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ABSTRACT

**Objective:** To provide epidemiological description of the cholera outbreak which occurred in Kampala between December 1997 and March 1998.

**Design:** A four-month cross-sectional survey.

**Setting:** Kampala city, Uganda.

**Main outcome measures:** Number of cases reported per day, attack rate per age group and per parish, case fatality ratio.

**Results:** The cholera outbreak was due to *Vibrio cholerae* 01 El Tor, serotype Ogawa. Between December 1997 and March 1998, 6228 cases of cholera were reported, of which 1091 (17.5%) were children under five years of age. The overall attack rate was 0.62%, similar in the under-fives and five and above age groups. The case fatality ratio among hospitalised patients was 2.5%. The peak of the outbreak was observed three weeks after the report of the first case, and by the end of January 1998 (less than two months after the first case), 88.4% of the cases had already been reported. The occurrence of cases concentrated in the slums where the overcrowding and the environmental conditions resembled a refugee camp situation.

**Conclusion:** The explosive development of the cholera outbreak in Kampala, followed by a rapid decrease of the number of cases reported is unusual in a large urban setting. It appeared that each of the affected slums developed a distinct outbreak in a non immune population, which did not spread to contiguous areas. Therefore, we believe that, a decentralised strategy, that would focus the interventions on each heavily affected area, should be considered in these circumstances.

MATERIALS AND METHODS

INTRODUCTION

The extension of the epidemic of cholera that has been observed in 1997 - 1998 through various countries of eastern and southern Africa has probably been facilitated by the phenomenon El Nino, and the heavy rains that accompanied it(1). In Uganda, sanitation was recognised as a major concern during a national forum convened in October 1997, and preparedness activities had been planned(2). The country experienced the epidemic in November 1997 through its eastern border with Kenya. At that time, several countries of the Horn of Africa were already affected(3).

In Kampala, as in all the southern parts of Uganda, the rainfall was unusually high in 1997. In addition, the only outbreak of cholera reported during the nineties did not spread much (106 cases in 1995), resulting in a low level of immunity against the disease for the population. Those two factors, with the poor sanitary conditions prevailing in the city slums, undoubtedly favoured development of the major outbreak reported here.

**Case definition:** Clinical case definitions were used. A case of cholera was defined as any patient, living in Kampala, and presenting with an acute watery diarrhoea during the period of the outbreak. A severe case was a case of acute watery diarrhoea requiring intravenous rehydration and/or admitted in any in-patient facilities. A moderately severe case was a case of acute watery diarrhoea rehydrated with oral rehydration salt (ORS) but not hospitalised.

**Population figures:** The last census, conducted in 1991 gave the population of Kampala as 774,241 inhabitants, of which 134,832 (17.4%) were under -fives(4). Assuming an annual population growth rate of 4.5%, the 1997 population figures were estimated at 1,000,014 inhabitants, including 174,002 under -fives.

The city of Kampala is a district which is made up of five divisions. Each division is divided into parishes making a total of 64 parishes. The population figures per parish were extrapolated from the 1991 census data(4).

**Surveillance system implementation for cholera:** Cases and deaths of cholera were reported daily from all the hospitals, and from twelve major health centres (HC), all located within Kampala

district. Once set up, the two Cholera Treatment Centres (CTC) became part of the surveillance system.

All the health facilities selected were visited every morning, and the following information, concerning the previous 24 hours (from 8 a.m. to 8 a.m.), was collected: number and type of cases (severe or moderate), age group (under -fives or five and above), parish of origin and death from cholera. Cases originating from outside Kampala were entered separately and are not reported here.

**Laboratory:** Stool samples were collected from patients at the beginning of the outbreak, and then at regular intervals. Water samples were also taken from springs (the primary source of water in Kampala) every month throughout the city. All samples were initially cultured in alkaline peptone water and sub-cultured in thiosulphate citrate bile salts sucrose medium. After 18 to 24 hours, typical colonies were inoculated in Kligler iron agar medium, and incubated for 18 to 24 hours. The identification of *Vibrio cholerae* was made by oxidase test and by agglutination with a polyvalent antiserum. Monovalent antisera were used for serotyping.

## RESULTS

The first case of cholera was reported from Banda parish in Nakawa division on 9<sup>th</sup> December 1997. *Vibrio cholerae* O1 El Tor, serotype Ogawa was isolated by the Central Public Health Laboratory in Kampala and confirmed by the Pasteur Institute in Paris. It was sensitive to ampicillin, tetracycline, erythromycin, cefuroxime and ciprofloxacin, and was resistant to chloramphenicol, nalidixic acid and cotrimoxazole.

By 29<sup>th</sup> March 1998, 6228 cases, of which 1091 (17.5%) among children under five years of age, had been reported by the surveillance system. Of these, 4948 (79.5%) were severely affected cases. The attack rates (AR) between 9<sup>th</sup> December 1997 and 29<sup>th</sup> March 1998 were 0.63% and 0.62% in the under-fives and the five and above age groups respectively.

Given the high number of cases, and the need for isolation of the patients, two CTCs were built and became operational on the 18<sup>th</sup> and 22<sup>nd</sup> of December respectively. Patients were treated following the WHO guidelines (5). Severely dehydrated cases received a three day course of oral antibiotic (erythromycin for children, pregnant and lactating women and doxycycline for others).

A national cholera task force was set up to plan and co-ordinate the various activities. An intensive social mobilisation was put in place with the collaboration of NGOs, through massive media information campaign, development of a network of community health workers, and distribution of guidelines for sanitation in schools. Outreach activities were conducted to establish ORT corners in the communities, identify local conditions of transmission, and to perform health education.

