Chronic Obstructive Pulmonary Disease Among the Users of Improved Cooking Stove and Traditional Cooking Stove

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Abstract

Background: Use of Improved Cooking Stove (ICS) is increasing in Bangladesh. It is expected that the use of ICS will decrease the occurrence of respiratory diseases, which remains to be explored.

Objective: The current study was an attempt to find out the occurrence of respiratory illnesses, particularly the Chronic Obstructive Pulmonary Disease (COPD) among the ICS users and comparing such illness among Traditional Cooking Stove (TCS) users.

Methods: This was a cross-sectional comparative study carried out among the women who were using ICS and TCS for cooking purposes. Women aged 35 years and above and cooking for more than 3 years were the study population. A total of 674 respondents were selected from a selected rural area, of which 232 were ICS users and 442 were TCS users. The study participants of both groups were age-matched (±2 years). Questionnaire on respiratory illness, COPD Population Screener (CPS) and COPD Assessment Test (CAT) questionnaires were used to collect necessary data from the respondents.

Results: The average age of the respondents was 43.96±7.632 years. Significantly (p=.000) a higher proportion of the TCS users had no formal education (46.4%). None of the respondents had smoking habits, but 16.8% of them had the habits of chewing tobacco. Overall, 85.5% of the respondents used biomass fuel. The average cooking year of the respondents was 26.9±8.59 and the daily average cooking duration was 3.09 hours. Among the TCS users, COPD (23.6%) and other respiratory illnesses (49.5%) were significantly (p=.001 and p=.014 respectively) higher than those of the ICS users. Logistic regression analysis revealed that biomass fuel had the strongest ability (3.8 times) to predict COPD followed by the ability (1.8 times) of TCS use.

Conclusion: The study revealed that TCS users significantly suffered more from COPD than that of ICS users. Respondents having poor socio-economic conditions, a lower proportion of them were found to use ICS; not affordable was a reason. Along with TCS use, biomass fuel should also be discouraged.

Keywords: Respiratory disease, Biomass, Traditional cooking stove, Improved cooking stove

Introduction

Man learned to use fire as long as 500,000 years ago. Initially, ancient people created the fire for getting warm, for protection against wild animals and to some extent for cooking food. They discovered that food cooked with fire was easy to chew and increased the taste than raw foods.¹,² Stove use had been started since the beginning of human history.³,⁴ However, the clay made stove was first known to use in China from 221-207 BC.⁵

Use of traditional stoves began around thousands of year back. In Bangladesh, traditional cooking stoves (TCS) known as Chula is made of clay, commonly used in rural area.³,⁶ Biomass is the principal source of fuel of Chula, which contributes more than 90% of the total fuel supply of the country. About 30 million households in Bangladesh use biomass fuels for cooking purpose, and of them 24 million households are from rural areas.²,⁷,⁸ The common biomass fuels used for cooking are wood, leaves, cow-dung, straw, paddy husk, jute sticks, bagasse, sawdust etc.⁸-¹¹ TCSs produce heavy smoke due to incomplete combustion and release many pollutants like particulate matters, carbon monoxide, nitrous oxides, sulphur dioxide, formaldehyde and carcinogens.⁷,⁹ Women and children in the household, spend 3 to 7 hours near the stoves while cooking and are exposed to these pollutants every day specially the particulate matter up to 20 times higher than recommended levels of the WHO.⁷,⁸,¹² WHO assessed that pollution due to biomass fuel accounts for 1.6 million death and 39
problems.2,4,9,15,16 ICS has been further developed to reduce the health problems particularly the lower million disability-adjusted life years (DALY) every year.13 and responsible for 3.7% overall disease burden in developing countries;14 and contribute to increase the greenhouse gases in the atmosphere.4,15 Exposure to the pollutants released from the stoves may cause many health effects particularly asthma, acute respiratory infections, pneumonia, chronic obstructive pulmonary diseases (COPD): low birth weight and various cancers.8,11-14 It was reported that under 5 children who were exposed to smoke of solid fuels, more than 1.8 times likely to develop pneumonia. According to a WHO report, smoke from cooking fuels account for nearly 2 million deaths mostly women and children, more than 99 percent of which occurs in developing countries. Further, it has been estimated that by 2030, over 4,000 people will die prematurely each day due to household air pollution. In developing countries 730 million tons of biomass fuel burned annually for cooking, which increases the greenhouse gases by emitting >1 billion tons of carbon dioxide into the atmosphere.4,13,14

