Cholera Prevention With Traditional and Novel Water Treatment Methods: An Outbreak Investigation in Fort-Dauphin, Madagascar

| Megan E. Reller, MD, Yves J.M. Mong, MSc, Robert M. Hoekstra, PhD, and Robert E. Quick, MD, MPH

In March 1999, cholera appeared in Madagascar after a long hiatus and caused more than 37 000 cases and 2200 deaths. In October 1999, the Cooperative for Assistance and Relief Everywhere (CARE) and the Centers for Disease Control and Prevention (CDC) Health Initiative funded CARE Madagascar to implement a household-based safe water intervention. CARE contracted with Population Services International to socially market a sodium hypochlorite solution, named Sûr'Eau. In February 2000, cholera reached the southern port city of Fort-Dauphin. Sûr'Eau was introduced to the region in December 2000; cholera peaked in January 2001 in Fort-Dauphin. We conducted a case–control study to investigate risk factors for cholera transmission from February 11 to 20, 2001.

Cases were selected from 113 patients registered at the Cholera Treatment Center of Hôpital Philibert Tsiranana. We defined a case of suspected cholera as 3 or more watery stools per 24 hours in a person 12 years or older who was hospitalized at the Cholera Treatment Center between January 1 and February 7, 2001, resided in Fort-Dauphin, and was the primary household case patient. For each case, we selected 2 age- (±5 years), sex-, and neighborhood-matched control subjects from households free of diarrhea during the outbreak. We interviewed patients about symptoms and treatment received and queried patients and control subjects about beverages and foods consumed in the 5 days before the patient's illness. We cultured stool samples from patients at the Cholera Treatment Center.

We analyzed water quality data obtained by CARE from 12 public taps and 61 randomly selected households in December 2000. Samples were tested for free and total chlorine residuals and for *Escherichia coli* with the membrane filtration technique.[1]

We performed univariate and multivariate analysis, including conditional logistic regression, to determine independent risk factors for infection.

We excluded 76 of the 113 patients for the following reasons: not found (24), lived outside of Fort-Dauphin (20), younger than 12 years (17), died (6), incarcerated (5), and secondary cases (4). The median age of the 37 remaining patients was 37 years (range= 12–64 years); 46% were female. Eleven (30%) patients were illiterate, compared with 11 (15%) of the 74 control subjects (P=.09).

The median duration of illness was 3 days (range=1–7 days). Symptoms included diarrhea (100%), vomiting (78%), and leg cramps (68%). Oral rehydration solution and intravenous fluids were given to 92% of the patients, and oral rehydration solution only was given to 8%. All received doxycycline.

Water sources included a public tap for 78 (70%) of the 111 respondents, household taps for 21 (19%), shallow wells for 10 (9%), and a river or lake for 2 (2%). Of the 106 respondents who stored water, 103 (97%) used a bucket, 2 (2%) a jerry can, and 1 (0.9%) a clay pot. Overall, 52 (49%) covered their water vessel; 100 (94%) removed water from the vessel with a ladle or cup, 4 (4%) removed water by pouring, and 2 (2%) did both. Water sources and handling practices did not differ between cases and controls.

Patients were more likely than control subjects to have drunk untreated water (matched odds ratio [OR]=5.0; 95% confidence interval [CI]=1.3, 25.4; Table 1). Drinking heated rice water (a traditional drink prepared after meals by heating water with remaining grains of rice) or water from a household tap was protective against cholera (OR=0.1; 95% CI=0.0, 0.6 and OR=0.1; 95% CI=0.0, 0.9, respectively), whereas drinking cold rice water was not. Using Sûr'Eau or always boiling water tended to be protective (Table 1).

Illness was not associated with consuming lemonade, unwashed produce, cold leftover rice, or foods or beverages from street vendors (Table 1). Consuming chicken, eggs, milk, or leftover rice was protective. Using soap to wash hands was protective against illness (OR=0.2; 95% CI=0.0, 0.7).

In a multivariate model that controlled for the differences in diet between patients and control subjects, illness was independently associated with consuming untreated water or a food or beverage on a trip outside Fort-Dauphin (P<.05). Drinking heated rice water was protective (P<.05). Although the protective effect of Sûr'Eau was not statistically significant in the multivariate model because of small numbers, the estimated effect was highly protective (OR=0.1), was equivalent in magnitude to rice water, and persisted in different analytic models.

Three stool samples yielded toxigenic *Vibrio cholerae* O1, biotype El Tor, serotype Ogawa, which was resistant to doxycycline. Nine of the 12 public water taps sampled had free chlorine residuals of 0.2 mg/L or higher; 1 yielded *E coli*. Of the 61 stored water samples, 9 (15%) had free chlorine residuals of 0.2 mg/L or higher, and 42 (69%) yielded *E coli*.

In this investigation, we implicated untreated water as the principal vehicle of epidemic cholera in Fort-Dauphin. The community was at risk for waterborne illness despite having access to piped water. Possible reasons for increased risk included inconsistent chlorination of municipal water and domestic storage in wide-mouthed buckets, which permitted hands to touch, and contaminate, stored drinking water.[2,3] Not using soap to wash hands increased the risk of cholera. Improving access to narrow-mouthed containers with covers[4,5] and to soap would reduce the risk of disease.

Increased access to point-of-use water treatment options also is needed, as evidenced by the protective effect of 3 interventions—rice water; a household tap, which eliminated the need for storage; and Sûr'Eau. The protective effect of Sûr'Eau, although consistently high in different multivariate models, did not reach statistical significance only because of small numbers.

