EPIDEMIOLOGICAL ASPECTS OF CHOLERA IN CÔTE D'IVOIRE FROM 2002 to 2013

Lallié Hermane Désiré[1], Dago Dougba Noel[1*], Moroh Aboya Jean Luc[1], S.N. Dagnan[2], D. Cherif[2], Kouamé Jean-Pierre[2] and Coulibaly Daouda[2]
[1]Unité de Formation et de Recherche (UFR) des Sciences Biologiques Université Peleforo Gon Coulibaly BP 1328 Korhogo, Côte d'Ivoire.
[2]Institut National d'Hygiène Publique de Côte d'Ivoire, B.P. V14 Abidjan, Côte d'Ivoire.

Abstract

Background: Our study aimed to identify the main epidemiological characteristics of cholera in Côte d'Ivoire. **Methods**: It consisted of a descriptive retrospective analysis of all reported suspected and confirmed cases of cholera at the National Institute of Public Hygiene of Côte d'Ivoire from 2002 to 2013. **Results**: During this period, 8028 suspect case of cholera were recorded and 101 cases had been confirmed out of 462 cases sampled. The most affected regions with 44.1% and 25.3% respectively were "Lagunes 1" and "Lagunes 2", Southern of Côte d'Ivoire. The adults (as from 15 years old) with nearly 80% of cases where mostly affected category. Notifications on sex and clinical symptoms were not available. Out of 8 028 notified cases, 297 deaths were deplored (case fatality rate 3.7%).
Conclusion: Our study showed that cholera is a real public health problem in tropical sub-Saharan Africa area particularly in Côte d'Ivoire. Then, efficient and effective fight against this disease in above mentioned area were required applying better prevention approach as well as improving population living conditions.

Introduction

Cholera is an acute bacterial infection of the intestines, leading in its most serious form to a non-aching diarrhoea and to vomiting causing quickly a serious dehydration which can lead to death [1]. The pathogenic agent of this sickness is of type Gram-negative, belonging to the family of Vibrionaceae and to Cholerae kind, having many serotypes (more than155) in which only two (*Vibrio cholerae O1 Classique and El Tor and Vibrio cholerae O139*), producing the cholera victim toxin are responsible of epidemics[2]. Reporting word public health problematic situation to the 6 firsts pandemics, it is noteworthy to underline that cholera occupied a relevant place in particular in Africa were more than 90% of cholera cases were identified [2; 3]. Moreover, in 2007, the World Health Organization (WHO) recorded 177963 cholera cases in the world for 4031 deaths. During the same period in Africa, it has recorded 166 583 cases be it around 94% of cases for a total of 3994 deaths be it more than 99% of deaths in the world[1]. Indeed, the first cases of cholera were pointed out in Côte d'Ivoire a Western Africa country during the 7th pandemic in 1970 and 1971 with respectively 868 and 668 cases [4]. Since then the cholera stayed endemic with some epidemic explosions notably from 1990, certainly extended by the socio-politics and economics crisis the country faced. However, the epidemic of 2001 was the most virulent with 5912 recorded cases and 305 deaths (fatality rate of 5.2%) [1; 2]. Côte d'Ivoire (West Africa country) got its independence in 1960 and known a relative period of stability until the end of eighties. At the beginning of nineties Côte d'Ivoire experienced it first economic difficulties. That was because of its debt and the fall in the cost of the farm products. This crisis has direct consequences the devaluation of the Franc CFA and the creation of a structural adjustment program limiting then any investment in the field of health. That situation combined with the occurrence of many socio-political crisis

originated the advanced damage of Ivorian sanitary system. That unrest longed from the end of nineties and finished only in 2012 after post electoral war. Then, the last two decades favoured the destabilisation of the social system particularly those of the sanitary device causing a pauperization of the population, the unemployment and the movement of the population to the south mainly in Abidjan. That situation leads to the overcrowding and to the creation of urban and precarious urban areas. This strong demographic pressure causes the deterioration of the facilities and in the growth of bad practice of hygiene and of the life. The main objective of the present paper has been to establish the epidemiological profile of cholera in Côte d'Ivoire from 2002 to 2013. For this purpose we based on collected data from the National Institute of Public Hygiene of Côte d'Ivoire which is the central organ for collecting, managing as well as analysing risk of potential epidemic decease in above mentioned country.

