



# Determinants of Treatment Adherence Among Patients Living With Noncommunicable Diseases: A Mixed-Method Study in a Rural Area of West Bengal

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Ankush Banerjee, MBBS<sup>1</sup> , Bobby Paul, DCH, MD(PSM)<sup>1</sup>,  
Madhumita Dobe, MD(PSM)<sup>1</sup>, Lina Bandyopadhyay, MD(PSM)<sup>1</sup>,  
Madhumita Bhattacharyya, MD(Pediatrics)<sup>1</sup>,  
and Monalisha Sahu, MD(PSM)<sup>1</sup>

## Abstract

The multisectoral impact of the COVID-19 pandemic can impair treatment adherence of patients with noncommunicable diseases (NCDs). This mixed-method study, conducted from November 2020 to January 2021, assessed the quantum of their treatment adherence and its determinants in rural West Bengal. Quantitative data were collected from 213 NCD patients while qualitative exploration for barriers of treatment adherence was conducted as 6 in-depth Interviews. Treatment adherence was assessed by “Medication Compliance Questionnaire” and “Adherence to Healthy Lifestyle and Follow-up Advice” Questionnaire. A total of 39.4% were nonadherent to medications while 67.1% had nonadherence to healthy lifestyle and follow-up advice. Significant predictors associated with nonadherence were increasing age, female gender, lower socioeconomic status, decreasing patient empowerment, and decreasing trust in the medical profession. Economic crisis, fear of contagion, and nonavailability of investigation facilities were some new emerging barriers in addition to preexisting barriers of treatment adherence. Therefore, measures for improving patient empowerment and patient-provider relationship by motivation and counseling, taking proper care of vulnerable patients affected by the pandemic, and correcting deficiencies at the health-system level should be given utmost priority.

## Keywords

treatment adherence, noncommunicable diseases, mixed-method, COVID-19 pandemic, rural West Bengal

## Introduction

Over the past few decades, noncommunicable diseases (NCDs) have emerged as a major challenge in the field of public health. According to the World Health Organization (WHO), NCDs are responsible for 71% of global deaths each year among which 15 million people die prematurely between 30 and 69 years of age<sup>1</sup>. In India, there has been an increase in the contribution to the total disease burden by NCDs from 30% in the year 1990 to 55% in 2016.<sup>2</sup> The key contributor to the increased burden of morbidity and mortality from NCDs is due to inadequate disease control status of the patients, a major and potentially modifiable cause of which is treatment adherence.<sup>3</sup> Treatment adherence has been defined by the WHO as “the extent to which a

*person’s behaviour—taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider.”* Globally, only 50% of patients with chronic diseases are adherent to their treatment regimens.<sup>4</sup> Studies in India have shown a varying prevalence of nonadherence to medication among patients suffering from NCDs.<sup>5,6</sup> Poor

<sup>1</sup>All India Institute of Hygiene & Public Health, Kolkata, West Bengal, India

### Corresponding Author:

Ankush Banerjee, Preventive & Social Medicine, All India Institute of Hygiene & Public Health, 110, Chittaranjan Avenue, Kolkata, West Bengal 700073 India.  
Email: ankush.banerjee20@gmail.com



adherence can lead to an increased risk of complications resulting in a rise of out-of-pocket expenditure due to frequent hospitalization.

The multisectoral impact of the COVID-19 pandemic has posed an extra burden on patients with NCDs.<sup>7</sup> Disruption of health services, coupled with increased exposure to numerous behavioral risk factors and decreased likelihood of treatment-seeking due to fear of contagion during the pandemic can impair treatment adherence leading to worse health outcomes.<sup>8</sup> Therefore, further research in this field is needed considering the current scenario.

With this backdrop, this study thus envisaged to assess the quantum of treatment adherence and elicit its major determinants among patients living with NCDs in rural West Bengal by incorporating both medication adherence as well as adherence to healthy lifestyle and follow-up advice as studies are scarce addressing holistically both these dimensions. A mixed-method study is particularly apt in this regard as it provides a deeper insight into the patients' perspectives to both existing and emerging barriers (with special regards to the COVID-19 pandemic) of treatment adherence. The findings of this study would help in implementing strategies at the policy level aimed to improve treatment adherence among patients with NCDs.

## Materials and Methods

This cross-sectional study with a mixed-method design (explanatory sequential approach) was conducted from November 2020 to January 2021 among patients diagnosed with NCDs for at least 1-year duration, residing in the rural field practice area of All India Institute of Hygiene & Public Health situated in Singur, West Bengal. Participants who did not give written informed consent or were critically ill were excluded from the study. The 2 primary health centers in the study area conduct outdoor clinics every week to provide basic healthcare services for major NCDs included under the National Health Mission.<sup>9</sup> Some medicines and routine investigation facilities (blood pressure measurement, blood glucose, and cholesterol) are available to the beneficiaries free of cost.

