Vaccine xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

Socioeconomic risk factors for cholera in different transmission settings: An analysis of the data of a cluster randomized trial in Bangladesh

Amit Saha [a,b], Andrew Hayen [a,c], Mohammad Ali [d], Alexander Rosewell [a], John D. Clemens [a,e,f], C. Raina MacIntyre [a], Firdausi Qadri [b,*]

[a] School of Public Health and Community Medicine, UNSW Australia, NSW, Australia
[b] International Centre for Diarrhoeal Disease Research Bangladesh (icddr,b), Dhaka, Bangladesh
[c] Australian Centre for Public and Population Health Research, Faculty of Health, University of Technology Sydney, Australia
[d] Johns Hopkins Bloomberg School of Public Health, Baltimore, USA
[e] UCLA Fielding School of Public Health, Los Angeles, USA
[f] Korea University School of Medicine, Seoul, South Korea

ARTICLE INFO

Article history:
Received 18 April 2017
Received in revised form 16 June 2017
Accepted 6 July 2017
Available online xxxx

Keywords:
Cholera
Oral cholera vaccine
Vaccination
Risk factors
Socio-economic factors

ABSTRACT

Background: Cholera remains a threat globally, and socioeconomic factors play an important role in transmission of the disease. We assessed socioeconomic risk factors for cholera in vaccinated and non-vaccinated communities to understand whether the socioeconomic risk factors differ by transmission patterns for cholera.

Methods: We used data from a cluster randomized control trial conducted in Dhaka, Bangladesh. There were 90 geographic clusters; 30 in each of the three arms of the study: vaccine (VAC), vaccine plus behavioural change (VBC), and non-intervention. The data were analysed for the three populations: (1) vaccinees in the vaccinated communities (VAC and VBC arms), (2) non-vaccinated individuals in the vaccinated communities and (3) all individuals in the non-vaccinated communities (non-intervention arm). A generalized estimating equation with logit link function was used to evaluate the risk factors for cholera among these different populations adjusting for household level correlation in the data.

Results: A total of 528 cholera and 226 cholera with severe dehydration (CSD) in 268,896 persons were observed during the two-year follow-up. For population 1, the cholera risk was not associated with any socioeconomic factors; however CSD was less likely to occur among individuals living in a household having ≤4 members (aOR = 0.55, 95% CI = 0.32–0.96). Among population 2, younger participants and individuals reporting diarrhoea during registration were more likely to have cholera. Females and individuals reporting diarrhoea during registration were at increased risk of CSD. Among population 3, individuals living in a household without a concrete floor, in an area with high population density, closer to the study hospital, or not treating drinking water were at significantly higher risk for both cholera and CSD.

Conclusion: The profile of socioeconomic factors associated with cholera varies by individuals' vaccination status as well as the transmission setting. In a vaccinated community where transmission would be expected to be lower, socioeconomic factors may not increase the risk of the disease.

1. Introduction

Cholera continues to be a public health threat for low and middle income countries, particularly in Asia, Africa and recently in the Caribbean [1]. People living in urban slums and highly dense settings, with a lack of safe water and proper sanitation facilities are particularly vulnerable to the disease [2–4]. Studies have shown that population density and low educational status are risk factors for cholera infection [5]. Global climate change, including rapid and often unplanned urbanization, could also increase the rates of cholera infection [6]. These factors enhance an individual's vulnerability to infection and contribute to transmission, but are unlikely to be reduced in the short-term with current levels of investment.

Killed whole-cell oral cholera vaccines (OCV) are now a cornerstone of public health programs to prevent cholera infections and reduce the severity of the disease [7–9]. A global stockpile of the OCV has been created to control cholera outbreaks. Due to

* Corresponding author at: Infectious Diseases Division, icddr,b, GPO Box 128, Dhaka 1000, Bangladesh.

http://dx.doi.org/10.1016/j.vaccine.2017.07.021
0264-410X/

increasing demand for the vaccine, global cholera vaccine production is set to double [10]. Studies conducted in different settings have shown that prequalified OCVs offer 80% protection at 6 months and 65% at 5 years [8,11]. The efficacy of the vaccine could be highly variable geographically, and the variability may be driven by several socioeconomic factors [12]. On the other hand, socioeconomic risk factors could also depend on the transmission pattern of the disease. In a vaccinated area or community where the transmission would be expected to be lower due to widespread vaccination, it is possible that the risk factors may differ to those in a non-vaccinated area or community where there would be increased transmission of the disease.

Since OCVs provides both direct and indirect protection, it is important for us to understand the impact of vaccination on socioeconomic risk factors for cholera, so that the knowledge could help making a well-planned intervention strategy to get maximum benefit from a mass vaccination program. However, there is a lack of information on the impact of a mass vaccination on the socioeconomic risk factors for cholera. To fill this knowledge gap, we assessed the impact of vaccination with OCV on the socioeconomic risk factors for cholera in an urban cholera prone population in Bangladesh.

