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Post-vaccination campaign coverage evaluation of oral cholera vaccine, oral polio vaccine and measles–rubella vaccine among Forcibly Displaced Myanmar Nationals in Bangladesh

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ABSTRACT

Background: The new influx of Forcibly Displaced Myanmar Nationals (FDMNs) into Bangladesh started in August 2017 through different entry points of Bangladesh. Considering the imminent threat of infectious diseases outbreaks, the Government of Bangladesh (GoB) decided to vaccinate children against three deadly diseases (measles, rubella and poliomyelitis) and oral cholera vaccine (OCV) for all except <1 year children. After completion of the campaigns, post-vaccination campaign evaluation was carried out to assess the coverage of OCV, OPV and MR vaccines during campaigns.

Methods: Post-vaccination campaign evaluation was conducted after completion of the 2nd dose of oral cholera vaccine (OCV2) and oral polio vaccine (OPV2) through a cross-sectional survey. The evaluation was conducted in the Balukhali camps under Ukhiya upazilla. Precision-based sample size was calculated to estimate the vaccine coverage. Ninety-two trained interviewers were involved to collect data from the target of approximately 40000 FDMNs between 18 and 25 November 2017.

Results: Data were collected from 39,438 FDMNs during the survey period. The highest coverage was observed for OCVs (94% for OCV1 and 92% for OCV2). On the other hand, lower coverage was observed for the other vaccines; the coverage for OPV1, OPV2 and MR were 75%, 88% and 38%, respectively. Unawareness (30.7% did not know about the campaign) was the most notable cause of lowering down MR vaccine coverage.

Conclusion: The experience in Bangladesh demonstrates that vaccine campaigns can be successfully implemented as part of a comprehensive response toward disease outbreak among high-risk populations in humanitarian crisis.

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Introduction

Vaccination against infectious diseases is one of the most important public health tools that can be implemented quickly during the inter-epidemic period and which results in significant reduction of mortality and morbidity.[1,2] The risk of communicable disease epidemics is increased due to the increasingly large numbers of displaced populations residing in camps, informal settlements, inadequate water and sanitation facilities or temporary placement sites.[3] The most recent massive exodus of Forcibly Displaced Myanmar Nationals (FDMNs) from northern parts of Myanmar's Rakhine State started on 25 August 2017. The people, globally known as Rohingya, entered through different entry points of Cox's Bazar, the southern border district of Bangladesh. Till November 2018, there has been an influx of more than 700,000 FDMNs, mostly women and children, who joined an estimated 300,000 Rohingyas from past migrations, making a total of more than a million people living in 32 camps in Ukhiya and Teknaf upazilas (sub-districts) of Cox's Bazar.[4] Due to the lack of resources, they were sheltered in makeshift settlements with unhygienic living conditions, poor access to safe water, and lack of a proper sanitation system. Observing risk factors in this humanitarian crisis and initial rapid risk assessment for disease (such as cholera) outbreak, was done by a team which consisted of GoB, WHO, UNICEF, icddr,b and IOM. Given the risk factors, they took into consideration that cholera might occur in refugee settlements especially in cholera endemic settings like Bangladesh.

After the influx, people were being affected by infectious diseases including diarrheal diseases, respiratory tract infections, diphtheria, and measles among others. Since 8 November 2017, diphtheria case was reported and this outbreak continued among the FDMNs camps lead to 44 deaths (Bangladesh Rohingya Emergency Response, Epidemiological Bulletin, Week 47). In the recent past, for example in Yemen, South Sudan, Haiti and other countries, the lack of WaSH and public health facilities have led to large epidemics with high numbers of cholera cases and death.[5–7] Bangladesh is an endemic country with one of the world's highest burdens of cholera, with an estimated 109,052 cholera cases annually while ~66 million population are at risk with an annual incidence rate of 1.64/1,000 along with 3% case fatality.[8] After analyzing the risk, International Co-ordination Group

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(ICG) for OCV allocated 900,025 doses of OCV from the global stockpile to prevent the spread of cholera in this vulnerable population.[9] In the first phase, 700,487 doses of OCV were given to the people aged 1 year and above (OCV1). Sixteen days after first dose, the rest of the supplied OCV doses were given as second dose (OCV2) to 199,472 children aged between 1 and 5 years, for added protection.[10] In addition to OCV2, a total number of 236,696 bOPV (OPV2) doses were administered to all children less than 5 years of age. In September–October 2017, prior to this campaign, EPI program of the Government of Bangladesh (GoB) vaccinated 136,000 children aged 6 months to < 15 years with one dose of measles-rubella (MR) vaccine, and 72,334 children under 5 years of age received bOPV (OPV1). The objectives of this survey were to evaluate the OPV vaccination status of 0–5 years children, MR vaccination status of 6 months to less than 15 years old children, as well as one dose OCV coverage status of people aged > 1 year and 2 dose of OCV coverage among children aged 1-<5 years.

