

# BMJ Open Prevalence, pattern and sociodemographic differentials in smokeless tobacco consumption in Bangladesh: evidence from a population-based cross-sectional study in Chakaria

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## ABSTRACT

**Background:** The health hazards associated with the use of smokeless tobacco (SLT) are similar to those of smoking. However, unlike smoking, limited initiatives have been taken to control the use of SLT, despite its widespread use in South and Southeast Asian countries including Bangladesh. It is therefore important to examine the prevalence of SLT use and its social determinants for designing appropriate strategies and programmes to control its use.

**Objective:** To investigate the use of SLT in terms of prevalence, pattern and sociodemographic differentials in a rural area of Bangladesh.

**Design:** Population-based cross-sectional household survey.

**Setting and participants:** A total of 6178 individuals aged  $\geq 13$  years from 1753 households under the Chakaria HDSS area were interviewed during October–November 2011.

**Methods:** The current use of SLT, namely *sadapatha* (dried tobacco leaves) and *zarda* (industrially processed leaves), was used as the outcome variable. The crude and net associations between the sociodemographic characteristics of respondents and the outcome variables were examined using cross-tabular and multivariable logistic regression analysis, respectively.

**Results:** 23% of the total respondents (men: 27.0%, women: 19.3%) used any form of SLT. Of the respondents, 10.4% used only *sadapatha*, 13.6% used only *zarda* and 2.2% used both. SLT use was significantly higher among men, older people, illiterate, ever married, day labourers and relatively poorer respondents. The odds of being a *sadapatha* user were 3.5-fold greater for women than for men and the odds of being a *zarda* user were 3.6-fold greater for men than for women.

**Conclusions:** The prevalence of SLT use was high in the study area and was higher among socioeconomically disadvantaged groups.

## Strengths and limitations of this study

- Data were of very high quality as they were collected as part of a regular health and demographic surveillance system by a team of highly trained interviewers with very strong supervision for quality control.
- Multivariable logistic regression analysis using Generalised Estimating Equation (GEE) resulted in accurate estimates of the effects of the independent variables on the use of SLT.
- Use of SLT was assessed based on self-reported data and may suffer from under-reporting.
- No casual inference could be made as the study was based on a cross-sectional survey.
- The study findings cannot be generalised for Bangladesh.

The limitation of the existing regulatory measures for controlling the use of non-industrial SLT products should be understood and discussion for developing new strategies should be a priority.

## INTRODUCTION

The tobacco epidemic is one of the biggest public health threats the world has ever confronted, which is believed to account for about 6 million deaths a year.<sup>1</sup> Although tobacco use is a problem in both the developed and developing world, the problem is more acute in developing countries. The use of tobacco also varies between low-income and high-income countries with regard to the different forms of tobacco consumed.<sup>2–4</sup> Strict regulatory measures help high-income

countries to control the level of tobacco use, whereas in low-income countries there is an absence of regulation and/or weak implementation of existing regulations.<sup>5</sup> In addition, the availability of crude tobacco products in processed and/or unprocessed forms further aggravates the situation in a country such as Bangladesh, which perhaps exposes the disadvantaged section of the population more to the health hazard of smokeless tobacco products (SLT).<sup>6</sup> In Bangladesh the two major forms of SLT products are *zarda* (industrially processed tinned tobacco leaves) and *sadapatha* (dried whole tobacco leaves, mostly done at home), both of which are usually consumed with betel leaves.<sup>7,8</sup> As these products (especially *sadapatha*) are not industrially manufactured or processed products, they are outside the regulatory framework and do not have any packaging on which to show any regulatory warning about their nicotine content and adverse health effects.<sup>8</sup> The consumption of such SLT products may not be perceived to be as harmful as smoking, which increases the consumption of SLT among the general population, especially the illiterate and economically disadvantaged.

As reported in many studies, SLT products have a high level of toxicity, mutagenicity and cancer-causing elements and roughly 4200 low-grade chemicals<sup>9,10</sup> which would disproportionately affect health. SLT products are also associated with several adverse health outcomes including cancer,<sup>11,12</sup> cardiovascular disease,<sup>13–15</sup> oral pain,<sup>16</sup> chronic disease (hypertension, diabetes, tuberculosis, chronic obstructive pulmonary disease (COPD))<sup>17–19</sup> and life-threatening complications in reproductive stages of women, with adverse pregnancy outcomes (eg, stillbirth, low birth weight).<sup>20,21</sup> Despite the adverse health hazards of SLT, unlike smoking tobacco, very few initiatives have been undertaken by government and non-governmental agencies to control its use.

