

Letter to the Editor

Questioning the Effectiveness of Oral Cholera Vaccine in Port-au-Prince Slums

Dear Sir:

Oral cholera vaccination (OCV) has been validated by the World Health Organization (WHO) as a valuable tool to complement water, sanitation, and hygiene (WASH) activities in cholera prevention for high-risk areas and populations.¹ We read with great interest the recent study published by Sévère and others,² which evaluated the effectiveness of a mass OCV campaign targeting approximately 70,000 inhabitants in several slums of Port-au-Prince, Haiti, between April and June 2012. The authors reported a 75% vaccine coverage and, using a cohort design, a striking 97.5% vaccine effectiveness in the 37 months postvaccination, whereas controlled clinical trials have measured OCV vaccine efficacy around 57% [95% confidence interval, 44–67%] during the first 2 years.³ Although it was expected that 56% of cholera cases would occur among vaccinated individuals according to the WHO screening method,⁴ the same proportion was 5% in the Sévère and others cohort.

A thorough analysis of this study shows that the authors did not evaluate the isolated effectiveness of OCV. They rather estimated its combined effectiveness together with WASH-associated measures. To assess the importance of such methodological bias, we computed provided data using a bias-indicator cohort analysis, as previously described in another OCV campaign,⁵ and found that their strategy exhibited a 95% effectiveness [93–97%] against noncholeric diarrheas as well. Pondering such bias would require adjusting the results on the observance of WASH prevention methods, which may have differed between nonvaccinated and vaccinated groups.

A cohort study requires that the population be carefully defined and monitored. Conversely, cholera surveillance of both groups was only passively conducted from the GHESKIO (The Haitian Group for the Study of Kaposi's Sarcoma and Opportunistic Infections) cholera treatment center (CTC), and many cholera cases may have been treated elsewhere. During the study period, at least seven CTCs operated in Port-au-Prince within a 5-mile radius around GHESKIO, including three major CTCs operated by *Médecins Sans Frontières*, and over 20,000 suspected cholera cases were reported to the Haitian Ministry of Public Health and Population.⁶ In addition, the OCV campaign was conducted from April to July 2012, during the main cholera peak of the study period. As the authors started to record cholera cases from April, the cholera attack rate of the nonvaccinated group was overestimated.

Therefore, Sévère and others should have rather conducted a case-control study. Field effectiveness of OCV has previously been evaluated with a test negative case-control design using participant-based analysis with censoring for cholera.⁷ Computing such an analysis using the study data with noncholeric diarrheas as the control group, we found an OCV effectiveness of 67% (41–82%), which is close to the 58%

effectiveness (13–80%) of a concomitant OCV campaign conducted in rural Haiti using the same vaccine.⁸

Field reports of OCV campaigns can be interesting to evaluate the feasibility and impact of such strategies. Estimating vaccine effectiveness is also important to detect unexpected programmatic errors. However, vaccine effectiveness results are hampered by many biases that are difficult to ponder in observational studies. Consequently, effectiveness results shall neither be confounded with the experimentally measured vaccine efficacy, nor replace the proper evaluation of vaccine impact on the course of an epidemic.

Finally, as stated by the WHO position paper on cholera vaccines¹ and suggested by our additional analysis of Sévère and others data, WASH activities remain the corner stone of cholera control and elimination strategies. In Haiti, money is currently lacking to sustain the nationwide reactive program of community awareness and water treatment, and only a tiny fraction of the resources requested by the National Plan for Cholera Elimination in Haiti, 2013–2022⁹ for long-term water and sanitation infrastructures has been pledged so far. Such spectacular but biased OCV effectiveness results shall not even more divert stakeholders and donors from funding these crucial short and long-term WASH programs.

STANISLAS REBAUDET
Assistance Publique—Hôpitaux de Marseille
Marseille, France; and
UMR MD3
Aix-Marseille University
Marseille, France
E-mail: stanreb@gmail.com

JEAN GAUDART
Assistance Publique—Hôpitaux de Marseille
Marseille, France; and
UMR 912 SESSTIM (AMU, INSERM, IRD)
Aix-Marseille University
Marseille, France
E-mail: jean.gaudart@univ-amu.fr

AARON ARUNA ABEDI
Ministry of Health
Kinshasa, Democratic Republic of the Congo
E-mail: arunaaaron@yahoo.fr

RENAUD PIARROUX
Assistance Publique—Hôpitaux de Marseille
Marseille, France; and
UMR MD3
Aix-Marseille University
Marseille, France
E-mail: renaud.piarroux@ap-hm.fr

This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

REFERENCES

1. World Health Organization, 2010. Cholera vaccines: WHO position paper. *Wkly Epidemiol Rec* 13: 117–128.
2. Sévère K, Rouzier V, Anglade SB, Bertil C, Joseph P, Deroncelay A, Mabou MM, Wright PF, Guillaume FD, Pape JW, 2016. Effectiveness of oral cholera vaccine in Haiti: 37-month follow-up. *Am J Trop Med Hyg* 94: 1136–1142.
3. Sinclair D, Abba K, Zaman K, Qadri F, Graves PM, 2011. Oral vaccines for preventing cholera. *Cochrane Database Syst Rev* 16: CD008603.
4. Orenstein WA, Bernier RH, Dondero TJ, Hinman AR, Marks JS, Bart KJ, Sirotkin B, 1985. Field evaluation of vaccine efficacy. *Bull World Health Organ* 63: 1055–1068.
5. Khatib AM, Ali M, von Seidlein L, Kim DR, Hashim R, Reyburn R, Ley B, Thriemer K, Enwere G, Hutubessy R, Aguado MT, Kieny M-P, Lopez AL, Wierzba TF, Ali SM, Saleh AA, Mukhopadhyay AK, Clemens J, Jiddawi MS, Deen J, 2012. Effectiveness of an oral cholera vaccine in Zanzibar: findings from a mass vaccination campaign and observational cohort study. *Lancet Infect Dis* 12: 837–844.
6. Ministère de la Santé Publique et de la Population de la République d’Haïti, 2011–2016. Rapports choléra. *Centre de Documentation*. Available at: <http://mspp.gouv.ht/newsite/documentation.php>. Accessed March 23, 2016.
7. Ali M, You YA, Sur D, Kanungo S, Kim DR, Deen J, Lopez AL, Wierzba TF, Bhattacharya SK, Clemens JD, 2016. Validity of the estimates of oral cholera vaccine effectiveness derived from the test-negative design. *Vaccine* 34: 479–485.
8. Ivers LC, Hilaire IJ, Teng JE, Almazor CP, Jerome JG, Ternier R, Boncy J, Buteau J, Murray MB, Harris JB, Franke MF, 2015. Effectiveness of reactive oral cholera vaccination in rural Haiti: a case-control study and bias-indicator analysis. *Lancet Glob Health* 3: e162–e168.
9. Republic of Haiti, Ministry of Public Health and Population, National Directorate for Water Supply and Sanitation, 2013. *National Plan for the Elimination of Cholera in Haiti 2013–2022*. Port-au-Prince, Haiti, 114. Available at: http://www.paho.org/hq/index.php?option=com_docman&task=doc_view&gid=20326&Itemid=270&lang=en. Accessed March 23, 2016.