Materials and Methods

Experimental Site: the present study has been performed in Côte d'Ivoire a Sub-Sahara tropical country Western of Africa. Its economics capital city Abidjan is the most populate town of the country with 4 799 432 habitants in 2011 [4]. Côte d'Ivoire is constituted by 19 regions and 76 sanitary districts harmonized according the many administrative divisions available during the period of the present study (Figure 1). Its population in 2011 was estimated to 18 914 000 inhabitants, be it 59 inhabitants per km^2 [4]. It has two kind of climates, all along the coastal we have equatorial climate and for the staying rest of the country we have dry and humid tropical climate [4]. The climate is made of two dry seasons, a long from November to May, a short from July to October and of two rainy seasons, a long from May to July and a short from October to November [4].

Figure 1. Map of Côte d'Ivoire, 2011

(ii) *Kin of study*: we carried out a retrospective descriptive study on all reported and confirmed suspect cases of cholera at the National Institute of Public Hygiene (INHP) from year 2002 to year 2013.That gathered data (no individual files) organized in epidemiological weeks S1 to S53 are collected from phone calls of sanitary districts by the epidemiological overseer or focal point to the cell of data collection of INHP. That collected data procedure called **"weekly notification plug of the case of yellow fever, cholera, meningitis, measles, district plug"**, are transported to data management service where they are computerized for constituting data basis of epidemiological

potential disease of Côte d'Ivoire. Furthermore, data processing was performed by Epi info version 3.5.2, software and the cartography was done by the Health Mapper 4.3.2 software.

Results

Epidemiologic and spatial-temporal variable analysis assessing cholera proportion in Cote d'Ivoire (form 2002 to 2013)

The present analysis allowed to discover 8028 suspect cases of cholera (669 suspect cases/year), for 101 confirmed cases out of 462 analysed samples. Further, sex was not differentiated in each of the suspect cases. In fact the notification form of cholera cases per district has been reported considering age parameters (0-4 years, 5-14 years and 15 years and more) promoting the number of suspects and death per district and per week. Then, concerning the age, adults (15 years and more) were the more affected with 79.9% reported suspect cases, followed by children (5 to 14 years) with 10.5% of cases (see table1). Processing spatiotemporal variables analysis we were able to show that suspect cases of cholera were recorded during all the study period. However the years 2002, 2003 and 2011 with 53%, 15% and 18% of cases respectively recorded the more serious cholera epidemic episode (Figure 2).

