Adherence to healthy behavioral practices promotes COVID-19 preventive behavior among chronic disease patients: A cross-sectional study from urban Rajasthan, India

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ABSTRACT

Background: The coronavirus disease-19 (COVID-19) pandemic has led to unprecedented morbidity and mortality across the world. Chronic disease patients of urban poor neighbourhoods are one of the most vulnerable population subgroups as the number of cases and deaths increase exponentially in India. The study aims to explore the factors associated with desirable health behaviours among chronic disease patients availing care from a primary health facility and examine their association with the COVID-19 preventive behaviour. Material and Methods: A cross-sectional study was conducted among chronic disease patients attending a health centre in an urban area of Jodhpur, Rajasthan. An interviewer administered semi-structured questionnaire was pilot tested and validated prior to initiation of data collection. A total of 520 patients were enrolled for the study. Results: Poor adherence to health behaviour was observed among a majority of the respondents (infrequent physical activity: 72.0%, one or less fruit serving per day: 96.5%, one or less vegetable serving per day: 88.8%). A factor analysis revealed three domains of COVID-19 preventive behaviour: sanitisation, preventive hygiene and social distancing. Multiple regression revealed respondents opting for COVID-19 screening and those with lower salt intake followed the overall and individual COVID-19 preventive behaviour. Conclusion: The health behaviour assessment and inter-personal counselling by the health care providers at the primary health facilities may contribute to the increasing adherence for the COVID-19 preventive behaviour among chronic disease patients.

Keywords: Chronic disease patients, COVID-19, COVID preventive behaviour

Introduction

The COVID-19 pandemic has led to unprecedented morbidity and mortality across the world. India’s current COVID-19 surge is a public health crisis with the cases rising exponentially since early March 2021. The surge peaked at around 400,000 COVID-19 cases around 6–8 May 2021[1]. With the recent decline in COVID-19 cases, the weekly epidemiological update dated 6 July 2021 shows that India accounts for around 12% of the new cases being reported globally. COVID-19 seriously affects patients with chronic comorbidities. Although the population-level case fatality rate of COVID-19...
is less than 1%, older people and those with comorbidities are prone to severe manifestations and increased mortality. Diabetes, hypertension, stroke, coronary artery disease and chronic obstructive pulmonary disease have been shown to result in the greater requirement of intensive care admission and poorer prognosis overall. For example, greater case fatality is reported among people with diabetes as compared to those without diabetes.

Treatment adherence is a challenge in chronic disease patients. Adherence is defined as the extent to which a person's behaviour such as taking a medicine, following a diet and executing lifestyle changes corresponds with the agreed recommendation from a health care provider. Several studies suggest poor adherence to the treatment among chronic disease patients. A study by Jüngst et al. shows only 57% of the coronary artery disease patients adhering to the recommended treatment. Studies conducted across India also suggest the treatment adherence of below 50% among chronic disease patients. Studies conducted in South India show the adherence of 49.3 and 45.8% in diabetic and hypertensive patients.

Primary health care facilities are the first point of contact for patients with chronic diseases such as diabetes and hypertension. Primary care physicians have an important role to play in the treatment of these patients. They can counsel them regarding healthy behaviours such as taking medications regularly, adhering to a healthy diet, engaging themselves in physical activity.

Primary health care providers possess a unique opportunity to support behaviour change among patients of chronic diseases including the preventive behaviours effective in containing COVID-19.

Our study aims to explore the factors associated with desirable health behaviours among chronic disease patients availing care from the primary health facility and examine their association with the COVID-19 preventive behaviour. This will be crucial in identifying and supporting the population sub-groups least likely to follow behavioural interventions both for self-management of the disease and COVID-19.

