Evaluation of Knowledge and Practices Regarding Cholera, Water Treatment, Hygiene, and Sanitation before and after an Oral Cholera Vaccination Campaign—Haiti, 2013–2014

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Abstract. In 2013, the Government of Haiti implemented its first oral cholera vaccine (OCV) campaign in Petite Anse, an urban setting, and Cerca Carvajal, a rural commune. We conducted and compared responses to two independent cross-sectional knowledge and practices household surveys pre- ($N = 297$) and post- ($N = 302$) OCV campaign in Petite Anse. No significant differences in knowledge about causes, symptoms, and prevention of cholera were noted. Compared with precampaign respondents, fewer postcampaign respondents reported treating (66% versus 27%, $P < 0.001$) and covering (96% versus 89%, $P = 0.02$) their drinking water. Compared with precampaign, postcampaign survey household observations showed increased availability of soap (16.2% versus 34.5%, $P = 0.001$) and handwashing stations (14.7% versus 30.1%, $P = 0.01$), but no significant changes in handwashing practices were reported. Although there was no change in knowledge, significant decreases in water treatment practices necessary for cholera and other diarrheal diseases prevention were noted in the postcampaign survey. Future OCV campaigns in Haiti should be used as an opportunity to emphasize the importance of maintaining good water, sanitation, and hygiene practices, and include a comprehensive, integrated approach for cholera control.

INTRODUCTION

Since October 2010, Haiti has experienced a cholera outbreak with approximately 768,970 suspected cases and 9,201 cholera-related deaths as of January 30, 2016.¹ In response to this outbreak, the Haitian Ministry of Health and Population (Ministère de la Santé Publique et de la Population [MSPP]) developed the National Plan for the Elimination of Cholera, 2013–2022.² The plan of action proposed to work toward building better health coverage, improving sanitary and hygiene facilities, and increasing access to potable water as long-term solutions to eliminate cholera.² In addition, immediate short-term interventions such as vaccination of populations living in areas with difficult access to health care or with lack of access to potable water and proper sanitation were proposed.³ The Haitian government estimated that 600,000 people should be targeted for oral cholera vaccination during 2013–2015.³

In 2013, MSPP carried out its first oral cholera vaccine (OCV) campaign using Shanchol[™] vaccine (Shantha Biotechnics, Hyderabad, India). The target population included persons aged 1 year and older excluding pregnant women. Petite Anse (an urban section communale in the North department with an estimated target population of 86,989) and Cerca Carvajal (a rural commune in the Center department with an estimated target population of 20,917) were selected for the campaign due to poor water and sanitation infrastructure, poor access to healthcare facilities, high cholera attack rates, and the fact that population size of the two areas was approximately equal to the number of available doses of the vaccine (~200,000 doses of OCV to cover two doses per person). The first round of OCV campaign was conducted on August 5–9, 2013. The second round was conducted on August 26–30, 2013, in Cerca Carvajal, and split between August 26–28 and September 9–10

of the same year in Petite Anse. The overall coverage with two doses of OCV among persons aged 1 year and older excluding pregnant women was 63% in Petite Anse and 77% in Cerca Carvajal. Further details on the vaccination campaign and coverage have been previously published.⁴

Social mobilization before and during the campaign consisted of oral messaging that provided information on the dates of the campaign and target population (1 year and older excluding pregnant women), posters, and pamphlets. Posters were placed at vaccination sites, and their main message was that people should practice good hygiene and take two doses of the vaccine to prevent cholera. The pamphlets were distributed to people who came for vaccination and included general information on cholera symptoms (vomiting, severe white-colored diarrhea), transmission (contaminated water and food), treatment (oral rehydration solution [ORS] and going to health center), prevention (good hygiene, treatment of drinking water, and taking two doses of the vaccine), information on good hygiene practices (wash hands with clean water and soap after using the toilet, before washing fruits and vegetables, before eating, and after cleaning the baby), water treatment practices (always use treated water, properly treating water includes boiling or adding bleach, and proper water storage), and OCV (the need to receive two doses for protection, take the second dose 15 days after the first dose, safe and effective vaccine with no serious side effects, cannot be given to pregnant women and children < 1 year old).