### Sampling

Although globally the ratio of prevalence of adherence to nonadherence to therapy among patients with chronic diseases is approximately 1:1, a study conducted in rural southern India under conditions similar to our study setting found prevalence of nonadherence to prescribed medications among diabetics to be 43.5%.<sup>5</sup> Considering  $P = .435$  and absolute error of precision ( $L$ ) = 7%, the minimum sample size estimated using standard Cochran's formula came to be 193.<sup>10</sup> Considering a 10% nonresponse allowance, the final sample size was 213.

For the quantitative part of the study, a list of all patients (536) diagnosed with NCDs who had attended the 2 primary health centers in the previous year (from January to December 2019) was obtained. From the list, 213 participants selected by simple random sampling, were approached at their residence with the help of accredited social health activists (ASHA workers). For the qualitative part of the study, participants were selected by purposive sampling.

### Data Collection, Study Tools, and Parameters Used

The quantitative part of the study was conducted through face-to-face interviews and a review of past medical records (to confirm the NCD). A predesigned, pretested structured questionnaire translated into the local language (Bengali) was developed, which consisted of the following items:

- (a) *Socio-demographic characteristics and clinical profile of the study participants.*
- (b) *Patient empowerment (PE) to health* was assessed with the help of an 8-item Health Empowerment Scale-Short Form (HES-SF) arranged in a 5-point Likert scoring pattern ranging from 1 = "Strongly Disagree" to 5 = "Strongly Agree" (Cronbach's alpha = 0.81).<sup>11</sup> The total scores could range from 8 to 40.
- (c) *Patient's trust in the medical profession* was assessed by a validated 5-item Wake-Forest Trust in Medical Profession scale with a 5-point Likert scoring pattern ranging from 1 = "Strongly Disagree" to 5 = "Strongly Agree" (Cronbach's alpha = 0.82).<sup>12</sup> The total scores could range from 5 to 25.
- (d) *Medication adherence* was assessed by a validated Medication Compliance Questionnaire (MCQ), used previously for assessing patients' intentional and unintentional nonadherence to medication (Cronbach's alpha = 0.79).<sup>13</sup> The 7-item questionnaire had a 4-point Likert scoring pattern ranging from "never" = 4 points to "always" = 1 point. Total scores ranged from 7 to 28. The cut-off for good adherence was  $\geq 27$  as surveyed previously in other studies<sup>14</sup> (Supplemental material Table S1).
- (e) *Adherence to healthy lifestyle and follow-up advice* was assessed by a 16-item questionnaire, which incorporated domains as per WHO recommendations for healthy lifestyle and treatment patterns of NCDs.<sup>15,16</sup> The "Adherence to Healthy Lifestyle & Follow-up Advice" questionnaire encompassed the following domains: diet (10 items), physical activity (2 items), substance use (2 items), and health check-up (2 items). Pretesting was done among 40 NCD patients in a different setting who were not included in the study (Cronbach's alpha = 0.78). Face and construct validity were checked by public health experts. Each item had 5 options with

scores ranging from 1 to 5. To give equal weightage to each domain, a composite score for each domain (ranging from 1 to 5) was calculated by dividing the total score in each domain by the number of items present in that domain. The total score (attainable range: 4-20) was calculated by adding the score of the individual domains. The cut-off for adherence was taken to be 12 or more (50% of the attainable total scores) (Supplemental material Table S2).

After a preliminary data analysis of the quantitative part of the research, the qualitative part was conducted in the form of in-depth interviews (IDIs) with the help of a pretested semi-structured interviewer guide. Data collection was done till the point of data saturation. Six willing participants having poor treatment adherence (nonadherent to both medications as well as to healthy lifestyle and follow-up advice) were interviewed to explore their perspectives regarding barriers of treatment adherence (K1 = an elderly male with hypertension and diabetes, K2 = an elderly female with diabetes, K3 = a middle-aged male with diabetes and dyslipidemia, K4 = a middle-aged female with hypertension and diabetes, K5 = an elderly male with hypertension, K6 = a middle-aged female with hypertension, dyslipidemia, and diabetes). Each interview took around 20 min, which were audio-recorded with consent.

