Cholera in Mikumi

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1. Introduction.

Tanzania is still a victim of the 7th cholera pandemic which started in 1961 and caused by the *Vibrio cholerae* El Tor. The disease has become endemic in Tanzania and hardly a year passes without waves of outbreaks or epidemics of cholera throughout the country. The pandemic has reached nearly a 100 countries now. Recently Peru was hit seriously for the first time since some 100 years. In Figure 1 the countries which are affected are shown.

In this presentation I have avoided an extensive review of cholera and just highlighted issues wich have relevance for the Mikumi outbreak. The endemicity of cholera in most countries is basically caused by poverty, overcrowding and poor sanitation. Unfortunately, the *Vibrio cholerae* El Tor survives for long periods and multiplies easily in a variety of fluids and food, water being the main carrier. Survival periods of 34 to 58 days have been reported, brackish water and milk being the most favourable. Vibrios do not survive in alcohol but have been demonstrated in a local beer called *mbege*. The vibrios survived 2 days. However, transmission of cholera in bars and beer halls is usually associated with gatherings of people with poor hygienic and sanitary practices.

Cholera being endemic indicates the persistent presence of the vibrio in a given area. Endemic disease becomes epidemic if environmental or host influences change in a way which favours transmission. This pattern is seen in Tanzania where epidemics, or waves of outbreaks of cholera coincide mostly with the rainy seasons, occurring between October and April.

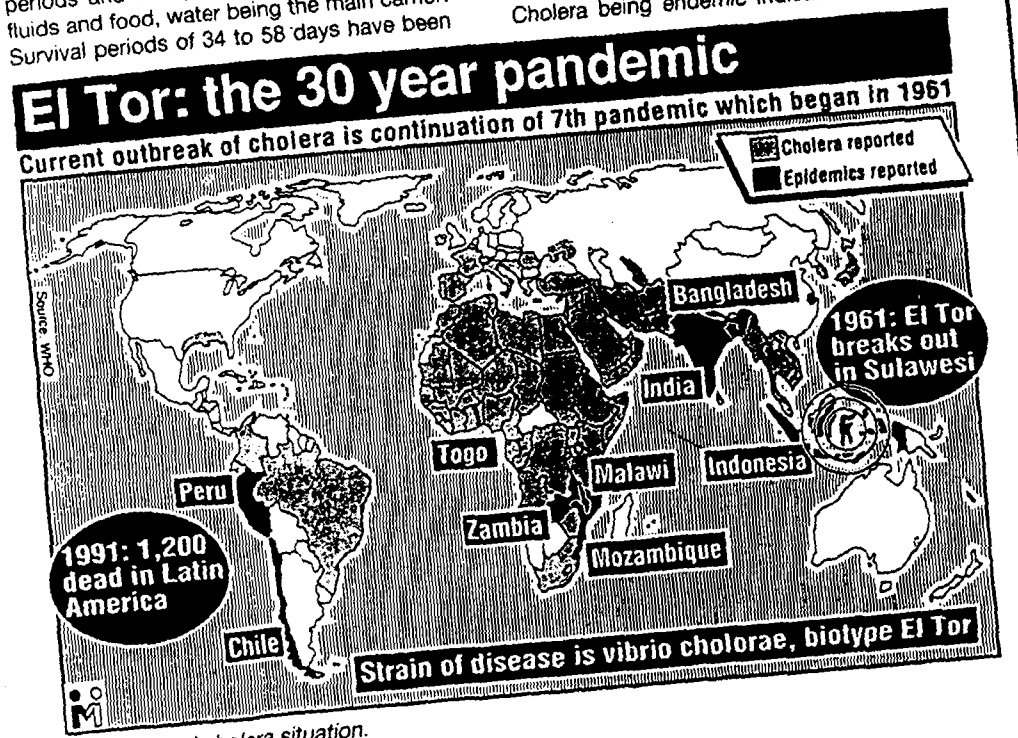
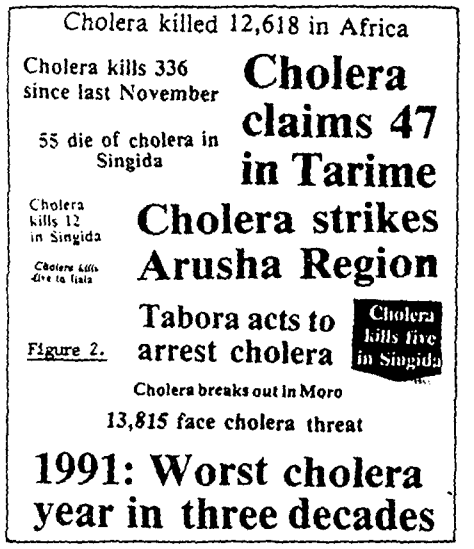


