CHAPTER 5:
Data Interpretation

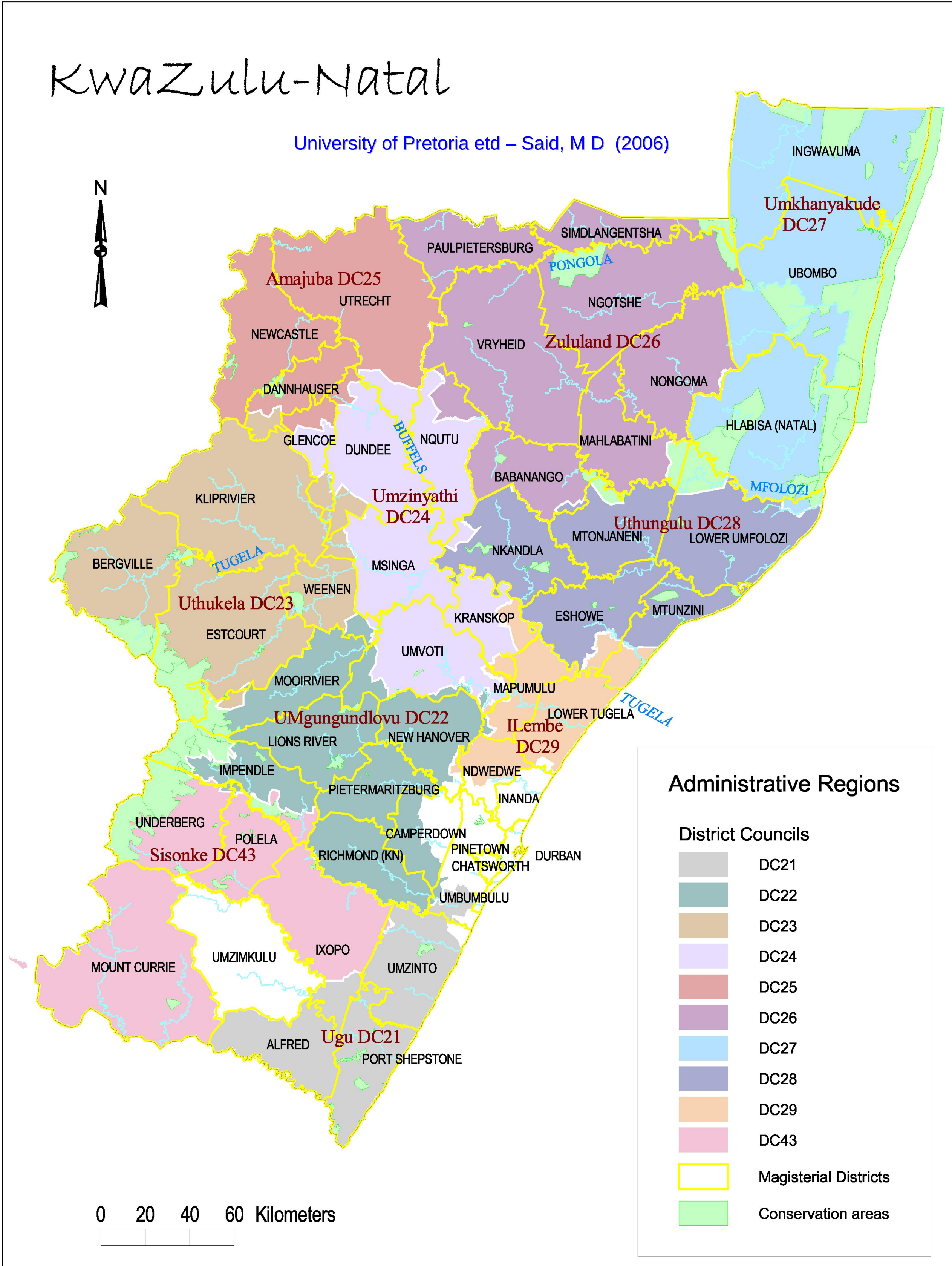
5.1 Introduction

The KZN cholera outbreak of 2000-2004 caused widespread suffering and in some cases it even led to death. The Cholera Database afforded a sound basis for the study to investigate the epidemic. The aim was to investigate the epidemic trend from a demographic, socio-economic and climatic perspective, using the methodology explained in Chapter 4. The intention behind the multitudes of analyses was to get an insight into the disease drivers of the 2000 - 2004 cholera epidemic. The preliminary assessment was done by means of spreadsheets (Microsoft Excel 2000) and thereafter followed by statistical and spatial manipulations of the database. The study yielded useful results that suggested which variables among the demographic, socio-economic and climatic parameters might have possibly contributed to the epidemic.

5.2 The general epidemic picture

5.2.1 Cholera within the demarcation of KwaZulu-Natal

KZN Province is made up of 10 District Councils (DCs) and the Metropolitan Council of eThekwini (Durban) (Map 28). Within the 10 DCs, are 52 Magisterial Districts (MDs), which together form the administrative demarcations of the province of KwaZulu, Natal. The preliminary results describe a holistic picture of the epidemic whereby the annual trend from 2000-2004 are presented as well as the cholera cases within the different DCs and MDs of KZN. In addition, the demographic profile of the cholera patients within the administrative borders (DCs and MDs) of KZN is illustrated and the possible relationship between the monthly cholera cases and the monthly climatic variables highlighted. The presentation of the results in this chapter is based on a total of 136 793 cholera cases, collectively reported from all the nine district councils. A categorization of the cholera cases in question is presented in Table 5.1. DC 28 (Uthungulu) reported more than half (52.2%) of the cases in KZN making it the focal point of the epidemic. This was further supported by a similar pattern at the MD level whereby 50% of the 10 most affected MDs belong to DC28, while three (MD26, MD27 & MD29) of the remaining five MDs are



Map 5: KwaZulu-Natal: District Councils, Magisterial Districts and Conservation Areas

neighbours to DC28 (Map 28). The percent cumulative incidence rate (%CIR) of DC28 was also the highest in relation to the other DCs (Fig 5.1). As it were, when cholera started in August 2000, all the reported cases in that month were exclusively confined to DC28 (Fig 5.1).

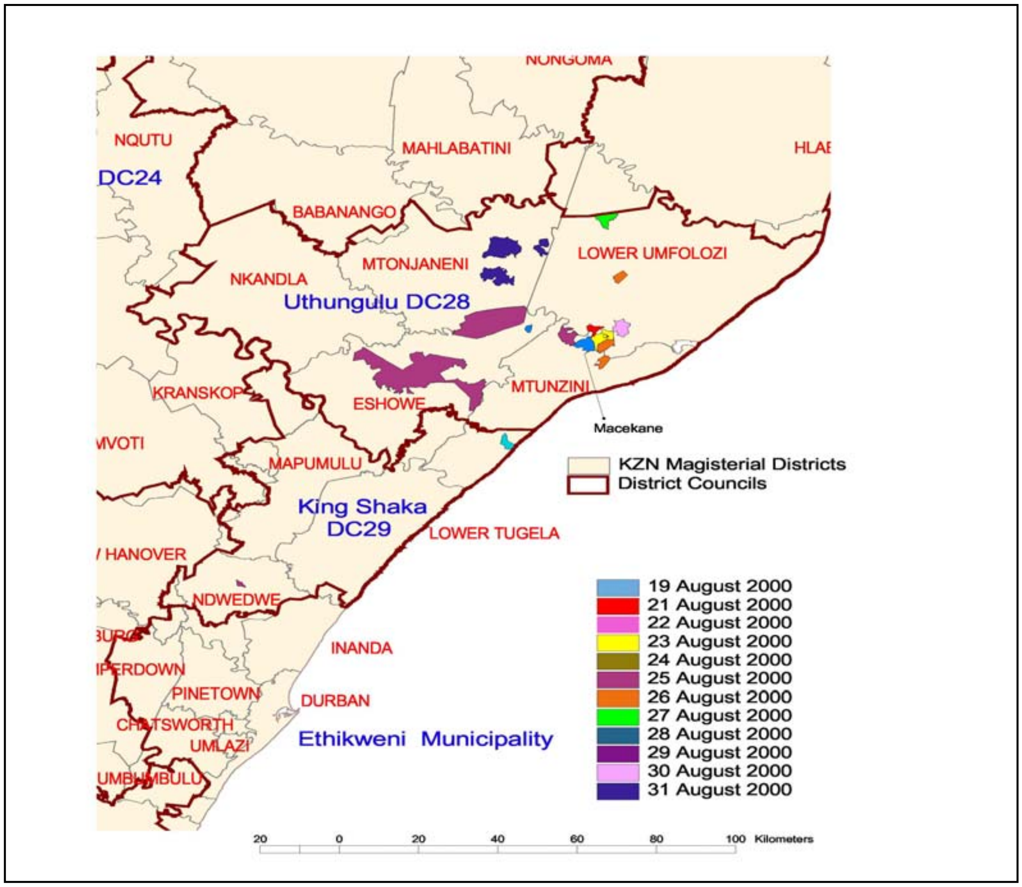


Figure 5.1: Initial cases as reported in KZN during the month of August 2000.

5.2.2 The annual trends of cholera in KwaZulu-Natal: 2000-2003

The first confirmed cholera case in KZN was reported on 14th August 2000 (Mugero and Hoque, 2001). Though the earliest cholera case report documented in the Cholera Database was on 19th August 2000. From then onwards, there was a progression of cholera case reports. All the cases that were reported and recorded in the Cholera Database between the 19th and 31st August 2000, were exclusively confined to DC28 and in particular the MDs of Lower Umfolozi, Mtunzini, Eshowe and Mtonjaneni (Figure 5.1). It is from this initial focal point illustrated in Figure 5.1 that that cholera started spreading to the other DCs, and eventually affecting the entire province of KZN.