### Data Analysis

Quantitative data were analyzed by Microsoft Excel (2016) & SPSS software (IBM Corp. version 16). Appropriate descriptive statistics were utilized for denoting the outcome variables (medication adherence and adherence to healthy lifestyle and follow-up advice) as well as the predictor variables (age, gender, religion, educational qualification, present occupational status, socioeconomic status, type of family, NCD status, duration of treatment, PE to health, and patient's trust in the medical profession). After excluding multicollinearity (variance inflation factor > 5), predictors of nonadherence to medication and predictors of nonadherence to healthy lifestyle with follow-up advice were analyzed by a test of significance ( $P$ -value < .05) via univariate logistic regression analysis separately. All the biologically plausible significant predictors in the respective univariate analysis were included in the final multivariable models.

Qualitative data were transcribed in verbatim format in Microsoft Word (2016) and appropriate codes were generated using both inductive and deductive approaches. Thematic analysis was done manually to derive appropriate themes and sub-themes.

## Results

### Socio-Demographic Characteristics and Clinical Profile of the Study Participants

Among the 213 study participants, the median age was 56 years (IQR = 47-66). Males (52.1%) and females (47.9%)

formed a similar proportion among the study participants. The majority had educational level as primary and below (60.6%) while 58.7% of them belonged to Class IV or below socioeconomic status.<sup>17</sup> Hypertension and other cardiovascular diseases were the most common NCD detected (61.5%) followed by diabetes mellitus (51.2%) and dyslipidemia (35.2%). Multimorbidity was seen among 52.1% of the participants.

### PE to Health and Trust in Medical Profession Characteristics

PE scores showed a median value of 25 (IQR = 16-34) while the patient's trust in medical profession scores had a median value of 16 (IQR = 12-21).

### Treatment Adherence Characteristics of the Study Participants

The MCQ scale showed that 84 (39.4%) participants were nonadherent to their prescribed medications. The total score obtained in the "Adherence to Healthy Lifestyle & Follow-up Advice" questionnaire had a median value of 9.5 (IQR = 7.5-13). Nonadherence to a healthy lifestyle and follow-up advice was seen among 143 (67.1%) of the participants. Overall, 23.9% of the participants were found to have poor treatment adherence (Supplemental material Figure S1).

### Predictors of Treatment Adherence

Significant predictors of nonadherence to medication were increasing age [aPR = 1.28, 95% CI = 1.19-1.47], female gender [aPR = 2.94, 95% CI = 2.72-4.36], Class IV or below socioeconomic status [aPR = 1.9, 95% CI = 1.2-3.46], the presence of multimorbidity [aPR = 2.96, 95% CI = 1.75-5.23], decreasing patient empowerment [aPR = 1.92, 95% CI = 1.85-2.11], and decreasing trust in medical profession [aPR = 1.41, 95% CI = 1.30-1.47]. The multivariable regression model deduced was of good fit (nonsignificant Hosmer-Lemeshow test,  $P$ -value > .05) while 47% to 61% of the variance of nonadherence to medications could be explained by this model (Table 1).

Significant predictors of nonadherence to a healthy lifestyle and follow-up advice were increasing age [aPR = 1.44, 95% CI = 1.31-1.52], female gender [aPR = 2.45, 95% CI = 1.55-3.89], Class IV or below socioeconomic status [aPR = 3.65, 95% CI = 2.18-6.24], decreasing patient empowerment [aPR = 1.25, 95% CI = 1.16-1.43], and decreasing trust in the medical profession [aPR = 2.17, 95% CI = 2.08-2.36]. The nonsignificant Hosmer-Lemeshow test of significance (0.315) indicated goodness of fit of this multivariable model; 35% to 52% of the variance of the dependent variable could be explained by this model (Table 2).

**Table 1.** Predictors of Nonadherence to Medication Among the Study Participants: Logistic Regression Analysis (N = 213).