The effectiveness of OCV varies depending on the period since vaccination, and the epidemiological situation of cholera in the country. OCV effectiveness 6 months after a vaccination campaign to control an outbreak in Guinea was 86%.⁵ In cholera-endemic settings, cumulative protective efficacy of OCV has been shown not to exceed 65% 5 years after vaccination in Kolkata, India,⁶ overall protective effectiveness against severely dehydrating cholera did not exceed 45% after 2 years of vaccination in Bangladesh,⁷ and most recently a 63% vaccine effectiveness was reported within 2 years of vaccination in a rural area of Haiti.⁸ Hence, vaccination campaigns should

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not replace existing interventions built on health education and improving access to clean water, sanitation, and hygiene (WASH) practices, but rather complement and reinforce these interventions.^{9,10} World Health Organization guidance for OCV campaign planning and implementation stresses the importance of social mobilization and dissemination of messaging on cholera prevention through several media channels to widely spread the need to maintain and reinforce use of safe drinking water, safe food, good personal hygiene, and adequate sanitation.¹¹

Limited information is available on the impact of OCV campaigns on WASH practices. Some argue that OCV use may detract from existing cholera control and prevention interventions, and inadvertently have a negative impact if vaccinated people stop implementing recommended WASH behaviors (water treatment, good hygiene) necessary for cholera prevention due to a false sense of security after receiving the vaccine by assuming that the vaccine is 100% effective in preventing cholera.¹² Others have shown that OCV campaigns when conducted with a strong educational messaging and promotion of improvements in water and sanitation can lead to significant improvements in knowledge and practices related to cholera and waterborne diseases prevention.¹³ Knowledge and practices surveys have been used to assess knowledge and practices related to cholera and OCV,¹⁴ as well as evaluate any changes in those aspects pertaining to diarrheal diseases after educational sessions and OCV campaigns.^{13,15,16} Knowledge and practices surveys before and after OCV campaigns help identify and measure knowledge and behavioral changes, and deepen the understanding of the use of OCV campaigns as integrated methods for comprehensive cholera control and prevention.

We conducted two knowledge and practice surveys to evaluate any changes in knowledge and practices regarding cholera, WASH practices before and a year after the 2013 OCV campaign in Haiti.

MATERIALS AND METHODS

Design and sampling. We conducted two independent cross-sectional knowledge and practices surveys of representative samples of households in Petite Anse. Two independent samples were used rather than a paired sample design to allow for comparison of population averages, to reduce the risk of lost to follow-up, and to ensure responses in the postcampaign survey were not being influenced by knowledge of the questions used in the precampaign survey. Sample size was calculated using a two-sided pooled z test to detect a 15% change from baseline in knowledge and practices after the OCV campaign, assuming 50% of respondents would have good knowledge and practices regarding cholera, and WASH practices before the OCV campaign ($\alpha = 0.05$, power = 90). Inflating the sample size by a design effect of 1.2 and a 10% nonparticipation rate, a total of 303 households were needed for each of the pre- and postcampaign knowledge and practices surveys. The design was a two-stage cluster survey using the 2011 population and household database of the Haitian Institute of Statistics and Information as the sampling frame, and enumeration areas (EAs) as the primary sampling unit. Thirty-one EAs were selected by systematic probability proportional to size based on the number of households in each EA. Interviewers had maps and

Global Positioning System (GPS) devices to guide them in the selected EA. Within each selected EA, survey teams selected 10 households for interview by starting with the first household on the corner of the EA and subsequently moving in a clockwise manner covering every street and using a predetermined sampling interval based on the estimated total number of households in the cluster (approximately number of households in EA/10). A household was defined as a group of people who live and eat together under one roof.

Only one family member per household, preferably the female head of household, was interviewed after consent had been obtained. If the female head of household was not available, an available adult household member over the age of 18 years able to provide answers to the questions and preferably a female was selected. Selected household members should have lived in Petite Anse at the time of the surveys and during the OCV campaign of 2013. The protocol was approved by the National Ethics Committee in Haiti. The protocol was reviewed by Centers for Disease Control and Prevention and determined to be a program evaluation activity that did not constitute human subject research.

Data collection. The precampaign survey was conducted during August 1–4, 2013, 1 week before the OCV campaign. The postcampaign survey was conducted during July 17–22, 2014, almost 1 year after the OCV campaign. Graduates of the Haiti Field Epidemiology Training Program conducted the interviews for both surveys. Interviewers were trained before each survey on the household selection methodology, interviewing techniques, use of smartphones as data collection devices, and use of GPS devices to orient themselves in the cluster. The precampaign survey was administered through paper questionnaires, and data were entered in Census Survey Processing System. Data for the postcampaign survey were collected electronically using smartphone technology.