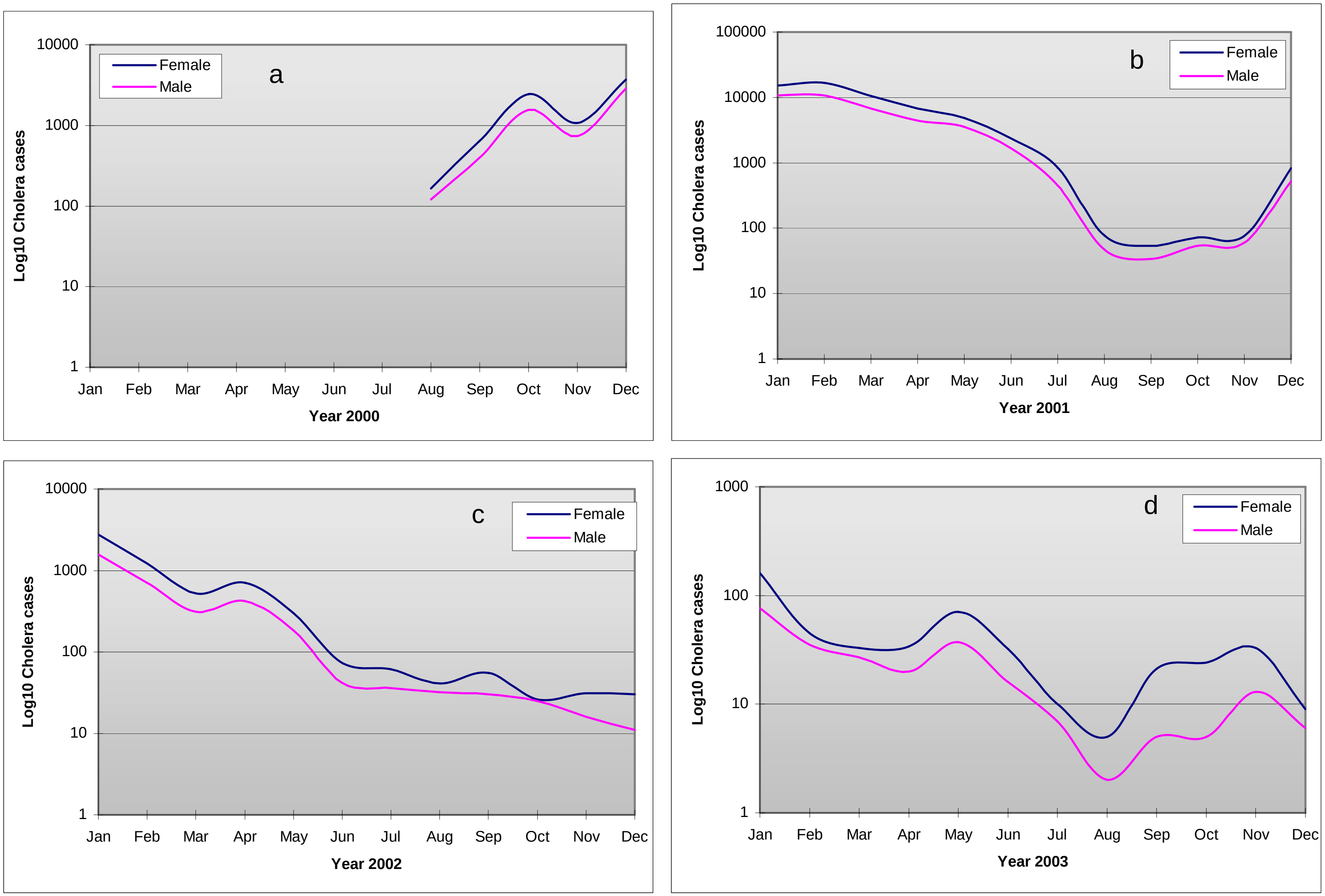


Figure 5.2 a-d: The annual cholera case trends in KZN.

From the onset of the epidemic in August 2000, there was a steady increase in cholera cases (Fig 5.2a). This was to be expected, as the majority of individuals in the KZN population had most probably not been previously exposed to the infection, considering cholera was last reported in significant numbers in the mid 1980s (DOH-Statistical Notes, 2000a). Thus as a consequence, the majority of individuals most probably had low levels of immunity if any, to the cholera pathogen. The rate of increase in cholera cases was at peak proportions from November 2000 to February 2001. This was the time the major epidemic peak was experienced (Figure 5.2b). At this point, cholera had spread beyond the original focal point of the disease in DC28 to affect every DC within KZN. Cholera cases started waning to low numbers in July 2001. Overall, the decline in case numbers reflected the effect of good case management through intervention measures (Mugero and Hoque, 2001). These included provision of treated clean water to the affected communities using water tanker-trucks; the establishment of rehydration centres within the affected communities to provide prompt medical assistance; addition of medical personnel to the province to help manage the epidemic and education and awareness campaigns through mainstream media (radio, TV), pamphlets and posters (Reeves and Boshielo, 2001). A similar upward trend in cholera cases was noted between December 2001 and February 2002 when the cholera epidemic experienced a minor peak, again waning to a minimum in July 2002. The case numbers during the previous major peak of the year 2001 were 6 times those of the minor peak, probably as a result of the positive outcome and experience of the intervention measures already described, during the major peak (Figure 5.2c). The cholera cases reported in the year 2003 were 10 times lower than those reported in 2001 (Figure 5.2d). These relatively fewer incidents may have been as a result of applying the lessons leant from the intervention measures since the beginning of this outbreak to prevent cholera transmission in vulnerable communities. Albeit, by the year 2003, most of the cases were random reports from areas were cholera still persisted, which may also have been indicative of an endemic situation setting in, rather than an epidemic situation. As aptly defined by Kamal (1963), “Endemicity of cholera is a phenomenon involving the continuous circulation of the pathogenic vibrio to and fro between patients, carriers and vehicles of infection, particularly water”. Therefore, within the larger context of the epidemic period in KZN, there were inter-epidemic periods whereby case numbers would wane in between the two epidemic peaks.

From a climatic perspective, the regularity of the monthly trends in the two consecutive years of 2001 and 2002 is suggestive of a seasonal link to the incidence of cholera, whereby the peak incidences occurred after the onset of the main summer rains in KZN (Refer: Figure 4.3). During the epidemic period that encompassed the two cholera peaks, there was a decrease in cholera cases during the winter months between June and August, only to pick up again as the temperatures increased (Refer: Figure 5.3). Isaäcson (1986) and Küstner and Du Plessis (1991), observed a similar trend in previous cholera epidemics in South Africa whereby cholera was linked with the summer rain months and a lull in cholera case reports was observed during the winter months.

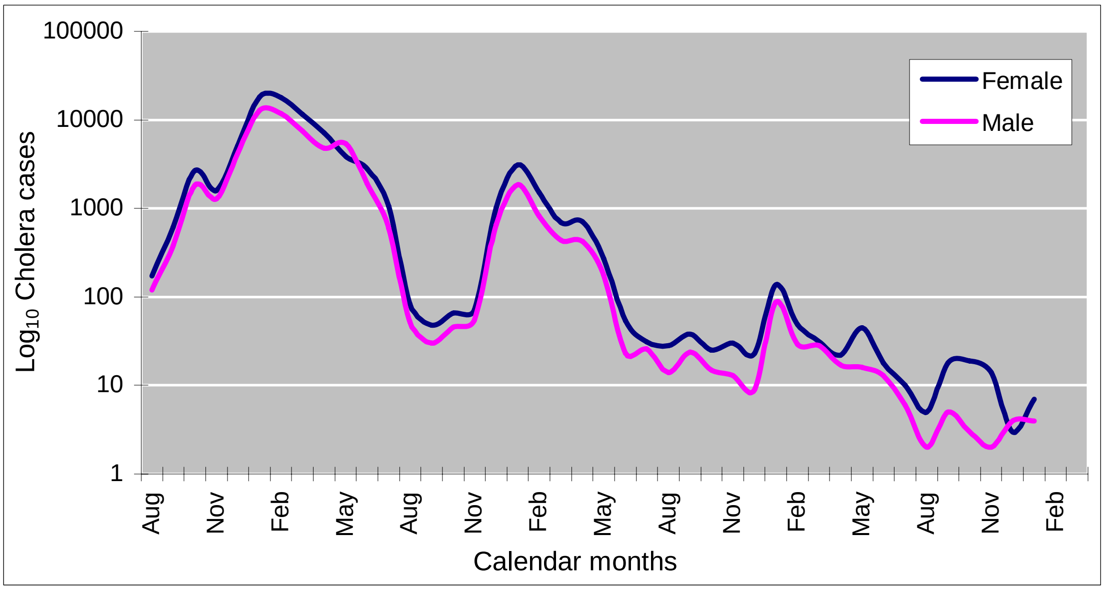


Figure 5.3: Annual epidemic trends of cholera in KZN from Aug 2000 to Feb 2004.