The prevalence of SLT use in most of the South Asian countries is much higher than in sub-Saharan Africa, Central and Western Asia and other developed countries.<sup>22–24</sup> In South and Southeast Asia SLT is used in diverse forms, particularly in Bangladesh where an increasing array of SLT products such as *sadapatha* is widely available.<sup>4,25,26</sup> Moreover, Bangladesh is one of the main cultivators of tobacco in the world, and tobacco leaves are readily available for use as SLT.<sup>4</sup> The most common forms (*zarda* and *sadapatha*) are easily accessible to the general population. However, the prevalence and pattern of SLT consumption among the general population is unknown. Although several studies have been conducted to assess the prevalence, pattern and determinants of smoking tobacco in Bangladesh, similar studies on SLT—particularly on *zarda* and *sadapatha*—are very limited.<sup>6</sup> It is against this background that this study investigated the prevalence, pattern and sociodemographic differentials in SLT consumption, mainly *zarda* and *sadapatha*, using data from a cross-sectional study in Chakaria, a rural area in Bangladesh. The findings of the study will help in designing

appropriate policies and programmatic interventions to protect people from the harmful effects of SLT consumption.

## MATERIALS AND METHODS

### Study area

The study was conducted in Chakaria upazila, a subdistrict of Cox's Bazar District, which is located in the southeast of Bangladesh. The population density of Chakaria is 782 per square kilometre, which is a little lower than the national density of 964 per square kilometre.<sup>27,28</sup> Over 3393 acres of agricultural land have been used for growing tobacco, which could have been used to produce other crops.<sup>29</sup> The study area has been one of the most conservative areas in terms of religious belief and openness to modern ideas with a very low level of secular education. Ninety-one per cent of the population in Chakaria are Muslims while the remainder are either Hindu or Buddhist.<sup>30</sup> The literacy rate among the population aged  $\geq 7$  years is 47.6%, with a similar level for men and women.<sup>31</sup> In Chakaria, pulmonary tuberculosis, acute respiratory infection, stroke, diabetes mellitus and COPD have been the leading causes of death in all age groups.<sup>32</sup>

### Study design and data collection

Data for this study came from a baseline survey carried out as part of a study on reducing tobacco use through an awareness building-based intervention. The study was conducted in 30 randomly selected villages out of 183 during October and November 2011. Twenty-two female interviewers who had at least 10 years of schooling and who came from the locality formed the data collection team with two experienced supervisors. To ensure the quality of the data, a supervisor revisited 5% of the respondents, chosen randomly, within 2 days of data collection by the field workers. Later, the supervisors and data collectors together sorted out any inconsistencies found in the collected data. All the completed questionnaires were manually checked for completeness and for any inconsistencies before the data were entered in the computer database. Finally, 6178 randomly selected individuals aged  $\geq 13$  years from 1753 households were successfully interviewed.

### Definition of variables

The dependent variables used in this study are the use of SLT (yes/no) in the form of *sadapatha* (dried tobacco leaf available as loose leaves) or *zarda* (processed tobacco leaves as flakes produced industrially and available in a tin). The respondents were first asked whether they currently use either of the SLTs and, if yes, at what age they started. *Sadapatha* is commonly sundried without any additive ingredients and can be produced at the household level while *zarda* is made from tobacco using lime spices, vegetable dyes and areca nut. *Sadapatha* is more raw in nature than *zarda* and is cheaper.

Sociodemographic characteristics of the respondents other than age were collected at the time of the

interview. Age was obtained from the existing database maintained by the health and demographic surveillance system. The independent variables included age, education, marital status, occupation and household socioeconomic status which were used as categorical variables in logistic regression analysis. Household socioeconomic status was determined by the wealth index computed from ownership of a standard set of household items observed by the interviewers using principal components analysis.<sup>33 34</sup> In principal component analysis the first component (a linear combination of the assets weighted by the coefficient or factor loading) that possesses maximum variability in the data was used to calculate the score or wealth index. The wealth index was then used to categorise the individuals into five equal groups (or quintiles) where the first quintile is the poorest 20% of households and the fifth quintile is the wealthiest 20% of households.<sup>35 36</sup>