Unlike many investigations,[6] this study did not implicate specific food items as risk fac-

TABLE 1—Number (%) of Cholera Case Patients and Control Subjects Exposed to Food and Drink Items: Fort-Dauphin, Madagascar, February 2001

Exposure	Case Patients (%)	Control Subjects (%)	OR	95% CI	*P*
Untreated water, any source	32/36 (88.9)	49/73 (67.1)	5.0	1.3, 25.4	.02
Boiled water	24/37 (64.9)	60/74 (81.1)	0.4	0.1, 1.1	.09
Water treated with Sûr'Eau[a]	1/37 (2.7)	11/74 (14.9)	0.1	0.0, 1.2	.11
Heated rice water	27/36 (75.0)	71/74 (95.9)	0.1	0.0, 0.6	.004
Cold rice water	18/26 (69.2)	55/71 (77.5)	0.6	0.1, 2.2	NS
Water from home faucet	3/37 (8.1)	18/74 (24.3)	0.1	0.0, 0.9	.04
Beverage outside of home	21/36 (58.3)	49/73 (67.1)	0.7	0.2, 1.9	NS
Lemonade	9/37 (24.3)	17/74 (23.0)	1.1	0.4, 3.1	NS
Stored water touched by hand	19/36 (52.8)	29/70 (41.4)	1.8	0.7, 5.4	NS
Water stored in covered container	22/36 (61.1)	33/70 (47.1)	3.3	0.6, 15.0	NS
Food or beverage in market	15/37 (40.5)	29/74 (39.2)	1.1	0.4, 2.6	NS
Food or beverage from street vendor	15/37 (40.5)	31/74 (41.9)	0.9	0.3, 2.5	NS
Food or beverage during trip outside Fort-Dauphin	6/37 (16.2)	5/74 (6.8)	2.8	0.6, 13.2	NS
Meat or fish	36/37 (97.3)	72/72 (100)	Undefined	Undefined	NS
Beef	10/37 (27.0)	16/72 (22.2)	1.5	0.5, 4.9	NS
Chicken	2/37 (5.4)	17/72 (23.6)	0.1	0.0, 0.8	.03
All meat	27/37 (73.0)	60/74 (81.1)	0.6	0.2, 1.8	NS
Shellfish	17/37 (45.9)	28/74 (37.8)	1.4	0.6, 3.3	NS
Eggs	0/37 (0)	20/74 (27.0)	Undefined	Undefined	.002
Milk	6/37 (16.2)	29/74 (39.2)	0.3	0.1, 0.9	.03
Fruit	31/37 (83.8)	70/74 (94.6)	0.3	0.1, 1.4	.13
Vegetables	5/37 (13.5)	20/74 (27.0)	0.4	0.1, 1.3	NS
Unwashed produce	15/37 (40.5)	23/74 (31.1)	0.5	0.6, 3.4	NS
Leftover rice	16/35 (45.7)	54/74 (73.0)	0.3	0.1, 0.8	.015
Unheated leftover rice	5/16 (31.3)	12/54 (22.2)	6.5	0.5, 295.4	NS
Using soap to wash hands	9/37 (24.3)	37/74 (50.0)	0.2	0.0, 0.7	.008

Note. NS = not significant.
[a]Socially marketed 0.5% sodium hypochlorite solution.

tors, but the multivariate model did show the risk of consuming foods or beverages during travel outside of Fort-Dauphin. The protective effect of consuming chicken, eggs, or milk, all expensive in Fort-Dauphin, was likely a surrogate for relatively higher socioeconomic status.

In much of the developing world, delivery of consistently disinfected, piped water will remain out of reach for many households in the foreseeable future because of limited resources.[7] Inexpensive point-of-use treatment and safe storage interventions that are currently available can reduce the risk of disease now. ■

About the Authors

Megan E. Reller and Robert E. Quick are with the Foodborne and Diarrheal Diseases Branch, Division of Bacterial and Mycotic Diseases, Centers for Disease Control and Prevention, Atlanta, Ga. Yves J.M. Mong is with the Centre National de Récherches sur l'Environnement, Antananarivo, Madagascar. Robert M. Hoekstra is with the Biostatistics and Information Management Branch, Division of Bacterial and Mycotic Diseases, Centers for Disease Control and Prevention, Atlanta, Ga.

Requests for reprints should be sent to Megan E. Reller, MD, Foodborne and Diarrheal Diseases Branch, Mailstop A38, Centers for Disease Control and Prevention, Atlanta, GA 30333 (e-mail: mhr6@cdc.gov).

This brief was accepted June 5, 2001.

Note. Use of trade names is for identification only and does not constitute endorsement by the Centers for Disease Control and Prevention or by the US Department of Health and Human Services.

Contributors

M.E. Reller, Y.J.M. Mong, and R.E. Quick designed the study, analyzed the data, and wrote the paper. R.M. Hoekstra supervised data analysis and contributed to the writing.

Acknowledgments

We thank Patricia Riley, Dr Luke Nkinsi, Reema Jossy, and Lori Buhi of the CARE–CDC Health Initiative for their support and Caran Wilbanks for her editorial assistance. We are grateful to Lysa Rasoanirina, Juvenal Eliasy, Charles Razafimandimby, and Blaise Todisoa for their good-natured, reliable assistance in the field. We are grateful to Georges Mamy Randrianaina, mayor of Fort-Dauphin, for logistical assistance and overall facilitation of this investigation. Above all, we thank Rabenjanoelina, assistant mayor of Fort-Dauphin, for his exceptional logistical, administrative, and field support.

References

1. Mates A, Shaffer M. Membrane filtration differentiation of *E. coli* from coliforms in the examination of water. *J Appl Bacteriol.* 1989;67:343–346.

2. Han AM, Oo KN, Midorikawa Y, et al: Contamination of drinking water during collection and storage. *Trop Geogr Med.* 1989;41:138–140.

3. Swerdlow DL, Malenga G, Begkoyian G, et al. Epidemic cholera among refugees in Malawi, Africa: treat-

ment and transmission. *Epidemiol Infect.* 1997;118: 207–214.