Fig. 1. Global cholera situation.

There is inconclusive evidence for continued immunity after having recovered from cholera and the relation, therefore, between clinical case attack rates and herd-immunity in an assumed endemic area is hitherto unclear. Generally, the attack-rate varies between 0.2 and 2% depending on pre-existant immunity in the population. One should realize that about 90% of all cholera cases are inapparent and indistinguishable from other diarrhoeal diseases. This is the reason that when the first clinical case presents, the *vibrio* has already spread substantially via subclinical carriers.
In 1991, outbreaks of cholera occurred in various regions of Tanzania and received much publicity in the press. (Fig. 2).
In the newspapers, the following reasons for the epidemic were given:

- unprotected wells
- uncovered dustbins
- neglected latrines
- contaminated food
- unhygienic bars
- heaps of garbage
- open flowing sewage trenches

The fact that initial mortality during these outbreaks was high, in spite of the fact that Tanzania already had 15 years of experience with cholera epidemics, was most disappointing. This year, mortality rates of over 10% (Singida) have been reported. Overall mortality reached 9% in 1991. This is in striking contrast with mortality rates of below 1% when case management is adequate, even in rural settings.


Cholera killed 12,618 in Africa

Cholera kills 336 since last November

55 die of cholera in Singida

Cholera claims 47 in Tarime

Cholera kills 12 in Singida

Cholera strikes Arusha Region

Cholera kills five in Singida

Figure 2.

Tabora acts to arrest cholera

Cholera breaks out in Moro

13,815 face cholera threat

1991: Worst cholera year in three decades

Fig. 2. Selected announcements in newspapers.

At this moment, outbreaks of cholera are still being reported from various parts of the country. The influence of a poor rainy season for most of the country is difficult to assess, but may have increased the spread of the disease, because sources of water tend to dry up or only contaminated water is available in many areas.
The apparent lack of general hygienic measures such as adequate latrines, boiling water and washing hands, all indicate that the population has little learned from the past. Increased economic hardships such as high fuel prices, limited funds for water and sanitation programmes may have contributed towards the unsatisfactory situation at present.

2. The onset of cholera in Mikumi

On the 15th of October 1991, a few days after the opening of the new Health Centre in the village of Kidoma, near Mikumi, a 70 years old