Material and Methods

Study setting and design

A cross-sectional study was conducted among chronic disease patients attending a health centre in an urban area of Jodhpur, Rajasthan. Jodhpur is one of the major cities of Rajasthan. It encompasses an area of 22,850 km² and houses a population of 1,033,756. Although Jodhpur has a population of 1,033,756, its urban/metropolitan population is 1,138,300 (Census 2011). All chronic disease patients aged 18 and above seeking treatment at the urban primary health centre were included in the study. An interviewer administered a semi-structured questionnaire, pilot-tested and validated before initiation of data collection was used. The socio-demographic details and clinical profile (information about the disease and its duration, comorbidities, medications, family history, dietary history, physical activity), family support for intake of medications and personal preventive behaviour against COVID-19 were assessed for the study population. The socioeconomic status was assessed using the Modified BG Prasad classification.

Sample size

In a study conducted for assessing the COVID preventive behaviour in chronic disease patients by Gautam et al. it was observed that about half (45.1%) of the patients were having an appropriate COVID preventive behaviour. Based on this prevalence and absolute precision of 5%, alpha value of 5% and maximum expected non-response rate of 20%, the sample size was calculated to be 460 using the standard approach.

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N = \left( Z_{1-\alpha/2} \right)^2 \times P \times (1-P)/d^2.
\]

- \( n \) = sample size
- \( Z = \) value of \( Z \) statistic at \( \alpha \) level of significance
Subsequently, the precision of estimate.

Parameters measured

Medication adherence

For measuring adherence, the respondents were asked ‘How often do you have difficulty remembering to take all your medications in the past one month?’ The responses were coded as all the time, usually, sometimes, once in a while, never/rarely and scored as 0,1,2,3,4, respectively. The responses with scores of 0,1,2 were clubbed under ‘poor adherence’ and the responses with scores 3 and 4 were clubbed as ‘good adherence’.

Personal preventive behaviour against COVID-19

The personal preventive behaviour against COVID-19 in the past 7 days was assessed using a 09‑item tool.[18] The response was recorded as ‘sometimes,’ ‘seldom,’ ‘never’ and ‘often’ and was given a score of (0), (1), (2) and (3), respectively.

Operational definitions

Frequency of Medication

It was depending on the number of doses the patient was taking. The patients’ dosage is considered as once daily, twice daily or thrice daily.[4]

Physical Activity

The physical activity respondents were asked as to how often they did physical activity for at least a minimum of 30 min for at least 5 days a week.[16]

Tobacco current use: It was considered for those who smoked or used tobacco in any form either daily or occasionally.[17]

Alcohol current use: It was considered for those who consumed one or more than one drink of alcohol in the year preceding the survey.[17]

Servings of Vegetable: One cup raw, leafy green vegetables (spinach, salad, etc.), one and a half cup of other vegetables, cooked or raw (tomatoes, pumpkin, beans, etc.), or half a cup of vegetable juice was considered as one serving of vegetable.[18]

Servings of fruit: One medium-sized piece of fruit (banana, apple, etc.) or half a cup of raw, cooked or canned fruit, or half a cup of juice from fruit (not artificially flavoured) was considered as one serving of fruit.[19]

Data analysis and statistical methods

The IBM Corp.’s Statistical Package for Social Sciences (SPSS v. 23) was used. The frequencies, mean and range of the variables were calculated using descriptive statistics.

The participant’s characteristics and personal preventive behaviour against COVID-19 were analysed using frequencies, percentages, mean and standard deviations. Using the independent sample t‑test and analysis of variance (ANOVA), bivariate analysis was performed between the independent variables (socio‑demographic features and clinical profile) and dependent variables, such as adherence to personal preventive behaviour against COVID-19. Exploratory factor analysis and reliability analysis were performed for the COVID-19 preventive behaviour scale.