4. Hammad ZH, Dirar HA. Microbiological examination of sebeel water. *Appl Environ Microbiol.* 1982;43: 1238–1243.

5. Quick RE, Venczel LV, Mintz ED, et al. Diarrhoea prevention in Bolivia through point-of-use water treatment and safe storage: a promising new strategy. *Epidemiol Infect.* 1999;122:83–90.

6. Mintz ED, Tauxe RV, Levine MM. The global resurgence of cholera. In: Noah N, O'Mahony M, eds. *Communicable Disease Epidemiology and Control.* Chichester, England: John Wiley & Sons Ltd; 1998: 63–104.

7. Mintz ED, Bartram J, Lochery P, Wegelin M. Not just a drop in the bucket: expanding access to point-of-use water treatment systems. *Am J Public Health.* 2001; 91:1565–1570.

Seeking Safe Storage: A Comparison of Drinking Water Quality in Clay and Plastic Vessels

Paul Ogutu, Valerie Garrett, MD, Peter Barasa, Sam Ombeki, Alex Mwaki, and Robert E. Quick, MD, MPH

Several point-of-use water treatment interventions have shown the beneficial health effect of drinking water treated and stored in narrow-mouthed, spigoted plastic vessels designed to reduce chlorine decay and limit recontamination.[1,2] However, more than 90% of the 43 000 households targeted by the Nyanza Healthy Water Project in western Kenya, Africa, preferred traditional, wide-mouthed clay vessels.[3] In laboratory- and village-based evaluations, we compared chlorine decay and disinfection rates in turbid surface water treated and stored in locally available clay vessels and plastic jerry cans.

We evaluated 3 vessel types: (1) wide-mouthed, 20-L clay vessels; (2) narrow-mouthed, 20-L clay vessels with lids and spigots (modified clay vessel); and (3) narrow-mouthed, 20-L plastic jerry cans with lids (Figure 1). We treated water with 1% sodium hypochlorite and measured free chlorine levels with colorimetric comparators. We assessed the microbiological quality of treated and untreated water with the membrane filtration technique and culture media selective for *Escherichia coli*.[4]

In the laboratory evaluation, we determined that the chlorine dose necessary to achieve a free chlorine level greater than 0.20 mg/L for 24 hours or longer was 16 mL. We then treated 20-L water samples in each vessel with 16 mL of 1% sodium hypochlorite (8 mg/L); measured free chlorine levels after 0.5, 4, 8, 12, and 24 hours; and cultured water after 0.5 and 24 hours.

In the village evaluation, 10 of 20 volunteer households were randomly selected to receive new, modified clay vessels. The remaining 10 used their own freshly cleaned traditional clay vessels. Within each group, 5 households also were selected to receive plastic jerry cans. We then filled each vessel with 20 L of river water, treated it with 16 mL of 1% sodium hypochlorite (8 mg/L), and measured free chlorine levels and cultured water after 0.5 and 24 hours.

In the laboratory evaluation, untreated river water had a baseline *E coli* count of 100 colony-forming units (CFUs) per 100 mL. After treatment, the free chlorine decay rate was 4% per hour in the plastic jerry can, 8% per hour in the modified clay vessel, and 9% per hour in the traditional clay vessel (Figure 2). After 24 hours, the free chlorine level was highest in the jerry can; however, all vessels had a free chlorine level greater than 0.2 mg/L. *E coli* (range= 5–21 CFU/100 mL) was recovered from

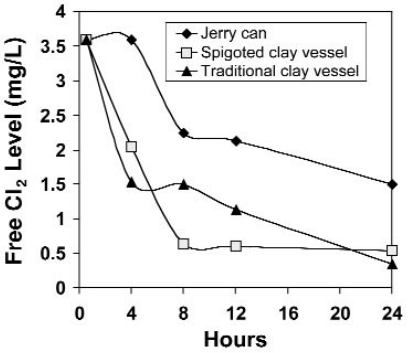

FIGURE 2—Free chlorine (Cl_2) levels in river water treated with 16 mL (8 mg/L) of 1% sodium hypochlorite solution, by time interval: Laboratory study, Ariri, Kenya, May 2000.

FIGURE 1—Vessels used in laboratory and village evaluations in western Kenya.

TABLE 1—Median Free Chlorine Levels and *Escherichia coli* in River Water After Treatment With 16 mL (8 mg/L) of 1% Sodium Hypochlorite Solution: Village Study, Homa Bay, Kenya, May 2000

	0.5 Hour After Treatment			24 Hours After Treatment		
Vessel Type	Median Free Chlorine, mg/L (Range)	No. (%) of Samples With *E coli*	Median *E coli*, CFU/100 mL (Range)	Median Free Chlorine, mg/L (Range)	No. (%) of Samples With *E coli*	Median *E coli*, CFU/100 mL (Range)
Traditional clay vessel (n = 10)	3.4 (2.0–3.5)	0/10 (0)	0 (0)	0.2 (0.1–0.4)	2/10 (20)	0 (0–20)
Modified clay vessel[a] (n = 10)	2.0 (1.4–3.5)	0/10 (0)	0 (0)	0.2 (0.0–0.7)	0/10 (0)	0 (0)
Plastic jerry can (n = 10)	3.5 (2.1–3.5)	1/10 (10)	0 (0–2)	0.25 (0.1–0.7)	0/10 (0)	0 (0)
Total (N = 30)	3.4 (1.4–3.5)	1/30 (3)	0 (0–2)	0.15 (0.0–0.7)	2/30 (7)	0 (0–20)

Note. CFU = colony-forming unit.
[a]With spigot and lid.

water from each vessel 0.5 hours after treatment. *E coli* was not recovered from water from any vessel 24 hours after treatment.

In the village evaluation, untreated river water had a baseline *E coli* count of 170 CFU/100 mL. After treatment, the free chlorine decay rate was 9% per hour in each vessel type. After 24 hours, the free chlorine level had decayed to a median of 0.2 mg/L (range=0–0.7 mg/L), with similar levels in all vessel types (Table 1). *E coli* (2 CFU/100 mL) was recovered from water from 1 (10%) of the 10 jerry cans 0.5 hours after treatment. *E coli* (range=12–20 CFU/100 mL) was recovered from water from 2 (20%) traditional clay vessels, but no jerry cans or modified clay vessels, 24 hours after treatment.