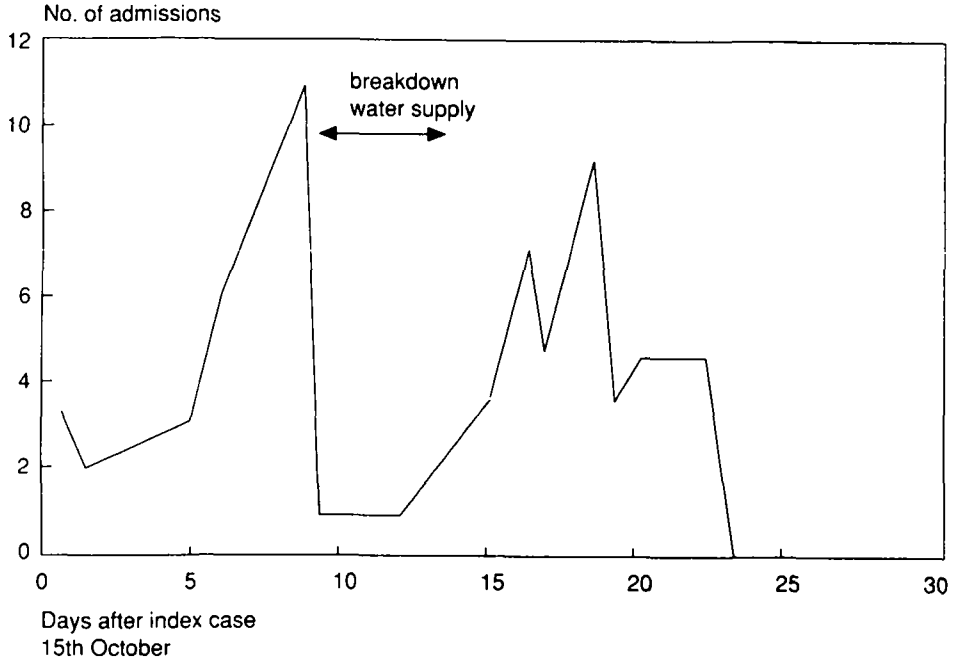


Fig. 3. Admissions for cholera treatment.

man was admitted early in the morning with severe dehydration and unconsciousness following heavy diarrhoea at home. A drip was set up, but a few hours later the patient died. On the same day, some hours later his son-in-law was brought to the Health Centre (HC), severely dehydrated, restless, with cold extremities, no peripheral pulse and an unmeasurable blood pressure (BP).
Cholera was then suspected and a large bore canula was inserted, infusion commenced and ORS was prepared. Laboratory examination was inconclusive mainly due to the fact that the trained laboratory assistant had not yet come across cholera during her professional career. However, the clinical picture and the death of the father-in-law due to diarrhoea left us with little doubt.

Expecting the worst, the obstetric ward, which had not yet been completed and which was still under construction, was rearranged and prepared to admit the expected new cases. Soon, additional clinically suspect patients suffering from diarrhoea and vomiting, attended the Out Patient Department (OPD) and the outbreak became a reality. Shortly afterwards, more patients presented at the government dispensary in Mikumi, where a treatment centre was set up in the local beer hall.

3. Pattern of the outbreak

The index case was rapidly followed by an increasing number of patients suggesting a point-source epidemic. In Figure 3, the number of admitted patients for each day after the admission of the index case is shown. Patients

from both Kidoma and Mikumi are combined. The total number of patients admitted was 78.

There was a male preponderance (male/female ratio 47:31). With an estimated population of 10.000 in the ward Mikumi the attack rate for severe clinical disease was 0.8 %. The mortality in the Health Centre at Kidoma was 5,6% (2 out of 36 cases). At the Mikumi treatment centre the mortality was 14,3% (6 out of 42 cases).

People in Mikumi had hardly suffered cholera in the past, the last outbreak dated back to 1978, when the current pandemic reached Tanzania for the first time. The present point-source outbreak and the distribution of age of patients (Fig. 4) suggested that cholera endemicity in Mikumi was probably low or absent. A relative small number in children presenting with severe G.E. and a higher proportion of adults (the mobile group in the community) was typical for an outbreak in a non-endemic area.

4. The geographical distribution

The Mikumi H.C. is situated in the village Kidoma, 1 mile from Mikumi. The village is at the crossroad between the Tanzam highway and the main road between Kilosa and Ifakara. It is along this highway that AIDS has spread at an alarming rate, whereas cholera has tended to spread along the gravel road that links Kilosa via many smaller villages to Ifakara in the south. Mikumi and Kidoma have a large number of bars and lodgings with poor sanitary facilities, which serve the numerous travellers and transport drives who pass the crossroads. It is here that one could ironically say, 'where the *Vibrio cholera El Tor* meets the *human immuno-deficiency virus'*.
Mikumi is supplied with water from a mountain intake. The water is piped to the village through a piped system and is considered to