Since 1970s, Bangladesh has worked to popularise the use of improved cook stoves (ICS) with an aim to reduce indoor air pollution. In the 1990s, ICS has been developed to make it more energy-efficient, smoke removal, and user-friendly to cut the fuel consumption, decrease the emission of pollutants and greenhouse gases as well, thus to reduce the health problems particularly the lower respiratory tract infections, COPD and eye problems.2,4,9,15,16 ICS has been further developed in 2005 and 2010 to make ICS more acceptable and durable.2,29 Use of ICS has been increasing in Bangladesh, in 2011 about 510,000 ICSs were in use, which was increased from 424,000 ICSs in 2010. Recently over 800,000 ICSs have been installed by GIZ throughout Bangladesh. There is a target that 30 million households in Bangladesh will use ICS by 2030 to meet the goal of 100% clean cooking environment.9

It is expected that by using modified ICS, the household condition will be better in-terms of cleanliness and decreased pollutants emission.2,4,9 Hence, will decrease the exposure to toxic substances, as a result, the occurrence of respiratory problems will be reduced particularly among the women and children. To find out whether the use of ICS could reduce the occurrence of respiratory illnesses particularly the COPD or not, need evidence-based study, but there lacks such study. The current study aimed to explore the occurrence of respiratory illnesses and COPD as well, among the ICS users while comparing the occurrence of such illnesses with TCS users.

**Materials and Methods**

This was a cross-sectional community based comparative study carried out to assess COPD and other respiratory illnesses among the women who used ICS. For comparison, the women who used TCS were included in the study. The women from a selected rural area where both TCS and ICS users were accessible and who were aged 35 years and above, and had a history of cooking more than three years was the study population. The study population was approached for consent to be a participant of the study and who agreed, was selected as the respondent. Initially, ICS users were selected then age-matched (±2 years) TCS users were selected as the respondents. For each ICS user respondent, two TCS user respondents were selected. Ultimately, a total of 674 respondents were included in the study of which 232 were ICS users and 442 were TCS users. Twenty-two respondents from TCS users could not be included because of their unwillingness to participate or not available during data collection. The respondents were interviewed face to face by using a pretested questioner for data collection on socio-demographic characteristics, personal habits and cooking practices. For respiratory illnesses, a questionnaire on respiratory illness based on NHANES 2012 was used.17 To assess COPD, COPD Population Screener (CPS) and COPD Assessment Test (CAT) questionnaires were used to collect necessary data from the respondents.18,19 A respondent scored 5 or more in CPS, identified as most likely suffering from COPD. While a respondent scored up to 5 in CAT, identified as normal, healthy, not suffering from COPD. In this study, a participant was identified as suffering from COPD if she scored >4 in CPS and >5 in CAT. Based on CAT score, the COPD was categorised as normal (upto 5), low (<10), medium (10-20) and high (>20) COPD. In this study, spirometry test of the respondent could not be done because the study was done at the village level where the women were shy to do spirometry test and even after several orientations on the use of a spirometer, they could not do it properly. However, to ascertain the COPD and other respiratory diseases the study physicians collected necessary information from the respondents.

**Data analysis:** The data entry and analysis were done using SPSS. Before entry collected data were
checked and verified for any inconsistencies. Initially, descriptive analysis such as frequency, percentage, mean and standard deviation was done. For inferential statistics, student’s t-test for quantitative variables and to find associations between the qualitative variables chi-square test was conducted. Finally, a binary logistic regression analysis was done to find the predictors for COPD.