The results indicate that jerry cans and clay vessels can achieve adequate chlorine levels to disinfect turbid, contaminated source water in laboratory and household settings. The village evaluation findings suggest that disinfected water stored in traditional clay vessels is at risk for recontamination, which may result from contact with hands during water retrieval. Previous studies have found that water stored in wide-mouthed vessels typically becomes contaminated, and wide-mouthed storage vessels have been implicated in transmission of cholera.[5,6] The finding that water stored in modified clay vessels had no detectable *E coli* 24 hours after treatment suggests that water recontamination was reduced by use of the lid and spigot. The effectiveness of these vessels will be best defined by a health outcome assessment, which is under way.

For more complete data, please refer to http://www.cdc.gov/safewater. ■

About the Authors

Paul Ogutu, Peter Barasa, Sam Ombeki, and Alex Mwaki are with CARE Kenya, Homa Bay, Kenya, Africa. Valerie Garrett and Robert E. Quick are with the Foodborne and Diarrheal Diseases Branch, Division of Bacterial and Mycotic Diseases, Centers for Disease Control and Prevention, Atlanta, Ga.

Requests for reprints should be sent to Robert E. Quick, MD, MPH, Foodborne and Diarrheal Diseases Branch, Mail Stop A38, Centers for Disease Control and Prevention, Atlanta, GA 30333 (e-mail: rxq1@cdc.gov).

This brief was accepted June 5, 2001.

Contributors

P. Ogutu, V. Garrett, P. Barasa, S. Ombeki, A. Mwaki, and R.E. Quick all contributed to the evaluation design, data analysis, and writing of the paper.

Acknowledgments

This project was supported by a grant from the CARE–CDC Health Initiative (CCHI).

We thank Patricia Riley, Luke Nkinsi, Reema Jossy, and Lori Buhi of CCHI and Dr Adam Koons and George Kidenda of CARE Kenya for their support of this project. We thank Gwen Ingraham for her editorial assistance. We are especially grateful for the cooperation and enthusiasm of the community members of Ariri village.

References

1. Mintz ED, Reiff FM, Tauxe RV. Safe water treatment and storage in the home: a practical new strategy to prevent waterborne disease. *JAMA.* 1995;273:948–953.

2. Quick RE, Venczel LV, Gonzalez O, et al. Narrow-mouthed water storage vessels and in situ chlorination in a Bolivian community: a simple method to improve drinking water quality. *Am J Trop Med Hyg.* 1996;54:511–516.

3. Makutsa P, Nzaku K, Ogutu P, et al. Challenges in implementing a point-of-use water quality intervention in rural Kenya. *Am J Public Health.* 2001;91:1571–1573.

4. Mates A, Shaffer M. Membrane filtration differentiation of *E coli* from coliforms in the examination of water. *J Appl Bacteriol.* 1989;67:343–346.

5. Deb BC, Sircar BK, Sengupta PG, Sen SP, Saha MR, Pal SC. Intra-familial transmission of *Vibrio cholerae* biotype El Tor in Calcutta slums. *Indian J Med Res.* 1982;76:814–819.

6. Swerdlow DL, Malenga G, Begkoyian G, et al. Epidemic cholera among refugees in Malawi, Africa: treatment and transmission. *Epidemiol Infect.* 1997;118:207–214.

Care Seeking During Fatal Childhood Illnesses: Siaya District, Kenya, 1998

Renu Garg, MD, MPH, Washington Omwomo, Janet M. Witte, BS, Lisa A. Lee, VMD, MPH, and Michael S. Deming, MD, MPH

In developing countries, the majority of the approximately 12 million fatal illnesses that occur each year among children younger than 5 years can be prevented or treated effectively by means of simple interventions.[1] In Nyanza Province, Kenya, 1 of every 5 children dies before reaching 5 years of age.[2] CARE Kenya's Community Initiatives for Child Survival in Siaya project trained community health workers in approximately 200 villages and established community pharmacies in an effort to reduce childhood mortality in Siaya District, one of the least developed areas of Nyanza Province.

The community health workers were trained to treat children with fever, cough or difficult breathing, and diarrhea; refer seriously ill children; and promote illness prevention behaviors. A year after the health workers were trained, we investigated care-seeking itineraries during terminal illnesses to identify opportunities to further reduce childhood mortality.

We identified deaths that occurred among children younger than 5 years during the period May 1 through August 30, 1998, by reviewing community health workers' monthly household registers and asking the health workers, at the end of each month, whether any children who had died in their village were not recorded in the registers. We interviewed caregivers about the deceased children's symptoms and duration of terminal illness, types of health providers consulted, and number, chronology, and timeliness of visits.

Overall, 99 deaths among children younger than 5 years were identified in the project area; we interviewed caregivers of 97 children. The median interval between date of death and interview was 29 days (range: 7–152 days). Seventy percent of the children were infants, and 44% were female. During their terminal illness, most of the children received care outside the home, yet 90% died at home, and only 6% received inpatient care at any time during the illness (Table 1).

The median duration of terminal illnesses was 7 days (range: 4 hours to 92 days). Ninety percent of the children had fever, cough or difficult breathing, or diarrhea. Caregivers usually consulted multiple health providers (mean: 3.8; range: 1–15). Caregivers consulted traditional healers most frequently (51%); 76% of the caregivers who consulted traditional healers returned to them a second time. In all, 46% of the caregivers consulted a health worker at a health facility, and 26% consulted a community health worker.

In all, 58% of the 97 children were seen by a trained provider of Western medical care (either a community health worker or a health worker at a health facility). Only 32% (18/56) of the children seen by a trained provider of Western medical care returned to such a provider for follow-up care.