Initially, the reliability of the questionnaire was determined by internal consistency (Cronbach’s alpha) coefficient and Cronbach’s alpha coefficient >0.70.[19] Subsequently, the Kaiser-Meyer-Olkin (KMO) test and Bartlett’s test of sphericity were done to determine the sampling adequacy of the data for factor analysis. Next, exploratory factor analysis (EFA) was performed using principal axis factoring with varimax rotation. The factor retention was based on an eigenvalue of more than one, and the point of inflexion was determined with the help of the Scree plot. Variables with factor coefficients of 0.40 or more were retained in the final model. A multiple linear regression modelling using the stepwise method was used to account for confounders.

Ethical consideration

The study was approved by the All-India Institute of Medical Science Institutional Ethics Committee in Jodhpur (AIIMS/IEC/2020/3251). The respondents were explained regarding the survey’s intent. Only those consenting to participate in the study were subsequently interviewed for data collection. During the interview, the patient’s privacy was maintained. The data collected were anonymised before the analysis.

Results

A total of 520 patients participated, of whom more than half (285 [54.8%]) were females [Table 1].

The mean age of the respondents was 57.12 ± 11.41 years and almost half (252 [48.46%]) were above 60 years of age. The females observed better COVID preventive behaviour compared to the males. One-fourth of the respondents were employed (134 [25.77%]); almost half of them had no formal education (256 [49.23%]). As per the Modified BG Prasad socioeconomic status scale, one-third of the respondents belonged to the lower class.