Parameters	Total number (N)	Nonadherent n (%)	Unadjusted PR (95% CI)	P-value	Adjusted PR (95% CI)	P-value
Increasing age (years) <sup>a</sup>			1.25 (1.17-1.31)	<.001	<b>1.28 (1.19-1.47)</b>	<b>.002</b>
Gender						
Male	111	24 (21.6%)	1 (Ref)		1 (Ref)	
Female	102	60 (58.8%)	3.34 (2.82-4.78)	<.001	<b>2.94 (2.72-4.36)</b>	<b>.008</b>
Religion						
Hindu	170	56 (32.9%)	1 (Ref)		1 (Ref)	
Muslim	43	28 (65.1%)	3.04 (1.62-4.12)	.002	4.21 (0.64-4.56)	.56
Educational qualification						
Primary and below	129	72 (55.8%)	4.22 (2.22-6.22)	<.001	2.44 (0.86-4.33)	.142
Above primary	84	12 (14.3%)	1 (Ref)		1 (Ref)	
Present occupational status						
Unemployed	79	34 (43%)	1.22 (0.87-2.32)	.32	–	–
Employed	77	28 (36.4%)	0.72 (0.56-4.32)	.12	–	–
Retired	57	22 (38.6%)	1 (Ref)		–	–
Socioeconomic status <sup>b</sup>						
Above Class IV	88	19 (21.6%)	1 (Ref)		1 (Ref)	
Class IV or below	125	65 (52%)	2.14 (1.56-3.21)	<.001	<b>1.9 (1.2-3.46)</b>	<b>.015</b>
Type of family—						
Nuclear	109	44 (40.4%)	1.1 (0.84-3.21)	.34	–	–
Joint	104	40 (38.5%)	1 (Ref)		–	–
Number of chronic NCDs associated with health						
Only one co-morbidity present	102	22 (21.6%)	1 (Ref)		1 (Ref)	
Multimorbidity present	111	62 (55.9%)	3.21 (1.82-5.61)	<.001	<b>2.96 (1.75-5.23)</b>	<b>.012</b>
Increasing duration of treatment in years <sup>a</sup>			1.25 (0.53-4.56)	.321	–	–
Decreasing patient empowerment <sup>a</sup>			2.07 (1.97-2.22)	<.001	<b>1.92 (1.85-2.11)</b>	<b>.027</b>
Decreasing trust in medical profession <sup>a</sup>			1.46 (1.32-1.51)	<.001	<b>1.41 (1.30-1.47)</b>	<b>.002</b>

NCDs, noncommunicable diseases.

Hosmer-Lemeshow test statistic = 0.156, Cox and Snell's  $R^2 = 0.47$ , and Nagelkerke's  $R^2 = 0.61$ .

<sup>a</sup>Continuous variables.

<sup>b</sup>According to BG Prasad Scale 2020, PR = prevalence ratio, CI = confidence interval.

### Qualitative Exploration of Patient's Perspectives to Barriers of Treatment Adherence

Information from the IDIs revealed 2 major themes: (I) barriers of medication adherence and (II) barriers of adherence to a healthy lifestyle and follow-up advice.

Under the first theme, the major sub-themes were "Patient," "Family," "Community," and "Health Facility"-related barriers (Figure 1). In the "Patient"-related barriers, economic problems posed a major concern which has been greatly deteriorated due to the COVID-19 pandemic. In this context, K1 reiterated:

I have to buy certain medicines from outside shops. It is not always possible for me to buy every month as my husband is an idol-maker and we have been hit hard due to this coronavirus disease which has emerged.

Under the "Community" sub-theme, negative suggestions from peers posed a major threat to medication adherence. K3 said in this regard:

I used to take 4 tablets for sugar control and 2 tablets for cholesterol per day. My friends told me that if I take too many tablets for sugar control, I can become unconscious. So, I started taking tablets on alternate days.

Among the "Health Facility"-related barriers, K2 and K4 both believed that doctors are "too busy" and "cannot give much time during check-up" due to the huge burden of patient load.

Under the second theme, the major sub-themes that emerged were "Diet," "Physical activity," "Substance Use," and "Health Check-up"-related barriers (Figure 2). In the "Diet"-related barriers, K3 and K5 were of the consensus that healthy foods mean only "boiled" and "tasteless" foods. Lack of time and lack of faith in exercise were the major "Physical Activity"-related barriers while dependence emerged as a major barrier in the "Substance Use" sub-theme. Under the "Health Check-up" sub-theme, fear of contracting infection postemergence of the COVID-19 pandemic, inconvenience with the clinic and testing timing, and nonavailability of certain investigation facilities which have been disrupted postemergence of the pandemic were

**Table 2.** Predictors of Nonadherence to Healthy Lifestyle and Follow-up Advice Among the Study Participants: Logistic Regression Analysis (n = 213).