Ethical clearance: Ethical approval of the study was taken from the Ethical Review Committee of Bangladesh University of Health Sciences (BUHS). The participating women were briefed about the purpose of the study and the data collection procedure. The participating women were also informed that their participation would be voluntary and they could withdraw themselves from the study whenever they wanted to do.

Results
Overall, the mean age of the respondents was 43.9±7.8 years. Comparatively, TCS users had a lower mean age (43.5 years). Almost half (47.6%) of the respondents had education up to primary level. Significantly (χ²=27.149; p=.000) a higher proportion of the TCS users had no formal education (46.4%) while 5.2% of the ICS users had education up to HSC and above. Two-thirds (66.9%) of the respondents had family members up to 4 and comparatively ≥5 family members was higher among TCS users. The monthly family income was significantly higher among ICS users (Taka13295±6076) than that of the TCS users. Majority of the respondents lived in semipucca house (34.4%) however, significantly (χ²=39.374; p=.000) a higher proportion of the TCS users lived in katcha house (19.0%) (table I).

None of the respondents had the habits of smoking; however, 16.8% of them had the habits of chewing tobacco. The consumption of tobacco was significantly (χ²=7.833; p=.005) high (19.7%) among TCS users than that of ICS users (11.2%). The chewing tobacco was Jarda (53.1%) tamak (23.9%) and gul (23.0%). Exposure to second-hand smoking (smoking by HH member) was significantly (χ²=9.202; p=.005) high among the

Table I: Socio-demographic characteristics of participating women distributed by cooking stove

| Characteristics          | TCS user (%) | ICS user (%) | Total (%) | Test of Significance |
|--------------------------|--------------|--------------|-----------|----------------------|
| Age (years)              |              |              |           |                      |
| 35-44                    | 223 (50.6)   | 125 (53.6)   | 348 (51.6)| χ²=0.71; p=.398      |
| 45 and Above             | 219 (50.5)   | 107 (46.1)   | 326 (48.4)|                      |
| Meant±SD                 | 44.19±7.995  | 43.53±7.515  | 43.96±7.834| t=1.039; p=.299      |
| Non formal               | 205 (46.4)   | 61 (25.3)    | 266 (39.5)|                      |
| Upto Primary             | 191 (43.3)   | 130 (55.8)   | 321 (47.6)|                      |
| SSC                      | 34 (7.7)     | 29 (12.4)    | 63 (9.3)  |                      |
| HSC & Above              | 12 (2.7)     | 12 (5.2)     | 24 (3.6)  |                      |
| Upto 4                   | 297 (67.2)   | 154 (66.4)   | 451 (66.9)|                      |
| 5 and Above              | 145 (32.9)   | 78 (33.5)    | 223 (33.1)|                      |
| Monthly Income Mean± SD  | 9346±4832    | 13295±607    | 10705±5612| t=9.202; p=.000      |
| Katcha                   | 84 (19.0)    | 20 (8.6)     | 104 (15.4)|                      |
| Tin                      | 139 (31.5)   | 59 (25.3)    | 198 (29.4)|                      |
| Semi pucca               | 117 (26.5)   | 115 (49.4)   | 232 (34.4)|                      |
| Pucca                    | 102 (23.1)   | 38 (16.4)    | 140 (20.8)|                      |

Table II: Tobacco consumption and cooking practice by the participating women

| Tobacco Use | TCS user n=442 (%) | ICS user n=322 (%) | Total n=674 (%) | Test of Significance |
|-------------|---------------------|---------------------|-----------------|----------------------|
| Tobacco Consumed |                  |                    |                 |                      |
| Yes         | 87 (19.7)           | 26 (11.2)           | 113 (16.8)      | χ²=7.833; p=.005     |
| No          | 355 (80.4)          | 206 (68.4)          | 581 (83.2)      |                      |
| Jarda       | 44 (73.3)           | 16 (26.7)           | 60 (53.1)       |                      |
| Tamak       | 22 (81.5)           | 5 (18.5)            | 27 (23.9)       | χ²=0.970; p=.616     |
| Gul         | 21 (80.8)           | 5 (19.2)            | 26 (23.0)       |                      |
| Second hand | 219 (49.5)          | 91 (39.4)           | 310 (46.0)      | χ²=6.528; p=.011     |
| Smoking in home |                |                    |                 |                      |
| Yes         | 223 (50.6)          | 141 (60.5)          | 364 (54.0)      |                      |
| No          | 371 (49.4)          | 205 (39.5)          | 576 (46.0)      |                      |