Results

The details of vaccination period, target age group and population, and the number of vaccinated participants by OPV, OCV and MR among FDMN are given in Table 1. A total of 39,438 FDMN members were interviewed from a target population of 40,779. The non-responder rate was ~3%. The overall coverage of OCV1, OCV2, OPV1, OPV2 and MR were 94%, 92%, 75%, 88% and 38%, respectively (Table 2).

Based on regression analysis, vaccine coverage was similar for different age groups except for MR vaccine [AOR (95%CI): 1.12 (1.05, 1.27)], which was more likely to cover children aged 0–5 years compared to 6–15 years. Relatively higher coverage of OCV1 was observed among people living in camps for 4–-6 months compared to people living there for more than 6 months. Other vaccine coverage showed no association with the duration of staying in Bangladesh (Table 3).

We also investigated the probable reasons of non-vaccination. The most common reasons for not being vaccinated were lack of awareness (individuals did not know about the campaign, not knowing the place and date), sickness, and traveling to other places. Specifically, unawareness (30.7% did not know about the campaign) was the most notable cause of decreasing MR vaccine coverage (Table 4).

Discussion

There was a surge of FDMN population entry in Bangladesh within a very short period of time, for which the country was not ready in terms of immediate accommodation and management. The displaced population took shelter in wide places with no facility of safe water and sanitation system. The vaccination status and health seeking awareness of these FDMN Rohingya populations was unknown by the GoB and other supporting agencies. Moreover, there were known histories of circulatory vaccine-derived poliomyelitis (cVDP). Though there were no known active cholera outbreaks in the Rakhine state of Myanmar from where they are mainly displaced, still the people are at risk as Bangladesh is endemic for cholera. Following influx, they were considering as a high-risk population and most vulnerable to develop many infectious diseases. After their arrival, the GoB devised immediate measures to protect FDMN children against major vaccine preventable diseases such as measles, rubella, poliomyelitis and cholera. The target population set for OPV was 0–5 years children; on the other hand, for measles-rubella vaccine, the age group was 6 months to <15 years children and for OCV the target age was over 1 year. Conducting the vaccination campaign was quite challenging due to regular influx, scattered settlement in wide areas, population mobility within the camps, misconception on vaccination, and language barriers of the FDMN population. These challenges were overcome with a multi-sectoral collaborated approach. The initial vaccination campaign for OPV1 and MR vaccine was rapidly implemented following request from multi-sectoral partners. Due to the short campaign duration, the vaccination coverage had not reached the satisfactory level (75% OPV1; 38% MR). The relatively low coverage can be attributed to the continuation of high influx, the FDMNs' initial priority toward relief collection than vaccination, the lack of adequate communication due to language barrier. Furthermore, the relatively complex administration of intra-muscular vaccine injection compared to oral vaccination, may be another plausible reason for the lower coverage of MR vaccination. After the coverage survey more MR campaign has been conducted and that decision was taken based on the lower coverage and new cases of measles. The Moreover, the involvement of icddr,b along with WHO, UNICEF and other non-government organizations during the OCV campaign helped to increase the overall coverage of OCV1 (94.73%), OCV2 (91.85%) and OPV2 (88.7%).

The coverage of OCV in FDMN population was comparatively higher than coverage received from the other large OCV

Table 2. Overall coverage rate of Rohingya vaccination coverage.

Vaccination campaign	Target population (n)	Vaccinated population	Coverage rate (%) (95% CI)
OCVD1	39438	36939	94 (93, 94)
OCVD2	7618	6984	92 (91, 92)
OPVD1	8959	6733	75 (74, 76)
OPVD2	8959	7926	88 (88, 89)
MR	20288	7776	38 (38, 39)

Table 1. The vaccination period, target age group and population and the number of vaccinated participants by OPV, OCV and MR among FDMN.

Vaccination campaigns	Date of campaign	Antigen & target age group	Target	No. of vaccinated participants	Remarks
bOPV, MR	16 September–3 October 2017	MR-6 Month to <15 years	122,580	135,519	New influx of FDMN started on 25 August 2017
		bOPV <5 years	47,165	72,334	
OCV Campaign (1st Round)	10–18 October 2017	>1 year	658,371	700,487	Continuous influx increased the number of target
OCV and bOPV Campaign (2nd Round)	4–9 November 2017	bOPV- <5 years	209,931	236,696	
		OCV-1 to <5 years	182,317	199,472	

Source: WHO country office.

Table 3. Association of vaccine coverage rate with the demographic characteristics.