The same survey instrument was used for the pre- and postcampaign survey. It consisted of a questionnaire that assessed demographic (age, sex), socioeconomic (education level of the respondent and availability of electricity, bed, working refrigerator, television, radio, and mobile phone in the household), and household characteristics (number of people living in the household); knowledge about cholera (causes, symptoms, and prevention) and cholera treatment-seeking behaviors; exposure to cholera prevention messages within the 6 months before each survey (source and type of information received, educational materials or other items given during the training); water sources, storage, and treatment practices; hand hygiene and sanitation practices; knowledge and attitudes related to cholera vaccine (awareness of OCV, duration of protection from cholera, willingness to get OCV among precampaign survey respondents); and vaccination with OCV during the past year. After the interview, interviewers observed the households to assess the availability and type of water storage container, the availability of handwashing station and soap, and the availability and type of toilet used by household members.

Statistical analysis. Rao-Scott χ^2 tests were used to compare pre- and postsurvey categorical responses. Adjusted Wald F tests were used to compare the means of continuous responses. All tests accounted for the cluster design; we assumed that the sample was self-weighting. We categorized responses to the causes, symptoms, and methods of preventing cholera into no correct responses, one, two, three, and more than three correct responses. We also compared proportion of

respondents that provided < 3 versus ≥ 3 correct responses to the causes, symptoms, and methods of preventing cholera. We considered the following as correct answers to the questions about causes of cholera (drinking “bad” water, eating “bad” food, unwashed fruits/vegetables, bacteria, and poor hygiene/not washing hands), symptoms of cholera (vomiting, watery diarrhea, stomach/abdominal pain, and dehydration), and methods of preventing cholera (handwashing, cooking food, washing vegetables, disposing of human waste properly, boiling water, and treating water with chlorine or other solutions). Analysis to compare proportions of respondents reporting cholera prevention practices in the pre- and postsurveys (washing hands before eating and after using the toilet, treating water all the time during the past 6 months, treating drinking water within the past 24 hours) were computed using Fisher’s exact test for trend. We also compared results on cholera knowledge and prevention, and WASH practices between vaccinated and unvaccinated respondents to the postcampaign survey.

Statistical analysis was done using SAS v. 9.3 (The SAS Institute, Cary, NC) and STATA v. 14 (StataCorp LP, College Station, TX). *P* values < 0.05 were considered statistically significant.

RESULTS

Demographic and household characteristics. Of the 310 selected households in each survey, 297 (95.8%) participated in the precampaign and 302 (97.4%) participated in

the postcampaign survey. There was a significant difference in the status of the responder, with more female head of households interviewed in the precampaign (73.8%) compared with the postcampaign (64.2%) survey and more nonhead of households interviewed in the postcampaign (23.5%) compared with the precampaign (15.4%) survey (Table 1). The age, sex, and education level distribution of respondents, and the household characteristics were similar for the pre- and postcampaign surveys (Table 1). In the precampaign survey, 82.2% of households had a toilet or latrine assigned specifically to them compared with 78.4% in the postcampaign survey (*P* = 0.06). There were significant differences in the type of toilet facilities used by household members between the pre- and postcampaign surveys (*P* < 0.0001). The most common types of toilet facilities used by household members were a pit latrine with a cement slab (39.7%) and a ventilated and improved pit latrine (18.2%) in the precampaign survey, and a pit latrine with a cement slab (58.9%) and a flushing toilet connected to a septic pit (15.6%) in the postcampaign survey.

Cholera knowledge, hygiene, and treatment practices. All respondents to the pre- and postcampaign surveys had heard of cholera. Although there was a statistically significant difference in the number of correct causes of cholera provided by the respondents between surveys (Figure 1), no significant differences were observed in the percentage of respondents who reported greater than or equal to three correct causes of cholera (precampaign survey: 38.7% versus postcampaign

TABLE 1
Characteristics of participants and households interviewed in pre- and post-OCV campaign knowledge and practices surveys—Haiti, 2013–2014

