POPULATION DYNAMICS IN KOROGWE DEMOGRAPHIC SURVEILLANCE SYSTEM (DSS) IN TANGA REGION, TANZANIA

By

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PLAGIARISM DECLARATION FORM

This research is my original work, produced with normal supervisory assistance from my supervisor. All the relevant sources of knowledge that I have used during the course of writing this dissertation have been fully credited using the Harvard convention for citation and referencing. Also, this dissertation has not been submitted elsewhere for any academic or examination purpose at any other university.

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ABSTRACT

A demographic surveillance system (DSS) is commonly used to generate and handle longitudinal follow-up data relating to demographic and health related events in a specified area. In the Korogwe DSS site, information on vital events such as births, deaths and migration has been collected since the establishment of the site in 2005. The aim was to establish demographic and epidemiological indices so as to assist in the evaluation of health related interventions.

Data quality assessments were done to evaluate errors in age reporting and differential completeness of coverage by sex. This assessment was done using population pyramids, sex ratios, age ratios and summary indices. Estimates of the mortality levels were derived from information on deaths that was collected during household visits, whilst the cause of death information was obtained based on verbal autopsy questionnaires administered to parents or close relatives of the deceased. The birth history data were used to estimate the lifetime and period fertility for women aged 15-49 in the DSS site. Lifetime fertility was estimated using parity progression ratios, whilst period fertility was derived from age-specific rates. Estimates of crude migration rates, age specific migration rates and age profile measures were derived from a number of people moving in and out of the Korogwe DSS site and the person-years lived.

The indices used to validate the quality of the data in terms of age and sex reporting indicate that the DSS data are of acceptable and usable quality. From our findings, the observed infant mortality was 64 deaths per 1,000 live births for males and 52 deaths per 1,000 live births for females. The under-five mortality rate was 87.9 per 1,000 live births for males and 81.9 per 1,000 live births for females among the non-migrant population. Under reporting of deaths was noted in Korogwe DSS. The problem was more severe among adults. The probability of dying among adults ($_{30}q_{20}$) in Korogwe DSS for males was found to be 2.0 times more for males and 2.4 times more for females than the ones computed from the Coale-Demeny North Model Life Tables level 20.6, indicating excess deaths due to HIV/AIDS in the early adult ages. Communicable diseases accounted for 88.7 per cent of all the deaths in children under-five years. The major cause of deaths for children under-five years was malaria (52.9 per cent). For HIV/AIDS, 90.5 per cent of the deaths involved individuals aged 15-45 years, although the percentage of male deaths attributed to HIV/AIDS appear to be too low. The reason for this low rate for males cannot be explained. The lifetime and period fertility estimates were found to be 5.6 and 5.1 children per woman, respectively, therefore showing that fertility has decreased in the recent past in Korogwe DSS. Our results show that there are higher rates of out migrants compared to in migrants for both males and females in Korogwe DSS.

In conclusion, this analysis was able to provide reasonable demographic estimates of mortality, fertility and migration using the longitudinal data collected from the Korogwe DSS site. The findings can be used to ascertain the population structure of Korogwe area, and they can also be used to evaluate the health interventions being implemented in the DSS site, and be used by the District authorities as input for setting priorities and planning purposes.

ACKNOWLEDGEMENTS

First and foremost, I thank God, the Almighty for sustaining me as I was working on my thesis (Psalms 138:7). My sincere gratitude to my employer, the Ministry of Health and Social Welfare, which through the administration of the National Institute for Medical Research (NIMR) Tanzania, granted me permission to pursue my studies at the University of Cape-Town (UCT) in South Africa. I am particularly indebted to my supervisor Professor Tom Moultrie for his patience, tireless efforts, invaluable ideas and insightfulness. I am indebted to thank Professor Rob Dorrington for imparting me with valuable knowledge throughout my studies.

In close memory and heartfelt good wishes, I cannot forget my family members and friends who supported me financially and emotionally while I was too busy concerning on my studies, they missed me and I missed them, but we remained closely tied. Last, but not least, I am grateful to the staffs and my colleagues at the UCT for giving me moral and partly academic support without which my life as a student would be difficult. My fellow employees at the Tanga Medical Research Centre, Tanzania and Dr. Godfrey M. Mubyazi at NIMR Headquarters are remembered for their support and advice throughout my career as a research scientist.

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CHAPTER 1: BACKROUND AND RATIONALE

1.1 Introduction and rationale

Accurate vital registration is not adequately covered in most of the developing countries, and this leads to scarcity of empirical data for determining demographic and epidemiological indices. As a result, most of the mortality information is derived based on interpolation and/or extrapolation of data from existing model life table system (Brass 1971; 1966; United Nations 1981). The model life tables are used widely in demographic, epidemiological, and economic analyses. The major challenge regarding the utility of these life tables is misstatements of age at death which has been reported to be problematic (INDEPTH Network 2004; Murray, Ferguson, Lopez *et al.* 2003). The establishment of the Demographics Surveillance System (DSS) in Africa and Asia has helped in filling the gap of empirical data. Demographic surveillance system is the process of defining the risk and corresponding dynamics in demographic rates in a population over time (Phillips 1998). DSS are set-up to acquire the most crucial health information in a well-defined population (Satoshi, Emmanuel and Mohamed 2007). These sites collect longitudinal data on births, deaths and migration in the geographic areas under surveillance.