Variables	OCV1		OCV2		OPV1		OPV2		MR	
AGE (years)	AOR (95% CI)	CR (%)	AOR (95% CI)	CR (%)	AOR (95% CI)	CR (%)	AOR (95% CI)	CR (%)	AOR (95% CI)	CR (%)
0–5	1.07 (0.92, 1.54)	95	–	92	–	75	–	88	1.12*(1.05, 1.27)	41
6–15	1.11(0.89, 1.59)	95	–	–	–	–	–	–	1.00	36
16+	1.00	93	–	–	–	–	–	–	–	–
SEX										
Male	1.09* (1.00, 1.18)	94	0.98 (0.83, 1.16)	92	1.03 (0.93, 1.13)	75	0.99 (0.87, 1.14)	88	1.07*(1.00, 1.13)	39
Female (ref)	1.00	93	1.00	92	1.00	75	1.00	88	1.00	38
Duration of live in BD (months)										
0–3	1.04 (0.93, 1.59)	93	0.99 (0.47, 1.19)	91	0.41*(0.35, 0.48)	71	0.98 (0.41, 1.63)	87	0.66*(0.61, 0.71)	35
4–6	1.13*(1.04, 1.60)	97	1.03 (0.91, 1.47)	94	0.92 (0.71, 1.18)	86	1.10 (0.93, 2.37)	93	0.95 (0.84, 1.06)	46
7–12 (ref)	1.00	91	1.00	91	1.00	87	1.00	88	1.00	47

*AOR: adjusted odds ratio; CR: coverage rate; *Significant (5% level).*

Table 4. Reasons for vaccine dose not taken.

Reasons	OCV1 (%)	OCV2 (%)	OPV1 (%)	OPV2 (%)	MR (%)
Did not know about the campaign	316 (12.65)	129 (20.35)	653 (29.34)	215 (20.81)	3841 (30.7)
Did not know about the place or date of the campaign	258 (10.32)	63 (9.94)	206 (9.25)	115 (11.13)	1776 (14.19)
Did not give importance	304 (12.16)	93 (14.67)	125 (5.62)	119 (11.52)	720 (5.75)
Sick	194 (7.76)	86 (13.56)	143 (6.42)	122 (11.81)	526 (4.2)
There was no vaccine at the vaccination site.	42 (1.68)	27 (4.26)	114 (5.12)	19 (1.84)	524 (4.19)
There was no vaccinator at the site.	43 (1.72)	24 (3.79)	39 (1.75)	33 (3.19)	608 (4.86)
Fear of vaccine	21 (0.84)	5 (0.79)	8 (0.36)	16 (1.55)	87 (0.70)
Fear of reaction	8 (0.32)	2 (0.32)	5 (0.22)	6 (0.58)	23 (0.18)
Site was too far	17 (0.68)	3 (0.47)	7 (0.31)	3 (0.29)	36 (0.29)
Very long queue	10 (0.40)	0 (0.00)	2 (0.09)	1 (0.1)	34 (0.27)
Traveling	596 (23.85)	89 (14.04)	375 (16.85)	119 (11.52)	1508 (12.05)
Other	690 (27.82)	113 (17.82)	549 (24.66)	265 (25.65)	2829 (22.61)
Total	**2499**	**634**	**2226**	**1033**	**12512**

campaigns previously conducted in Bangladesh.[11] However, the coverage rate is similar with other OCV campaigns conducted in humanitarian crisis.[3,12] The two dose regimen of OCV are recommended but it was not possible in this campaign due to shortage vaccines in the global stockpile; therefore, only children aged 1–5 years were targeted for 2nd dose as single dose provides 16% vaccine protective efficacy whereas double dose 52% against all cholera episodes in this age group.[13,14] Meanwhile, diphtheria case was reported since 8 November 2017, and this outbreak continued among the FDMNs camps leading to 44 deaths (Bangladesh Rohingya Emergency Response, Epidemiological Bulletin, Week 47). Majority of those affected are of age between 5 and 14 years. To combat such a morbid situation, third round of Diphtheria campaign has been completed for between 6 weeks and 15-year-old children.[15]

One of the main strengths was the involvement of skilled manpower from icddr,b who were previously well trained during several OCV vaccine delivery studies. We used of precision based cluster sampling technique for the calculation of sample size, which may be representative for all the FDMN camps also a strength of the study. In addition, interviewers took into consideration appropriate data collection times and language barriers like the interviewers having language similarity with Rohingya people were preferred for data collection. Also local community leaders from the FDMNs called "Majhi" helped the interviewers during the data collection process.

Limitations

This study has several limitations: firstly, the data were collected based on the interview of participants; the participants did not have any vaccination card, which may introduce recall bias. Secondly, age of the participants was determined based on the verbal screening which may include few participants beyond the target age group. Thirdly, we have selected one camp purposively as major bulk of the population was residing within the camp. The surveyed population that was sampled, henceforth, to generalize the whole population of the FDMNs.