The epidemic curve, including both severe and moderate cases, showed a sharp increase of the number of cases per day at the beginning of the outbreak, with a peak of almost 300 cases on 29<sup>th</sup> December, three weeks after the report of the first case (Figure 1). By the end of January 1998 (less than two months after the first case) 88.4% of

the cases had been already reported (5504/6228). A total of 122 deaths were reported among hospitalised patients between 9<sup>th</sup> December and 29<sup>th</sup> March, giving a case fatality ratio (CFR) for severe cases of 2.5% (122/4948). During this period, the weekly CFR was relatively constant.

Figure 1

Cases of cholera reported per day in Kampala district

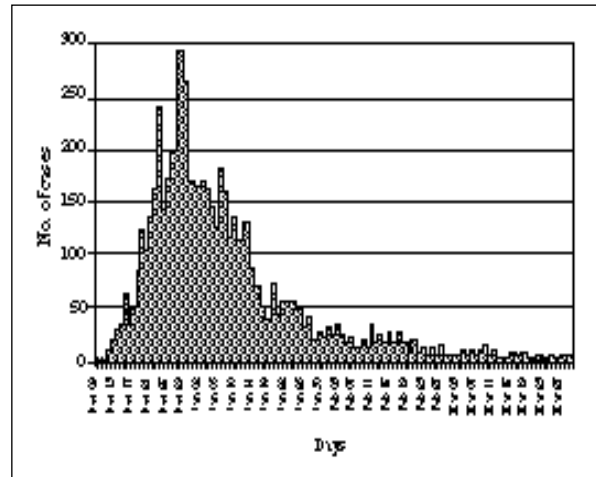
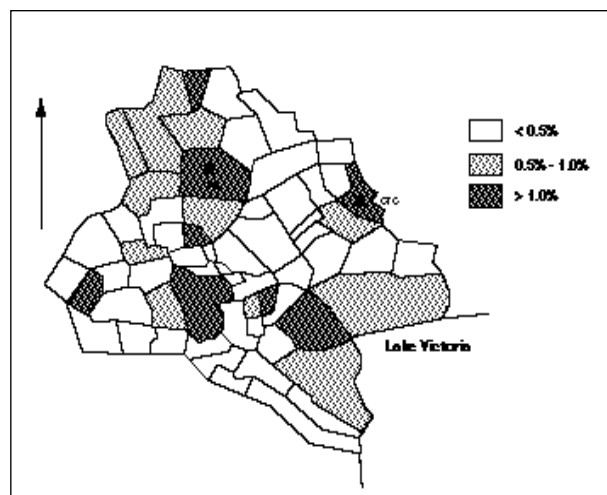


Figure 2

Distribution of the attack rate of cholera per parish



The areas most affected by cholera were the densely populated slums, scattered all around the city. Out of 64 parishes, nine (cumulated more than 200 cases each (moderate and severe) during the outbreak. Those parishes accounted for together 51.0% of the total number of cases reported (3179/6228). Twenty one parishes had more than 100 cases each for a total of 4882 cases (78.4% of all the cases). The highest attack rate observed during the outbreak in a parish was 3.4%, and ten parishes had attack rates greater than one per cent. These had 2685 cases of cholera (43.1% of the total) (Figure 2).

In December 1997, 71.6% of the spring water samples taken throughout Kampala were contaminated with more than 50 faecal coliforms colonies per 100 ml (the maximum permissible level of microbiological contamination). This proportion went down to 60.9% in January and to 36.6% in June 1998.

## DISCUSSION

The 1997-1998 cholera epidemic in Uganda which started in the eastern districts of Iganga and Bugiri in November 1997 spread to the western part of the country by January 1998, before extending to the northern districts. By November 1998, 47,759 cases and 1,955 deaths (CFR = 4.1%) had been reported from 41 out of 45 districts. The most affected districts were Kasese (AR = 1.76%), Bundibugyo (1.05%) and Kabarole (0.70%) in the west, Mbale (1.03%) in the east and Kampala (0.62%). The current trend is towards control of cholera throughout the country. The last case of cholera from Kampala was reported in July 1998.

The moderate AR and the high CFR observed during the cholera outbreak in Kampala were expected in this urban setting. To the contrary, its explosive development followed by a rapid decrease of the number of cases reported is unusual and is more characteristic of refugee camps situations (6,7). In refugee camp settings, outbreaks last generally from three weeks to more than three months with an AR range from 0.4 to 8% (with 50 to 85% of the cases as severe cholera). CFR remain below one per cent with adequate treatment (6-9). In open situations, outbreaks of cholera usually last longer, have lower AR, and higher CFR (6,7,9).

The expansion of large cities in most of developing countries has favoured the rise of huge slums in sub-urban areas, where living conditions often resemble situations found in a refugee camp. As a result, overcrowding, poor sanitation, inadequate water supply and poor public health activities, which increase the risk of cholera outbreaks in refugee settings, might prevail to the same extent in some open situations (10). This could have an influence on the epidemiological characteristics of the cholera outbreaks in urban settings.

In fact, analysis of the epidemiological characteristics of the cholera outbreak in Kampala revealed an important concentration of cases in the slums and swampy areas, where latrines are difficult to construct, and availability of safe drinking water is almost non-existent. One could therefore assume that each of the slums developed a

distinct cholera outbreak in a non immune population which did not spread to contiguous areas, thus explaining the shape of the overall epidemic curve observed.

The rapid extension of the epidemic and the size of the population exposed to the risk made the classical preventive and curative measures against cholera difficult to implement with short delays. The observations made in Kampala might tell us that, in the context of a cholera outbreak in a non immune urban population in Africa nowadays, the centralised, hospital based strategy usually used in refugee settings might not be the most effective. A decentralised approach which focusses interventions on each heavily affected area warrants consideration. Its effectiveness should however be studied in similar future circumstances.

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