Health-related behaviours

Approximately one-fifth (99 [19.04%]) of the respondents reported tobacco consumption of whom 40 were females. Low levels of physical activity were reported by a majority (72%) of the participants. The intake of at least one fruit serving (79.4%) and one to two servings of vegetables (87.9%) daily was observed.
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| Characteristics                     | Categories                        | Frequency (%) | COVID preventive behaviour Mean (SD) | t/F  | P     |
|-------------------------------------|-----------------------------------|---------------|-------------------------------------|------|-------|
| **Socio-demographic**               |                                   |               |                                     |      |       |
| Age (in years)                      | 30-44                             | 82 (15.77)    | 17.15 (4.49)                        | 1.04 | 0.271 |
|                                     | 45-59                             | 186 (35.77)   | 16.66 (4.61)                        |      |       |
|                                     | ≥60                               | 252 (48.46)   | 16.28 (4.14)                        |      |       |
| Gender                              | Male                              | 235 (45.19)   | 16.92 (4.68)                        | 0.081|       |
|                                     | Female                            | 285 (54.81)   | 16.24 (4.08)                        |      |       |
| Marital status                      | Married                           | 490 (94.23)   | 16.72 (4.33)                        |      |       |
|                                     | Separated/Divorced/Widow          | 30 (5.77)     | 13.83 (4.30)                        | 3.56 | 0.000*|
| Year of schooling (years)           | No formal education               | 256 (49.23)   | 15.88 (3.89)                        | 8.52 |       |
|                                     | 1-5                               | 78 (15)       | 16.48 (4.43)                        |      |       |
|                                     | 6-10                              | 103 (19.81)   | 16.48 (4.53)                        |      |       |
|                                     | ≥10                               | 83 (15.96)    | 18.6 (4.53)                         |      |       |
| Occupation                          | Employed                          | 134 (25.77)   | 17.13 (4.79)                        | 0.207|       |
|                                     | Unemployed                        | 69 (13.27)    | 16.71 (4.15)                        | 1.52 |       |
|                                     | Retired from job                  | 79 (15.19)    | 15.86 (5.47)                        |      |       |
|                                     | Homemaker                         | 238 (45.77)   | 16.37 (3.79)                        |      |       |
| Socioeconomic status                | Upper and upper middle class      | 90 (17.31)    | 17.27 (3.98)                        | 0.001*|       |
|                                     | Middle class                      | 101 (19.42)   | 17.7 (4.59)                         | 5.76 |       |
|                                     | Lower middle class                | 152 (29.23)   | 16.38 (4.05)                        |      |       |
|                                     | Lower class                       | 177 (34.04)   | 15.67 (4.52)                        |      |       |
| Health-related behaviours           | Tobacco consumption               |               |                                     |      |       |
|                                     | Present                           | 99 (19.04)    | 16.42 (4.61)                        | -0.318| 0.751 |
|                                     | Absent                            | 421 (80.96)   | 16.58 (4.32)                        |      |       |
| Alcohol consumption                 | Present                           | 22 (4.23)     | 16.77 (5.76)                        | 0.187| 0.853 |
|                                     | Absent                            | 498 (95.77)   | 16.54 (4.31)                        |      |       |
| Physical activity                   | Always                            | 75 (14.42)    | 17.28 (4.04)                        | 2.55 | 0.055 |
|                                     | Often                             | 69 (13.27)    | 17.01 (4.25)                        |      |       |
|                                     | Sometimes                         | 243 (46.73)   | 16.64 (4.50)                        |      |       |
|                                     | Rarely/Never                      | 133 (25.58)   | 15.74 (4.29)                        |      |       |
| Number of servings of fruit per day | 0 serving                         | 89 (17.12)    | 16.48 (4.87)                        | 5.73 | 0.003*|
|                                     | 1 serving                         | 413 (79.42)   | 16.42 (4.18)                        |      |       |
|                                     | 2 servings                        | 18 (3.46)     | 19.94 (4.91)                        |      |       |
| Number of servings of vegetables per day | 0 serving          | 5 (0.96)      | 14.40 (3.34)                        | 0.426|       |
|                                     | 1 serving                         | 457 (87.89)   | 16.52 (4.42)                        | 0.85 |       |
|                                     | 2 servings                        | 58 (11.15)    | 16.95 (4.02)                        |      |       |
| Importance of lowering salt in diet | Very important                   | 186 (35.77)   | 18.16 (4.64)                        | 23.13| 0.001*|
|                                     | Somewhat important                | 297 (57.12)   | 15.81 (4.04)                        |      |       |
|                                     | Not at all important              | 37 (7.11)     | 14.38 (2.82)                        |      |       |
| Medical diagnosis                   | DM                                | 126 (24.23)   | 17.09 (4.41)                        | 1.82 | 0.164 |
|                                     | HTN                               | 230 (44.23)   | 16.18 (4.29)                        |      |       |
|                                     | DM + HTN                          | 164 (31.54)   | 16.65 (4.43)                        |      |       |
| Duration of disease (years)         | <3                                | 174 (33.46)   | 16.83 (5.01)                        | 1.10 | 0.347 |
|                                     | 3-5                               | 200 (38.46)   | 16.64 (3.95)                        |      |       |
|                                     | 5-10                              | 90 (17.31)    | 15.82 (4.21)                        |      |       |
|                                     | >10                               | 56 (10.77)    | 16.52 (3.88)                        |      |       |
| Comorbidities                       | Present                           | 29 (5.58)     | 15.96 (3.904)                       | -1.99| 0.047*|
|                                     | Absent                            | 491 (94.42)   | 16.76 (4.514)                       |      |       |
| No. of medications                  | 1                                 | 102 (19.62)   | 16.26 (3.77)                        | 0.058|       |
|                                     | 2-3                               | 291 (55.96)   | 16.3 (4.49)                         | 2.87 |       |
|                                     | ≥4                                | 127 (24.42)   | 17.35 (4.47)                        |      |       |
| Frequency of medications            | Once daily                        | 184 (35.38)   | 16.14 (3.94)                        | -1.67| 0.095 |
|                                     | Twice a day/more                  | 336 (64.62)   | 16.78 (4.58)                        |      |       |

**Table 1: Descriptive characteristics of the study population and its association with COVID=19 preventive behaviour (n=520)**

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The importance of lowering salt in the diet was well-recognised by a majority of the participants (92.8%). The days of fruit intake per week, servings of fruit per day and lowering of salt intake were statistically significant with observing the COVID-19 preventive behaviour.