No predominant reason was given for not consulting a community health worker or a health worker in a health facility. The most frequently mentioned reason for not consulting a community health worker was not knowing about such individuals (26%), whereas the reason most frequently given for not consulting a worker in a health facility was preference for traditional healers (16%).

TABLE 1—Sources of Health Care During Terminal Illnesses of 97 Deceased Children Younger Than 5 Years: Siaya District, Western Kenya, 1998

Source of Care	No. (%)
Treatment at home	
Home care (massage, fluids)	58 (60)
Tried medicines available at home	39 (40)
Consultation outside the home	
Drug vendor	42 (43)
Traditional healer	49 (51)
Untrained practitioner of Western medicine	20 (21)
Community health worker	25 (26)
Health worker at a health facility	46 (47)
Inpatient care	6 (6)
Trained provider of Western medical care (community health worker or health worker at a health facility)	56 (58)
Referred to higher level care	10 (10)
Returned for follow-up care	
Returned to a traditional healer	37 (76)
Returned to a trained provider of Western medical care	18 (32)
Returned to a drug vendor	6 (14)
Returned to an untrained practitioner of Western medicine	11 (55)

Only 10% of the 97 children were referred for higher level care. The median delay in consulting a health provider after onset of symptoms was 2 days; promptness of care seeking did not differ by type of provider consulted.

This investigation of fatal childhood illnesses involved important limitations, including possible underreporting of childhood deaths and potential recall bias in information obtained from caregivers. Because we included in the study only children who had died, we were not able to identify risk factors for death or measure the effectiveness or coverage of project interventions. However, the findings point to opportunities for further reducing childhood deaths.

First, follow-up care and referral were infrequent. Only 32% of the children seen by a trained Western medical provider returned to such a provider for follow-up care, and only 10% were referred for higher level care. Only 6% of the children were hospitalized. Better use of referral facilities might be achieved by offering community health workers and health facility staff additional in-service training in recognizing severe illnesses and in counseling caregivers to return for follow-up care.

Second, traditional healers are a potential resource for improving child survival.[3,4] Traditional healers saw half of the children who died, and 76% of the children they saw returned to a traditional healer. Dialogue with traditional healers might lead to an understanding of how they can help ensure that the severely ill children they see are also seen at a health facility prepared to offer them appropriate treatment.

Finally, community health workers, although easily accessible, are underused by caregivers of terminally ill children; only 26% of the children in our study were seen by a community health worker. The main reason given by caregivers for not using community health workers was not knowing they existed. Traditional gatherings and village meetings can enhance dissemination of information in rural Kenyan communities to increase awareness of community health workers. ■

About the Authors

Renu Garg, Lisa A. Lee, and Michael S. Deming are with the Division of Parasitic Diseases, National Center for Infectious Diseases, Centers for Disease Control and Prevention, Atlanta, Ga. Washington Omwomo is with Community Initiatives for Child Survival in Siaya, CARE Kenya, Siaya, Kenya. Janet M. Witte is with the School of Medicine, Emory University, Atlanta.

Requests for reprints should be sent to Michael S. Deming, MD, MPH, Division of Parasitic Diseases, National Center for Infectious Diseases, Centers for Disease Control and Prevention, Mail Stop F22, 4770 Buford Hwy, Atlanta, GA 30341 (e-mail: msd1@cdc.gov).

This brief was accepted June 5, 2001.

Contributors

R. Garg led in writing the protocol, training interviewers, analyzing the data, and writing the manuscript. W. Omwomo and J.M. Witte supervised fieldwork, data entry, and data editing. L.A. Lee was a coauthor of the protocol and helped to guide data analysis. M.S. Dem-

ing was a coauthor of the protocol and helped to guide data analysis and write the manuscript.

Acknowledgments

This study was funded by a grant from the R.W. Woodruff Foundation to CARE and the CDC Foundation, as part of the CARE–CDC Health Initiative. The authors thank Leo Roozendaal, CARE Country Director, for organizational support; the CARE Siaya field staff for data collection; and Margarette Koczak for assistance with data analysis.

References

1. Gove S. Integrated management of childhood illness by outpatient health workers: technical basis and overview. *Bull World Health Organ.* 1997;75(suppl 1): 7–24.

2. *Kenya Demographic and Health Survey 1998.* Calverton, Md: National Council for Population and Development, Central Bureau of Statistics, and Macro International Inc; 1999.

3. Sustrina B, Reingold A, Kresno S, Harrison G, Utomo B. Care-seeking for fatal illnesses in young children in Indramayu, West Java, Indonesia. *Lancet.* 1993; 342:787–789.

4. Makemba AM, Winch PJ, Makame VM, et al. Treatment practices for degedege, a locally recognized febrile illness, and implications for strategies to decrease mortality from severe malaria in Bagamoyo District, Tanzania. *Trop Med Int Health.* 1996;1:305–313.

Monitoring Behavioral Risk Factors for Cardiovascular Disease in Russia

Helena Zabina, MD, Thomas L. Schmid, PhD, Igor Glasunov, MD, Rimma Potemkina, MD, Tatiana Kamardina, MD, Alexander Deev, PhD, Sveltlana Konstantinova, MD, and Marina Popovich, MD

In Russia, as in the United States, the leading causes of death and disability are directly associated with behavioral risk factors such as tobacco use, poor diet, inadequate physical activity, and excessive alcohol consumption.[1] As part of an ongoing collaboration between the Centers for Disease Control and Prevention (CDC) and the Russian National Center for Preventive Medicine, a telephone-based behavioral risk factor surveillance survey was developed and tested in Moscow.

The questionnaire was modeled after the American Behavioral Risk Factor Surveillance System survey[2] and gathered information on participants' demographic characteristics, health status, quality of health care, fruit and vegetable consumption, smoking status, level of physical activity, and alcohol consumption. Moreover, it included items addressing respondents' awareness of their cholesterol, blood pressure, diabetes, and cardiovascular disease status. The survey comprised 13 modules, included 51 questions, and required approximately 10 to 15 minutes per interview.