Table 1. Distribution of suspect cases according to the age and evolution

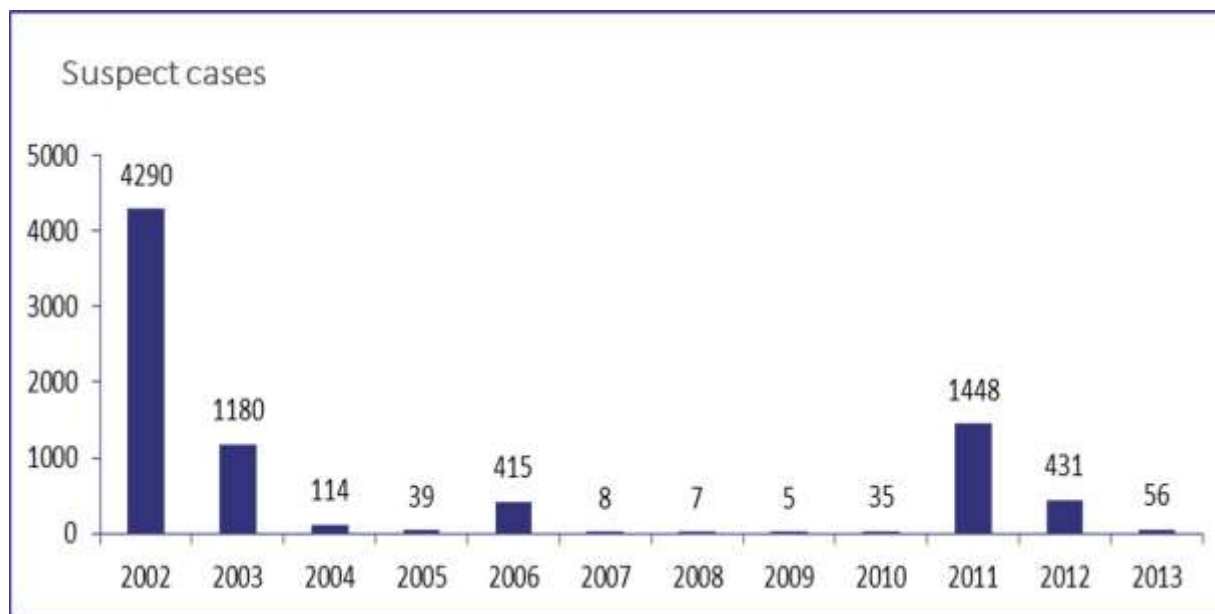| Age Bracket	Frequency	Proportion	Mortality	Fatality
0-4 years	772	9.6	20	2.59
5- 14 years	842	10.5	30	3.56
≥15	6405	79.9	247	3.86

Figure 2. Spatiotemporal variables analysis of suspects cases of cholera according to years (from 2002 to 2013)

Season impact and health indicators in cholera epidemic distribution in Cote d'Ivoire (from 2002 to 2013)

The distribution of suspect cases according to the month showed that August and July recorded the most cases with19% and 14% as rate respectively (Figure 3). The distribution of cases according to epidemiological week evidenced an increase tendency of cholera cases in the weeks 26 to36 from Jun to September and in the weeks 3 to 8 l corresponding at the end January to February (Figure 4). Next we performed progressive variable survey showing that in the 8028 suspect and confirmed cases of cholera, 297 cases of death was found be it a fatality of 3.7%.The distribution of the case of death is reported in Table I. in addition the same analysis evidenced that adult subjects

(≥15 years) represented more than 83% of death, but without significant difference (chi two=2.99; p-value > 0.05). Assessing health indicator parameter in cholera epidemic in Cote d'Ivoire, it is noteworthy to underline that the incidence of annual mortality rate per region were illustrated by Figure 5. Indeed, the most highest annual incidence rate were recorded in "Lagune 1", "Lagunes 2" and "Marahoué" regions with 12.14 ; 5.97 and 5.99 cases for 100,000 habitants respectively. Moreover, concerning annual mortality rates, the most highest were recorded in Moyen-Comoé, Sud-Comoé and Lagune1 areas with 0.36; 0.31 and 0.30 deaths for 100, 000 inhabitants respectively (Figure 5).
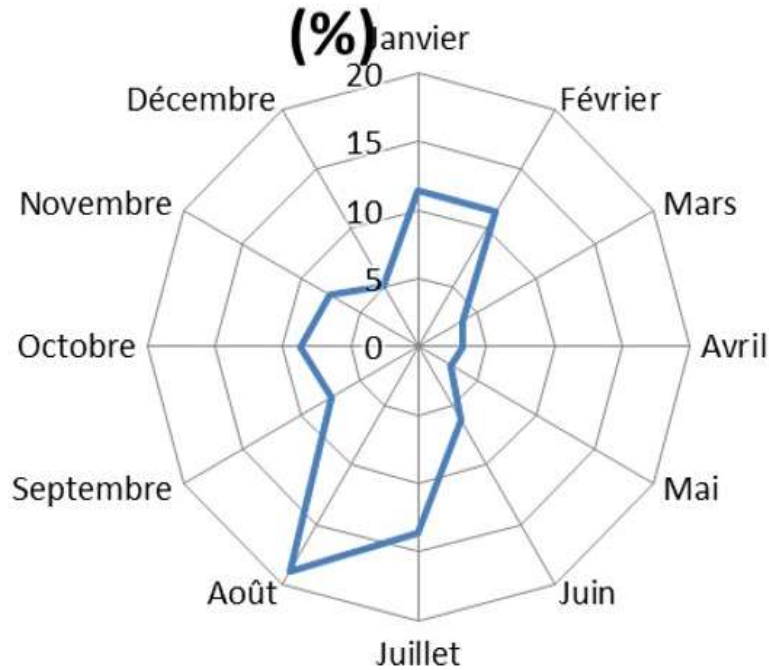