None of the respondents had the habits of smoking; however, 16.8% of them had the habits of chewing tobacco. The consumption of tobacco was significantly (χ²=7.833; p=.005) high (19.7%) among TCS users than that of ICS users (11.2%). The chewing tobacco was Jarda (53.1%) tamak (23.9%) and gul (23.0%). Exposure to second-hand smoking (smoking by HH member) was significantly (χ²=6.528; p=.011) high among the
households of TCS users (49.5%) compared to that of ICS users (39.9%). (table II)

Table III: Distribution of respiratory problems and COPD of the participating women

| Suffering from Respiratory Disorders | TCS user (%) | ICS user (%) | Total (%) | Test of Significance |
|-------------------------------------|--------------|--------------|-----------|---------------------|
| Respiratory problems                |              |              |           |                     |
| No                                  | 223 (50.6)   | 140 (60.3)   | 363 (53.9)| χ²=5.92; p=.008     |
| Yes                                 | 219 (49.5)   | 93 (39.9)    | 311 (46.1)|                     |
| COPD*                               |              |              |           |                     |
| No                                  | 337 (76.4)   | 201 (86.3)   | 538 (79.8)| χ²=10.2; p=.001     |
| Yes                                 | 105 (23.6)   | 31 (13.4)    | 136 (20.2)|                     |
| Low (<10)                           |              |              |           |                     |
| Medium (10-20)                      |              |              |           |                     |
| High (>20)                          |              |              |           |                     |
| Asthma                              | 117 (53.4)   | 37 (40.2)    | 154 (22.8)| χ²=4.52; p=.033     |
| Dyspnoea                            | 114 (52.3)   | 35 (38.0)    | 149 (22.0)|                     |
| Chest tightness                     | 121 (55.2)   | 39 (42.4)    | 160 (23.7)|                     |
| Chronic cough                       | 76 (34.7)    | 21 (22.8)    | 97 (14.4) |                     |
| Cough & Mucus                       | 111 (50.9)   | 43 (46.2)    | 154 (22.8)|                     |
| Nasal block                         | 140 (63.9)   | 51 (55.4)    | 191 (28.3)|                     |
| Nasal discharge                     | 137 (62.6)   | 44 (47.8)    | 181 (26.6)|                     |

Table IV: COPD participating women distributed by socio-demographic characteristics

| Characteristics | COPD | No (n=538) (%) | Yes (n=136) (%) | Total (n=674) (%) | Test of Significance |
|-----------------|------|----------------|----------------|------------------|---------------------|
| Age             |      |                |                |                  |                     |
| (Years)         | Mean | 43.3±4.3       | 46.7±3.7       | 43.96±4.0        | χ²=11.80; p=.0001   |
| Education       |      |                |                |                  |                     |
| Primary         | SD   | 7.575          | 8.263          | 7.834            |                     |
| SSC             |      | 56             | 07             | 63               |                     |
| HSC & Above     |      | (10.4)         | (5.1)          | (9.3)            |                     |
| Monthly income  |      |                |                |                  |                     |
| Katcha          | Mean | 11055          | 9319           | 10705            | χ²=166; p=.008      |
| Income          | SD   | ±5685          | ±5103          | ±5612            |                     |
| type            |      |                |                |                  |                     |
| Pucca           | Mean | 114            | 26             | 140              | p=.032              |
| Semi Pucca      |      | 114            | 26             | 140              |                     |