Parameters	Total number (N)	Nonadherent n (%)	Unadjusted PR (95% CI)	P-value	Adjusted PR (95% CI)	P-value
Increasing age (years) <sup>a</sup>			1.47 (1.35-1.58))	<.001	<b>1.44 (1.31-1.52)</b>	<b>.026</b>
Gender						
Male	111	58 (52.3%)	1 (Ref)		1 (Ref)	
Female	102	85 (83.3%)	2.14 (1.56-3.33)	<.001	<b>2.45 (1.55-3.89)</b>	<b>.035</b>
Religion						
Hindu	170	122 (71.8%)	2.21 (0.82-10.58)	.95	–	–
Muslim	43	21 (48.8%)	1 (Ref)		–	–
Educational qualification						
Primary and below	129	105 (81.4%)	3.06 (1.89-5.65)	.03	2.11 (0.76-4.22)	.78
Above Primary	84	38 (45.2%)	1 (Ref)		1 (Ref)	
Present Occupational status						
Unemployed	79	53 (67.1%)	1.34 (0.82-2.21)	.45	–	–
Employed	77	52 (67.5%)	1.12(0.34-2.45)	.81	–	–
Retired	57	38 (66.7%)	1 (Ref)		–	–
Socioeconomic status <sup>b</sup>						
Above Class IV	88	38 (43.2%)	1 (Ref)		1 (Ref)	
Class IV or below	125	105 (84%)	4.14 (2.31-6.22)	<.001	<b>3.65 (2.18-6.24)</b>	<b>.017</b>
Type of family—						
Nuclear	109	72 (66.1%)	1 (Ref)		–	–
Joint	104	71 (68.3%)	1.01 (0.22-5.32)	.84	–	–
Number of chronic NCDs associated with health						
Only one co-morbidity present	102	89 (87.3%)	3.21 (2.44-6.21)	<.001	2.22 (0.85-4.23)	.524
Multimorbidity present	111	54 (48.6%)	1 (Ref)		1 (Ref)	
Increasing duration of treatment in years <sup>a</sup>			2.15 (1.23-6.56)	.024	1.85 (0.87-5.62)	.444
Decreasing patient empowerment <sup>a</sup>			1.23 (1.12-1.39)	<.001	<b>1.25 (1.16-1.43)</b>	<b>.021</b>
Decreasing trust in medical profession <sup>a</sup>			2.24 (2.11-2.42)	<.001	<b>2.17 (2.08-2.36)</b>	<b>.008</b>

NCDs, noncommunicable diseases.

Hosmer-Lemeshow test statistic = 0.315, Cox and Snell's  $R^2$  = 0.35, and Nagelkerke's  $R^2$  = 0.52.

<sup>a</sup>Continuous variables.

<sup>b</sup>According to BG Prasad Scale 2020, PR = prevalence ratio, CI = confidence interval.

the major findings. Notable verbatim by K6 concerning fear of coming for consultation was:

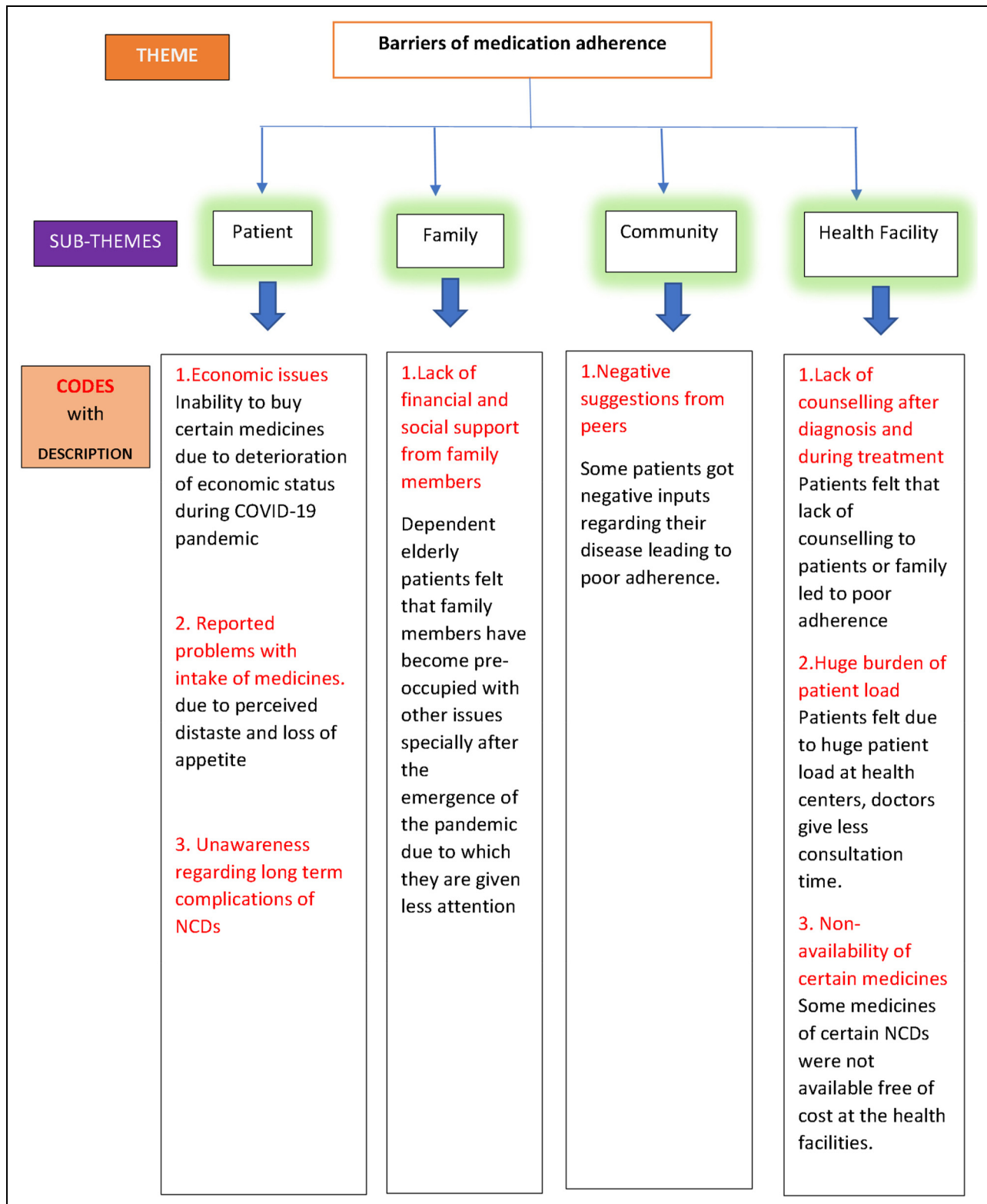
I used to come regularly to the clinic every month. But after this Coronavirus disease started, I felt scared going to any doctor. I have also not been able to undergo a blood test for my diabetes for about 1 year.