Figure 3. Percentage of suspect cases of cholera according to season parameters.
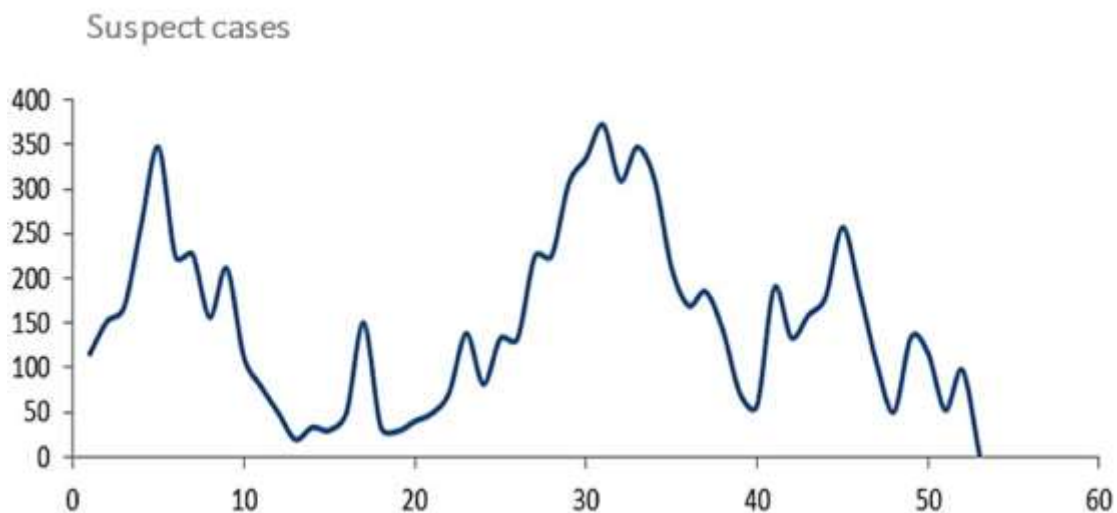