Based on CAT scores, COPD was categorised as low, medium and high stage, and a majority (55.1%) of the respondents were in low stage and only 7.4% were in the high stage. The high stage COPD was more common among the TCS users (7.8%) than that of ICS users (6.5%). Respondents suffering from COPD significantly (t=-4.622; p=.000) had a higher mean age (46.7±8.263 years), 51.5% had no formal education (χ²=11.804; p=.008) and had a lower (Taka 9319) monthly income (t=3.245; p=.001) (table IV). Moreover,

Overall, 85.5% of the respondents used biomass fuel and of them, ICS users were 87.1% and TCS users were 84.6%. Respondents had a cooking length of 26.9±8.6 years and TCS users had a little higher length (27.3±8.8 years), and in this cooking length with ICS was 7.2±4.972 years. However, the daily cooking hours between TCS (3.13±0.675) and ICS users (3.02±0.59) was significantly (t=-1.960; p=.050) different. (table II) The common biomass fuels used for cooking, were wood (78.3%), cow-dung (75.0%) and leaves (26.6%). The reasons for not using ICS as stated, ICS was not suitable (34.0%), would not be comfortable to use (29.1%), not affordable (27.1%), didn’t know about ICS (11.2%), need more fuel to use ICS (9.0%), and didn’t find any necessity to use ICS (7.6%).
occurrence of COPD was found significantly higher (22.2%) among the biomass fuel users ($\chi^2=10.278; \ p=.001$), who had a longer length (29.52 ± 9.064 years) of cooking experience ($t=3.911; \ p=.001$), and habits (31.0%) of chewing tobacco ($\chi^2=9.823; \ p=.002$) (table V).

**Table V: COPD by cooking practice and tobacco use of the respondents**

| Factors                  | COPD          | Total   | Test of Significance |
|--------------------------|---------------|---------|----------------------|
|                          | No (%)        | Yes (%) | n=674 (%)            |                       |
| Fuel type                |               |         |                      |                       |
| Biomass                  | 448 (77.9)    | 128 (22.1) | 576 (85.5)            | $\chi^2=10.278; \ p=.001$ |
| Non-biomass              | 90 (85.8)     | 18 (14.2)  | 108 (98)             |                       |
| Biomass                  | 263 (81.8)    | 53 (18.2)  | 316 (80)             |                       |
| Duratio of cooking       | Mean± SD      |         |                      |                       |
| Yrs                      | 8.350± 9.064  | 8.589 ± 8.589 | 8.496 ± 8.596        | $t=3.911; \ p=.000$  |
| Cooking time             | Mean± SD      |         |                      |                       |
| Hrs                      | 0.662± 0.604  | 0.650 ± 0.650 | 0.649 ± 0.650        | $t=.681; \ p=.496$   |
| Tobacco Use              |               |         |                      |                       |
| Tobacco                  |                |         |                      |                       |
| Yes                      | 78 (69.0)     | 35 (31.0)  | 113 (83.2)            | $\chi^2=10.823; \ p=.002$ |
| No                       | 460 (82.0)    | 101 (18.0) | 561 (100)            |                       |
| Consumption              |                |         |                      |                       |
| Yes                      | 39 (18.6)     | 21 (60)   | 150 (86.2)            |                       |
| No                       | 207 (81.4)    | 34 (13.8)  | 241 (94.0)            |                       |
| Type of cooking          |                |         |                      |                       |
| Jarda                    | 34.5          | 21       | 55 (18.3)             |                       |
| Tamak                    | (17.7)        | 7        | 24 (27.3)             |                       |
| Gal                      | (18.6)        | 4        | 22 (23.0)             |                       |
| Smoking                  |                |         |                      |                       |
| Yes                      | 243 (81.0)    | 67       | 310 (94.0)            |                       |
| No                       | 295 (79.4)    | 69       | 364 (96.0)            |                       |

