Title: Potential determinants of COVID-19 vaccine confidence and receptivity among the primary school's stakeholders in Bangladesh: A cross-sectional study to assess the effects of education

Methods

Study and questionnaire design

The study conducted among the cohort of primary school stockholders and data were collected from 25th February, 2022 to 15th April, 2022. A face-to-face interview approach was applied to 699 participants while 10.3% of them declined to give consent. A total of 627 respondents included in the final analysis. The theoretical concept of COVID-19 vaccine acceptance and hesitancy was conceptualized using recent systematic reviews conducted on the topic.[24] A validated, anonymous, semi-structured, and multi-items questionnaire was developed from a theoretical analysis of recent reviews focused on childhood vaccination.[25-27] The questionnaire was originally developed in English language and then translated by the expert to native language (Bengali) because translating into native language was considered as a key task in capturing the respondent's perception in a survey based study. The items in the preliminary questionnaire were validated by a panel of public health experts from reputed universities in Bangladesh to ensure the relevance and clarity of the instruments. The first part of questionnaire contains the socio-demographic information where the participants were asked about age, gender, education level, marital status, job position, religion etc, while the later part of the questionnaire comprised of predictive construct of childhood COVID-19 vaccine confidence. Permission to conduct this cross-sectional comparative study has been obtained from the "Ethical Review Committee" (ERC), Faculty of Biological Science and Technology, Jashore University of Science and Technology in Bangladesh. The detail research protocol was reviewed and evaluated by the ERC before the study began. Data were collected and analyzed anonymously, while no clinical intervention was applied to the subjects. Hence, the Ethical Review Committee **o**f the university approved the study as exempt. There was no external funding.

Respondents and settings

We carried out this cross-sectional study by applying self-administered anonymous questionnaire to those who were capable to understand the questionnaires and fill it out personally. Face-to-face interview approach was done for participants who were seeking help from the investigator

to understand clearly the questionnaires content. At first, we selected several upozilla of South-western part in Bangladesh to collect data initially by using purposive sampling technique. The areas were selected because of convenience for data collections by the investigators. According to the latest census of 2020, out of a population over 160 million in Bangladesh approximately 66.88% were residing in rural places, of them, at least 46.72% was women and girls. Bangladesh has a total of 108515 primary schools of which 63041 are government schools and 45475 are private schools of them. Nonetheless, the South-western parts of Bangladesh have a total of 8348 primary schools.

.   The eligibility criteria for the participants were: (i) to sign a consent form agreeing to the study objectives and provide anonymous data on COVID-19 vaccine and vaccination, (ii) parent or guardian the students studying in primary schools, (iii) teacher of the primary educational institutes, and (iv) administrative staff of the primary schools.

Patient and public involvement

No patient was involved in this study; however, the public characterized as the stakeholders of primary schools (parents, teachers and administrative staffs) who were potentially eligible involved in this study analysis purposes. All participants provided objectives of the study and informed consent prior to study participations. This study did not harm the individuals because no intervention was applied to the subjects. The individual participant was free to reject the participation.

Sample and data collection

Due to the prevalence of COVID-19 pandemic, we ensured compliance with community health measures such as wearing face mask and maintaining social distancing strictly. The study conducted among the cohort of primary school stockholders and data were collected from 25th February, 2022 to 15th April, 2022. Purposive sampling technique was used for 627 respondents by interviewing face-to-face approach. For observational studies with large sample size, taking a minimum sample size of 500 is necessary to derive the binary logistic regression statistics that represent the parameters. The other recommended rules of thumb are event per variable (EPV) of 50 and the formula; n=100+50*i,* where *i* indicates to number of independent variables incorporated to in the final model.[28] The questionnaire was distributed among parents, teachers,

guardians and administrative personnel's while encouraging them to participate in this study. Face-to-face interview approach ensured the avoidance of missing value in the received data set.

Study tools and survey instruments

The questionnaire included sections on socio-demographic characteristics; willingness to receive a COVID-19 vaccine for children/students, factors motivated them to vaccine confidence. The revised questionnaire was subsequently pre-tested on 20 participants from the respondents; who, later were excluded from the final analysis. Binary logistic regression tool was employed to analyze the correlations and, significance level between predictor variables and outcome variable was tested at 95% Confidence Interval (CI).

Study variables

The study had three objectives. The first objective was to assess the COVID-19 vaccine willingness among the primary school stockholders for the respective students; the second objective was to identify the key considerations influencing their vaccine confidence, while the third objective was to explore the effect of education on vaccine confidence. To address the first two objectives, the response variable of study we measured as willingness to uptake a new vaccine and the presence of persistent confidence on vaccination in which the responses were measured as a binary variable (1=Yes, 0=No). The socio-demographic characteristic and other categorical variables such as age, educational level, job position, gender, marital status, religion, existence of COVID-19 positive experiences of the respondents was also captured. For the third objective, we examined the impact of health education and vaccine related factors itself on the outcome variable dichotomized into 1=Yes and 0=No.

Binary regression equations

The general form of logistic regression is as follows:

$$y = \text{Constant (B)} + b_1x_1 + b_2x_2 + b_3x_3 + \ldots\ldots\ldots\ldots\ldots + b_mx_m \ldots\ldots\ldots\ldots\ldots(.1)$$

Where y is the linear combination function while defined as equation (1) and its value varies from $-\infty$ to $+\infty$, x_1, x_2……..x_m are explanatory variables and the parameters b1, b2……bm are slope coefficient of the logistic regression model. The computational algorithms are as follows:

$$P = P(z = 1) = Bx / [1 + \exp(Bx)] \ldots\ldots\ldots(2)$$

Here, *P* is referred as the probability of vaccine uptake, x=vector of independent variables and B represent the regression coefficient to be estimated. Function of y is represented as logit (p), i,e ., the log (to base e) of the odds or likelihood ratio that the dependent variable z is 1.

y= $\log_e$ [$P/1\text{-}P$] = logit (P)………..(3)

$P=e^y/(1+e^{-y})$……………………… (4)

Usually equation (2) and (3) is written as logit (P) or the log odd ratio as follows-

logit (P)= $\log_e$ [$P/1\text{-}P$]=Bx……….(5)

B reflects the degree of influence of predictor variables on the vaccine uptake intention.

Data analysis

Descriptive statistics utilized weighted frequencies and percentages of the variables to analyze socio-demographic profiles and categorical variables. A non-parametric data analytical tool called binary logistic regression was employed to explore the pattern of association between explanatory variables and the response variable. All the key assumptions related to binary regression analysis were examined to adjust the model suitability. Assumptions of binary logistic analysis were tested. Raw data were inserted into Microsoft Excel version 10 and imported to Statistical Package for the Social Science (SPSS) software. IBM-SPSS version 25 (RRID: SCR_016479) was used for analyzing the data. In this study analysis, $p<0.05$ was considered statistically significant cut-point. The in-person survey denied the acceptance of incomplete survey responses; thus, no missing data were analyzed.