	Pre-OCV campaign survey August 2013		Post-OCV campaign survey July 2014		<i>P</i> value
	<i>N</i> = 297		<i>N</i> = 302		
	<i>n</i>	%	<i>n</i>	%	
Respondent status					
Female head of household	206	73.8	194	64.2	0.04
Male head of household	30	10.8	37	12.3	
Other adult	43	15.4	71	23.5	
Sex of respondent					
Female	249	83.8	241	79.8	0.22
Male	48	16.2	61	20.2	
Age of respondent (mean ± SE)	36.0 ± 0.73		36.3 ± 0.84		0.80
Education level of respondent					
None	35	11.8	32	10.6	0.49
Some primary	44	14.8	49	16.2	
Primary	36	12.1	54	17.9	
Some secondary	137	46.1	124	41.1	
Completed secondary or higher	45	15.2	43	14.2	
Number of people in household (mean ± SE)	5.8 ± 0.19		5.7 ± 0.16		0.77
Household characteristics					
Bed available	288	97.0	291	96.4	0.76
Mobile phone	271	91.2	277	91.7	0.84
Working radio	165	55.6	145	48.0	0.09
Electricity	144	48.5	151	50.0	0.82
Working television	129	43.4	121	40.1	0.57
Working refrigerator	41	13.9	42	13.9	0.99
Toilet or latrine observed in the household	240	82.2	232	78.4	0.06
Toilet facilities used by household members					
Pit latrine, with cement slab	118	39.7	178	58.9	< 0.0001
Pit latrine, ventilated and improved	54	18.2	9	3.0	
Flush, connected to septic pits	32	10.8	47	15.6	
Pit latrine, without cement slab	28	9.4	9	3.0	
Bucket toilet	17	5.7	4	1.3	
No toilets: canal or open defecation	15	5.1	10	3.3	
Other	33	11.1	45	14.9	

OCV = oral cholera vaccine; SE = standard error.

FIGURE 1. Comparison of cholera knowledge in the pre- and post-OCV campaign knowledge and practice surveys—Haiti, 2013–2014. OCV = oral cholera vaccine. Correct causes of cholera were drinking bad water, eating bad food, eating unwashed fruits/vegetables, bacteria, and poor hygiene/not washing hands. Correct signs or symptoms of cholera were vomiting, watery diarrhea, stomach/abdominal pain, and dehydration. Correct methods of cholera prevention were handwashing, cooking food, washing fruits/vegetables, disposing of human waste properly, boiling water, and treating water with chlorine.

survey: 35.4%, $P = 0.6$). There were no statistically significant differences in the distribution of correctly reported numbers of cholera symptoms, and in the reported methods of cholera prevention (Figure 1). The majority of respondents (> 70%) were able to correctly report two signs or symptoms of cholera in the pre- and postcampaign surveys, and in both surveys almost 15% were able to report three or more correct symptoms (Figure 1). In both surveys, respondents knew that watery diarrhea (> 90%) and vomiting (87%) were symp-

ptoms of cholera, but few were aware of dehydration (< 10%) (Table 2). Knowledge of washing hands with soap and water as a method of cholera prevention was similar in the pre- and postcampaign surveys (82.8% and 74.8%, respectively) (Table 2).

In both surveys, almost 88% of respondents reported washing their hands before eating and after using the toilet (Table 2). There was no statistically significant difference in reported use of soap for handwashing in the pre- (85.9%)

TABLE 2
Cholera knowledge and hygiene practices among participants in pre- and post-OCV campaign knowledge and practices surveys—Haiti, 2013–2014

	Pre-OCV campaign survey August 2013		Post-OCV campaign survey July 2014		P value
	N = 297		N = 302		
	n	%	n	%	
Knowledge					
Heard of cholera	297	100	302	100	—
Knew watery diarrhea was a symptom of cholera	275	92.6	286	94.7	0.38
Knew vomiting was a symptom of cholera	260	87.5	263	87.1	0.88
Knew dehydration was a symptom of cholera	19	6.4	29	9.6	0.24
Knew about washing hands with soap for cholera prevention	246	82.8	226	74.8	0.07
Knew about boiling or treating water for cholera prevention	189	63.6	217	71.9	0.06
Knew about cooking food thoroughly for cholera prevention	115	38.7	130	43.0	0.46
Heard of OCV	86	29.2	248	82.1	< 0.0001
Practice					
Reported washing hands before eating	272	95.8	275	91.1	0.09
Reported washing hands after using the toilet	271	96.1	287	95.0	0.65
Reported washing hands before eating and after using the toilet	256	88.9	265	87.4	0.77
Soap or detergent reported to be available at home	291	98.3	264	87.4	< 0.0001
Observed place for handwashing	43	14.7	89	30.1	0.01
Observed soap at handwashing station	46	16.2	102	34.5	0.001
Reported using soap for handwashing	250	85.9	218	82.6	0.55
Reported receiving OCV the year before the survey	4	1.4	183	60.6	< 0.0001

OCV = oral cholera vaccine.

and post- (82.6%) campaign surveys. However, compared with the precampaign survey, more households in the post-campaign survey had a handwashing station (14.7% versus 30.1%, $P = 0.01$), and soap at the washing station (16.2% versus 34.5%, $P = 0.001$) based on interviewers' observations.