Moscow was selected because there is almost universal residential telephone coverage, results could be used to plan prevention programs for a large portion of the population, and findings would be salient to Ministry of Health officials who reside in Moscow. The Russian National Center for Preventive Medicine conducted the survey as part of its ongoing public health responsibilities, and CDC provided assistance in analyzing the data.

A random sample of 3032 residential telephone numbers was selected. Up to 15 telephone calls were made to interview an adult aged 25 to 64 years in each household, and 1693 interviews were completed (representing 69.1% of those contacted and eligible, or 55.8% of the original sample). Prevalence rates of selected risk factors are shown in Table 1. The results of the survey indicate that telephones are a feasible way to collect behavioral risk factor data in Moscow, and these data provide valuable information that can be used to plan preventive programs and evaluate their effectiveness.

This survey was a first attempt in Russia to collect, by telephone, information on risk factors related to chronic diseases. The response rate was similar to rates found for other methods, and neither respondents nor interviewers appeared to have problems in asking or responding to the questions. A number of issues must be addressed before a national risk factor surveillance system can be established in Russia. Only a few communities have adequate telephone coverage, so many areas will have to be surveyed via personal or mail-based interviews.

TABLE 1—Prevalence of Selected Self-Reported Behavioral Risk Factors and Cardiovascular Disease in Moscow: Russian Behavioral Risk Factor Survey, 2000

Risk Factor	Men (n = 542), %	Women (n = 1151), %
Current smoking[a]	62.3	25.8
Blood pressure ≥ 140/90 mm Hg	32.9	28.4
Controlled hypertension	4.3	7.8
Body mass index ≥ 25.0	50.6	51.9
Low fruit and vegetable consumption[b]	65.6	66.8
Alcohol consumption		
<7 drinks/wk	62.6	77.1
7–14 drinks/wk	15.1	0.6
>14 drinks/wk	8.3	0.4
Binge drinking[c]	14.1	0.1
Sedentary lifestyle[d]	25.0	25.2
Cardiovascular disease or symptoms[e]		
Myocardial infarction	4.6	2.6
Angina or coronary heart disease	8.7	12.2
Stroke	1.3	1.3

[a]Those who have smoked at least 100 cigarettes and currently are smoking regularly.
[b]Less than 400 grams of fruits and vegetables (other than potatoes) consumed daily.
[c]More than 5 drinks on one occasion during the month preceding the interview.
[d]Mainly sedentary at work and during leisure time and less than 60 minutes of daily walking.
[e]As diagnosed by a physician.

Response reliability and validity must also be addressed. While complete standardization between methods may be impossible, harmonization of questions, data analysis, and interpretation will be required. Currently, the infrastructure for a national surveillance system is inadequate; most health data are facility based and focus on counting numbers of medical procedures or calculating rates of infectious diseases. Finally, the value of tracking population levels of risk factors for noncommunicable diseases must be demonstrated.

The collaboration between CDC and the Russian National Center for Preventive Medicine has been successful in placing prevention and public health on the national agenda; an important goal in our future collaboration is institutionalizing adequate data collection systems for planning and program evaluation. As a next step toward the goal of establishing a countrywide behavioral risk factor surveillance system, 15 more sites have agreed to collect risk factor prevalence information in 2001–2002. ■

About the Authors

Helena Zabina and Thomas L. Schmid are with the Division of Nutrition and Physical Activity, Centers for Disease Control and Prevention, Atlanta, Ga. Igor Glasunov, Rimma Potemkina, Tatiana Kamardina, Alexander Deev, Sveltlana Konstantinova, and Marina Popovich are with the Russian National Center for Preventive Medicine, Moscow.

Requests for reprints should be sent to Thomas L. Schmid, PhD, Mail Stop K-46, 4770 Buford Hwy, Centers for Disease Control and Prevention, Atlanta, GA 30341 (e-mail: tls4@cdc.gov).

This brief was accepted June 5, 2001.

Contributors

H. Zabina and T.L. Schmid provided technical assistance in the analysis of the survey data and wrote the initial manuscript. I. Glasunov, R. Potemkina, T. Kamardina, A. Deev, S. Konstantinova, and M. Popovich contributed to the design, conduct, and analysis of the survey and to the writing of the manuscript.

Acknowledgments

Technical assistance and workshops on surveillance and policy development were supported, in part, by a grant from the Office of Global Health, Centers for Disease Control and Prevention.

Robert Baldwin provided valuable management and intellectual support, and Dr Becky Lankenau was a cardinal member of the initial collaboration on health promotion policy development.

References

1. Oganov R, Maslenikova G. Cardiovascular diseases in the Russian Federation in the second half of the twentieth century: tendencies, possible causes, perspectives [in Russian]. *Cardiology (Russia).* 2000;6:4–8.

2. Centers for Disease Control and Prevention. The Behavioral Risk Factor Surveillance System. Available at: http://www.cdc.gov/nccdphp/brfss. Accessed March 15, 2001.

Hormonal Pregnancy Tests in Sub-Saharan Africa

John Stanback, PhD, and Elizabeth Raymond, MD, MPH

Until the mid-1970s, it was common practice worldwide to rule out, or to confirm, a pregnancy by using reproductive steroids to provoke withdrawal bleeding in women with late periods. This practice nearly disappeared after warnings about its ineffectiveness[1] and possible teratogenicity[2] and after fast, accurate pregnancy tests became available. We recently collected data in sub-Saharan Africa, however, that suggest that the practice of inducing menses to rule out pregnancy is still widespread.