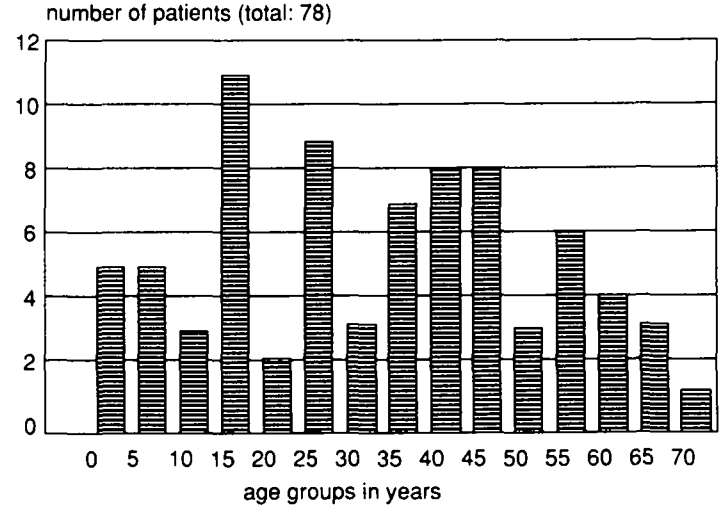


Fig. 4. Age distribution of admitted patients.

be safe, because the intake is high and far in the mountains, where there is no human population or agriculture. The supply of water is erratic at times.
In Kidoma the same water is supplied but there are only 4 public water taps, 1 at the health centre and 1 at the petrol station at the crossroads, 1 near the beer hall and 1 at the party office.

A river passes through the center of Kidoma and is the main source of water for the inhabitants. Apart from household consumption, it is used for washing and it is believed to be frequently contaminated via defaecation.
At the time of the onset of cholera, the expected short rains had not yet begun and the water level in the river was at its lowest with many isolated pools and extensive vegetation along the banks.
The high proportion of patients coming from Kidoma (Fig. 5) strongly suggested that this river was apparently contaminated with *vibrio cholera*.

One week after the onset, the piped water supply for Mikumi broke down, which initially caused considerable logistical problems in the management of clinical cases at the health centre, but may also have caused the second wave of patients (see Fig. 3). Although initially nearly all patients were from Kidoma, after one week more patients came from Mikumi. This was assumed to be associated with the breakdown of the piped water supply.

5. Clinical features and management of patients at Mikumi HC

Only patients who required intravenous infusion were admitted to the 'future' obstetric ward which was arranged to receive the cholera patients. Patients who were not severely dehydrated were observed at OPD level, rehydrated with ORS and received Erythromycin for 3 days. Many patients were managed in this way and in such mild cases the diagnosis cholera could not be definitely established.

However the clinical picture in the severely affected patient was unmistakably that of classical cholera: acute onset of profuse watery diarrhoea and vomiting. The rapidly developing severe dehydration caused shock, absent pulse, unmeasurable BP, cold limbs, hoarse voice and typical cramps in the muscles due to Potassium loss. Vomiting usually started some time after the onset of diarrhoea. However, the patients remained conscious. Patients did not develop fever, but were rather undercooled at admission.

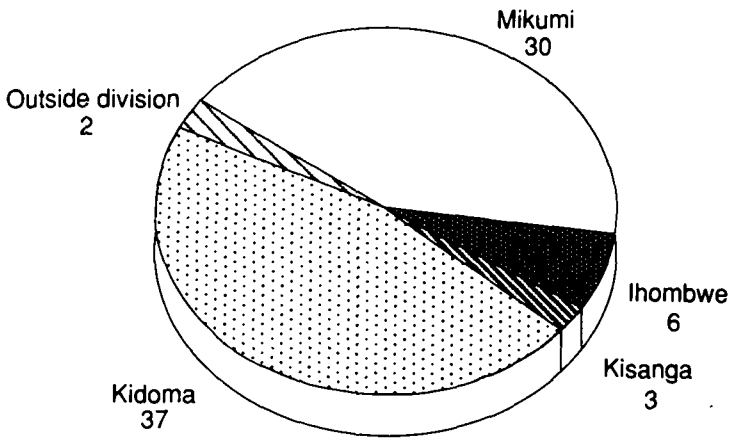


Fig. 5. Domicile of admitted patients.