Cholera treatment-seeking behaviors in case of illness were not significantly different in both surveys. Respondents most commonly reported that they would use ORS (precampaign: 46.5% versus postcampaign: 37.7%), go to a cholera treatment center (CTC) (precampaign: 33% versus postcampaign: 42.1%), and to the clinic or hospital (precampaign: 17.3% versus postcampaign: 19.5%) if they or a family member had cholera. Most of the respondents reported that they could reach a CTC or other hospital within less than 30 minutes (precampaign: 63.5% versus postcampaign: 72.6%), whereas it took more than 1 hour to reach a CTC/hospital for 3% and 8% of the pre- and postcampaign survey respondents, respectively.

Water source, treatment, and storage practices. Packaged water or water sold by a company was the main source of drinking water (92%) in both surveys (Table 3). Almost two-thirds of precampaign survey respondents (65.7%) reported treating their drinking water, whereas a significantly lower proportion of postcampaign survey respondents (27.2%) reported doing so ($P < 0.001$). In the pre- and postcampaign surveys, among those who reported treating their water, 81% used water treatment tablets. Use of chlorine or bleach solution was reported by 62.1% and 37.8% of pre- and postcampaign survey respondents who reported treating their water, respec-

tively ($P = 0.01$). Among respondents who treated their water, 90.3% of precampaign survey respondents reported treating their drinking water all the time compared with only 65.9% of postcampaign survey respondents doing so ($P < 0.001$) (Table 3). Similarly, among those who reported treating their drinking water, a lower proportion of postcampaign survey respondents (37.8%) reported doing so in the past 24 hours compared with precampaign respondents (60.8%) ($P = 0.01$). Among respondents who reported not treating their drinking water, the main reason for not doing so was because they considered their current water source to be safe and did not need treatment (precampaign: 83% versus postcampaign: 95.4%; $P < 0.01$), whereas other reasons included lack of chlorine solution (precampaign: 10% versus postcampaign: 3.2%; $P = 0.04$) or lack of money (precampaign: 5% versus postcampaign: 0.9%; $P = 0.02$) (Table 3).

During the observation, the majority (> 90%) of households both pre- and postcampaign had a container to store drinking water (Table 3). Among households that had a water container, the container was covered in a higher proportion of households in the precampaign survey (95.6%) compared with the postcampaign survey (89.4%) ($P = 0.02$), and there was a significant decrease in the number of households that had a narrow-mouthed water container (precampaign: 69.0% versus postcampaign: 46.3%) ($P = 0.01$).

Receipt of educational messages on cholera and OCV. Almost half of respondents reported that they were exposed to

TABLE 3

Drinking water source, treatment, and storage practices among participants in the pre- and post-OCV campaign knowledge and practices surveys—Haiti, 2013–2014

	Pre-OCV campaign survey August 2013		Post-OCV campaign survey July 2014		P value
	N = 297		N = 302		
	n	%	n	%	
Main source of drinking water					
Packaged water or water sold by company	275	92.6	278	92.1	0.86
Piped water, public	13	4.4	12	4.0	
Other	9	3.0	12	4.0	
Treats water before drinking	195	65.7	82	27.2	< 0.001
Drinking water treatment methods*†					
Add tablets (Aquatabs/PUR sachet/Gadyen Dlo or Dlo Lavi)	158	81.0	67	81.7	0.90
Add bleach or chlorine solution	121	62.1	31	37.8	0.01
Boil	14	7.2	4	4.9	0.44
Frequency of drinking water treatment in past 6 months*					
All the time	176	90.3	54	65.9	< 0.001
Sometimes	16	8.2	23	28.0	
Did not treat water during past 6 months	3	1.5	5	6.1	
Last time treated current drinking water*					
Within the last 24 hours	118	60.8	31	37.8	0.02
Between 1 and 2 days ago	28	14.4	12	14.6	
More than 2 days ago	8	4.1	10	12.2	
Did not treat current drinking water	40	20.6	29	35.4	
Main reason for not treating drinking water‡					
Current water source is safe/does not need treatment/buy treated water	83	83.0	209	95.4	< 0.01
No chlorine solution in house	10	10.0	7	3.2	0.04
No money/cannot afford	5	5.0	2	0.9	0.02
Drinking water storage observations					
Observed container to store drinking water	271	91.9	283	96.9	0.04
Observed water container is covered§	258	95.6	253	89.4	0.02
Observed water container opening is narrow-mouthed§	185	69.0	131	46.3	0.01
Observed water container has a spigot/tap§	30	11.4	25	8.8	0.37

OCV = oral cholera vaccine.