Clinical profile
Approximately one-third (164 [31.54%]) of the respondents were having both diabetes and hypertension. More than half (291 [55.96%]) of them were taking two to three medications per day and almost two-thirds (361 [69.42%]) of the respondents reported good adherence to medications in the past 1 month.

Past experience with COVID-19
The COVID-19 test of one or more family members was reported by nearly half of the participants (47.1%) along with two deaths attributed to COVID-19 among the family members.

Social support
One-third of the respondents (32.31%) were enrolled in social security schemes and observed good COVID preventive behaviour (P = 0.002). A majority of the participants (67.8%) experienced support of family members ensuring medications for chronic disease.

COVID-19 preventive behaviour
In our study, most of the COVID-19 preventive behaviour recommendations were followed (either often or sometimes) by a majority of the participants, except for practices related to sanitisation requiring use of alcohol/bleach [Table 2].

Factor analysis of COVID-19 preventive behaviour
The KMO index was 0.725 and the Bartlett test of sphericity was significant (P < 0.001). Thus, the data were suitable for the EFA analysis. For factor extraction, scree plot and Kaiser criterion with an eigenvalue of more than one showed that the instrument contained three factors which represented 67% cumulative variance.

The item designation criteria (factor loading of more than 0.4, and cross-loading of less than 0.35) were used for the reduction of the instrument to a simple factor structure [Table 3]. The pattern matrix of factor loading of each item was more than 0.4. Out of the original nine items, the item “wearing a surgical mask when going out” did not load on any factor.

Reliability analysis: Cronbach’s alpha was 0.77 for eight items of the COVID preventive behaviour scale and was acceptable for all subscales: sanitisation: 0.81; social distancing: 0.76 and 0.70 for preventive hygiene.

Predictors—socio-demographic status: Bivariate analysis was done and the variables with a P value of up to 0.2 were included in the final model [Table 4]. A stepwise regression analysis was performed to examine the factors predicting the overall and individual COVID-19 preventive behaviour.

Overall Personal Preventive Behaviour: The respondents with more than 10 years of education (β = 1.57, P < .001), married (β = 2.53, P < .001), from middle class socioeconomic status (β = 1.15, P < .001) and enrolled in social security schemes (β = 1.92, P < .001) were more likely to follow the overall COVID-19 appropriate behaviour.

Sanitisation: The patients having higher education (β = 0.63, P < .05) and those with positive COVID-19 screening history for self or family members (β = 1.35, P < .001), were found to be positive predictors whereas enrolment in social security schemes was observed to be negative predictor of this behaviour (β = -0.97, P < .001).

Social distancing was observed significantly by the respondents with more than 10 years of education (β = 0.662, P < .001) and those enrolled in social security schemes (β = 1.14, P < .001) but was found to be poor among the participants who were...
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Table 2: Personal preventive behaviours against COVID-19 in the past 7 days

| COVID-19 awareness                                      | Never (0) | Seldom (1) | Sometimes (2) | Often (3) | Mean (SD) |
|--------------------------------------------------------|-----------|------------|---------------|-----------|-----------|
| Wash hands before eating                               | 1 (0.2)   | 44 (8.5)   | 131 (25.2)    | 344 (66.2)| 2.57 (0.65)|
| Wash hands after using the toilet                      | 2 (0.4)   | 21 (4)     | 89 (17.1)     | 408 (78.5)| 2.74 (0.54)|
| Wear a surgical mask when going out                    | 102 (19.6)| 141 (27.1)| 169 (32.5)    | 105 (20.2)| 1.54 (1.03)|
| Wear a fabric mask when going out                      | 5 (1)     | 64 (12.3)  | 209 (40.2)    | 242 (46.5)| 2.32 (0.72)|
| Wash hands with alcohol-based sanitisers              | 84 (16.2) | 181 (34.8) | 166 (31.9)    | 89 (17.1) | 1.50 (0.96)|
| Add water/bleach to household drainage system         | 103 (19.8)| 228 (43.8)| 141 (27.1)    | 48 (9.2)  | 1.26 (0.88)|
| Keep distance from people in public areas (e.g., 1.5 m)| 24 (4.6)  | 143 (27.3)| 262 (50.4)    | 91 (17.5) | 1.81 (0.77)|
| Reduce social contact with relatives/friends/ighbours | 50 (9.6)  | 132 (25.4)| 275 (52.9)    | 63 (12.1) | 1.68 (0.81)|
| Use alcohol/bleach to clean daily necessities          | 128 (24.6)| 217 (41.7)| 144 (27.7)    | 31 (6)    | 1.15 (0.86)|