Following up on anecdotal reports of the use of combined oral contraceptives to induce menses, we surveyed family planning providers in 3 countries. From May to July 2000, we surveyed 124 providers in 50 clinics in Ghana and 177 providers in 72 clinics in Kenya. Thirteen percent of the Kenyan providers and 22% of the Ghanaian providers reported that they had induced menses in their clients in the previous 6 months. Among supervisors in 10 family planning clinics surveyed in Zambia in January 2000, 40% reported that providers in their clinics "regularly induce menses." Use of this practice appears to be most common with postpartum family planning clients whose lactational amenorrhea makes it difficult for providers to rule out pregnancy with certainty.

We believe that this practice persists for 2 reasons. First, although the cost of pregnancy tests continues to decline, even inexpensive tests may be prohibitively expensive (in comparison with the cost of subsidized hormonal contraceptives) for resource-strapped clinics in Africa. Second, family planning providers in Africa and other regions are often loath to prescribe contraception to nonbleeding clients for fear that they might inadvertently expose a fetus to steroids.[3] Paradoxically, this reluctance can result in the use of hormones to provoke bleeding, because providers are afraid to prescribe a hormonal method.

Although the risk of exposing fetuses to oral contraceptives is no longer considered significant,[4] inducing withdrawal bleeding to rule out pregnancy should no longer be tolerated. In areas where pregnancy tests are unavailable or unaffordable, evidence shows that a client history and examination is a safe way to screen nonmenstruating family planning clients in primary care settings, allowing providers to exclude pregnancy with more than 99% certainty.[5] ■

About the Authors

The authors are with Family Health International, Research Triangle Park, NC.

Requests for reprints should be sent to John Stanback, PhD, Family Health International, PO Box 13950, Research Triangle Park, NC 27709 (e-mail: jstanback@fhi.org).

This brief was accepted January 23, 2001.

Contributors

J. Stanback conceived the study and was responsible for data collection, management, and analysis. E. Raymond interpreted the findings and added the necessary medical context.

Acknowledgments

Funding for this research was provided by the US Agency for International Development.

We wish to thank Dr Marcia Angle, Ethel Mangani, and Dr David Grimes for their helpful comments.

References

1. Vengadasalam D, Lean TH, Kessel E, Berger GS, Miller ER. Estrogen-progesterone withdrawal bleeding in diagnosis of early pregnancy. *Int J Gynaecol Obstet.* 1976;14:348–352.

2. Gal I. Risks and benefits of the use of hormonal pregnancy test tablets. *Nature.* 1972;240:241–242.

3. Shelton J, Angle M, Jacobstein R. Medical barriers to access to family planning. *Lancet.* 1992;340: 1334–1335.

4. Bracken MB. Oral contraception and congenital malformations in offspring: a review and meta-analysis of the prospective studies. *Obstet Gynecol.* 1990;76: 552–557.

5. Stanback J, Qureshi Z, Sekadde-Kigondu C, Gonzalez B, Nutley T. Checklist for ruling out pregnancy among family planning clients in primary care. *Lancet.* 1999;354:566.

Mortality From Unintentional Injuries in Japan, 1899–1998

Masao Ichikawa, MPH

Clark et al. presented interesting findings on injury mortality in East Germany in terms of social changes.[1] In fact, injury mortality trends reflect histories of societies. Here I provide an example from Japan, with an overview of trends in mortality due to unintentional injuries over the past 100 years. Mortality data presented here were derived from governmental statistical records.[2,3]

Figure 1 shows mortality due to unintentional injuries, by sex, between 1899 and 1998. Historically, men have been more likely than women to be killed as a result of unintentional injuries. Death rates for both sexes for 1923 and 1995 were exceptionally high owing to significant earthquakes that occurred in those years. It is also noteworthy that there was a sharp decline in mortality in the 1970s followed subsequently by a slight increase in the 1990s.

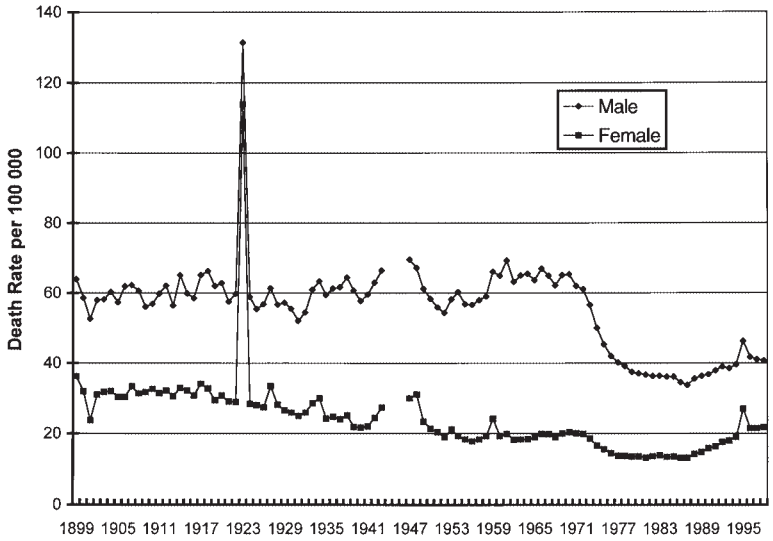

FIGURE 1—Mortality from unintentional injuries: Japan, 1899–1998.

Figures 2 and 3 show mortality due to motor vehicle crashes and other unintentional injuries between 1947 and 1998. Mortality due to motor vehicle crashes increased consistently after the end of the Second World War. However, rates began to decrease rapidly in the early 1970s.

Conversely, mortality due to other unintentional injuries continued to fall through the late 1980s but rose gradually during the 1990s as a result of the increased mortality rates among older adults owing to suffocation, drowning, and falls (data not shown). The reduced mortality from all unintentional injuries during the 1970s was proportional to the reduced mortality from motor vehicle crashes, whereas the increase occurring in the 1990s reflected elevated mortality due to other unintentional injuries. The trends just described were consistent for both sexes.