* Among respondents who treat their water before drinking (presurvey, $N = 195$; postsurvey, $N = 82$).

† Respondents were able to give more than one possible answer.

‡ Among respondents who do not treat their water before drinking (presurvey, $N = 100$; postsurvey, $N = 219$).

§ Among those where a water container was observed (presurvey, $N = 271$; postsurvey, $N = 283$).

educational information on cholera within 6 months of each survey. Radio and television were the most common sources of information on cholera (Table 4). The most frequent message was to wash hands with soap and water (precampaign: 71.5% versus postcampaign: 66.9%). Overall, 24.8% and 17.9% of respondents to the pre- and postcampaign surveys reported having received educational and cholera prevention materials after the educational sessions, respectively. Water treatment tablets, ORS, and chlorine solution were the most frequently reported items received (Table 4).

Among the 183 vaccinated respondents in the postcampaign survey, 49.2% reported receiving information on cholera prevention during vaccination. The majority of respondents to the pre- (85%) and post- (88%) campaign surveys reported that they did not know how long OCV would protect them from cholera. In the precampaign survey, 8.1% of respondents reported that OCV provided lifetime protection compared with 3.3% in the postcampaign survey.

Receipt of OCV. A higher proportion of respondents had heard of OCV in the post (82.1%) compared with the pre- (29.2%) campaign survey ($P < 0.0001$) (Table 2). In the precampaign survey, 92.3% of respondents were willing to get OCV and 89% were willing to have their child receive OCV, if available. More respondents reported receiving OCV within the previous year in the postcampaign survey (61%) compared with the precampaign survey (1.4%) ($P < 0.0001$).

Cholera knowledge and WASH practices among vaccinated and unvaccinated respondents in the postcampaign knowledge and practices survey.

Among the 183 vaccinated and 119 unvaccinated respondents in the postcampaign survey, 49% and 50.4% reported receiving educational information on cholera within the past 6 months ($P = 0.9$). There were no significant differences in the distribution of respondents who provided correct answers to causes or symptoms of cholera between the vaccinated and unvaccinated respondents. However, 53% of vaccinated respondents were able to correctly report three or more methods for cholera prevention compared with 39% of unvaccinated respondents ($P = 0.03$). Less than one-third of vaccinated (24%) and unvaccinated (32%) respondents reported treating their drinking water ($P = 0.16$). Among those who reported treating their drinking water, more than half of vaccinated (73%) and unvaccinated respondents (58%) reported treating their water all the time during the past 6 months ($P = 0.21$). Among those who did not treat their water, a higher proportion of vaccinated respondents (99%) stated their current water was safe and did not need treatment compared with unvaccinated respondents (90%) ($P = 0.01$). The majority of vaccinated (90%) and unvaccinated (83%) respondents had soap or detergent available in their household ($P = 0.08$). There was no difference in the proportion of vaccinated (90%) versus unvaccinated (84%) respondents who reported washing their hands before eating and after using the toilet ($P = 0.07$).

TABLE 4

Receipt of educational information about cholera in the 6 months before the pre- and post-OCV campaign knowledge and practices surveys—Haiti, 2013–2014

	Pre-OCV campaign survey August 2013		Post-OCV campaign survey July 2014		P value
	N = 297		N = 302		
	n	%	n	%	
Exposed to educational information on cholera during the past 6 months	158	53.2	151	50.0	0.58
Source of information on cholera*†					
Radio	107	67.7	93	61.6	0.36
Television	59	37.3	41	27.2	0.12
Clinician/health-care worker	31	19.6	43	28.5	0.13
Neighbor/friend	31	19.6	27	17.9	0.73
Community health worker	23	14.6	33	21.9	0.14
Family member	10	6.3	14	9.3	0.44
Community meeting	10	6.3	6	4.0	0.40
Other	10	6.3	8	5.3	0.77
Information received verbally*†					
Wash hands with soap and water	113	71.5	101	66.9	0.57
Cook food thoroughly	78	49.4	61	40.4	0.23
Wash vegetables/fruits	67	42.4	68	45.0	0.68
Drink or use water treated with chlorine products	66	41.8	92	60.9	0.02
Boil water	36	22.8	22	14.6	0.18
Cover food to keep away from flies	26	16.5	31	20.5	0.49
Dispose of human waste properly	23	14.6	21	13.9	0.92
Clean cooking utensils/vessels	16	10.1	30	19.9	0.09
Take ORS/go to cholera center if have cholera	12	7.6	48	31.8	< 0.001
Other	30	19.0	9	6.0	0.03
Received materials during the educational sessions*	39	24.8	27	17.9	0.16
Materials received†‡					
Water treatment tablets (Aquatabs/PUR tablets/Dlo Lavi)	28	71.8	17	63.0	0.49
ORS	14	35.9	13	48.2	0.30
Chlorine solution	9	23.1	7	25.0	0.78
Soap	9	23.1	3	11.1	0.19
Print material (brochures, pamphlets, posters)	6	15.4	7	25.9	0.28