Logistic regression analysis was carried out to see the impact of the factors which were found to have a significant relationship with the occurrence of COPD. As such, age of the respondents, education, monthly income, years of cooking, chewing tobacco, biomass fuel and use of improved stove was controlled for to see the ability to predict the likelihood of occurrence of COPD (table V). Independently age of the respondents ($p=.032$), chewing tobacco ($p=.029$), cooking stove ($p=.018$) and biomass fuel ($p=.001$) had the significant ability to predict the likelihood of developing COPD. Use of biomass fuel was the strongest (3.8 times) predictor for COPD followed by the use of TCS (1.8 times). Furthermore, each unit increase of age significantly had 1.01 times ability to predict the development of COPD (table VI). A second logistic regression analysis was carried out to see the ability of TCS as a predictor for COPD after removing the control for biomass. The analysis revealed that the ability of TCS use to predict the likelihood of developing COPD was reduced after removing the control for biomass. However, in this model, TCS use was the strongest predictor (1.6 times) for COPD while the impact of chewing tobacco became insignificantly predictor for COPD (table VI).

**Table VI: Logistic regression predicting likelihood of occurrence of COPD among the respondents**

| Dependent Variables | COPD among the TCS and ICS users women | 95% Confidence Interval |
|---------------------|----------------------------------------|-------------------------|
| Independent Variables | B          | S.E. | Wald | P    | Exp (B) | Lower  | Upper  |
|---------------------|------------|------|------|------|---------|--------|--------|
| a. Constant         | -5.108     | 1.050| 23.683| .000 | .006    |         |        |
| Cooking stove       | .576       | .243 | 5.621| .018 | 1.778   | 1.105  | 2.862  |
| Biomass fuel        | 1.345      | .403 | 11.162| .001 | 3.837   | 1.743  | 8.446  |
| Tobacco chewing     | .571       | .262 | 4.739| .029 | 1.769   | 1.059  | 2.957  |
| No education        | 1.894      | 1.827|      |      |         |        |        |
| Primary education   | .240       | .662 | .132 | .716 | 1.272   | .348   | 4.653  |
| Secondary education | .287       | .653 | .192 | .661 | 1.332   | .370   | 4.791  |
| Higher Sec educ     | -.095      | .755 | .016 | .899 | .909    | .207   | 3.995  |
| Monthly income      | .000       | .000 | 1.817| .178 | 1.000   | .100   | 1.000  |
| Age in years        | .049       | .023 | 4.588| .032 | 1.050   | 1.004  | 1.098  |
| Years of cooking    | -.004      | .022 | .034 | .853 | .996    | .955   | 1.039  |
| b. Constant         | -3.647     | .932 | 15.310| .000 | .026    |         |        |
| Cooking stove       | .482       | .240 | 4.049| .044 | 1.620   | 1.013  | 2.591  |
| Tobacco chewing     | .370       | .252 | 2.153| .142 | 1.447   | .883   | 2.372  |
| No education        | 1.305      | .728 |      |      |         |        |        |
| Primary education   | .359       | .652 | .302 | .582 | 1.431   | .399   | 5.141  |
| Secondary education | .309       | .644 | .229 | .632 | 1.361   | .385   | 4.813  |
| Higher Secondary education | -.109 | .746 | .021 | .884 | .897    | .208   | 3.868  |
| Monthly income      | .000       | .000 | 3.371| .066 | 1.000   | 1.000  | 1.000  |
| Age in Years        | .047       | .022 | 4.376| .036 | 1.048   | 1.003  | 1.095  |
| Years of Cooking    | -.005      | .021 | .052 | .820 | .995    | .954   | 1.038  |

Overall Chi Square 52.400; $p=.000$ and 37.963; $p=.000$ respectively.
Discussion

ICS had been initiated in Bangladesh to cut the biomass fuel use, particularly the consumption of firewood thus, to prevent the occurrence of respiratory illness and other diseases including cancer.4,6 ICS has been proved to be energy-efficient, reduce fuel consumption and less smoke emission but the main sources of fuel remain the biomass.2,8 About half of the world population still depends on biomass fuel and more than two billion people use biomass fuels such as dung, wood, crop residues and coal.8,20,21 In rural Bangladesh biomass is the principal sources of fuel which contributes more than 90% of the total fuel supply.8,21 In this study, most (85.5%) of the respondents were found to use biomass and the use was higher among the ICS users (87.1%), and the main biomass was wood and cow-dung.

