



**Global Task Force on Cholera Control (GT FCC) Working  
Group on Surveillance**

**Cholera Indicators**

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## Acronyms and abbreviations

CFR	case fatality rate
GTFCC	Global Task Force on Cholera Control
IBS	indicator-based surveillance
IDP	internally displaced population
IDSR	Integrated Disease Surveillance and Response
LGA	local government authority (Nigeria)
MAI	mean annual incidence
MSF	Médécins sans Frontières
NCCP	national cholera control plan
NCDC	Nigeria Centre for Disease Control
NGO	non-governmental organization
OCV	oral cholera vaccine
RDT	rapid diagnostic test
UN	United Nations
US CDC	US Centers for Disease Control and Prevention
WASH	water, sanitation and hygiene
WHO	World Health Organization

## Note to the reader

This report condenses discussions according to the subjects addressed, rather than attempting to provide a chronological summary. It addresses the themes emerging from wide-ranging discussions among all speakers, and do not necessarily imply consensus. Summaries of presentations and points made in discussion are presented as the opinions expressed; no judgement is implied as to their veracity or otherwise.

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This webinar was moderated by **David Olson** (WHO) and **Fran Luquero** (Médécins Sans Frontières/MSF).

## Cholera hotspot mapping in mainland Tanzania

*Neema Camara, Tanzania Ministry of Health*

Tanzania has experienced several waves of cholera since 1974, with the most significant epidemic occurring in 1992, when 18 526 cases resulted in 2 173 deaths (a case fatality rate, or CFR, of 11.7%). Between 1998 and 2010 there were 88 235 cases and 2 416 deaths. A long-term outbreak lasted from 2015 to 2018 and resulted in 33 319 cases and 550 deaths (a CFR of 1.7%). Particularly vulnerable populations have included mining and fishing communities, refugee camps, and casual and migrant farm workers.

Almost all of the country's 26 regions are currently affected to some extent by cholera. Hotspot mapping is therefore done to identify endemic areas, prioritize prevention resources, apply the proposed GTFCC approaches, and meet the national goal of ending cholera by 2030. The current methodology uses cholera data from 2010-18 and annual district population estimates, analysing data by "cholera year" using a web-based tool developed by Johns Hopkins University and MSF<sup>1</sup>. This is complemented by further analyses of risk factors (water, sanitation and hygiene/WASH status and underreporting) and specific at-risk areas and populations.

Ranking criteria for hotspots are based on three dimensions: mean annual incidence (MAI), maximum annual incidence, and stability. "Stability" in this context refers to districts that achieve

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<sup>1</sup> <https://scottyaz.shinyapps.io/tzchol/>

consistent relative thresholds of disease across the historical period under analysis—i.e. those that have shown a consistent “popping up” of cholera outbreaks.

This process has generated a list of 14 councils (containing a total of 73 wards and a total population of almost 1 200 000) that are classified as hotspots. These have been further categorized into high, moderate and low priority areas.

The results of this process have been used to develop a multisectoral national cholera control and prevention plan (NCCP) for 2019-24, which allocates resources and identifies at-risk populations and priority areas for intervention. This plan is being finalized at the time of writing, with only the costing still to be completed. When complete, the plan will be shared with all partners.

## Cholera hotspot mapping in Zambia

*Fred Kapaya, Zambia National Cholera Programme Coordinator*

Zambia has been implementing Integrated Disease Surveillance and Response (IDSR) since 2002, using both indicator-based surveillance (IBS) and event-based surveillance systems. Along with certain other diseases, cholera is reported weekly using IBS, and is an immediate notifiable disease. Weekly cholera data is published in an Epidemiological bulletin produced by the Disease Surveillance and Intelligence Unit of the Zambia National Public Health Institute.

Zambia’s first cholera outbreak occurred in 1977, and there have been 30 more since then, varying in magnitude varying from 14 to 13,500 cases, with CFR ranging from 0.5% to 9.3%. Four outbreaks involving more than 10 000 cases occurred in 1991, 1992, 1999 and 2004 respectively, and the last major outbreak ran from October 2017 to June 2018, with 5 935 cases and 114 deaths (a CFR of 1.9%). Most outbreaks occur in periurban areas and fishing camps.

Hotspot mapping was done between September and December 2017, and involved analysis of annual morbidity and mortality, environmental data, and risk and vulnerability assessments (including identifying a range of specific local risk factors such as WASH, surveillance and laboratory capacities). A mapping orientation was held at the start of the process to build capacity for the exercise, along with an expert review of cholera risk that included the MOH, WHO, UNICEF, WaterAid, the Red Cross and all other partners—noting that this was done before GTFCC mapping tool was developed. After this, cholera data was reviewed from 2008-2016. This data included MAI, persistence, and risk factor and population vulnerability assessments looking at factors including WASH facilities, frequency of flooding, presence of fishing camps, and potential for displaced and unplanned settlements.