OCV = oral cholera vaccine; ORS = oral rehydration solution.

*Among respondents who were exposed to educational information on cholera during the past 6 months (presurvey, N = 158; postsurvey, N = 151).

†Respondents were able to give more than one possible answer.

‡Among respondents who were handed education materials (presurvey, N = 39; postsurvey, N = 27).

DISCUSSION

We evaluated the knowledge and practices regarding cholera, water treatment, hygiene, and sanitation before and after the 2013 OCV campaign in Haiti. Although there was no significant change in cholera knowledge, treatment of drinking water significantly decreased. Moreover, there was a decrease in the proportion of respondents who safely stored their drinking water (i.e., covered, narrow-mouthed container with spigot tap). It is concerning that a similarly low percentage of respondents reported treating drinking water before consumption in 2011 (30.3%), before implementation of educational interventions to curb the cholera epidemic in Haiti, and in the postcampaign survey reported here (27.2%).¹⁶ Knowledge and practices surveys conducted before and after a 2012 OCV campaign implemented by a non-governmental organization (NGO) in a rural area of Haiti reported a significant increase in the percentage of respondents who always treated their drinking water (49–62%).¹³ The percentage of people that reported treating their drinking water in our pre-2013 campaign knowledge and practices survey (66%) was similar to that of the post-2012 campaign knowledge and practices survey (62%). Treating drinking water was a significant protective factor during the cholera epidemic in Haiti.¹⁷ Even though drinking water might not be contaminated at the point of purchase, there is a risk of contamination during transport or during storage because water bought from private vendors (i.e., private kiosks selling reverse-osmosis-treated water) is not treated with chlorine.^{18–25} A study conducted in 2012 showed that with the decreasing number of cholera cases and deaths, and accompanying response activities, people reported difficulties finding water treatment products and, in addition, their concern about cholera has declined in Haiti.²⁶ Another survey conducted in 2012 also found that the main reported reason for not treating water was lack of access to water treatment products.¹³ Therefore, future OCV campaigns could be used as an opportunity to distribute water treatment products and inform people on the need to appropriately treat and store water even when purchased from private vendors.

In both surveys, a high proportion of respondents reported washing their hands, and the proportion of households with handwashing stations and soap doubled in the postcampaign survey. The proportion of respondents who reported washing their hands with soap remained high (precampaign: 86% versus postcampaign: 83%), but was lower than the proportion reported in a Knowledge, Attitude and Practices (KAP) survey conducted directly after the start of the cholera outbreak (94.1%).¹⁶ The decrease in some cholera prevention practices might be due to the timing of the surveys. Although Beau De Rochars and others¹⁶ conducted their survey at the peak of the cholera outbreak when there was a high prevalence of cholera prevention practices because of the perceived risk of having the disease and seeing family members die of cholera, we conducted our surveys when cholera had become endemic and the number of cases and deaths had decreased significantly compared with 2010–2011. Hence, people might have become less concerned about applying good WASH practices.²⁶ In other countries, a decreased perception of cholera risk occurred with longer time since the start of the outbreak and during the dry season.^{27,28}