Figure 4. Evaluation of the number of suspect cases of cholera according to epidemiological week S1 to S53 (see Materials and Methods) in Cote d'Ivoire.
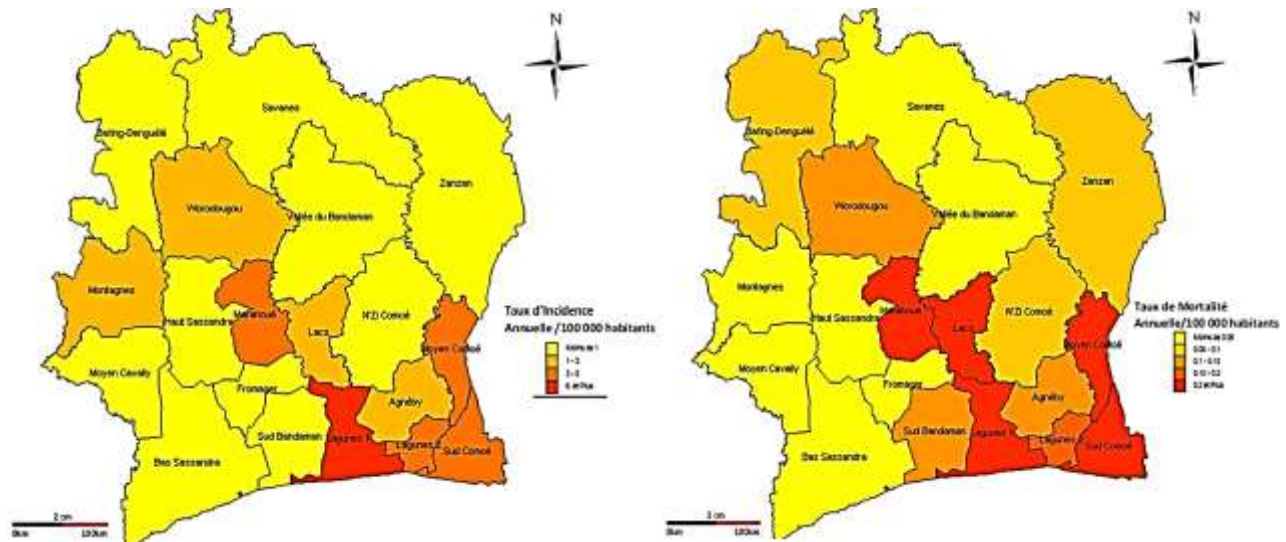
Figure 5. Graphic representation of mortality rate and of incidence per area.

Discussion

Since the seventh pandemic and the appearance of the first case in Africa, the cholera is endemic in Côte d'Ivoire as well as in most of the under region country and of the Sub-Saharan-Africa [5]. During the period of our study from 2002 to 2013, we recorded near 8028 suspect cases of Cholera (669 cases/year), for a confirmation rate of cases near 22% (Figure 2). However we estimate that this rate reported to cholera situation and/or case in above mentioned country would be inferior to the reality; because of the under notification of reported case in black Africa. That could explain reason there was not suspect case in the region of the "Fromager" (see Figure 5). In our study the sex as well as age average were not determined. In fact during the call collecting data, two variables were not informed by the caller who informs only on the number of cases and of death per age bracket and per district (Table 1). Nevertheless, the large majority of cases were in the age bracket of 15 years old and more as notified in many studies on the continent [5-7]. In fact, this age bracket represented the active population who eat in their working place or at school in poor hygiene condition. Moreover, the majority of cholera cases occurred in both July and August months, during the long rainy season (Figure 3). That agrees with the studies carried in Abidjan in 2001, in Ouganda between 2002 and 2003 and in Bénin 2008 [5; 8; 9]. Joshua Mendelsohn and Terry Dawson having even deepened the statistical analysis find a positive significant correlation between the precipitation level and the cholera incidence in the town of Kwazulu-Natalin South Africa during the epidemic of 2000-2001 [10]. Indeed, the incidence of cholera cases was more high in the regions of the Centre and South-East of Cote d'Ivoire, reaching the 12 cases for 100 000 habitants in the region of "Lagune1", region having the populated areas of Yopougon and Attécoubé where the majority of cases was recorded (Figure 5). In fact, such thick zones of are constantly crossed by rivers (Figure 1), gathers very poor population in general , and where there are problem of purification , insalubrity of water and bad living hygiene practice, making of them high risk zones of emergence and of propagation of cholera [2; 3; 5;10-13]. Even if it was very high in certain region of Cote d'Ivoire, the fatality average was 3.7%, largely up to the tolerated threshold (1%) exhibited by World Health Organization [14]. This strong fatality is caused by certain weakness noticed during the epidemic investigation constantly late taken in the declaration of cases, late taken in charge and to the politico-military crisis which causes the reduction of health staff in certain zones and an unavailability of medicines.