Table 3: Factor loading of individual item

| Factor | Sanitisation | Social distancing | Preventive hygiene |
|--------|--------------|-------------------|-------------------|
| Add water/bleach to household drainage system         | 0.843          |                   |                   |
| Use alcohol/bleach to clean daily necessities         | 0.764          |                   |                   |
| Wash hands with alcohol-based sanitisers              | 0.653          |                   |                   |
| Keep distance from people in public areas (e.g., 1.5 m)|             | 0.882              |                   |
| Reduce social contact with relatives/friends/ighbours |             |                   | 0.673              |
| Wash hands before eating                              |               |                   | 0.769              |
| Wash hands after using the toilet                     |               |                   | 0.768              |
| Wear a fabric mask when going out                     |               |                   | 0.503              |

*Principal axis factoring with promax rotation*

separated/divorced/widowed (β = -1.07, P < .001) and with a strong family support (β = -0.79, P = 0.001) and those having comorbidities (β = -0.72, P < .001),

Preventive hygiene was observed to be significantly low among the respondents who had a lower education status (β = -0.281, P < .05), were from a lower socioeconomic status (β = -0.260, P < .05), reported lower family support and were not consuming any vegetable servings per day.

Poor adherence to medications in the past 1 month had an inverse association with both the overall preventive behaviour (β = -1.27, P < .001), and specifically with the preventive hygiene behaviour (β = -0.39, P < .05).

The participants following a healthy lifestyle in the form of intake of two servings of fruits (β = 3.04, P < .001), and vegetables per day (β = 0.711, P < .001), engaging in physical activity sometimes (β = 1.12, P < .001) and laying emphasis on a low intake of salt had a positive (β = 1.89, P < .001), association with all forms of COVID-19 preventive behaviour.

Discussion

At the time of this study, Jodhpur had recovered from the first wave of COVID-19 and a few parts in India had started experiencing the second wave of the pandemic with a surge in the cases and deaths. Due to the differences in the underlying health conditions and demographics, the health impact of COVID-19 is unlikely to be the same for all population sub-groups. The most effective strategy to limit COVID-19 would be widespread adoption of preventive behaviour along with vaccination, especially in densely populated neighbourhoods. The success of these measures depends on the willingness and ability of the population to cooperate and engage in behavioural change. In this regard, primary care physicians can play an important role because chronic patients are more receptive to them.

A majority of our study participants represented the vulnerable urban population predominantly from lower education and socioeconomic status at risk of severe COVID-19 owing to their age and presence of comorbidities.

During the time the study was conducted, a mass campaign was in place regarding the COVID-19 preventive behaviour emphasising social distancing and the use of masks and hand hygiene. This possibly explains the desirable adherence for COVID-19 preventive behaviour related to handwashing (more than 60% reporting it as often) and wearing of fabric mask when going out (nearing 50%), also reported in other countries.

Social distancing was found to be low in our population, similarly observed in the studies from poor urban neighbourhoods.