Knowledge about cholera signs and symptoms, causes, and prevention was comparable in the pre- and postcampaign

surveys. The percentage of respondents who identified watery diarrhea (93%) and vomiting (87%) as signs of cholera were also comparable to a KAP survey conducted directly after the start of the cholera outbreak (89% and 83%, respectively).¹⁶ However, in the postcampaign survey, 35% and 47% of respondents were able to identify at least three correct causes and methods of cholera prevention, respectively, compared with 64% and 65% of respondents in a knowledge and practices survey conducted after an OCV campaign implemented in 2012 by an NGO.¹³ This substantial difference in cholera knowledge is likely due to differences in the educational and social mobilization strategies used in the 2012 and 2013 OCV campaigns. Although the 2012 OCV campaign incorporated strong educational and WASH components (educational information was circulated verbally through radio shows, sound trucks, town criers, local television, and was printed on T-shirts and posters, and vaccinators were encouraged to share information with the public and selected households),¹³ the 2013 campaign only included distribution of pamphlets with general information on cholera prevention methods (good hygiene and water treatment) and the need for two doses of OCV for protection. No oral messaging was circulated, a major limitation given the low literacy rates in Haiti.²⁹ In addition, the 2013 campaign was conducted 3 years after the cholera epidemic began, which might explain the differences in the results such as a perception of decreased risk as explained in the previous paragraph. In addition, 88% of respondents did not know the duration of protection offered by OCV because this information was not provided during the 2013 campaign. A study conducted shortly after the 2013 OCV campaign in Petite Anse also found that 73% of respondents did not know the duration of protection of OCV and 34% of respondents reported that OCV was enough to protect them from cholera.⁴ Hence, future campaigns need to include a strong educational component that emphasizes the importance of maintaining appropriate WASH practices for the prevention of cholera and other diarrheal diseases even after vaccination, and highlights the limited effectiveness and duration of protection of OCV. This is particularly important during preemptive OCV campaigns several years after the outbreak when perceived cholera risk has declined. When designing health education campaigns, teams should consider linking the educational activities to a theory of behavior change so that the activities are geared toward behavioral change.

Future OCV campaigns in Haiti will likely receive vaccine through the global OCV stockpile.^{30,31} The number of OCV doses in the stockpile is limited and receipt of OCV depends on several factors including the ability of the local government to carry out integrated OCV campaigns, which include adequate case management, improved hygiene and sanitation infrastructure, and social mobilization.^{10,30,32} Therefore in future OCV campaigns in Haiti, various stakeholders should coordinate to provide good educational and WASH messaging, and to improve WASH infrastructure concurrently with the campaign.

This study has four main limitations. First, we included only one of two areas targeted for vaccination in 2013, and did not include a control area. We do not know whether the observed changes in practices in Petite Anse also occurred in Cerca Carvajal or whether the changes happened in the Haitian population in general. Second, the surveys were conducted 1 year apart, so there may have been other factors

or interventions between the surveys that had an impact on the results, such as a decreased perception of risk of disease several years after the start of the cholera outbreak. However, a similar proportion of respondents reported having been exposed to educational information on cholera in the pre- and post-OCV campaign surveys. Third, several of the answers relied on self-reported information, which was difficult to verify. We found discrepancies between the reported availability and actual observations of soap at handwashing stations. Hence, there might have been a social desirability bias leading to overreporting of adequate practices. Fourth, we did not test the drinking water at the visited households to check for water contamination or chlorine levels.

Despite these limitations, this study is one of the few studies that assessed changes in cholera knowledge and WASH practices before and after an OCV campaign. Although findings revealed a consistent level of knowledge on cholera within the studied population, there were significant decreases in water treatment and storage practices important for cholera prevention. Those findings reinforce the need for sustained, comprehensive, and integrated approaches to control cholera. OCV campaigns are an opportunity to promote other practices essential for the prevention of cholera and other diarrheal diseases. Future OCV campaigns in Haiti and other countries should make sure to promote good water storage and treatment, and hygiene practices, and mention the need to maintain those practices even after receiving OCV.

Received July 5, 2016. Accepted for publication September 8, 2016.

Published online October 31, 2016.

Acknowledgments: We thank Marie Jose Laraque, Anne Marie-Desormeaux, Lesly Andrecy, Marie Fernande Leonard, Marie Claudine Felix, Elie Joseph, Ricot Felix, Sophonie Jean-Jacques, Margaret Bernateau, Brinel Jean, Samson Marseille, Destine Miracle Apollon, Jean Daniel Laguerre, Joseph Nicolas Petit, Field Epidemiology Training Program graduates and interviewers; Nadia Jean Charles, Anne Mutchelle Beaubrun, CDC Haiti; Alex Pavluck, Kristin Renneker, Task Force for Global Health; Barbara Marston, Eric Mintz, Molly Patrick, Alicia Ruiz, Heather Scobie, Nicolas Schaad, CDC; and the people of Haiti who participated in the survey.

Financial support: This work was supported by the Centers for Disease Control and Prevention.

Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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