### Data analysis

Both bivariate and multivariate statistical analyses were performed to explore the sex and socioeconomic differentials in the consumption of SLT. The 95% CI for the true prevalence of SLT use was calculated adjusting for clustering at the household level. Association between the dependent and independent variables was assessed by  $\chi^2$  test. Considering the prevailing variation of tobacco use between men and women in Bangladesh, further analysis was conducted to investigate the sex differential in the consumption of the two forms of SLT. To examine the net sex differentials adjusting for the effect of the independent variables, multivariable logistic regression analysis was carried out. As all members aged  $\geq 13$  years in a household were interviewed, multiple respondents were included in the study. This situation might have resulted in correlated observations within a household requiring a special statistical technique to avoid this problem. Two of the commonly used techniques in such a situation are the marginal model with generalised estimating equation (GEE) and a cluster-specific model.<sup>37 38</sup> We used the GEE model for these data and estimated the model using STATA software for Windows (V.13.1).

## RESULTS

### Initiation of SLT use

Both men and women started to use SLT in their 30s, with an average age of 35.0 years (mean $\pm$ SD 35.1 $\pm$ 13.6 years). Although the use of SLT started somewhat earlier in men than in women (33.7 $\pm$ 14.8 years vs 37.5 $\pm$ 10.9 years), in general the use of *zarda* started earlier in men than in women (28.3 $\pm$ 13.1 years vs 35.0 $\pm$ 12.8 years) while the use of *sadapatha* started earlier in women than in men.

### Prevalence and pattern of SLT use

The results presented in table 1 show that 22.9% of the respondents in the study area reported using any form of SLT. Of these, 10.4% used only *sadapatha*, 13.6% used only *zarda* and 2.2% used both. The use of any form of SLT was significantly higher among men, people aged  $>45$  years, illiterate, ever married, day-labourers and people from poorer families. When the two forms of SLT (ie, *sadapatha* and *zarda*) were separately analysed it was found that the use of *zarda* was more prevalent in men than in women (22.4% vs 6.0%) while the use of *sadapatha* was higher in women than in men (14.4% vs 5.9%). The sex differentials in the use of *zarda* and *sadapatha* were statistically significant ( $p < 0.001$ ).

In addition to the results described above, the strong sex differential can also be explored using the disaggregated level of *zarda* and *sadapatha* use among the current SLT users. For example, among current SLT male users, 77% used *zarda*, 12% used *sadapatha* and 11% used both, while in female users, 24% used *zarda*, 68% used *sadapatha* and 8% used both (figure 1).

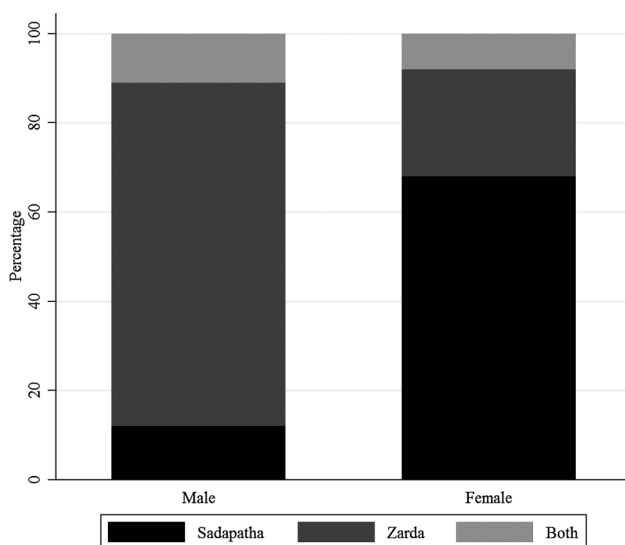
The results from multivariable logistic regression analysis revealed that the odds of being a SLT user among illiterate people, older people, ever married and day-labourers was significantly higher than for those who were literate, younger, unmarried and with an occupation other than a day-labourer (table 2). No significant sex differential was observed in the use of SLT. However, a significant sex differential was observed ( $p < 0.001$ ) when the separate model was fitted for *sadapatha* and *zarda*. The results indicated that the odds of being a *sadapatha* user were 3.5-fold greater for women than for men. The opposite scenario was observed in the use of *zarda* with an odds ratio of 3.6 for men to women. To investigate whether the observed sex difference was modified by other background factors such as age, education, marital status, occupation and socioeconomic status, a model with an interaction term consisting of sex and each of the background factors along with their main effects was fitted. The insignificance of the interaction terms suggests that sex differentials in the use of *sadapatha* and *zarda* were not modified by the other background factors (results not shown).