The general epidemic trend also displayed another distinct feature worthy of note. Throughout the epidemic period, both the two cholera peaks occurred at a time of increased mobility within the province because of end of year holidays and festivities. This is the time when individuals especially men, who are migrant workers return to their rural homes for their holidays (Koornhof and Keddy, 1998; Bateman, 2002). Looking at the trend, month wise, the timing of the occurrence of the annual cholera peaks are consistent throughout the epidemic period, irrespective of the actual number of cholera cases in a particular year. This is illustrated in Figure 5.3, whereby the peak cholera incidence for each of the peaks occurred during the month of January of the year in question. This adds credence that the transmission of cholera is favoured by holiday periods, which mostly involve community gatherings, festivities and movement of individuals from place to place. This possible link between increased mobility during holiday periods and the incidence of cholera in the precious cholera epidemics in South Africa was also likewise noted (Küstner *et al.*, 1981; Isaäcson, 1986; Sitas, 1986 and Küstner and Du Plessis, 1991). Figure 5.3 also reveals a slight increase in cholera cases in the months of April and May 2000 just after the two peaks; this incidentally also coincides with another holiday period of Easter. Unlike the previous scenario of the major peak, this rise shows the males dominating the disease picture, which may mean that there were more susceptible males than females in the population at the time. The increase in male cases may have been as a result of a new group of susceptible migrant workers returning to their rural homes (for holidays) in the cholera-affected province.

5.2.3 Cholera and climate

The monthly patterns of the climatic variables of rainfall, humidity and maximum temperature versus the spread of cholera throughout the epidemic period are highlighted in Figures 5.4 - 5.6. The average rainfall revealed an interesting trend whereby, both the major and the minor cholera peaks were experienced just after the high rainfall months. The consequence of this coincidence is reflected in the heavy rains and flooding at the time, which increased the risk of contamination to surface waters. KZN experienced heavy rains and flooding in 2000 just before and after the cholera outbreak in August 2000 (Kriner, 2001; Bateman, 2002). A similar occurrence was reported from Djibouti, whereby outbreaks occurred immediately after heavy rainfalls, which resulted in flooding and contamination of surface waters (Morillon *et al.*, 1998). The heavy rains between the Christmas and New Year of 2000/01 were also linked to increasing cholera case admission in some parts of KwaZulu-Natal (Wessels, 2001). This risk of the heavy rains was made worse because of the precarious sanitation situation that lead to human waste mixing with flood waters and consequently contaminating rivers and drinking wells, which could have been possible reservoirs for the cholera organisms (Kriner, 2001).

The monthly and seasonal variations of both the humidity and maximum temperature were not obvious as was the case with the average rainfall patterns throughout the

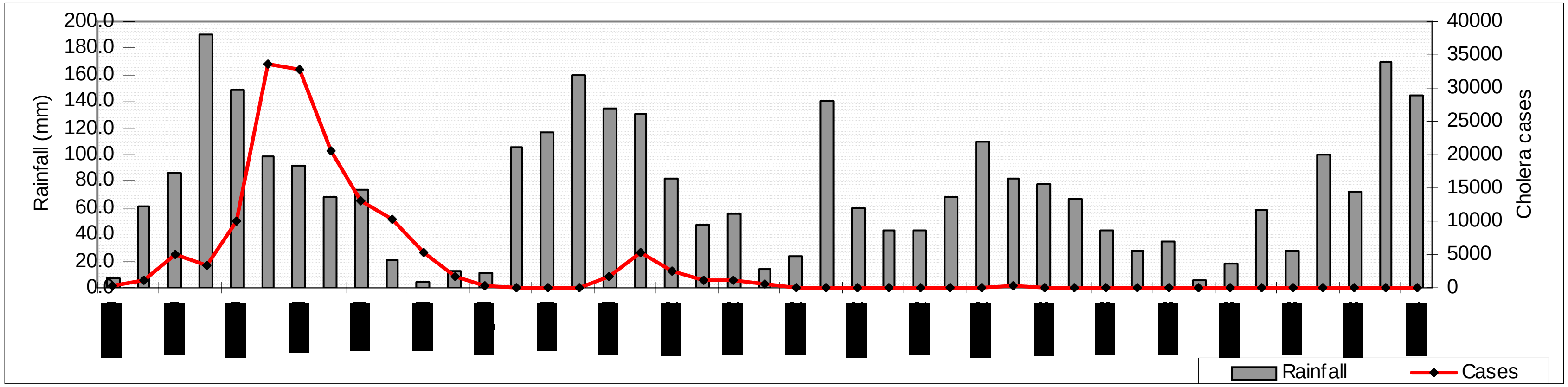


Figure 5.4: Variations in monthly rainfall (mm) patterns and the number of monthly cholera cases during the epidemic.

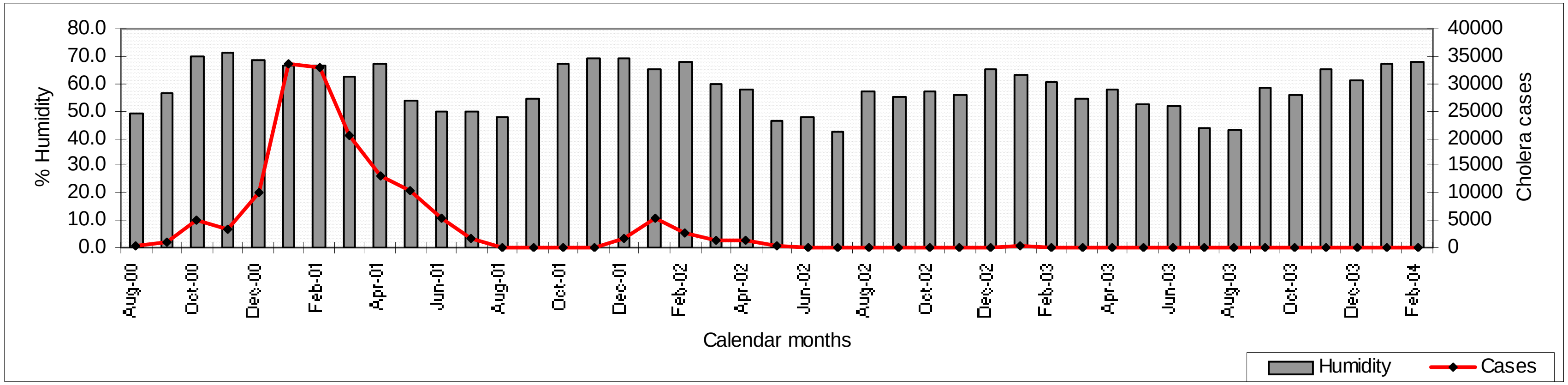


Figure 5.5: Variations in monthly humidity (%) and the number of monthly cholera cases during the epidemic.

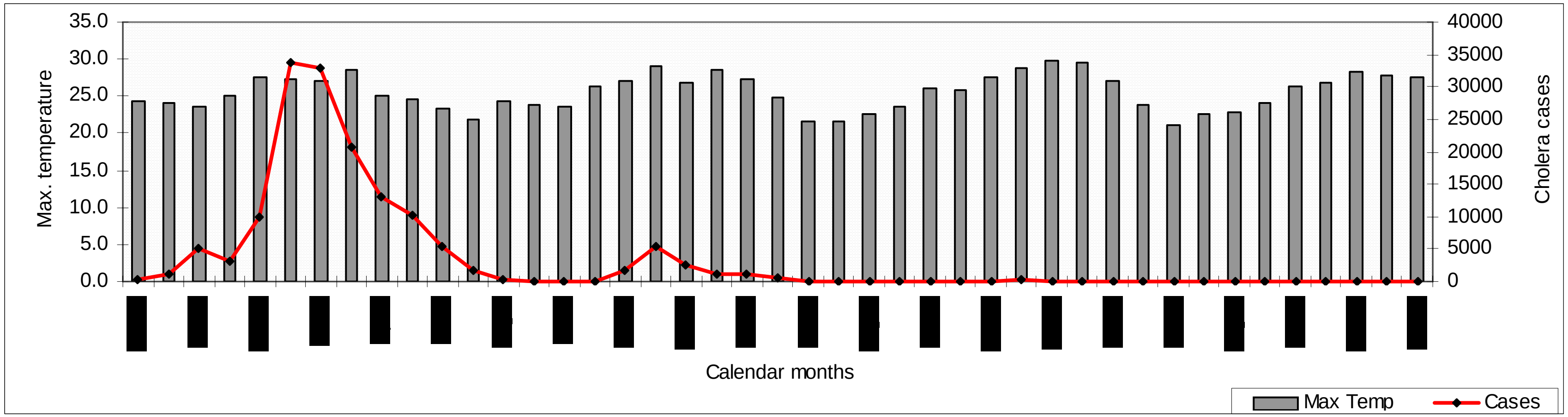


Figure 5.6: Variations in monthly max temperatures (^{0}C) and the number of monthly cholera cases during the epidemic.

epidemic period. Both humidity and maximum temperature were by and large range bound, with slight decreases in the winter months of June and July. Unlike rainfall, the measurements of the two factors, i.e. humidity and maximum temperature were not out of the ordinary to warrant any speculations from the public that they may have contributed to the spread of cholera. Humidity and high temperatures have been previously linked to high incidences of cholera in Lima and Delhi (Salazar-Lindo *et al.,* 1997; Speelmon *et al.,* 2000; Singh *et al.,* 1998). Such a relationship though was not apparent in Figs 5.5 and 5.6. Further elaboration on the possible spatial relationship between humidity and maximum temperature and cholera is presented in the following Chapter 6.