Our study population comprised of chronic disease patients likely practising a similar kind of preventive behaviour with no significant association being observed with age, sex and education of the participants contrary to what was reported in a multi-country study. Gender was not a significant predictor of the COVID-19 preventive behaviour as reported by Durizzo et al. Education of more than 10 years was associated with all forms of COVID-appropriate behaviours. Preventive hygiene behaviour
| Predictor variables                              | Personal preventive behaviour against COVID-19 | Sanitisation (568) | Social Distancing (378) | Preventive hygiene (124) |
|-------------------------------------------------|---------------------------------------------|-------------------|------------------------|------------------------|
|                                                 | Unstd B Coef | Std B Coef | P                   | Unstd B Coef | Std B Coef | P                   | Unstd B Coef | Std B Coef | P                   | Unstd B Coef | Std B Coef | P                   |
| Socio-demographic characteristics               |              |           |                     |              |           |                     |              |           |                     |              |           |                     |
| Education ≥10 years                              | 1.57         | 0.13      | 0.001               | 0.63         | 0.10      | 0.012               | 0.66         | 0.12      | 0.003               | -            | -          | -                   |
| Education 6-10 years                             |              |           |                     |              |           |                     |              |           |                     | -0.281       | -0.07      | 0.047               |
| Married                                          | 2.53         | 0.14      | 0.001               | -            | -         | -                   | -            | -         | -                   | 0.96         | 0.15       | 0.000               |
| Separated/divorced/widower                       |              |           |                     |              |           |                     |              |           |                     | -            | -          | -                   |
| Middle class socioeconomic status               | 1.15         | 0.11      | 0.005               | -            | -         | -                   |              |           | -                   | 0.37         | 0.09       | 0.013               |
| Lower middle class socioeconomic status          |              |           |                     |              |           |                     |              |           |                     | -0.26        | -0.08      | 0.045               |
| Social support                                  |              |           |                     |              |           |                     |              |           |                     | -            | -          | -                   |
| Enrolment done in social security schemes        | 1.92         | 0.21      | 0.000               | -0.97        | -0.19     | 0.000               | 1.14         | 0.26      | 0.000               | -            | -          | -                   |
| Past experience with COVID                       | 2.46         | 0.28      | 0.000               | 1.35         | 0.29      | 0.000               | 0.86         | 0.21      | 0.000               | 0.38         | 0.12       | 0.002               |
| Management (pharmacological and non-pharmacological) |            |           |                     |              |           |                     |              |           |                     | -0.39        | -0.12      | 0.004               |
| Poor adherence to medications in the past 1 month| -1.27        | -0.13     | 0.001               | -            | -         | -                   | -            | -         | -                   | -0.42        | -0.09      | 0.04                |
| Family supports always                           |              |           |                     | -            | -         | -                   |              |           |                     | -0.75        | -0.23      | 0.000               |
| Family supports often                            |              |           |                     | -            | -         | -                   |              |           |                     | -            | -          | -                   |
| Family supports sometimes/rarely/never           |              |           |                     | -            | -         | -                   |              |           |                     | -            | -          | -                   |
| Two servings of fruit in a day                   | 3.04         | 0.13      | 0.001               | 1.55         | 0.12      | 0.002               | 1.24         | 0.11      | 0.006               | -            | -          | -                   |
| Sometimes performs physical activity             | 1.12         | 0.13      | 0.001               | 0.45         | 0.09      | 0.02                | 0.72         | 0.18      | 0.000               | -            | -          | -                   |
| Considers lowering of salt very important in diet| 1.89         | 0.21      | 0.000               | 0.77         | 0.16      | 0.000               | 0.83         | 0.19      | 0.000               | 1.14         | 0.36       | 0.000               |
| Considers lowering of salt somewhat important in diet|      |           |                     | -            | -         | -                   |              |           |                     | 0.61         | 0.20       | 0.006               |
| Two servings of vegetables in a day              | 0.71         | 0.14      | 0.001               | -            | -         | -                   |              |           |                     | -0.74        | -0.21      | 0.000               |
| Not taking any vegetable servings                |              |           |                     | -            | -         | -                   |              |           |                     | -            | -          | -                   |
| Comorbidities present                           |              |           |                     | -            | -         | -                   | -0.72        | -0.16     | 0.000               | -            | -          | -                   |
| \( R^2 \)                                       |              |           |                     |              |           |                     | 27.6         | 19        |                     | 21.2         | 31.7       |                    |
was significantly poor among the lower socioeconomic group and those with some years of education. Education and occupation reportedly attenuate the role of income for health behaviours as people with higher education and better occupation have improved access to information about preventive behaviours. All other COVID-19 preventive behaviours were evenly distributed among the socioeconomic status. The possible association between low income and unhealthy behaviour was also reported by Laaksonen et al.[29]