## DISCUSSION

This study examined the prevalence, pattern and socio-demographic differentials in the use of SLT in two common forms, *sadapatha* and *zarda*. The findings of the study are somewhat consistent with the findings from the Southeast Asian region and other low-income countries.<sup>2 6 39 40</sup> The higher use of these SLT products among the disadvantaged population in the study area clearly indicated the vulnerability of this section of the population to the hazard of using SLT. Use of SLT products in the study area and in Bangladesh has been deep rooted in the Bangladeshi culture of hospitality. SLT products are the most common form of hospitality for both

**Table 1** Prevalence of smokeless tobacco use by sociodemographic characteristics in Chakaria, 2011

| Characteristics | n    | Sadapatha           |         | Zarda               |         | Smokeless tobacco   |         |
|-----------------|------|---------------------|---------|---------------------|---------|---------------------|---------|
|                 |      | % (95% CI)          | p Value | % (95% CI)          | p Value | % (95% CI)          | p Value |
| Sex             |      |                     | <0.001  |                     |         |                     | <0.001  |
| Men             | 2877 | 5.9 (5.1 to 6.8)    |         | 22.4 (20.8 to 24.0) | <0.001  | 27.0 (25.4 to 28.7) |         |
| Women           | 3291 | 14.4 (13.3 to 15.6) |         | 6.0 (5.2 to 6.8)    |         | 19.3 (18.1 to 20.6) |         |
| Age             |      |                     | <0.001  |                     |         |                     | <0.001  |
| 13–24           | 2339 | 0.4 (0.2 to 0.8)    |         | 8.1 (7.0 to 9.3)    | <0.001  | 9.2 (8.1 to 10.5)   |         |
| 25–44           | 2330 | 8.8 (7.6 to 10.1)   |         | 17.6 (16.1 to 19.2) |         | 25.6 (23.8 to 27.4) |         |
| 45–64           | 1122 | 28.3 (25.7 to 31.2) |         | 18.2 (16.0 to 20.6) |         | 41.4 (38.5 to 44.5) |         |
| 65+             | 377  | 29.4 (25.1 to 34.2) |         | 9.6 (7.0 to 13.0)   |         | 36.1 (31.5 to 40.9) |         |
| Education       |      |                     | <0.001  |                     |         |                     | <0.001  |
| None            | 1812 | 23.6 (21.6 to 25.6) |         | 15.6 (13.9 to 17.4) | 0.003   | 36.2 (33.9 to 38.5) |         |
| 1–5 year(s)     | 2219 | 6.4 (5.4 to 7.6)    |         | 15.0 (13.6 to 15.6) |         | 21.4 (19.7 to 23.2) |         |
| 6+ years        | 2136 | 3.4 (2.7 to 4.4)    |         | 10.4 (9.2 to 11.9)  |         | 13.2 (11.8 to 14.7) |         |
| Marital status  |      |                     | <0.001  |                     |         |                     | <0.001  |
| Unmarried       | 1992 | 0.8 (0.5 to 0.12)   |         | 9.3 (8.1 to 10.7)   | <0.001  | 10.5 (9.2 to 11.9)  |         |
| Married         | 3831 | 13.4 (12.2 to 14.6) |         | 15.9 (14.8 to 17.2) |         | 27.6 (26.2 to 29.1) |         |
| Divorced        | 24   | 8.3 (2.1 to 27.9)   |         | 20.8 (8.9 to 41.4)  |         | 33.3 (17.6 to 53.9) |         |
| Widowed         | 321  | 35.8 (30.7 to 41.2) |         | 12.2 (9.0 to 16.2)  |         | 42.7 (37.4 to 48.1) |         |
| Occupation      |      |                     | <0.001  |                     |         |                     | <0.001  |
| Day-labour      | 910  | 9.1 (7.4 to 11.3)   |         | 30.3 (27.4 to 33.4) |         | 39.0 (35.8 to 42.3) |         |
| Farmer          | 573  | 9.6 (7.5 to 12.3)   |         | 22.7 (19.4 to 26.3) |         | 29.1 (25.6 to 33.0) |         |
| Job/business    | 730  | 5.8 (4.3 to 7.7)    |         | 24.8 (21.7 to 28.2) |         | 29.9 (26.6 to 33.4) |         |
| Housewife       | 2028 | 15.6 (14.1 to 17.2) |         | 6.8 (5.8 to 8.0)    |         | 21.3 (19.6 to 23.1) |         |
| Unemployed      | 1740 | 8.3 (7.0 to 9.7)    |         | 4.9 (3.9 to 6.0)    |         | 12.1 (10.6 to 13.8) |         |
| Others          | 187  | 2.1 (0.8 to 5.0)    |         | 15.5 (11.0 to 21.4) |         | 16.0 (11.4 to 22.1) |         |
| Asset quintile  |      |                     | 0.444   |                     | 0.028   |                     | <0.001  |
| Lowest          | 1240 | 11.1 (9.4 to 13.1)  |         | 15.5 (13.5 to 17.7) |         | 26.4 (23.9 to 28.9) |         |
| Second          | 1214 | 11.1 (9.4 to 13.1)  |         | 13.2 (11.4 to 15.3) |         | 23.1 (20.8 to 25.5) |         |
| Middle          | 1249 | 10.4 (8.8 to 12.2)  |         | 14.5 (12.4 to 16.8) |         | 23.8 (21.2 to 26.5) |         |
| Fourth          | 1203 | 10.6 (8.9 to 12.5)  |         | 13.8 (11.9 to 16.0) |         | 22.4 (20.0 to 25.0) |         |
| Highest         | 1226 | 9.0 (7.4 to 10.8)   |         | 10.9 (9.2 to 12.9)  |         | 18.8 (16.7 to 21.0) |         |
| All             | 6168 | 10.4 (9.6 to 11.3)  |         | 13.6 (12.7 to 14.5) |         | 22.9 (21.8 to 24.0) |         |