5.2.4 Cholera and gender

The demographic trend of both the major and minor peaks consistently demonstrated male cholera cases being outnumbered by those of females (Fig 5.3). On average the male to female case ratio was 1:1.5 across all the DCs (Table 5.1). The high female case numbers is most probably a consequence of the labour migration practices of male adults in the affected communities leaving females to constitute a larger proportion of the population (Mugero and Hoque, 2001). As such, the exposure rate of females to the risk of cholera risk within the affected communities will inevitably also be high resulting in more female sufferers. The high numbers of female cholera patients may also be a reflection of them being more forthcoming in seeking medical assistance if they suspected they had the infection. Thus more females being represented in the cholera case count of the Cholera Database of KZN. Previous cholera outbreaks showed a similar bias in the infection rate towards the females (Kustner *et al.,* 1981; Sitas, 1986; Kustner and Du Plessis, 1991). The proportion of the total deaths was also highest in DC28 most probably because of the high number of cholera cases that gripped the district from the beginning. The overall CFR (case fatality rate) from the count represented in Table 5.1 was 0.33%. The CFR was thus well within the WHO expectations. According to the WHO cholera prevention and control guidelines, given good preparedness and implementation of control strategies, the CFR should be below 1% (WHO, 1993a).

5.2.5 Cholera and age

All the age groups were represented in the cholera dataset i.e. from infants of less than one year to the elderly of above 100 years. The dominant age groups are equally presented in all the DCs though they were more distinct in DC28 (Figure 5.7). This is

Table 5.1: Cholera case count per KZN District Councils.

DISTRICT NAME	FEMALE	MALE	TOTAL CASES (%)	FATALITIES (%)
DC28 - Uthungulu	42,925	28,677	71,602 (52.34)	116 (25.11)
DC26 - Zululand	8,666	5,475	14,141 (10.34)	23 (4.98)
DC29 - iLembe	7,692	5,665	13,357 (9.76)	83 (17.97)
DC23 - Uthukela	6,360	3,950	10,310 (7.54)	49 (10.61)
DC27 - Umkhanyakude	4,499	3,420	7,919 (5.79)	35 (7.58)
DC21 - Ugu	4,427	3,068	7,495 (5.48)	18 (3.90)
DC24 - Umzinyathi	3,724	2,554	6,278 (4.59)	49 (10.61)
Durban - eThekwini Metropolitan	1,653	1,298	2,951 (2.16)	51 (11.04)
DC22 - Umgungundlovu	918	609	1,527 (1.12)	17 (3.68)
DC25 - Amajuba	549	300	849 (0.62)	20 (4.33)
DC43 - Sisonke	220	144	364 (0.27)	1 (0.22)
Grand Total	**81633**	**55160**	**136793**	**462**

to be expected because the cholera case numbers were the highest in DC28 when compared to other DCs, and so easier to notice the age groups that were most affected by cholera. The age groups 15-19 years and 0-4 years featured more prominently in the overall epidemic picture followed by the 10-14, 20-24, and 5-9 year age groups respectively (Figure 5.7). Figures 5.8-5.16 give a more elaborate picture of the various age groups affected by cholera in all the DCs of KZN. This age pattern distribution whereby the younger age groups are more represented in the disease picture is said to be typical of an endemic scenario, whereby adults have a substantial immunity from previous infections (Mugero and Hoque, 2001).

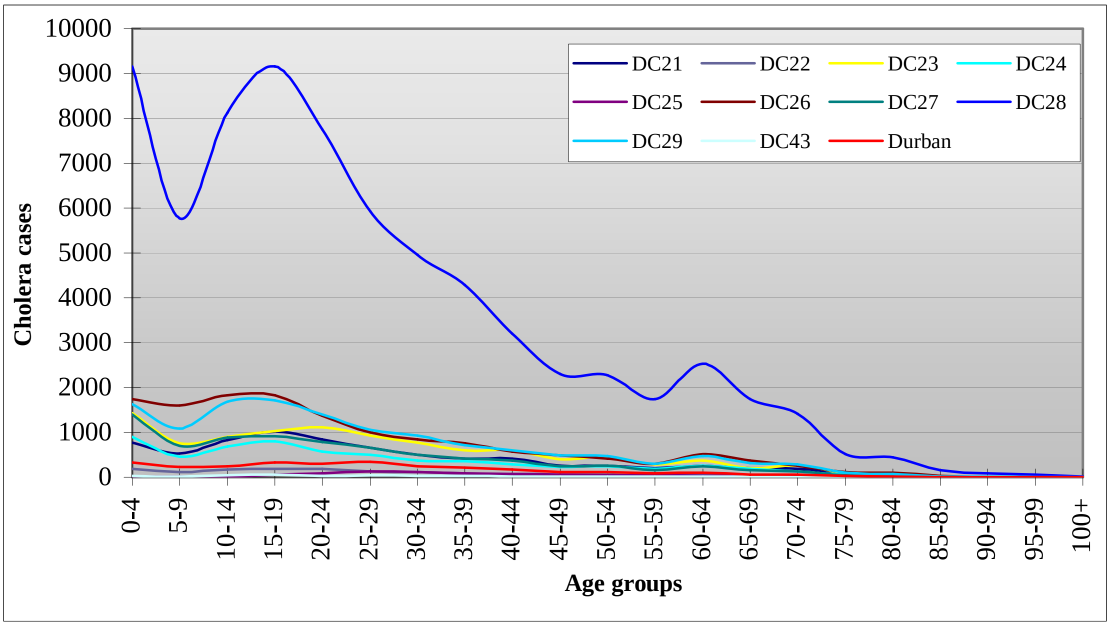
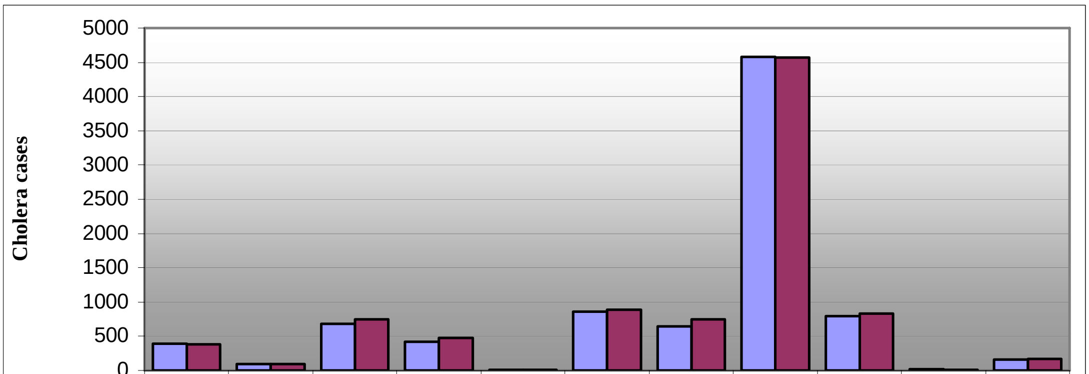


Figure 5.7: The age-group distribution of cholera cases within the DCs of KZN.



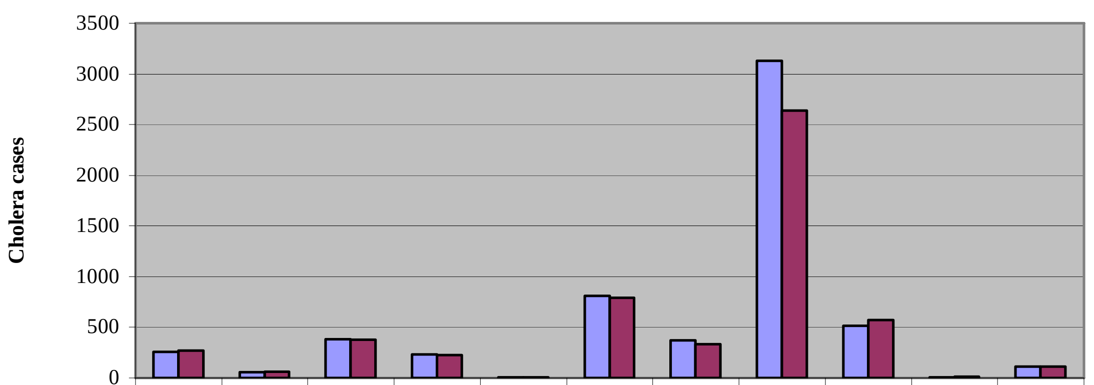
	DC21	DC22	DC23	DC24	DC25	DC26	DC27	DC28	DC29	DC43	Durban
0-4 Females	391	90	680	422	8	854	643	4579	795	20	155
0-4 Males	387	92	745	477	8	887	750	4573	827	12	172

District Councils

Figure 5.8: Cholera in the 0-4 years age group: August 2000- Mar 2004.

The 0-4 years age group was the second most affected by the epidemic with a total of 17 567 cholera cases recorded during the epidemic period (Figure 5.8). Accounting for the high infection rate of this group during the cholera epidemic is most probably their under developed immune system not being unable to offer adequate protection against the infection. This is typical of any infectious diseases within the paediatric age. The difference in case numbers between the genders was very small. Indicating both genders were exposed equally vulnerable to the predisposing factors to the disease (Figure 5.8).

There was a slight decrease in case numbers in the 5-9 ages group when compared to the previous age group (Figure 5.9). The immune system of the 5-9 ages group is more advanced than that of the 0-4 age group, having already been exposed to various infections since birth. The 5-9 year olds were thus in a better position to ward off infections, in this case, cholera. This age group also showed small differences in cholera case numbers between the genders. In addition to the immune status, it is possible that there were more cases in the age groups below 10 years because the individuals of these age groups were also more represented in the overall populations; thus contributing significantly to the base of the population pyramid of KZN (refer to Chapter 4: Figures 4.2 and 4.3).