Immediate I.V.-infusion of large quantities of fluid resulted in swift dramatic improvement. Vomiting subsided first, making oral rehydration and medication possible and effective. A minority of patients required I.V.-infusion for more than 24 hours. In many patients infusion for 4 to 6 hours was sufficient to reduce vomiting and enabled the patient to start therapy and to drink ORS. A rule of thumb is at admission to administer 10 % of bodyweight as fluids in the first 2 to 3 hours.
Initially, patients received Doxycycline, but the respons appeared to be slow. With regards to documented effectiveness studies in Turiani and other parts of Tanzania and the experiences in large epidemics in Turiani, patients were given Erythromycine, with excellent results (500 mg three times daily for 5 days).
A total of 36 patients was admitted. Apart from the index case who arrived in moribund condition, there was one more death, a 60 years old male patient who died suddenly 3 days after admission. This patient did not recover well, was confused and refused oral intake. All other patients recovered. The average admission time was only 2 days.

As reported in the literature, the early intake of ORS was of vital importance. The bicarbonate contents in ORS reduced acidosis and decreased vomiting. Especially in the mild OPD cases who were monitored throughout the day, rapid improvement was observed after intake of large quantities of ORS.

Since Ringers lactate (Hartmann's solution) as advised by the WHO and various textbooks was unavailable, we had to use normal saline and 5% dextrose, as well as full-strength Darrows solution. We did not observe any complications of initial rehydration with these fluids, but all patients indeed were encouraged to take ORS simultaneously, assisted by their vigorously instructed relatives.
Contact cases among relatives or health staff were not observed during or after the outbreak. After the index case who was followed by his son-in-law living under the same roof, no additional direct household contacts were identified. However, home visiting has not been carried out and therefore it remains speculative to comment on the person to person versus agent to person transmission of the disease. From the literature person to person transmission is considered to play a minor role, whereas some studies, notably in Tanzania, suggested strong individual contact transmission at community level.

6. The laboratory

The Health Centre has a laboratory in which a carefully selected range of essential tests can be performed. The microscope has no darkfield modification. Results of examining direct thin smears of the stools were inconclusive because the skilled laboratory technician, who was freshly trained, did not have the expertize required with cholera.
Eight rectal swabs from suspected patients were inoculated on TCBS medium which was provided by the Regional Hospital and returned to the regional laboratory. The results in four patients were strongly positive confirming that the outbreak was indeed caused by Vibrio cholera.

The following techniques are easy to perform and valuable in the field (AMREF Nairobi, rural laboratory project):
1. Very thin wet preparation ('hanging drop'). A single small drop of faeces is mixed with a drop of normal saline. Cover slip is put and the edges sealed with vaseline. Microscope with 40 x objective. Close diaphragm. Lower condensor. Look for the typical very mobile 'jumping' vibrios.
2. If the 'hanging drop' is inconclusive, make a thin smear of stool on a slide and let dry. Stain the slide with diluted carbofuchsine and wash it after 30 seconds. Examine with 100x objective under immersion oil. Look for the red- stained typical 'komma' shaped vibrio bacteria.

If the slide is to be transported for confirmation, fixing with 99% alcohol for 2 seconds before staining is recommended.
Sending material for culture elsewhere: use Stuart medium. This can be prepared locally (with 'modified Oxoid Stuart Medium powder'). The medium should have a pH of 8.5 to 9. If it is ready, fill a tests tube to one quarter with the medium, close with a cork or cotton wool and autoclave. If possible refrigerate prepared Stuart medium tubes after sterilization. Take a rectal swab and put it in a tube with the medium, close the tube with a cork. Now the tube can be sent or one can also set the tube aside for 24 hours (if possible at 37°C) to promote growth. After 24 hours a smear of the fluid in the tube can be made and will show many vibrios provided there was growth.

7. Control measures in the Mikumi and Kidoma community

Soon after the first patient was admitted, the District Medical Officer (DMO) and Regional Medical Officer (RMO) were informed. At the same time a make-shift treatment centre was set up the local beer hall in Mikumi, under the responsability of the DMO and supervised by the Regional Medical Assistent (RMA) and a Medical Assistent (MA) of the Mikumi Government dispensary. It was decided that patients from the Mikumi area would be treated at the Mikumi treatment centre, whereas patients from the Kidoma area were treated at the Health Centre in Kidoma.