A significant association of COVID-19 screening for self or any other family members was observed with the overall and individual COVID preventive behaviour as reported by Fodjo et al.[24] The awareness of being at a high risk of getting ill or infected is likely responsible for a higher adherence among these respondents. Future studies preferably in the form of cohorts are needed to understand the temporal association of the COVID-19 screening test by patients of chronic diseases or their family members and adoption of healthy behaviour interventions.

The risk of COVID-19 with adverse lifestyle choices was established in a large community-dwelling cohort and was unexplained by education, ethnicity and self-reported status of cardio-metabolic diseases of the patients.[27] Our study possibly explains this as the participants with adverse lifestyle choices are reportedly practising poor COVID-19 behaviour, and thus, are at a higher risk of getting infected. A significant association of other healthy behaviours with the COVID-19 preventive behaviour after adjusting for education, socioeconomic status and social support schemes highlights that the participants practising healthy behaviours will also observe COVID-19 preventive behaviour. This highlights the effectiveness of campaigning for healthy behaviours in the long run, especially by primary care physicians.

The participants engaging in physical activity even at low levels as compared to the recommended guidelines are reported to be at low risk of community-required infections including COVID-19.[27] The absence of dose-response at the higher levels of exercise is also reported previously.[28] Our study establishes the significant association of the low levels of physical activity with observing the COVID-19 preventive behaviour which possibly adds to the plausible biological mechanism linked to the protective role of physical activity.

There may be a potential for social desirability bias as data on adherence to healthy behaviours including COVID-19 were based on self-reports. The likelihood of people reporting their behaviours healthier as compared to reality is well-known but is considered reliable and unlikely to change across various income sub-groups. This possibly addresses the reporting bias which might have an influence on the findings on health behaviours across the socioeconomic category.

Further, this study was conducted among urban patients availing care from a single primary health facility influencing the external and internal validity. However personal interviews and no remuneration benefits to the participants establish the validity of these results and future studies must be conducted to substantiate our findings among poor urban neighbourhoods in India. Further, the household size or family member’s adherence to preventive behaviours are potential social determinants which are required to be included.[29,30]

**Key points**

Behaviour assessment and inter-personal counselling by primary health care providers offer a unique opportunity in influencing adherence for all behavioural choices including for COVID-19, especially for chronic disease patients. The integration of services for the non-communicable and communicable diseases at the primary care level is the need of the hour. Poor socioeconomic conditions and low knowledge makes it difficult for the vulnerable population to change behaviours. Mass education strategies alone might not be sufficient to promote the COVID-19 preventive behaviour among them. Adherence to one healthy behaviour promotes another, and thus, patient education strategy in primary health facilities should encompass appreciating healthy behavioural choices including the COVID-19 preventive behaviours.

New knowledge emerging from the manuscript:

Factor analysis of COVID-19 preventive behaviour led to the identification of three key domains—sanitary practices, personal hygiene and social distancing.

Chronic disease patients with adverse diet and physical activity-related practices and poor adherence to medications follow poor COVID-19 behaviour. The primary care physicians need to stress more on the counselling part regarding the above points, along with the treatment of the patients.

Social distancing practices are reportedly low among the patients with family support.

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**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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