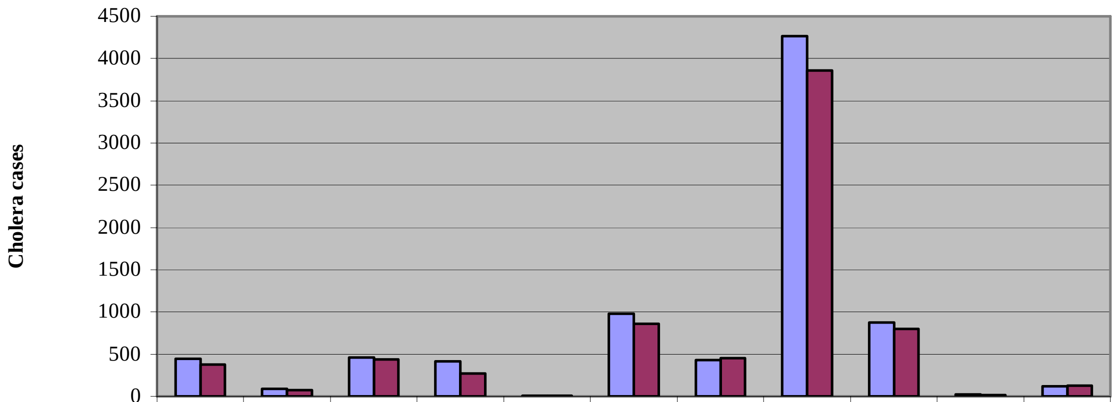


	DC21	DC22	DC23	DC24	DC25	DC26	DC27	DC28	DC29	DC43	Durban
5-9 Females	255	59	384	232	4	813	372	3128	516	9	113
5-9 Males	271	61	380	228	7	789	333	2637	573	12	111

District Councils

Figure 5.9: Cholera in the 5-9 year age group: August 2000 - March 2004.

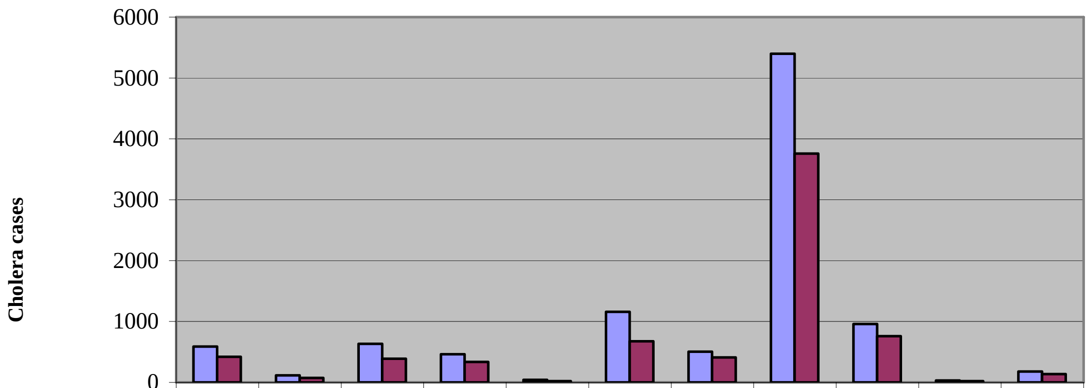
Cholera cases were high in the 10-14 year age group compared to the previous 5-9 year age group making it the third most affected age group (Figure 5.10). The cholera case numbers in this age group were consistently more in all the DCs when compared to the previous 5-9 year age group. For some reason, this pre-adolescent age group was more susceptible to cholera possibly because of other issues like age related behaviours that exposed them to situations or activities which were likely to bring them into contact with disease causing organisms like *Vibrio cholerae*. One possibility is that this age group, especially the girls are closely associated with issues associated with water provision in the house e.g. fetching water from rivers, streams and public taps. Thus if the disease causing organisms exist in any of the aforementioned environments, their risk to waterborne infections like cholera is increased.



	DC21	DC22	DC23	DC24	DC25	DC26	DC27	DC28	DC29	DC43	Durban
10-14 Females	447	89	462	417	9	978	426	4264	878	26	118
10-14 Males	378	79	436	269	10	857	454	3859	801	13	130

District Councils

Figure 5.10: Cholera in the 10-14 year age group: August 2000 - March 2004.

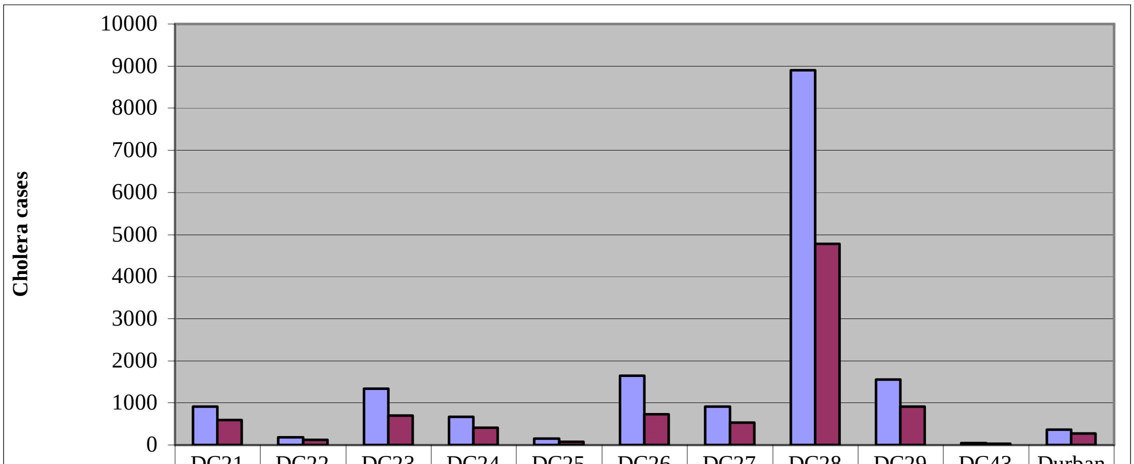


	DC21	DC22	DC23	DC24	DC25	DC26	DC27	DC28	DC29	DC43	Durban
15-19 Females	593	111	635	468	37	1156	506	5395	959	31	182
15-19 Males	420	75	390	336	18	676	412	3761	753	19	140

District Councils

Figure 5.11: Cholera in the 15-19 year age group: August 2000 - March 2004.

The group that recorded the highest number of cases was the 15-19 year age group (Figure 5.11). This age group contributes to the reproductive group of an expansive population like the one in KZN (PRB, 2005). The fact that this group was the most affected implies that the individuals had a higher risk of exposure to the factors associated with cholera transmission. The 15-19 year old individuals are semi independent in that they most probably still live with their parents though associate with their peers more freely than the younger age groups. Thus, the possibility of getting infected by their peers during various academic and social activities; is high. The females of this age group are also closely associated with the domestic affairs within a home such as the management and transport of water; as well as cooking, washing, cleaning and providing drinking water for the family (Throop, M. 2004). Therefore, those that belong to households that need to source their domestic water supply from external sources, in the event that the water resource is contaminated, females would be at a greater risk of getting exposed to the infection, than males. The difference in the cholera case numbers between the genders as seen in Figure 5.10 adds credence to this supposition, as there were more females affected than their male counterparts.



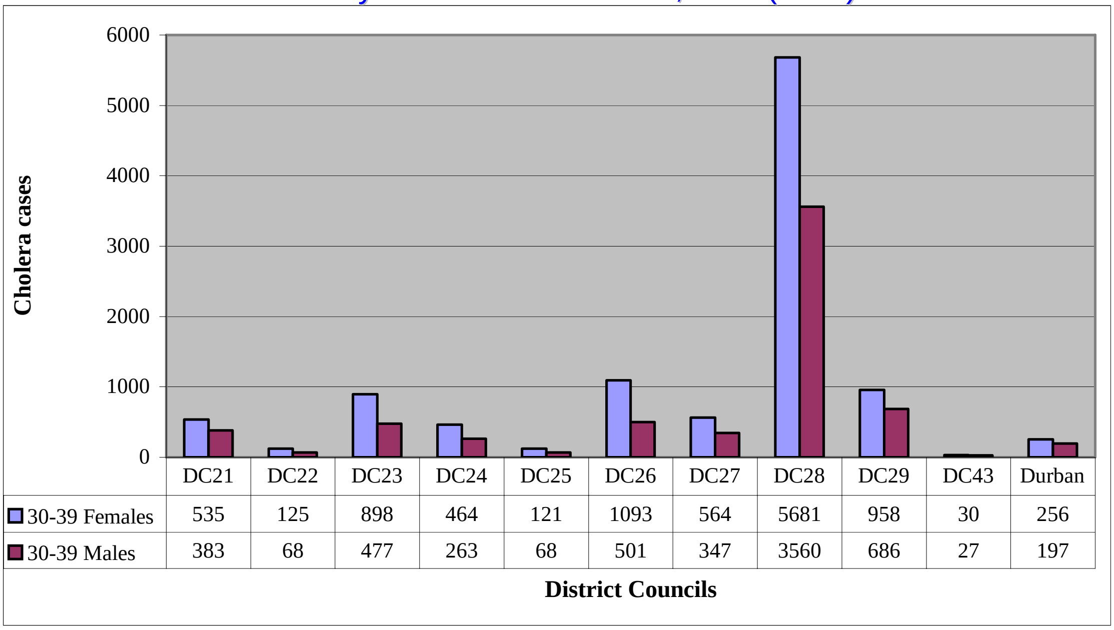
	DC21	DC22	DC23	DC24	DC25	DC26	DC27	DC28	DC29	DC43	Durban
20-29 Females	916	184	1335	665	149	1640	910	8911	1547	48	364
20-29 Males	591	121	707	411	72	736	528	4777	911	30	274

District Councils

Figure 5.12: Cholera in the 20-29 year age group: August 2000 - March 2004.