**Figure 1** Percentage of different forms of smokeless tobacco use among current users by sex.

casual family visitors and invited guests. *Paan* (betel leaves) is always served in Bangladesh with betel nuts and quite often with either of these two forms of SLT. In addition, there are innumerable ready-to-eat *paan* retailers in the country who always offer SLT with *paan*, making it very convenient to use. Use of SLT is also believed to be helpful during the early period of pregnancy by reducing vomiting and increasing the appetite.<sup>41</sup>

SLT products are less expensive than manufactured cigarettes. Furthermore, the use of SLT is more acceptable among women than tobacco smoking because it does not involve public exposure of the behaviour, as is the case with smoking products like cigarettes. There is an element of age and social hierarchy for smoking in Bangladesh: younger people and those from a lower socioeconomic group do not smoke in front of older people and those from a higher socioeconomic group. Breaking this hierarchy for smoking with subtle threshold levels, which are hard to define, is considered impolite. Thus, SLT is a very safe and convenient alternative to



**Table 2** Results from multivariable logistic regression analysis for smokeless tobacco consumption

|                | Sadapatha            |         | Zarda            |         | Smokeless tobacco |         |
|----------------|----------------------|---------|------------------|---------|-------------------|---------|
|                | OR (95% CI)          | p Value | OR (95% CI)      | p Value | OR (95% CI)       | p Value |
| Sex            |                      | 0.000   |                  | 0.000   |                   | 0.231   |
| Men            | 1                    |         | 3.6 (2.5 to 5.0) |         | 1.2 (0.9 to 1.5)  |         |
| Women          | 3.5 (2.5 to 5.1)     |         | 1                |         | 1                 |         |
| Age            |                      | 0.000   |                  | 0.008   |                   |         |
| <24            | 1.0                  |         | 1.0              |         | 1                 |         |
| 25–44          | 15.7 (7.4 to 33.5)   |         | 1.5 (1.2 to 2.0) |         | 2.2 (1.8 to 2.8)  |         |
| 45+            | 58.4 (26.8 to 127.3) |         | 1.3 (1.0 to 1.8) |         | 4.2 (3.2 to 5.5)  |         |
| Education      |                      | 0.000   |                  | 0.158   |                   | 0.000   |
| None           | 2.2 (1.6 to 3.0)     |         | 1.2 (1.0 to 1.6) |         | 2.0 (1.6 to 2.4)  |         |
| 1–5 year(s)    | 1.5 (1.1 to 2.1)     |         | 1.2 (1.0 to 1.5) |         | 1.6 (1.3 to 1.9)  |         |
| 6+ years       | 1                    |         | 1                |         | 1                 |         |
| Marital status |                      | 0.598   |                  | 0.001   |                   | 0.009   |
| Unmarried      | 1                    |         | 1                |         | 1                 |         |
| Married        | 1.3 (0.7 to 2.5)     |         | 1.4 (1.1 to 1.9) |         | 1.1 (0.9 to 1.4)  |         |
| Divorced       | 0.6 (0.1 to 2.8)     |         | 2.9 (1.0 to 8.7) |         | 1.4 (0.5 to 3.5)  |         |
| Widowed        | 1.3 (0.6 to 2.6)     |         | 2.6 (1.6 to 4.2) |         | 1.8 (1.2 to 2.5)  |         |
| Occupation     |                      | 0.1714  |                  | 0.000   |                   | 0.000   |
| Unemployed     | 1                    |         | 1                |         | 1                 |         |