## Discussion

Most of the studies done previously have concentrated on medication adherence while leaving uncharted territories in the other dimensions of treatment adherence. This study tried to address holistically all the dimensions and elicited some major determinants of treatment adherence among patients with NCDs in rural West Bengal especially in light of the COVID-19 pandemic. Although 39.4% of the participants were found to be nonadherent to their prescribed medications, more than two-thirds of the participants were found to be nonadherent to a healthy lifestyle and follow-up advice. Nonadherence to medication was found to be slightly less in our study

compared to the study done in rural Karnataka, India (43.5%) by Kumar et al.<sup>5</sup> A previous study in Puducherry, India by Yuvaraj et al<sup>18</sup> elicited increasing age and female gender to be significantly associated with poor medication adherence among patients with NCDs. Our study also found a similar association not only with regard to medication nonadherence but also with nonadherence to a healthy lifestyle and follow-up advice. Multimorbidity was present in more than half of the participants and showed significant association with nonadherence to medications similar to a Spanish study conducted by Fernandez-Lazaro et al.<sup>19</sup>

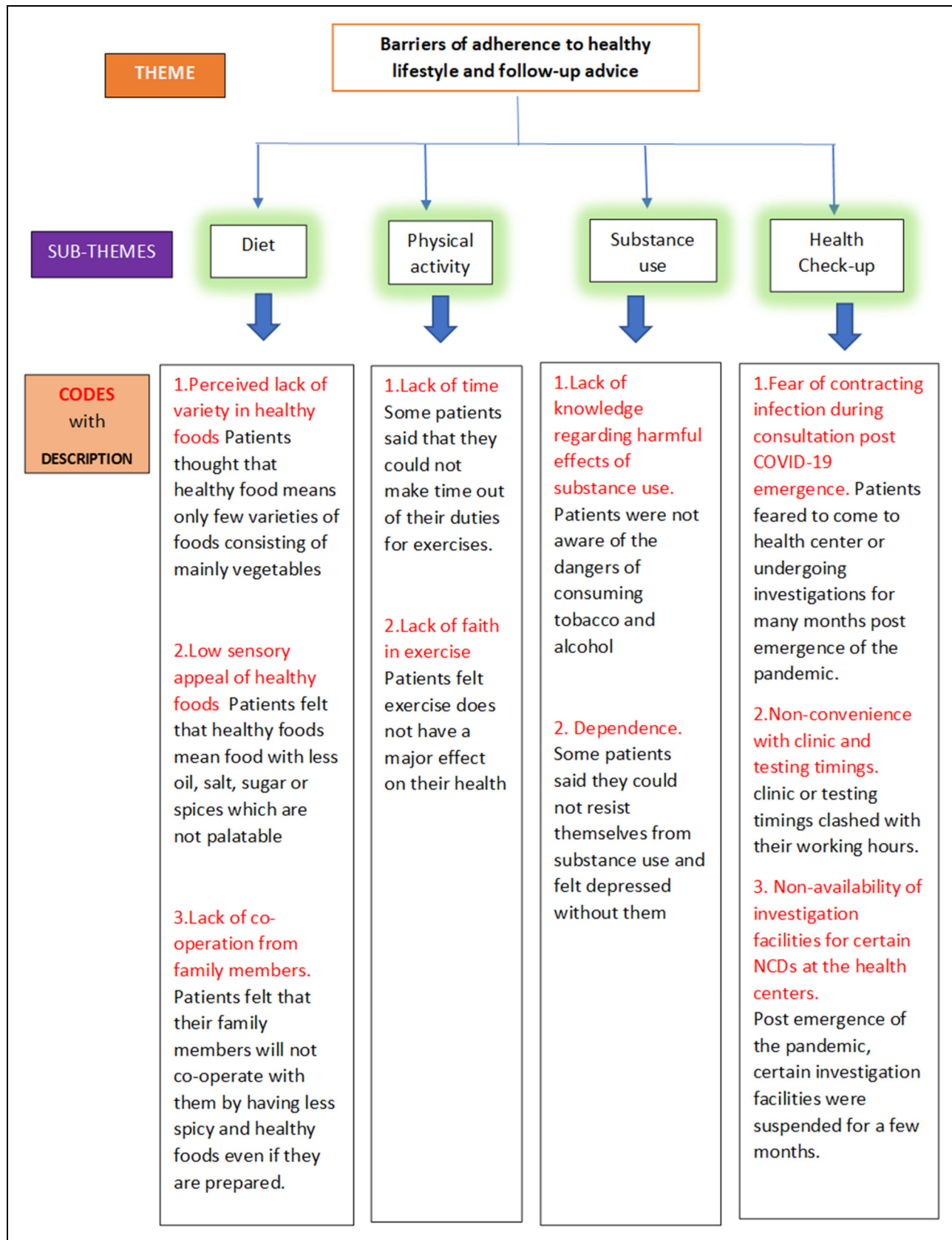
A study in the United States of America by Hernandez-Tejeda et al<sup>20</sup> revealed that increasing patient empowerment significantly improved medication adherence among diabetics. Our study found that it not only improves medication adherence but also significantly improves adherence to lifestyle and follow-up advice. Numerous researchers have shown the importance of health empowerment and self-efficacy as a major facilitating factor of improving treatment adherence.<sup>21</sup> Thus, similar findings in our study again emphasize the importance of patient empowerment as a



**Figure 1.** Barriers of medication Adherence among noncommunicable disease (NCD) patients with poor treatment adherence.

viable approach to improve treatment adherence especially among NCDs for the establishment of effective self-management in controlling the disease.

Decreasing trust in the medical profession was detected as a major predictor of nonadherence to medication as well to a healthy lifestyle and follow-up advice. Previous studies have