Various meetings took place in which the control situation was discussed and measures proposed. The local army camp was involved in order to implement the proceedings decided at the meeting, and included:
- Vigorous control of all households for the presence of a pit latrine. In case of absence or poor condition of the latrine, fines were imposed and even imprisonment was suggested. According to the local administrators, this was the only effective measure for this community!
- Health education at various levels, emphasizing personal hygiene. Health assistants and Village Health Workers (VHW) were the key persons for this task.
- Shutting down of all beer halls and bars. Prohibition for selling vegetables at the markets. Closure of all guesthouses.
- The Kidoma river, being strongly suspected as the main source of transmission, was banned as washing place and guards were posted to enforce this measure.
- A one day exercise for the community included cutting down vegetation along the river banks, allowing water to flow freely and reducing the number of hiding places for people along the river.

There was no overt panic and the atmosphere during the meetings was generally constructive and realistic. Most community leaders agreed that health education was useless, because according to them everybody knew exactly how cholera was spread. The fact that the cholera reoccurred was attributed to mere indifference, negligence and laziness. Strong disciplinary measures were mostly suggested, rather than an educative approach. It was discovered that drinking water in bars and guesthouses was unboiled, because that would consume too much wood or charcoal. Toilets and latrines in public places were in atrocious state and were certainly a poor example for the general population.

The break-down of the piped water supply lasted 7 days. During that time various hand-dug wells were used in Mikumi and the number of cases increased during that period. After repair, the number of cases with cholera decreased none 3 weeks after the onset.
Intensive communication with the regional water department resulted in surveys for the Mikumi piped supply and recommendations for complete rehabilitation of the scheme which then would have the capacity to provide both Mikumi and Kidoma with enough clean water from the large mountain intake.

8. Constraints

Soon after the first case, 2 treatment centres were operational:
1. The Mikumi Health Centre, a voluntary agency run by the Roman Catholic Diocese of Morogoro. The centre is situated in Kidoma and admitted the initial patients (total admissions: 36). Iron beds available. Running water if the village scheme was operational. Flushed sewage facilities. Adequate drugs and equipment. Shortage of I.V.-fluids.
2. The temporary treatment centre at the Mikumi beer hall was run by the government and supervised by the Mikumi dispensary staff (total admissions: 42). Patients came with their own, locally made bed, which was burnt on discharge. A heap of sand was put under the bed to contain excreta. Pitlatrines present. Water supply in buckets. No tap. Shortage of drugs and equipment. Infusion fluids present.

Although patients had to be admitted to each treatment centre, according to their home location, many patients attempted to ignore that rule. A number of patients preferred the Health Centre at Kidoma, because the services were believed to be better.
Other patients avoided the H.C. at Kidoma and went to Mikumi because they were afraid of the expenses at Kidoma (the H.C. has modest patient fees, being a voluntary agency). Most of these 'illegal' transfers occurred at night.

Generally, there was good co-operation between both centres and drugs and infusion fluids were exchanged. Shortage of infusion fluids was a frequent threat. Visits by the DMO and DC were regular. The H.C. obtained infusion fluid from the DMO and from the Turiani Hospital infusion production unit. Unfortunately the Morogoro Regional Hospital infusion unit which is designed to produce large quantities has a very limited production.

During the outbreak, the RMO visited Mikumi and urged the H.C. to stop admitting new patients. He advised to set up a treatment centre at the beer hall in Kidoma, similar to the centre at Mikumi, stating that a hospital was not the place to treat cholera patients.
However, survival rates seemed to be better at well equipped centres and direct transmission in hospital premises has hardly ever been conclusively proved in the literature. Lengthy and rewarding discussions and a guarantee for a well staffed and equipped centre at the Kidoma beer hall resulted in the decision to refer new patients to this centre which was indeed quickly established by the DMO. After the first patient was admitted there, the cholera vanished and both centres were closed down.
Both centres suffered staff shortage. The H.C. in Mikumi was just open but the staff requirements did not meet that of a cholera ward. However, the outbreak was accepted as a

challenge for the new H.C. and the dedicated and committed staff headed by the M.A. in charge managed the patients in a remarkable way.