The relationship between mortality due to motor vehicle crashes, mortality due to other unintentional injuries, and mortality due to all unintentional injuries was similar between males and females. Male mortality consistently exceeded female mortality, but there were exceptions in the case of particular unintentional injuries. For example, in 1959, elevated mortality due to unintentional injuries not stemming from motor vehicle crashes was more prominent in females. The reason is that females were more

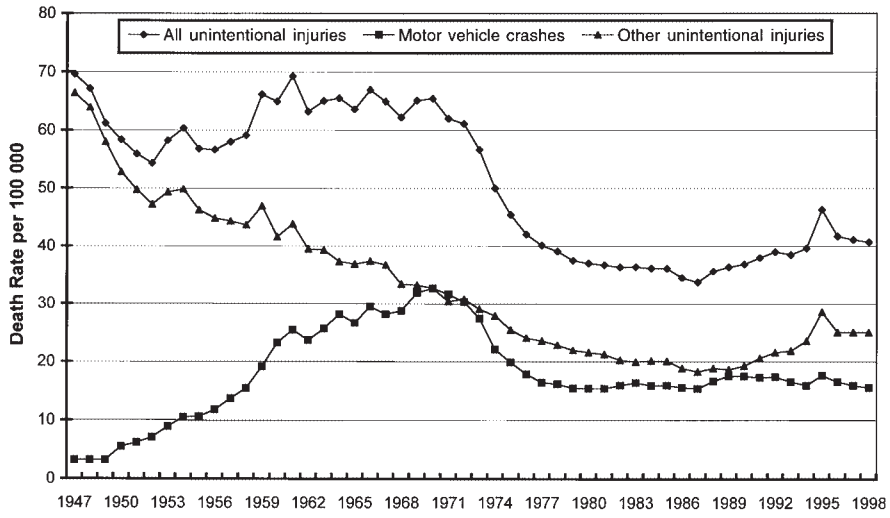

FIGURE 2—Male mortality from motor vehicle crashes and other unintentional injuries: Japan, 1947–1998.

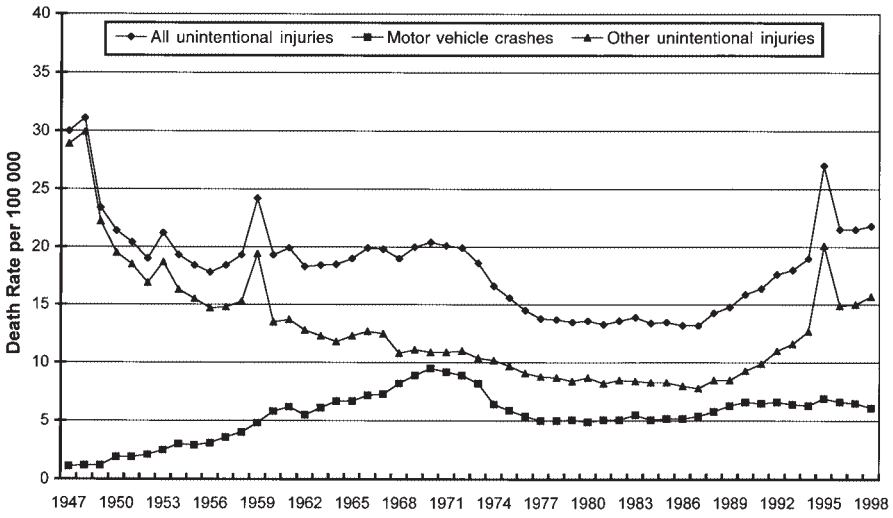

FIGURE 3—Female mortality from motor vehicle crashes and other unintentional injuries: Japan, 1947–1998.

victimized by natural disasters (typhoons and floods) that occurred in that year.

Increased mortality rates due to motor vehicle crashes were accompanied by an increase in the number of car owners.[4] However, the mortality rates have dramatically declined since 1970. In that year, the country's first traffic law was put in force, and traffic safety began to be planned and implemented nationwide.[5] This regulation effectively reduced motor vehicle crashes.

After decreasing constantly over the years as a result of public health efforts, mortality due to non–motor vehicle unintentional injuries began to rise in the 1990s. Examination of this trend by age group showed that mortality due to suffocation, drowning, and falls among older adults had increased in recent years.[6] This result may be associated with restricted physical functioning in later adulthood; however, other factors, such as living circumstances, could be related as well. For instance, in the past 2 decades, the number of individuals 65 years or older who live alone or only with their spouse has increased 4-fold.[7] Further investigation is required to confirm such potential effects of social factors on unintentional injuries. ■

About the Author

At the time of the study, the author was with the Department of Public Health, Juntendo University School of Medicine, Tokyo, Japan.

Correspondence should be sent to Masao Ichikawa, MPH, Department of Community Health, School of International Health, Graduate School of Medicine, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan (e-mail: masao@m.u-tokyo.ac.jp).

This brief was accepted March 10, 2001.

References

1. Clark DE, Wildner M, Bergmann KE. Injury mortality in East Germany. *Am J Public Health.* 2000;90:1761–1764.

2. Ministry of Health and Welfare. *Vital Statistics of Japan.* Tokyo, Japan: Japan Statistical Association; 1988–2000.

3. Management and Coordination Agency. *Historical Statistics of Japan, Volume 1.* Tokyo, Japan: Japan Statistical Association; 1987.

4. *Traffic Statistics: 1998/99* [in Japanese]. Tokyo, Japan: National Police Agency; 1999.

5. Ochi T. Changes in traffic management. *IATSS Rev.* 1994;20(suppl):4–15.

6. Ichikawa M, Marui E. Mortality of unintentional injuries in childhood and later adulthood in Japan: 1968–1997. *Jpn J Health Hum Ecol.* 2000;66:126–136.

7. Institute of Population Problems. *Study on the Model Projecting the Elderly's Living Arrangements: Projection of Living Arrangements of the Elderly in Japan 1990–2010* [in Japanese]. Tokyo, Japan: Ministry of Health and Welfare; 1995.