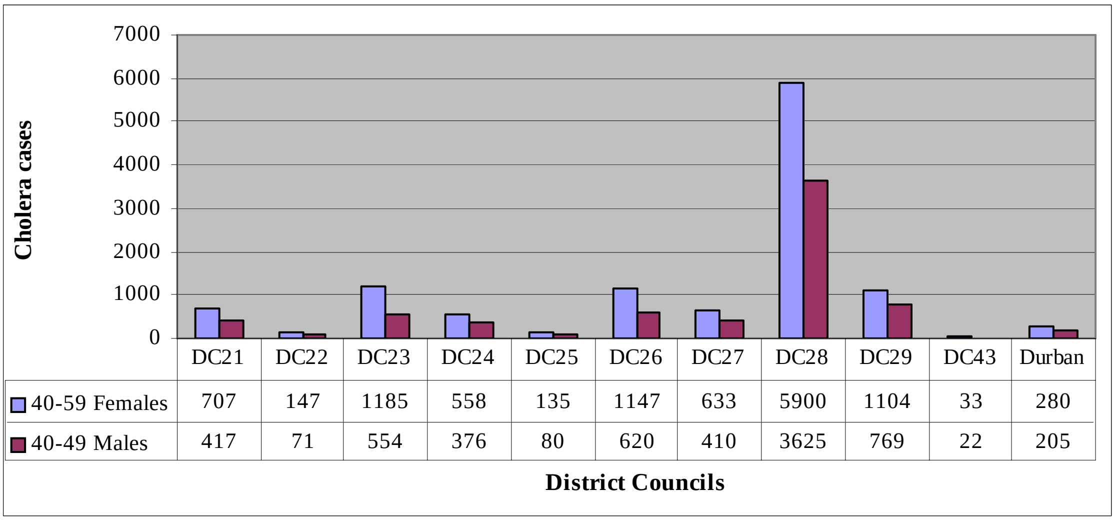
The 20-29 age groups make up the majority of the individuals in the reproductive base of the population (refer to Chapter 4: Figures 4.2 and 4.3). There is a marked difference in the cholera case numbers between the genders in this age group (Figure 5.12). This may be indicative of the migratory nature of the males in this group. It is a common assumption that most males of this age group would venture out to seek employment in areas that are far away from their parental or family homes especially in a province like KZN where the unemployment rate is high (Kustner *et al*, 1981, Mugero and Hoque, 2001). As such, the age group would mostly have a greater representation of females in all of the DCs of KZN. The same would thus also be true regarding the infection rate being more biased towards females than males (Figure 5.9). Incidentally, the females of this age group also feature prominently in the HIV/AIDS profile of KZN. A South African national survey of HIV sero-prevalence (serum samples tested for HIV antibodies) in women attending antenatal clinics in 2000, found the 25-29 year group to be the group with the highest sero-prevalence of 30.6%. Whereas those aged 20-24 yielded a sero-prevalence of 29.1% (DOH, 2001). A similar study in 2002 found a comparable trend with women aged between 25 and 29 years with an estimated 34.5% of pregnant women in this age group being HIV positive while those aged 20-24 years had a steady 29% positive test (DOH, 2003-a).

The 30-39 and 40-59 year age groups also showed a similar pattern of cholera incidence and distribution among the genders (Figures 5.13 and 5.14). The differences though, are slightly less than those seen for the 20-29 year age group. The 30-39 year age group is characterised with individuals who are in transition from the reproductive age group to a group with an established family. The 40-49 year age group would be in a similar family set up as that of the 30-39 year age group except that most would have children who are old enough to help with the day to day domestic chores of the household like fetching water, preparation of meals and taking care of the general cleanliness around the house. Thus the association of the 40-49 year age group is such that it is slightly detached from their children as most of the children would be independent or at least semi independent as young adults. That means that even the risk of cross infection between the heads of the family and the children would be to a degree minimised.



	DC21	DC22	DC23	DC24	DC25	DC26	DC27	DC28	DC29	DC43	Durban
30-39 Females	535	125	898	464	121	1093	564	5681	958	30	256
30-39 Males	383	68	477	263	68	501	347	3560	686	27	197

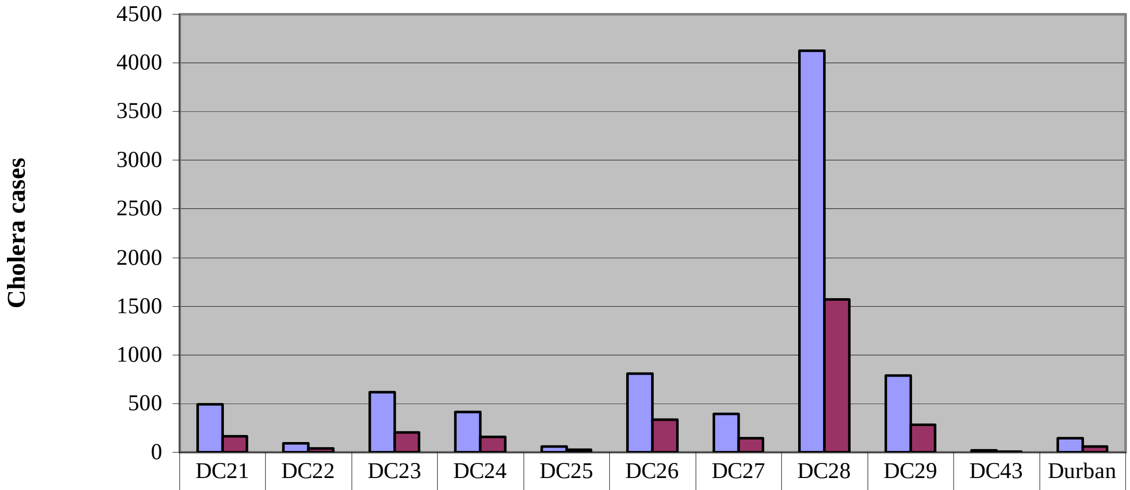
Figure 5.13: Cholera in the 30-39 year age group: August 2000 - March 2004.



	DC21	DC22	DC23	DC24	DC25	DC26	DC27	DC28	DC29	DC43	Durban
40-59 Females	707	147	1185	558	135	1147	633	5900	1104	33	280
40-49 Males	417	71	554	376	80	620	410	3625	769	22	205

Figure 5.14: Cholera in the middle age 40-59 year group: Aug 2000 - March 2004.

Cholera among the 60-74 year olds was quite marked especially in DC28 (Figure 5.15). On examining of the overall age group trends, the cholera cases among the 60-69 year age group were higher when compared to the other older age groups (Figure 5.7). The 60-69 year age group includes individuals who are approaching or are already at the retirement age. At this age, physiological changes including an aging immune system impacts on their susceptibility to infectious diseases, like cholera. Females suffered the brunt of the epidemic (Figure 5.15). In this era of HIV/AIDS, it



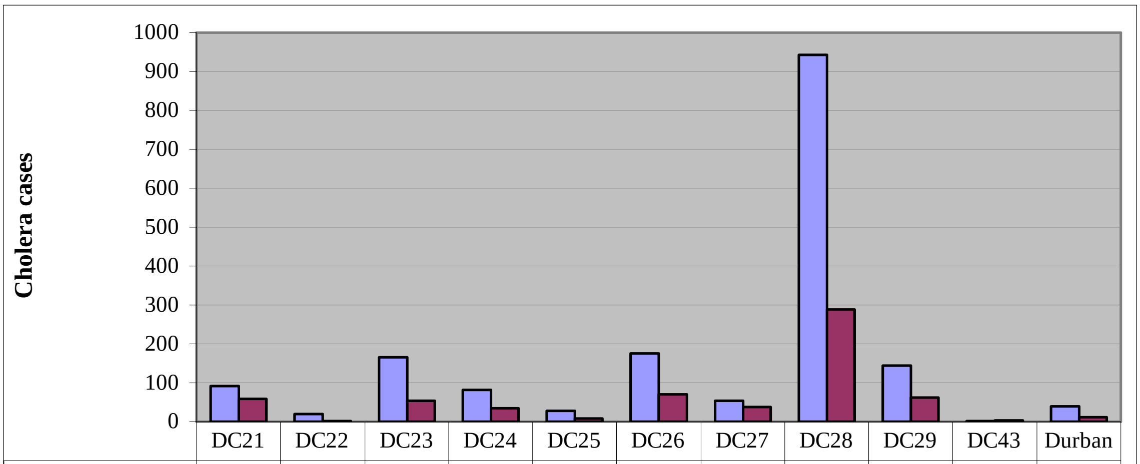
	DC21	DC22	DC23	DC24	DC25	DC26	DC27	DC28	DC29	DC43	Durban
60-74 Females	491	94	616	416	58	809	391	4125	790	22	146
60-74 Males	162	40	204	158	29	336	147	1573	282	6	56

District Councils

Figure 5.15: Cholera in the 60-74 year age group: August 2000 - March 2004.

is common to find grandmothers within 60-69 years age group tending to their grandchildren who have been orphaned as their parents succumbed to the AIDS pandemic. As such, it is quite probable that females between the ages of 60-69 are still associated with domestic chores and raising young children. Such a probable scenario would most probably expose female grandparents rather than the male ones to infectious diseases that children contract. Therefore, in the case of cholera, if there were a child under the care of a grandparent, it would be easy for a female individual in the 60-69 year age group to get infected. More so, as one considers that the immune system of the elderly has weakened in a way comparable to the underdeveloped immune state of the young.

