

Study provides data to focus diarrheal disease response in remote, resource-strapped area of Africa

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Kathleen Alexander, associate professor of wildlife, and Mpho Ramotadima, community extension officer at the Center for African Resource: Animals, Communities and Land Use (CARACAL), check water quality at a public faucet in a Botswana village. Alexander conducts research through CARACAL, a nonprofit nongovernment organization she co-founded in Botswana.

Using a simple survey tool, a team of researchers has done what complex studies have failed to do—provide data that identifies starting points for preventing diarrheal disease outbreaks in at least one region of Africa.

Diarrheal illness is a leading cause of disease and death in children under 5, and in HIV-plagued Botswana, it is a significant issue for those over 5 as well. "Yet we still know little about the dynamics of this illness and other [infectious diseases](#)," said disease ecologist Kathleen Alexander, associate professor of wildlife in Virginia Tech's College of Natural Resources and Environment and an affiliate faculty member with the university's Fralin Life Science Institute. "It is in these hard-hit areas that we know the least. Medical staff are so stretched that they can do little more than treat the sick and manage hospital functions during [disease outbreaks](#)."

One such area is the Chobe District of Botswana, where there are nine doctors for more than 23,000 people. The district's entire population is served by one primary hospital, three clinics, and 12 health posts. The 29-bed Kasane Primary Hospital is relatively unchanged since it was built in 1962.

"In such circumstances, waiting for complex studies of [diarrheal disease outbreaks](#) to be undertaken is just unrealistic," said Alexander. "How do we overcome these barriers? I wanted to see if we could use simpler tools in disease outbreak investigations that would engage the limitations of these resource-poor settings and allow us to begin to understand [public health](#) needs in these regions consistently and sustainably."

Alexander, working through the [Center for African Resources: Animals, Communities and Land Use](#) (CARACAL), a nonprofit organization she co-founded in Botswana, has been conducting a long-term study of human, wildlife, and environmental health in the Chobe District, an area that includes the Chobe National Park, forest reserves, and surrounding

villages.

Alexander and Jason Blackburn, assistant professor of geography and Emerging Pathogens Institute researcher at the University of Florida, undertook a study of diarrheal disease outbreaks in the Chobe District that relied only on the use of a simple questionnaire and existing hospital staff and infrastructure.

"The purpose of the questionnaire-based study was to try to find a way that governments in Africa like that of Botswana could begin to accumulate information on outbreak features that could be used even in the face of significant human resource, infrastructure, and technology constraints," Alexander said. "If we wait until there are more resources available to do sophisticated studies, they will never happen and we will continue to battle with diarrheal disease in much of Africa."

Using only local nursing staff, the questionnaire approach proved successful, providing information that would otherwise not been available and leading to immediate recommendations regarding control.

"This approach does not require increased human or economic resources or outside researchers, and it can give immediate insight into public health threats and disease outbreaks where this type of information otherwise would not be acquired. This is an important starting point," Alexander said.

Government medical staff assessed patients presenting with diarrheal disease during two diarrheal outbreaks in 2011–12. They reported the name of the village, the patient's gender and age, and whether the patient was hospitalized. The staff also asked patients various questions including, for example, whether they boiled their water, if there was dirt in the water, if they had flush toilets, whether other members of the household had diarrhea, whether child patients were breast fed, whether

water was piped indoors, if they stored water, and if water shortages occurred.

"A reasonable proportion of patients were surveyed during outbreak periods despite higher caseloads during outbreak periods," the researchers report in *BioMed Central's Public Health* journal.

In addition, using 2006–09 data provided by the Botswana Integrated Disease Surveillance and Response Program, the timing of recurrent diarrheal outbreaks was evaluated among patients under 5 years old.

"Outbreak periods appear to coincide with major rainfall and flood recession, identifying an important potential linkage between human health and environment," Alexander said.

"Information collected from patients affected with diarrheal disease supported the hypothesis that environmental factors are important in driving outbreaks in the region," she emphasized. "Water shortages and dirty water were also reported by patients in both of the 2011-12 outbreaks, identifying an important public health problem that can be immediately identified for action."

Despite water shortages, however, no one reported using the Chobe River for drinking water, countering the concern that the use of unsafe water from this source might be contributing to the occurrence of disease outbreaks.

The researchers reported that 44 percent of the 515 patients in the dry season and 25 percent of 333 patients in the wet season were over 5 years old. While global diarrheal disease surveillance is directed at monitoring children under 5, the authors suggest that this may not be appropriate in areas of high HIV prevalence such as in Botswana where a large immune-compromised population may warrant increased

surveillance across age groups.

"In the Chobe District, 13 percent of men and 30 percent of women have tested positive for HIV," Alexander said. "Infectious diarrhea can have an equally important impact on this vulnerable population."

"Identifying the interdependent manner in which climate, environment, poverty, behavior, and other diseases such as HIV influence pathogen transmission pathways presents one of the greatest challenges to management of this persistent public health problem," the article notes.

"But health studies that focus on the collection of complex and complete data sets are unlikely to happen in these regions in the immediate future," Alexander emphasized. "Waiting for this kind of effort only widens the health gap between developed and developing nations and our ability to respond to public health needs in the region."

"The use of a paper, pencil, and questionnaire is not a new or unique approach, but we are increasingly moving towards technology-dominated approaches in public health that might not work in these areas," she continued. "The use of a simple tool does not imply that you are moving backwards, but, in these settings, that you will move forward."

"To provide sustainable solutions in Africa, we need to know the limitations of the region so we can engage and not resist these constraints. We can make advances in improving public health even if the information we get has limitations. This was the first study of diarrhea in this region and it was done through the efforts of local hospital staff. That tells you something," Alexander stressed.

The researchers recommend that public health strategy be directed at securing improved water service to the region and correcting existing water quality deficiencies, and that public health education include

increased emphasis on the importance of improved sanitation practices when providing care to household members with diarrhea.

"Approaches that are constructed in response to regional circumstances are more likely to be sustainable. In health research in Africa, we need to be creative with simple tools that will last beyond the interest of a research group," Alexander said.

Alexander has reported the study results to the involved doctors, nurses, and laboratory staff and district health officials. "The greater understanding of diarrheal disease dynamics resulted in more positive views of the exercise and the investment of time it required," she said.

Alexander's and Blackburn's research appears in the August issue of *BioMed Central Public Health* in the article, "Overcoming barriers in evaluating outbreaks of diarrheal disease in resource poor settings: assessment of recurrent outbreaks in Chobe District, Botswana."

To learn more about Alexander's research in Botswana, visit her [program blog](#) and the [CARACAL Facebook page](#).

More information: www.biomedcentral.com/1471-2458/13/775

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