44	0.05	0.00*	0.29, 0.58
Wealth index	Poorest	0.13	0.07	0.05*	−0.01, 0.27
	Poorer	0.05	0.07	0.47	−0.09, 0.19
	Middle	−0.05	0.07	0.48	−0.19, 0.09
	Rich	−0.10	0.08	0.22	−0.26, 0.06
	Richest	Ref.			
Perceived quality of health service	Poor	Ref.			
	Medium	−0.02	0.06	0.76	−0.15, 0.11
	Good	−0.05	0.07	0.53	−0.19, 0.09
Radio	No	Ref.			
	Yes	0.09	0.09	0.26	−0.07, 0.26
Family size	<5	Ref.			
	≥5	−0.07	0.08	0.32	−0.22, 0.07
Educational status	Illiterate	Ref.			
	Reda and write	−0.03	0.06	0.66	−0.14, 0.09
	Elementary (1–4)	0.02	0.09	0.82	−0.15, 0.19
	Elementary (5–8)	−0.08	0.09	0.38	−0.25, 0.09
	Secondary and above	0.25	0.32	0.42	−0.37, 0.87
Age in years	18–30	Ref.			
	31–40	−0.08	0.06	0.17	−0.19, 0.04
	41–50	−0.09	0.07	0.21	−0.23, 0.05
	50+	−0.16	0.08	0.05*	−0.32, 0.01

Note: *Statistically significant at p-value ≤0.05.

a different reason for not bringing their sick child to the health facility, for instance, unable to travel, shortage of money for accommodation and other costs.

Generally, CBHI enrollment has a positive association with the use of sick children's healthcare services in the study area and the combined effect of demand-side (CBHI enrollment) and supply-side factors in terms of availability of health centers in a short radius possibly increase the chance of healthcare visits among enrolled households.

Contributions and Limitations of the Study

Overall, this study expected to contribute to the limited research on the association between CBHI and child healthcare use in Ethiopia. Moreover, this study also provides pieces of evidence for an evidence-based policy decision before the nationwide implementation of CBHI and social health insurance in Ethiopia.

The primary limitation of this study might be an introduction of selection bias due to the differences in risks/ health status between the CBHI members and non-members. However, we applied the bivariate probit model; a model recommended to control a binary endogenous regressor and have been used in health economics studies,[23] so that we can causally interpret the results. Moreover, the cross-sectional nature of our data may pause a challenge to causally interpret our result, and it can be considered as an additional limitation.

Conclusions

This study provides preliminary evidence suggesting that CBHI is a potential demand-side mechanism to improve sick children's healthcare visits in the study area. Therefore, the government and other responsible bodies need to strengthen this pre-paid mechanism by expanding benefits packages and enrollment to enhance further access

to healthcare services. Complementary supply-side inner-vations to improve the quality of and geographic access to health facility, especially access to primary hospitals are also critical for improving healthcare use. Moreover, in a rural and informal sector where the supply of health services is expected to be weak, both financing and provision aspects are essential to be tackled simultaneously. Additionally, continuous monitoring and rigorous evaluation of the existing CBHI scheme effect on different inpatient and outpatient healthcare services and OOP expenditures using a panel data set are essential.

Finally, further studies using a better sample size and data set to ensure that the present positive associations in the existing CBHI membership and healthcare visits are due to the previously unmet needs of the households or moral hazard-related demand of community-based health insurance membership are essential.

Data Sharing Statements

All the data supporting the findings are within the manuscript. Additional detailed information and raw data are available from the corresponding author on reasonable request.

Acknowledgments

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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