Thus the increase in the risk for cholera among the very young and the very old is proportionally comparable. The situation is not the same with the elderly males, in that they do not share the same burden as their female counterparts. The short life expectancy of the elderly males also implies that their overall numbers in the population is less when compared to the females in the same age group (Chapter 4: Figures 4.2 and 4.3).



	DC21	DC22	DC23	DC24	DC25	DC26	DC27	DC28	DC29	DC43	Durban
75-100+ Females	92	19	166	82	28	176	54	942	145	1	39
75-100+ Males	59	2	54	35	8	70	37	289	63	3	12

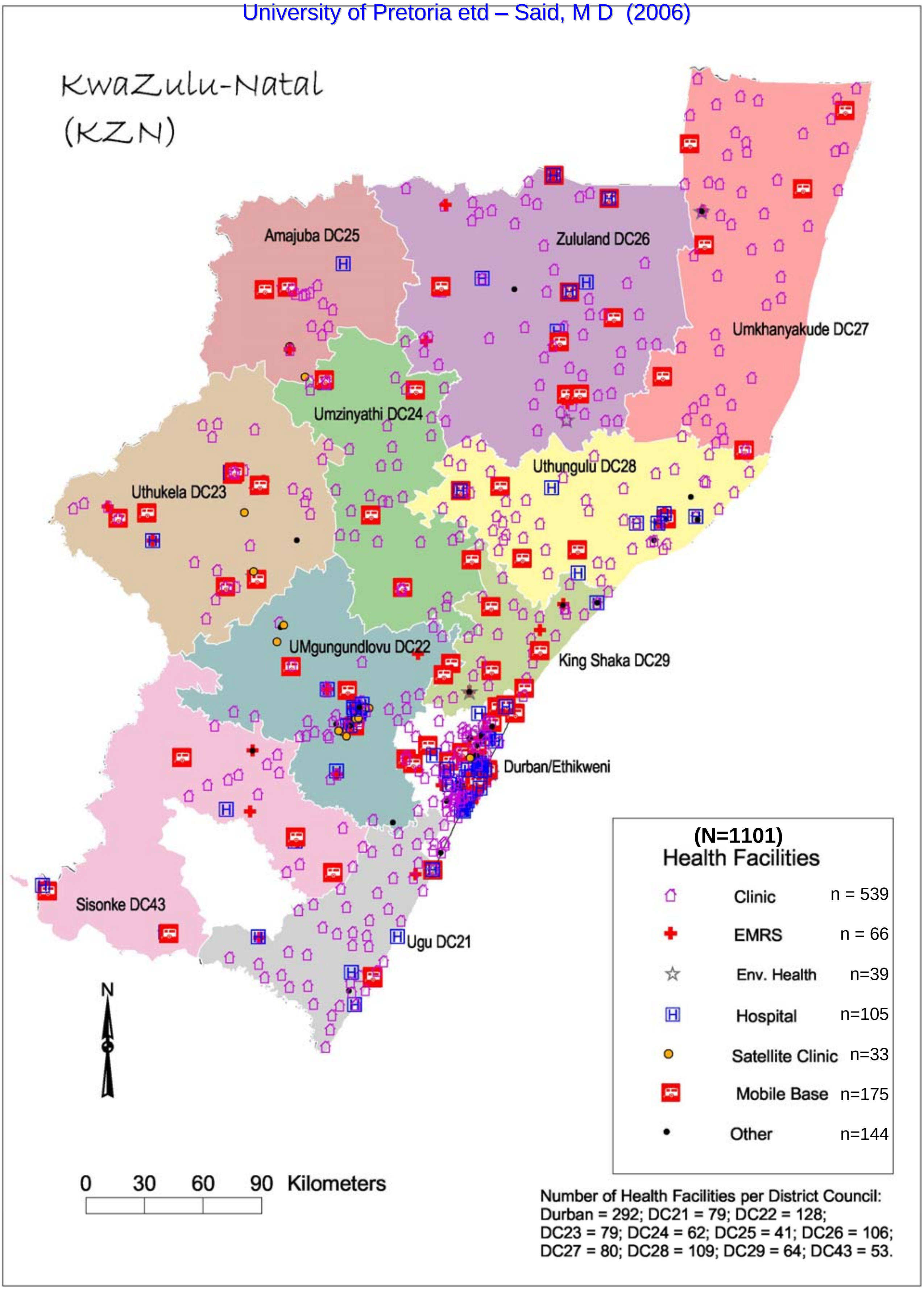
Figure 5.16: Cholera in the 75 and > 100 year age group: August 2000 - March 2004.

Cholera incidents were the lowest in the 70 to over 100-year age group. Nevertheless, more females than males were affected in this age group as well (Figure 5.16). There were very few individuals over 70 years in the population of KZN and likewise few cholera cases (Chapter 4: Figures 4.2 and 4.3). On the other hand, it could also be argued that the cholera cases reported is an underestimation of this group as most of them may have been too frail to access medical services when they contracted cholera. Hence only those who had assistance to get to a medical facility were included in the Cholera database, while many more could have been possibly left out.

5.2.6 Cholera among the DCs of KwaZulu-Natal

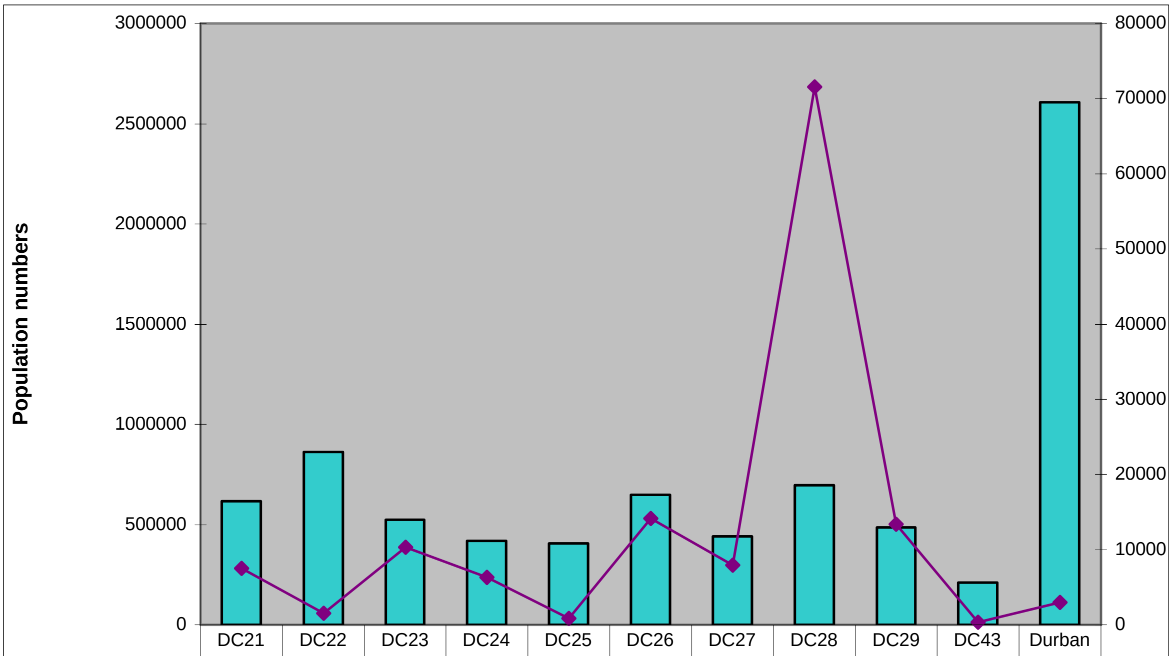
The proportion of cholera cases in the individual DC populations is given in Figure 5.17. Durban, being the provincial capital has the highest population, though it reported only 2 951 (2.16%) of the total cholera cases. This was attributed to the high level of service delivery in the sectors of health, water supply, sanitation and refuse collection. DC28 had the third highest population in KZN but the highest number of cholera incidents.

The %CIR standardised the actual infection rate in that it expressed the number of individuals that got infected per every 100 within a particular population (Figure 5.18).



Map 28: Distribution of Health Facilities in KZN

The percentage of cholera related deaths in this case refers to the percentage of individuals who died from the cholera incidents reported for a particular DC (Figure 5.18). DC25 had the highest percentage of deaths from cholera followed by Durban. It was argued that DC25 experienced such a high proportion of deaths because the numbers of health facilities (hospitals, clinics etc.) were fewer compared to the other DC's, thus a disadvantage in terms of health service delivery (Map 28). Death may have been as a result of various factors including patients seeking medical attention too late, the medical facilities not being easily accessible or the individuals not affording the transport and/or medical costs. Map 28 adds credence to this as it shows the health facilities being mostly situated at the centre of the district boundaries; implying that



	DC21	DC22	DC23	DC24	DC25	DC26	DC27	DC28	DC29	DC43	Durban
Population	618047	863095	523976	419238	406173	648555	441172	697269	486736	210297	2605482
Total # cholera	7495	1527	10310	6278	849	14141	7919	71602	13357	364	2951

District Councils

Figure 5.17: Cholera case distribution among the DCs in KZN: August 2000 - December 2004.

those who live in areas near the periphery of the district boundaries; may have to travel long distances to access a public health facility. On the other hand, the Durban Metropolis had the highest number of health facilities nonetheless it had the second highest proportion of cholera associated deaths at 1.73 % (51 cases). This high proportion of cholera-associated deaths in the Durban Metropolis may not be a true reflection of the actual situation in Durban *per se*. The following scenario is probable in explaining the high proportion of deaths in Durban. The Durban Metropolis, being the provincial capital has the highest number of health facilities in KZN. Among which are those that operate as referral hospitals for the province. It is thus to be expected that serious cases related to cholera were referred to some of these referral health facilities, where some of the fatalities subsequently occurred, especially if the patient initially sought medical attention in a facility that was scarcely equipped to assist in the matter. In the event that a death had occurred, it would have been registered as having taken place in the referral hospital, thus the apparent high number of deaths associated with cholera in the Durban Metropolis.