**Figure 2.** Barriers of adherence to health lifestyle and follow-up advice among noncommunicable disease (NCD) patients with poor treatment adherence.

demonstrated the importance of patient–provider relationship in clinical practice by playing a key role in improving patient satisfaction and compliance which in turn can significantly improve treatment adherence.<sup>22,23</sup> Our study also found this similar association as decreasing trust in the medical profession was found to be a major predictor of nonadherence to treatment regimens among patients with NCDs.

The mixed-method study is a strength in itself as qualitative exploration led to an in-depth understanding of the patient's perspectives to barriers of treatment adherence. Previous studies done worldwide and in India explored some major barriers of medication adherence such as being unaware of long-term complications of NCDs, reported incompatibility with medicines, lack of financial and social support from family members especially in dependent elderly patients, lack of counseling, and overburdening of health facilities.<sup>24-26</sup> In addition to these above findings, our study found some new emerging barriers like inability to buy medicines due to economic crisis which has been enhanced postemergence of the COVID-19 pandemic, negative suggestions from peers regarding their health, and non-availability of certain medications at the health centers.

With regard to barriers of adherence to a healthy lifestyle and follow-up advice, lack of sensory appeal in healthy foods, lack of faith in exercise were some of the preexisting barriers which were found similar to previous studies done in Saudi Arabia and India.<sup>27,28</sup> Some new emerging barriers in this theme were fear of coming for consultation postemergence of the COVID-19 pandemic and lack of investigation facilities for certain NCDs at the health facilities. The COVID-19 pandemic has disrupted many spheres of lives of patients with NCDs, especially those from the lower socioeconomic strata.<sup>7,8</sup> So appropriate suitable interventions are necessary so that they can gradually adjust to and overcome these preexisting as well as emerging barriers of treatment adherence.