Conclusion

The present study showed that cholera remains a main public health problem in Sub-Saharan Africa countries and in particularly in Côte d'Ivoire. Indeed, we believe that a rigorous prevention of cholera epidemic improving hygienic conditions of people in the problematic area is needed to contrast fatality average of the latter. Then, reduction of the present health problem is strongly correlated by (i) improvement of hygienic conditions of public toilette, (ii) development of innovative infrastructures regarding water canalization as well as (ii) teaching and/or population education regarding cleanliness practices before during and after cholera epidemic. Finally, training of regular health stall in detecting cholera cases and most in the vulgarization of first care methods associated to previous listed good health practices can help reducing cholera epidemic expansion in Côte d'Ivoire.

Interest Conflict: Authors declare no interest conflict.

References

1. Organisation Mondiale de la Santé. Maladies Transmissibles, Profil Épidémiologique: Côte d'Ivoire, 2010. Available WHO_HSE_GAR_DCE_2010.3_fre.pdf.
2. Janny T. Épidémies de Choléra en Afrique: Analyse d'une étiologie multifactorielle. Mémoire de l'École Nationale de la Santé Publique. Rennes, France, 2004.
3. Gaffga NH, Tauxe RV, Mintz ED. Cholera: a new homeland in Africa. Am J Trop Med Hyg 2007; 77:705-13.
4. World Health Organization, Global Task Force on Cholera Control. Cholera Country Profile: Côte d'Ivoire, 2011.
5. Gbary AR, Dossou JP, Sossou RA, Mongbo V, Massougbodji A. Aspects épidémiologiques et médico-cliniques de choléra dans le département du Littoral au Bénin en 2008. Med Trop 2011; 71 : 157-161.
6. Ndour CT, Manga NM, Kâ R, DiaBadiane NM, Fortez L, Seydi M et al.L'épidémie de choléra de 2004 à Dakar: aspects épidémiologiques, cliniques et thérapeutiques. Med Trop 2006; 66 : 33-8.
7. Dray X, Dray-Spira R, Mattera D, Bougere J, Garnotel E. Une épidémie de choléra à Djibouti (Mai 2000-Janvier 2001). Med Trop 2002 ; 62 : 497-502.
8. Tanon AK, Eholie SP, Ehui E, Coulibaly-Dacoury C, Kra O, Kacou N'Douba et al.Épidémie de choléra au C.H.U. de Treichville (Abidjan) en 2001 : Aspects épidémiologiques, cliniques et thérapeutiques. Med Afr Noire 2004; 51: 559-66.
9. Alajo SO, Nakavuma J, Erume J. Cholera in endemic districts in Uganda during EL Niño rains: 2002-2003. Afr health Sci 2006; 6: 93-7.
10. Mendelsohn J, Terry D. Climate and cholera in KwaZulu-Natal, South Africa: The role of environmental factors and implications for epidemic preparedness. Int. J. Hyg. Environ. Health 2008; 211: 156-162.
11. Guevart E, Noeske J, Solle J, EssombaJM, Edjenguele M, Bita A et al. Déterminants du choléra à Douala. Med Trop 2006; 66: 283-91.
12. Siddique AK, Salam A, Islam MS, Akram K, Majumdar RN, Zaman K et al. Why treatment centres failed to prevent cholera deaths among Rwandan refugees in Goma, Zaire. Lancet 1995; 345: 359-61.
13. Rose JB, Epstein PR, Lipp EK, Sherman BH, Bernard SM, Patz JA. Climate variability and change in the United States: potential impacts on water and foodborne diseases caused by microbiologic agents. Environ. Health Prospect 2001; 109 (Suppl 2), 211–221.
14. Organisation Mondiale de la Santé. Flambées de Choléra : Évaluation des mesures mises en œuvre en cas de flambées et amélioration de la préparation, 2006, Génève, page 7.