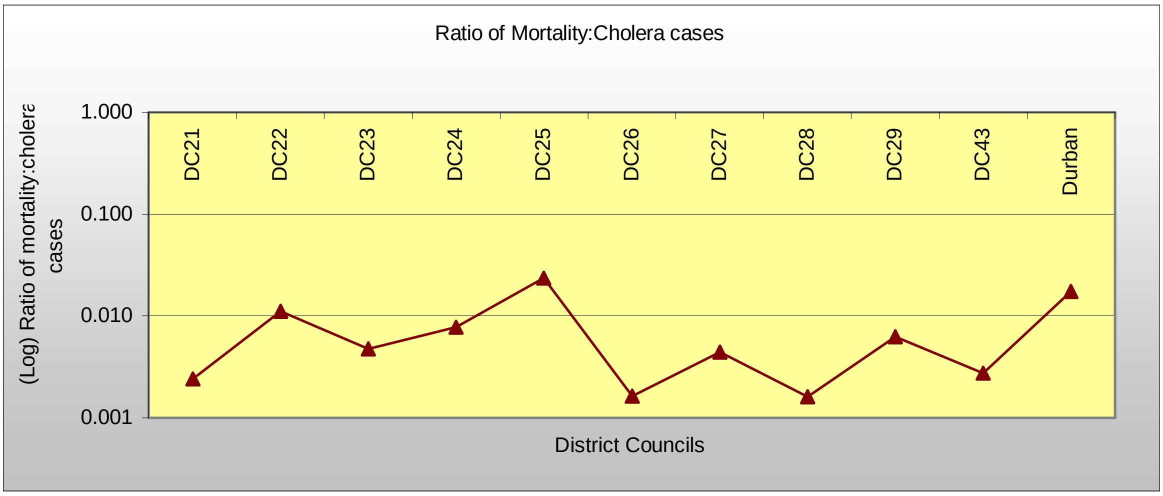


Figure 5.18: The ratio of mortality rate to total cholera cases among the DCs of KZN during the 2000 - 2004 epidemic.

Although DC28 reported most of the cholera incidents, it had the least proportion of cholera - associated fatalities at 0.16 % (116 cases), as was the case with DC26 at 0.16% (23 cases), when compared to the other DCs (Figure 5.18; Table 5.1). DC28 had a relatively even distribution of health facilities across the district (Map 28). This even distribution of health facilities may have positively contributed to keeping the percentage of fatal cases to a minimum. In addition, the fact that DC28 was the first to experience the cholera outbreak, the earlier health intervention measures complemented the health facilities in managing the epidemic. One of the immediate short-term interventions was to augmenting the health facilities with additional medical personnel to support in disease management and case surveillance. Parallel to this was the establishment of rehydration centres, extensive use of mainstream media for awareness campaigns, distribution of bleach to purify water and the service of water tankers to supply water to rural communities. These intervention measures collectively made DC28 better prepared to handle the casualties of the epidemic as cholera continued to spread to the other DCs of KZN.

The most affected MDs as well as the DCs each belongs to, as shown in Figure 5.19, whereby DC28 is highlighted as being the most affected. Among the 10 most affected MDs, half of them belong to DC28. A feature previously noted in other studies is that cholera reveals a strong association with the sea and those that depend on the sea for their livelihoods, e.g. fishermen (Colwell, 1986; Goodgame and Greenough III, 1975; Borroto and Martines_Piedra, 2000; Lipp *et al.*, 2002). As it were, eight of the most affected 10 MDs have a coastal border with the Indian Ocean. In the case of KZN though, no scientific documentation was found that linked seafood or fishermen of the rural coastal communities of KZN being an possible link to the introduction of cholera in those areas as compared to other coastal or lake communities in East Africa, West Africa, the Indian subcontinent, and South America, (Goodgame and Greenough, 1975; Glass *et al.*, 1991; Wilson; 1995a; Colwell; 1996; Birmingham *et al.*, 1997; Shapiro *et al.*, 1999 and Acosta *et al.*, 2001).

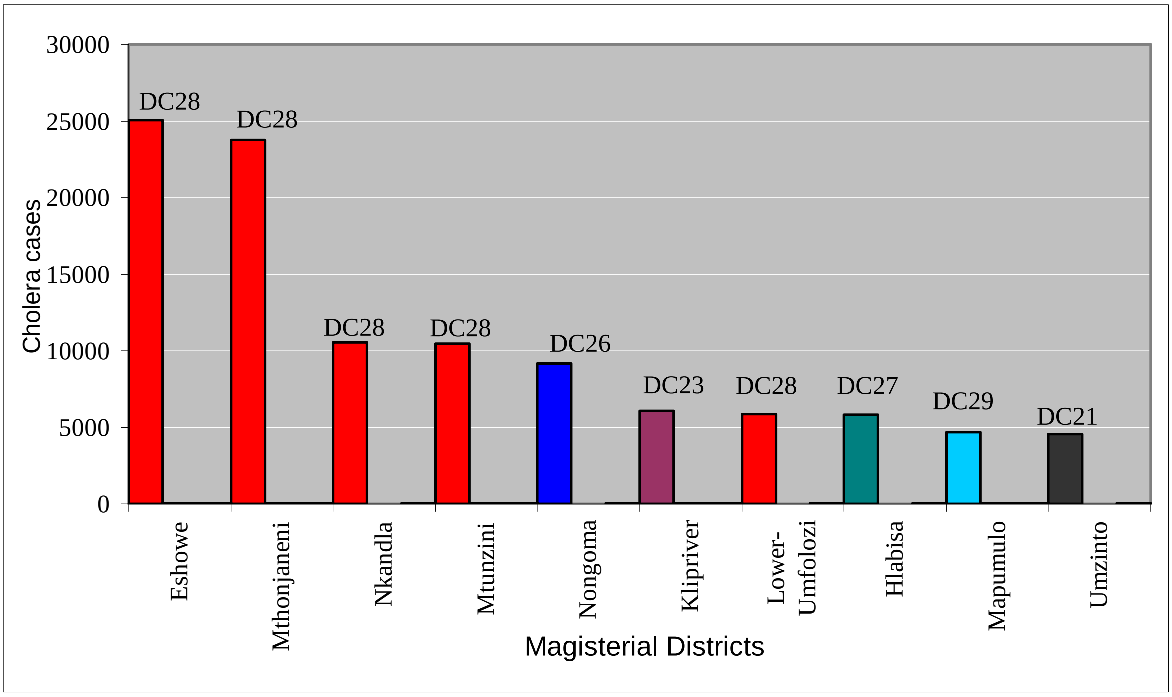


Figure 5.19: Magisterial Districts that reported the highest cholera cases during the epidemic period between August 2000 and February 2004.

This chapter sums up the database results within the administrative confines of KZN. In general cholera affected mostly the very young, young adults and the aged individuals of the communities affected. This age distribution pattern reflects an endemic scenario whereby it implies that majority of the adults may have had immunity from previous infections. That is to say, for the KZN population, the pool of susceptible individuals was mostly from the younger age groups and the older age groups for obvious reasons of being physiologically more susceptible to diseases. This possibility is supported by Codeço (2001); who through cholera modelling studies noted that endemism, especially in poor communities requires just transient reservoirs and sufficiently high number of susceptibles.

The centre of the epidemic was Uthungulu District (DC 28) where the initial outbreak of cholera was recorded. Judging from the total number cholera cases reported (71 602); the intervention measures introduced in the district must have matched the intensity of the outbreak. This also implies that as cholera spread to the other DCs, the interventions measures were well established in DC28. According to the KZN Cholera Database used in this study, the overall CFR for the epidemic was 0.34%. The most affected DC 28 had a CFR of 0.16%, indicating that the intervention measures put in place were effective in the overall management of the epidemic. The major peak of the cholera epidemic occurred in January 2001, and thereafter, there was an exponential decrease in case numbers (Figure 5.3). This reflects the period when all the relevant government sectors, NGOs and private organisations directly involved in curbing the epidemic were fully mobilised. The first (major) epidemic peak was a learning curve to evaluate how effective intervention measures were, especially those dealing with case management, hygiene practices and water handling practices. The lessons learned from the epidemic experiences of the major peak may also have significantly contributed to the reduction of the annual peak (minor) of December-February 2001/02; though this may also be attributed to the reduction of susceptible individuals in the affected communities.

The logistic and behavioural implication of the intervention measures were limiting in some aspects. This included availability and accessibility of water and sanitation services especially to the rural areas; shortage of health staff in some areas; and slow behavioural change and low community participation (Mugero and Hoque, 2001). Nonetheless, the intervention measures managed to reduce the burden of disease and the fatalities associated with cholera in the affected communities.