## Limitations of the Study

This study was done as a cross-sectional interview, and hence the causal relationship between nonadherence to treatment regimen and its predictors could not be determined. While most of the responses were recall-based, bias might be possible. Including 8 predictors in the final multivariable model might have led to the model becoming overfit. Healthcare providers' perspectives to barriers of treatment adherence among patients as well as suggestions from the patients' point of view for improving treatment adherence could have been explored qualitatively, but could not be done due to difficulties faced while collecting data in the community during the ongoing pandemic.

## Conclusion

This study reported a considerable proportion (23.9%) of patients with NCDs having poor treatment adherence.

Appropriate health education and motivation to empower patients (with special regard to elderly and females) regarding the importance of treatment adherence for NCD control should be imparted at every point of care. Improvement of patient–provider relationship by proper communication skills to gain trust in the medical profession among patients should be given priority for improving treatment adherence. Necessary steps to prevent the spread of COVID-19 infection at the facility level should be ensured by the authorities, which in turn will encourage patients to seek medical care. Patients, especially from lower-socioeconomic status, who are overburdened due to the pandemic need to be taken care of at the earliest by the health authorities. Regularization of investigation facilities and supply of medicines in the post-COVID-19 pandemic phase should also be given utmost importance.

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## Authors' Note

Ethical approval of this study was obtained from the Institutional Ethics Committee of All India Institute of Hygiene & Public Health (approval no: PSM/2020/171).


## Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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## ORCID iD

Ankush Banerjee  <https://orcid.org/0000-0003-2762-123X>

## Statement of Human and Animal Rights

All procedures in this study were conducted in accordance with the Institutional Ethics Committee of All India Institute of Hygiene & Public Health (approval no: PSM/2020/171) approved protocols.

## Statement of Informed Consent

Written informed consent was obtained from the study participants for their anonymized information to be published in this article.

## Award Received for This Paper

This paper was presented at the Annual National Conference of the *Indian Association of Preventive and Social Medicine* (IAPSMCON 2021) and was awarded the Best Paper under the category of *Kalu Ram Memorial Award* (best paper by a young male scientist on community-based research at the annual national conference of IAPSM).



## Supplemental Material

Supplemental material for this article is available online.

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## Author Biographies

**Ankush Banerjee**, MBBS, is currently working as a final year post-graduate trainee in the Department of Preventive and Social Medicine, All India Institute of Hygiene and Public Health (AIIHPH), Kolkata. He has an excellent academic record and has secured honors in multiple disciplines in the university examinations during his undergraduate tenure. He has been awarded the prestigious *Kalu Ram Memorial Award* by the Indian Association of Preventive and Social Medicine.

**Bobby Paul**, DCH, MD, is currently working as an associate professor and head of the Department of Preventive and Social Medicine, AIIHPH, Kolkata. She has 14 years of teaching experience and has authored 125 publications (national and international), one book, and two monographs. She is the Managing Editor of the Journal of Comprehensive Health, and editorial board member of the Indian Journal of Public Health.

**Madhumita Dobe**, DCH, MD, MCH, is currently working as Director-Professor, Department of Health Promotion & Education, AIIHPH, Kolkata. She has a brilliant academic record and has multiple national and international publications. She has been a member of the Governing Council of the World Federation of Public Health

Associations. Her special interest lies in Health Promotion, IEC, and Qualitative Research.

**Lina Bandyopadhyay**, MD, is currently working as a Public Health Specialist Grade-I and an associate professor, Department of Preventive and Social Medicine, AIIHPH, Kolkata. She has vast experience in the field of public health and has conducted multiple training programs. Her areas of expertise are epidemiology and non-communicable diseases.

**Madhumita Bhattacharyya**, MBBS, DMCW, MD, is currently working as an associate professor at the Department of Maternal and Child Health, AIIHPH, Kolkata. She has been conferred WHO fellowship in the field of maternal and child health and has conducted multiple training sessions for Maternal Infant and Young Child Nutrition under the Mothers Absolute Affection (MAA) programs.

**Monalisha Sahu**, MD, is currently working as an assistant professor at the Department of Preventive and Social Medicine at AIIHPH, Kolkata. She is a National Expert for the implementation of a research project on MIYCN and has been invited as a guest faculty at various reputed organizations. She has been a master trainer for Disaster Preparedness, Operational Research, and Research Methodology programs.