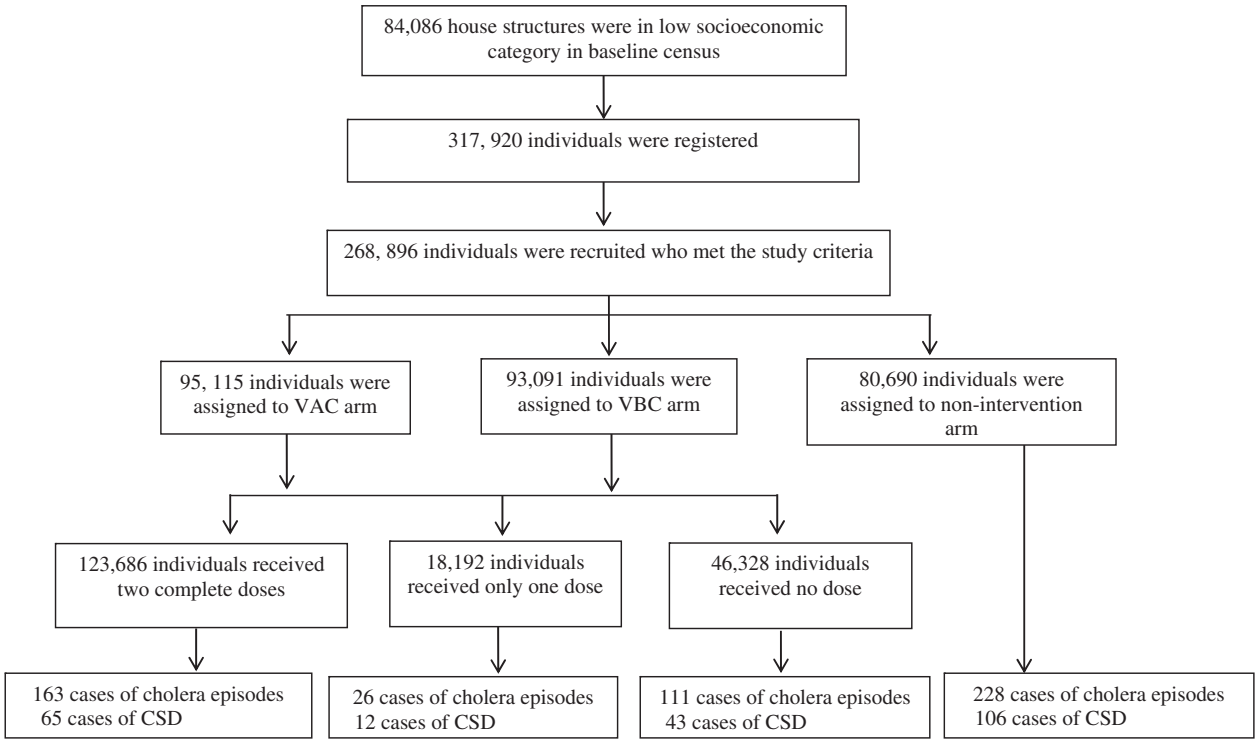
2. Methods

2.1. The study area

We used data from a cluster randomized trial conducted in Dhaka, Bangladesh [9]. The study area consisted of 6 high cholera incidence wards in Mirpur, in the north-west of Dhaka City [13]. The residents of this area were predominantly from low to middle income communities. The study area was divided into 90 geographic clusters, each of which was separated from others by a 30-meter buffer in order to minimize spill over of the effects of the intervention. The average population size in a cluster was 2988 (range: 2288–4299). The clusters were randomized into three arms: the vaccine (VAC) arm, the vaccine plus behavioural change component arm (VBC), and the non-intervention arm. There were 30 clusters in each arm. The VAC arm received the vaccine only; the VBC arm received the vaccine plus hand washing intervention and point-of-use, chlorinated water treatment; and the non-intervention arm continued their standard habits and practices. [9].

2.2. The study participants

The study included individuals from high risk populations based on socioeconomic, sanitation and hygiene status [13]. People who met one or more of the following criteria were included in the study: living in overcrowded conditions, unsafe water use, poor sanitation, unhealthy and unhygienic living conditions, sharing of toilet and kitchen. Overcrowding was defined as three or more adults living in one room. Unsafe water use was defined as the lack of clean water for drinking and for washing utensils. Poor sanitation was defined as the lack of a sanitary latrine such as a pour flush latrine, water sealed latrine, or improved pit latrine as well as with direct connection to a sewer line or septic tank. Unhealthy and unhygienic living conditions included water sources, kitchens, or toilets which were shared. The overall condition of each dwelling was assessed by trained field interviewers. A total of 317,920 residents were enumerated during a baseline census, of whom 268,896 people met the study inclusion criteria, i.e. they were high risk residents. Of the 268,896 individuals, 95,115 were in the VAC arm, 93,091 individuals were in the VBC arm, and 80,690 individuals were in the non-intervention arm (Fig. 1). A hand held device, PDA (personal digital assistant) was used to collect demographic, socio-economic and healthcare information. A unique ID was assigned to each individual in the study.



VAC: vaccine; VBC: Vaccine with behaviour change component; CSD: Cholera with severe dehydration

Fig. 1. Assembling the population for the analysis.

Please cite this article in press as: Saha A et al. Socioeconomic risk factors for cholera in different transmission settings: An analysis of the data of a cluster randomized trial in Bangladesh. Vaccine (2017), http://dx.doi.org/10.1016/j.vaccine.2017.07.021