Conclusion

Humanitarian crisis situation is always a threat for developing multiple infectious and deadly diseases as the crowd being concentrated in a very limited area with inadequate facilities. Recent examples of this were observed in Yemen, Haiti and some African countries where sudden cholera outbreak rapidly affected a large number of population. Most of these diseases are vaccine preventable. Given the recent migration of FDMNs from Myanmar to Bangladesh, this was taken into consideration, and immediate vaccination with routine EPI and cholera vaccines was provided with the target to resolve and prevent outbreak. In summary, a mass vaccination campaign with high coverage is possible even just after the influx of a large number of refugees in resource poor-settings, if there is a well collaborative approach from Government along with other national and international partners. Overall, the result will direct the public health leaders as well policy makers to face such humanitarian crisis over the globe. Continuous monitoring and adherence to vaccination against preventable diseases, along with proper implementation of WaSH facilities is crucial to prevent future outbreaks. Moreover, strong surveillance against all common infectious diseases will also play a vital role in such situations.

Comprehensive multi-sectoral involvement would be effective for implementing the vaccination program systematically and to prevent the infectious diseases.

Materials and methods

Study settings

Post-vaccination campaign evaluation was carried out after completion of OCV2 and OPV2 vaccination campaign. On request of the Expanded Programme on Immunization (EPI), and with the support of WHO country office for Bangladesh, the campaign evaluation was carried out by the Infectious Diseases Division of icddr,b. WHO and EPI (GoB) decided to carry out the post-vaccination campaign evaluation among the FDMNs in Balukhali camp (which is again sub-divided into block category A, B, C and so on) of Ukhiya upazilla of Cox's Bazar district in Bangladesh. Interview for data collection was continued from 18 to 25 November 2017.

Vaccination

Campaign was initiated with OPV and MR vaccines through EPI under MoHFW, later conducted OCV campaign by the GoB in collaboration with other national and international partners (WHO, UNICEF, MSF icddr,b and others). During OCV1 campaign, one dose of OCV was given to all FDMNs aged 1 year and above, between 10 and 18 October 2017. OCV2 campaign was conducted on 04–09 November 2017 when second dose bivalent OPV (bOPV2) was given to the children age group 0–<5years along with second dose OCV (OCV2) to the children age group 1–<5 years. It is noted that with the technical support of WHO and UNICEF, the EPI program of DGHS previously vaccinated with i) one dose of Measles-Rubella (MR) vaccine in children aged between 6 months and <15 years, and ii) one dose of bi-valent oral polio vaccine (bOPV1) in children <5 years. This MR-bOPV vaccination campaign was carried out from 16 September to 03 October 2017.

During OCV campaign, around 155 vaccination sites were set up around the four major settlements and in several other strategic locations in Cox's Bazar. Target population was estimated from the government records.

Sample size, sampling strategy and data collection

Sample size has been calculated to estimate the vaccine coverage assuming expected coverage is 50% among the Rohingya population with 2% precision, 98% level of confidence, 80% power and design effect 2 for cluster sampling design; we had to need 6766 individuals for this study. Since the study objective to estimate the coverage for three vaccines (OCV, OPV and MR) separately for different age groups, so we conducted this survey among around 40000 individuals to meet the desired sample size for all sub groups. The average cluster size is about 435; so we choose 92 clusters randomly from population and approximately all individuals interviewed for this survey.

icddr,b recruited 92 interviewers for collecting information of antigen wise (OCV, OPV and MR) vaccination status of the target population. All interviewers were provided training on vaccine, vaccination campaign, questionnaire, data collection and data input. Collected data was recorded in electronic devices. Data was collected through verbal interview, however data collector checked the vaccination card if available. First and second line supervisors from icddr,b were assigned for continuous monitoring and supportive supervision of the data collection process.

Data analysis method

The vaccination data of the post-campaign evaluation survey of OCV, OPV and MR, were collected by interviewing the FDMNs in Cox's Bazar. The data set was presented as frequency, percentage, and chi-square statistic p-value using bivariate statistical analysis scheme. The coverage associated covariates: age, sex, duration of living in Bangladesh, block and campaign name, were used to perform statistical analysis with the response variables (OCV, OPV and MR vaccination) at different dose labels. The vaccination coverage rates were calculated according to associated covariates with 95% confidence intervals (CI). To estimate the odds ratio (OR) and 95% CI of covariates with the response variables, multiple logistic regression model was used with appropriate adjustment of covariates. All the analysis in this paper were implemented by Stata version 13 (College Station, TX, USA).

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Disclosure of potential conflicts of interest

The authors have no conflicts of interest to disclose.

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