The data sources eventually used for hotspot ranking included IDSR reports by facility and outbreak reports, with the main variables being MAI and persistence. Risk factors and population vulnerabilities were only used in addition to MAI and persistence (WASH data were more qualitative in nature, as the tool used only captures accessibility in relation to targeted population and not other factors such as availability of yield per day).

The ranking system was applied as follows:

- High MAI + high persistence +/- poor WASH = Hotspot
- High MAI + low persistence +/- poor WASH = Hotspot
- Low MAI + high persistence + poor WASH = High Risk
- Low MAI + Low persistence = Low Risk

The MAI cutoff was set at 40 per 100 000 population (with > 40 per 100 000 = High and < 40 per 100 000 = Low) and minimum threshold was set at < 5 per 100 000 population). Persistence was defined as the proportion of annual cholera outbreaks between 2008 and 2016—i.e. the number of years with a confirmed outbreak divided by 9—where >0.4 indicated high persistence and <0.4 indicated low.

This process yielded a total of 29 high-risk districts, of which 14 were classified as hotspots. A similar exercise run by UNICEF identified almost the same hotspots. To eliminate cholera in Zambia, these hotspots should be targeted with interventions as outlined in the national multisectoral cholera elimination plan.

Zambia intends to repeat the mapping exercise annually using the GTFCC tool.

## **GTFCC hotspot identification tool: community risk factors**

*David Olson, WHO Headquarters*

Dr Olson outlined the planned next steps for the development of the GTFCC hotspot identification tool. A web session will be held on WASH indicators in hotspot selection, provisionally in September 2020, after which—based on the outcomes of webinars to date—the tool will be adapted with additional indicators in light of country experiences and expert input. This process will hopefully complete by the end of 2020.

In the interim, the current tool will be used for countries ready to plan NCCPs, with continuous development of data uploading and map support to accompany its use.

While the tool currently uses MAI, proportion of weeks with  $\geq 1$  case and the preceding five years of historical data as inputs, it is proposed that these be supplemented with additional indicators for CFR, cholera-attributed mortality, and other laboratory-supported indicators—as discussed in the previous webinar.

Factors that affect cholera risk and which ought to be taken into account in tool improvements include the presence and nature of special populations (e.g. refugee camps, unplanned settlements and high-density urban communities); the presence of fishing communities, irrigation farming and/or mining; natural factors like flood zones, cyclones and drought; the presence and type of trade routes and transportation hubs; high-incidence border zones; the state of the health system; civil conflict (and the no-go areas it can create which affect access to WASH and to health services); and any prior OCV immunization campaigns. All of these can make cholera transmission more likely and/or the impact of any outbreak more severe.

Factors for discussion as this process is taken forward include how to deal with separate risks that predict either a higher likelihood of transmission or a greater outbreak impact; whether to categorize these as stable (i.e. already captured by incidence/persistence) or non-stable (risk is expected); and whether risk factors should be of equal weight to incidence and/or persistence data, or used as a secondary weighting. If the latter is the case, this raises further questions: whether to consider standardized scoring systems for risk multipliers (for example, the yes/no presence of a refugee camp multiplies risk by 1.3, etc.); and whether secondary weights can or should be additive. Generating a vulnerability score also requires addressing which factors to combine, how to weight factors within the score, and how to weight the score itself.

Qualitative weighting can also be considered, whereby the answer to a yes/no question affects risk: e.g. a single “Yes” for the presence of a given risk factor moves the outcome to the next higher-risk group, two or more “Yes” answers move it to the high-risk group, and so on. This approach could be used to indicate the highest priority immediate intervention (whether that be case management, emergency OCV campaigns, WASH interventions, or something else).

## Discussion

- Data quality is a common and wide-ranging challenge. Hotspots are often missed due to poor surveillance data and the inability to get proper information, so approaches are needed to estimate and attribute risk for places with poor cholera data. As work is done to make the mapping process sustainable, the importance of high quality information must be stressed. Electronic IDSR systems will have a positive impact on the availability of good data.
- Proposed approaches raise the evergreen question of how to assign a quantitative value to a qualitative position for ranking purposes—is a binary yes/no ranking preferable to a calculation of severity and/or level of risk? As we want to standardize the processes and assign scarce resources such as OCV, answers to these questions are required. It should be acknowledged that to a certain extent hotspot identification is an art: “you have to know the context; you can’t just apply dry numbers.”
- The Tanzanian approach of factoring in analysis of wider risk factors is a good one, but it is not easy and it must be acknowledged that it included a lot of discussion based on historical data: when the ranking was done there was a meeting for discussion at which several qualitative and non-epidemiological risk factors were decided and assigned. There was general agreement that the Zambian and Tanzanian examples went the right way about complementing surveillance gaps with new information to provide a more complete picture of cholera risk. It was argued that the identification and prioritization of hotspots should be left to countries’ knowledge of their own populations and communities. One particularly illustrative issue in this regard is that of migrant farm workers who move around: living conditions and WASH access can be poor for these populations, and they can be cholera spreaders; but assessing the risks attached to these populations requires local knowledge of the country, how things are done, and how these workers fit in to the picture. The Zambian approach combined MAI and WAS-related data: this is one way to approach qualitative ratings—using them as a way of assigning identified locations to higher or lower risk categories.
- There was general discussion of whether it is appropriate for the GTFCC and the surveillance working group to attempt to assign risk to the novel factors suggested, and the question of whether this should be left to countries versus whether it would be desirable to standardize it so that there is some way of creating a global picture of who is affected and what resources are needed.
- For special populations (refugee camps, etc.) some of the risk will be picked up in the epidemiological data. It is important not to assume that conditions in camps are worse—for example, some camps may have better WASH and better knowledge and practice than in communities outside them.
- Part of prioritization should be to take into consideration the risk to other communities if cholera explodes within a given area—for example, if there is an outbreak in an urban area or a transportation hub from which people move out to rural areas, the risk factor would need to take into account the subsequent risk to other populations. A similar logic applies to places on borders with high incidence, and this cannot be addressed using numbers alone: some subjective assessment has to be done as well, and this is hard to model.
- There is going to be a great deal of difference between countries, even among the risk