Studies reported that poor socioeconomic conditions of the household had an important negative role in the ICS use.3,8,22,23 The current study also revealed that a majority of the TCS users belonged to the disadvantaged socioeconomic conditions. They had education up to primary level or no formal education, lower monthly income and lived in Tin house. On the contrary, the ICS users comparatively had a higher level of education (SSC and above), higher monthly income and majority lived in semi-pucca houses. ICS is fuel-efficient and takes less time to cook.2,9 The current study also revealed significantly a less cooking hour among the ICS users, which was on average 3.02 hours, while, overall daily cooking duration was 3.08 hours. Study in Bangladesh reported a higher average cooking hour (3.36) among rural women.11

Pollutants in cooking smoke may cause increased risk even more than double for developing various respiratory illnesses, specially the COPD and cancer.12,24,25 The current study indicated that TCS users might be at the double burden of risk of developing diseases particularly respiratory diseases and cancer because TCS users were being exposed to the pollutants in the smoke daily and significantly a higher proportion of them consumed tobacco like Jarda, Tamak and Gul. Studies revealed the association of the pollutants released from cooking smoke with the occurrence of respiratory diseases.2,8,11-15 In the current study, half (49.5%) of the TCS users were found to suffer from respiratory illnesses and almost one-fourth suffered from COPD (23.6%) which was significantly higher than those of ICS users and are reported to be attributable to biomass smoke.11-14

However, in the studies, the prevalence of COPD among the rural and urban people in Bangladesh was reported to be 13.5% and among the residence of Dhaka city aged ≥40 years was 11.4%.26,27

Studies from Bangladesh and elsewhere revealed an inverse relationship of socioeconomic factors and the occurrence of respiratory illnesses as well as COPD.27-33 The socioeconomic factors of the current study also had an influencing role in the occurrence of COPD. Respondents who had lower monthly income and had education up to primary level or no formal education were found to suffer significantly more from COPD. In addition, this study revealed an increased occurrence of COPD with a higher average year of cooking experience of the respondents. Moreover, logistic regression analysis revealed 1.01 times more risk of developing COPD with one year increased in age.

COPD is considered as a major cause of morbidity and mortality as well as the economic and social burden of a country. WHO estimates that currently, 65 million people worldwide have COPD and by 2030, COPD will be the 3rd main cause of death.28,30 Further, WHO report shows that biomass smokes is a major environmental risk factor and rank 8th important risk factor for the global burden of diseases and contributes for 2.7% of the burden of disease.2,13,14 This study revealed a higher occurrence of COPD (22.1%) among the biomass fuel users than that of non-biomass fuel users (8.2%). Moreover, logistic regression analysis revealed that both biomass fuel (3.8times) and TCS (1.8times) had strong ability to predict COPD. However, while the control for biomass fuel was removed from the analysis, the ability of TCS to predict the COPD was decreased. Thus, indicated an increased risk of developing COPD due to the combined effect of biomass fuel and TCS use and biomass had the main role to predict. Therefore, to reduce the risk of developing COPD, ICS use must be increased and the use of biomass fuel should be decreased. To undertake a preventive and control measures a regular community-based screening and monitoring service should be set up and community clinic services may be extended for this purpose so that in Bangladesh COPD would not be a burden by 2030 as estimated by the WHO.

Conclusion

The current study revealed that among the TCS users the occurrence of COPD significantly higher than that of ICS users. Further, this study revealed that the participating women who used biomass
fuel and had the habits of chewing tobacco suffered more from COPD. Comparatively, the respondents who had poor socioeconomic conditions, a lower proportion of them was to be found to use ICS.

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