| Day-labour     | 1.4 (0.9 to 2.0)     |         | 3.9 (2.8 to 5.2) |         | 3.5 (2.7 to 4.5)  |         |
| Farmer         | 1.1 (0.7 to 1.7)     |         | 2.2 (1.6 to 3.1) |         | 1.6 (1.2 to 2.2)  |         |
| Job/business   | 1.1 (0.7 to 1.7)     |         | 3.0 (2.2 to 4.1) |         | 2.7 (2.0 to 3.5)  |         |
| Housewife      | 0.9 (0.7 to 1.2)     |         | 1.8 (1.3 to 2.7) |         | 1.5 (1.2 to 1.8)  |         |
| Others         | 0.4 (0.1 to 1.2)     |         | 2.8 (1.8 to 4.5) |         | 1.6 (1.0 to 2.4)  |         |
| Asset quintile |                      | 0.5941  |                  | 0.231   |                   | 0.144   |
| Lowest         | 1.0 (0.7 to 1.4)     |         | 1.0 (0.7 to 1.3) |         | 0.9 (0.7 to 1.2)  |         |
| Second         | 1.2 (0.8 to 1.6)     |         | 1.0 (0.7 to 1.3) |         | 1.0 (0.8 to 1.2)  |         |
| Middle         | 1.1 (0.8 to 1.5)     |         | 1.2 (0.9 to 1.6) |         | 1.2 (0.9 to 1.5)  |         |
| Fourth         | 1.2 (0.9 to 1.6)     |         | 1.2 (0.9 to 1.6) |         | 1.2 (0.9 to 1.4)  |         |
| Highest        | 1                    |         | 1                |         | 1                 |         |

tobacco with smoke. This aspect of social conformity of SLT use makes it easy to be adopted by the younger generation and the process continues.

Control of the use of SLT in Bangladeshi society will therefore require a massive social awareness programme using the education system and various electronic media alongside the tobacco control programme. The traditional approach of labelling packages with warnings will not work for *sadapatha* because it is not industrially produced and does not have any packaging—they are presented as dried tobacco leaves. Although *zarda* is presented in packages, the ready-to-use *paan* retailers put a pinch of *zarda* or a piece of *sadapatha* in the *paan* if the customer requests it. Users therefore do not see the packet of *zarda* unless the whole packet is bought for domestic use. An additional challenge with *sadapatha* is that it can be home grown and therefore it is easy to use. It is very convenient for *paan* eaters to get a pinch of *zarda* or *sadapatha*.

### Study limitations

Our study has some limitations that need to be mentioned. First, SLT consumption was self-reported and may not be accurate. Evidence from other studies suggests that SLT users could be missed when self-reporting

is used.<sup>42</sup> Second, the study was based on a cross-sectional survey allowing only assessment of association and no causal relationship. Third, the study was not based on a statistically nationally representative sample and does not necessarily portray the national situation and may not be generalisable.

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**Contributors** AB, SyH, MNM, MSR, AS and ShH conceived and designed the experiments. SyH, MNM and ShH performed the experiments. AB, SyH, MNM and MSR analysed the data. AB, SyH, MNM, MSR, AS and ShH wrote the paper.

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**Data sharing statement** The authors confirm that all data underlying the findings are fully available without restriction. All data underlying the findings in this paper are freely available upon request subject to the adherence to ICDDR,B data sharing policy (<http://www.icddr.org/policies>). The request for the data can be sent to [hanifi@icddr.org](mailto:hanifi@icddr.org), the principal investigator of the project.

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