factors already discussed, and some countries will be stronger in some places than in others. It was argued that a definitive list of risks may not therefore be desirable: these issues could instead be considered as supporting information, a secondary tier of factors to identify potential risk areas. If cholera-specific epidemiological data can be used first, then supporting factors could subsequently differentiate between locations that appear moderate risk, or could be applied in areas with known issues around surveillance quality. It may, however, be difficult to standardize this type of approach to the level where the GTFCC could recommend it.

- A more quantitative approach could be used to address the issue of previous OCV campaigns: for example, time since vaccination occurred is known, and hopefully so would be the data for coverage, population turnover and so on; using these, a numeric method might be found to assess these populations for cholera risk. Other tools can also be examined in this fashion, including WASH as a primary pillar of sustainable cholera control and questions around access. For example, areas with access issues could be considered for reinforcement of case management or outbreak planning on the basis that they are places where high numbers of deaths might be expected.
- Just because a location has been vaccinated in the past few years does not necessarily mean its hotspot status has changed or should change. This begs the question of how to separate out hotspots from places where we OCV use is prioritized and/or places where WASH improvements are the order of the day. It might be better to keep all these considerations separate in order to avoid confounding hotspots with epidemiological characteristics with the question of where to target specific interventions. Part of NCCP planning is to think about hotspot identification first, then to do a separate OCV prioritization exercise for those hotspots.
- A lot of different risk factors direct us to list the various interventions that need to be priorities. Hotspot analysis can be used to identify where to give OCV, but not all hotspots need OCV, and there are other interventions that could be prioritised to prevent cholera so that OCV is not needed.

## Concluding remarks

*Philippe Barboza*

- It would be interesting to explore the application of different methodologies to data used in the past and see in what ways the results would differ. The refugee camp example illustrates the need to consider some of these vulnerability criteria from a number of different angles.
- The use of these new approaches is a very complex question—and these discussions have clearly underlined why the consensus at the start was to use MAI and persistence for the first level of screening, with the clear benefit of making data and assessments more comparable and objective as opposed to other indicators.
- One lesson of the discussion is the level of complexity involved in using all this data, considering how to transform qualitative into quantitative indicators while making sure that the information we look at is meaningful. We will need to be adaptable to different scenarios and not just expect to be able to use one-size-fits-all strategies. This point was heavily reinforced today.
- While there is more discussion to be had on which indicators to use and how, often the key point is how to measure and define the same indicators consistently in order to make them comparable.
- Despite the difficulty of this task, it has to continue. The definition of hotspots is not always linked to the type of intervention required, and the challenge for future is to define better, within hotspots, *how* best to target interventions. The way that hotspots are assessed so far

is a good starting point, but work is needed to try and developed an easy-to-use supporting tool to improve the targeting and monitoring of interventions.

- OCV is also an important issue: in areas where OCV campaigns have been done, it is crucial during the period following the campaign that all priority activity—WASH, access, engagements, etc.—is strengthened. Otherwise, it is back to square one: we do not want to repeat vaccinations in the same areas again and again.
- It is necessary to consider what evolves in hotspots and always to reassess what the next steps should be, including around the question of how to address preventive revaccination in hotspots, trying to find different options.
- The question that remains central in all these discussions is that of what to do in a hotspot once it has been identified. This is closely related to the issues of limited vaccine availability and the need to identify the most vulnerable areas to ensure that WASH and other interventions are targeted where they will have the greatest impact.
- These were interesting discussions with good points about the need for extreme caution in interpreting and qualifying different kinds of indicators—a good basis for further discussion. It is always useful to integrate good experiences that have been tested by countries, including CFR, laboratory data, WASH indicators and more.
- A more specific discussion will be required with the WASH working group to determine what indicators to collect and how to integrate them into the assessment of hotspots—in the long term, it will not just be numbers of cases that are considered.
- The road is long, but some progress has made. We will have to be progressive, and use flexible approaches to match tools with specific country situations.