Since a comprehensive community health programme had just started, but not reached maturity, the involvement of the community was limited during the outbreak. In the near future cholera prevention would be emphasised more during the implementation of the future community health programme at the Mikumi ward.
The temporary centre at Mikumi was managed by the local dispensary staff who deserve praise for their committment and the extent of overtime spent at the centre. Their problems included poor facilities, and shortage of drugs and equipment.

9. Conclusions and recommendations

The outbreak of cholera in Mikumi, which lasted 3 weeks and effected a total of 78 admitted patients was managed adequately and without unnecessary delay. The fatalities were minimal. The co-operation between Mikumi Health Centre, the Mikumi Government Dispensary, the local government and the District and Regional Health Authorities was cordial and efficient. Long-term measures for preventing further outbreaks have been taken. Poor general sanitation, low level of water in the river and a temporary break-down of the piped water supply in Mikumi were the main reasons that were responsible for imported cholera vibrios to have caused this outbreak.

Recommendations do not differ essentially from recommendations in the current literature and are not repeated. From the experience at Mikumi a few points however need to be stressed.

- Within the current endemic pattern of cholera in Tanzania, sudden outbreaks may be expected at any time and place. In order to prevent initial high morbidity and mortality the population needs to be continuously informed on the hazards and prevention of cholera. Community health workers and government employees have to continuously monitor sanitation and sewage in their respective areas. Attention should not sway, merely because of prolonged absence of clinical cases. A well established community health programme is a condition to fulfil this objective.
- Active tracing and treatment of potential cases (mild diarrhoea etc.) via home visits would prevent further contamination. Community Health workers, and even volunteers or students may serve as visitors.
- Each health facility should have at least a limited stock of I.V.-infusion and administering sets to cope with the first serious cases in an outbreak, and thus prevent high mortality rates in the first phase.
- Accurate recording of diarrhoea cases in a given area can lead to early detection of an impending cholera outbreak. A sudden increase in the number of 'normal' diarrhoea cases may indicate an oncoming outbreak of cholera.
- Public places such as government offices, restaurants, hospitals, schools etc. must pay far more attention to their sanitation facilities. This is imperative for successful education of the general population to have proper latrines at home.

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Samenvatting

Op 15 oktober 1991 is – kort na de opening van het gezondheidscentrum in Kidoma, Mikumi district, Tanzania – een eerste patiënt opgenomen in ernstig uitgedroogde toestand, die enkele uren na opname overleed. Nadat enige uren later zijn zoon werd opgenomen met eveneens diarree en ernstige uitdroging, is gedacht aan cholera.
In drie weken zijn in totaal 78 patiënten met cholera opgenomen waarvan slechts tien onder de 10 jaar. Een typisch beeld voor een cholera-epidemie in een niet endemisch gebied.
Naast – in een gezondheidscentrum uit te voeren – laboratoriumbepalingen ter bevestiging van de diagnose worden zowel de behandeling van de individuele patiënt als de bestrijding van de epidemie besproken.
Voor de behandeling van de individuele patiënt is het van belang, dat binnen 2-3 uur 10% van het lichaamsgewicht wordt gegeven aan vocht. In de ernstigste gevallen door Intraveneus (I.V.) fysiologisch zout, om eventueel braken te couperen, maar vooral door een snel begin met ORS (bicarbonaat). Daarmee werd een zeer snel herstel gezien. Veel patiënten kunnen dezelfde dag nog naar huis; in ieder geval de volgende dag. De gemiddelde opnameduur was slechts twee dagen.
Patiënten kregen ook Erythromycine 3 × daags 500 mg gedurende 5 dagen.
Voor de bestrijding van de epidemie werd – naast het Kidoma gezondheidscentrum – een tijdelijk rehydratiecentrum opgericht in de woonlokatie Mikumi. Verder zijn hygiënische maatregelen getroffen, waaronder controle van pitlatrines, sluiting van bars, stoppen van de groenteverkoop, voorlichting over gebruik van drinkwater etc.
De sterfte bleef beperkt tot twee personen.