In most areas where information on vital statistics is lacking, critical and incisive analysis of disease burden in the population has been noted (Sankoh, Kynast-Wolf, Kouyaté *et al.* 2004). This inadequate information on demographic and epidemiological indices might lead to insufficient planning and poor decision-making on the effectiveness of various interventions aimed at prevention and control of diseases (Unger and Dujardin 1992). The DSS sites have been widely used as the platform for other studies for generating evidence based hypotheses from a well-defined population in an area where reliable data are non-existent. These platforms provide sound scientific interventional research and give evidence that is beneficial for large scale use.

In Tanzania, there are six functioning DSS sites, namely Ifakara in Morogoro, Magu in Mwanza, Rufiji in Coast, Hai in Kilimanjaro, Ujiji in Kigoma and Korogwe in Tanga regions. All these DSS sites are linked to the Ministry of Health and Social Welfare (MoHSW) and their respective Districts and are meant for providing health information for planning purposes.

A detailed census is a prerequisite before any clinical trial since it may help to provide the basic information/data required for effective planning and execution of (Sankoh, Kynast-Wolf, Kouyaté *et al.* 2004). Information regarding fertility, mortality and migration is scanty in the Korogwe area as in other areas in the United Republic of Tanzania. Therefore, this raises a need for establishing DSSs and facilitates the computation of demographic and epidemiological indices to assist in evaluation of the effectiveness of health interventions carried out in the study sites.

The findings highlighted in this thesis are expected to contribute towards improvement of evidence-based planning. These findings will provide the district health and planning authorities with crucial demographic information that is useful to consider when setting priorities for development projects, including comprehensive district health plans.

1.2 Review of literature

DSS sites have been implemented in many countries in the world, especially in developing countries, where there is inadequate information on demographic indices such as fertility, mortality and migration (Ngom, Binka, Phillips *et al.* 2001). In 1998, a network was established named International Network for the continuous Demographic Evaluation of Populations and Their Health in developing countries (INDEPTH) was established with the aim of facilitating cross-site, longitudinal health and social studies, and impact assessments. The network has succeeded in different aspects especially strengthening the institutional capabilities of member sites, and also in the development of the INDEPTH model life tables system for sub-Saharan Africa (SSA) based on the Brass relational model. The model life tables were developed using empirical data from 19 INDEPTH sites for the period between 1995 and 1999 (INDEPTH Network 2004). These model life tables are INDEPTH Pattern 1 and 2. Pattern 1 reflects areas with low prevalence of HIV/AIDS while Pattern 2 reflects areas affected by HIV/AIDS. The advantages of the INDEPTH model life tables relative to the previous model life tables (Coale and Demeny or Princeton model life tables) is that they include data from sub-Saharan Africa and also incorporate the effects of HIV/AIDS.

All the demographic surveillance sites are usually in possession of data concerning population dynamics. The advantages of having a DSS in place is that it serves as a platform for monitoring population dynamics and provides a way of assessing changes in both communicable and non-communicable disease (NCD) risk factors. A study of three DSSs of Ethiopia, Vietnam, and Indonesia collected NCD risk factors and provided evidence of combining DSSs and WHO approach to address basic epidemiological questions on NCDs (Nawi, Minh, Tesfaye *et al.* 2006). Out of 19 DSSs sites which were used by INDEPTH-Network to produce pattern 1 and 2 model life table, 5 of the DSS sites were from Tanzania namely Dar-es-salaam, Hai, Ifakara, Morogoro and Rufiji (INDEPTH Network 2002, 2004). All of these DSS sites in Tanzania routinely collect births, deaths, migrations and health related information in their respective geographical areas. Likewise, given the strong correction between health and socioeconomic status, information on marital status, family relationship and economic status is collected. The estimation of adult morbidity and mortality in Tanzania was accomplished by using the information collected from

DSS sites (Hemed 2004) , and also information on HIV/AIDS mortality(Boerma, Ngalula, Isingo *et al.* 1997). Furthermore, Data from DSSs have helped in the demonstration of frequent inequalities even in small areas and also helping confirm the feasibility of studying economic inequalities in health(INDEPTH Network 2005).

Despite these advantages, still DSSs are facing challenges, including high running costs and the DSS findings describe relatively small areas that are not representative of all areas. Combining the DSS method and Sample Vital Registration has been noted to be remedies of the challenges since it offers a chance for elimination of cost disadvantage (Setel 2009), and the two methods produce a rich representation (MEASURE 2009).

1.3 Research questions

This study attempted to answer the following research questions:

i. What is the quality of population data by age and sex and the extent of coverage errors on the data collected from Korogwe DSS site?
ii. What are the mortality levels and causes of deaths in the study site?
iii. What is the impact of HIV/AIDS using model life table?
iv. What are the levels and patterns of fertility of women aged 15-49 in Korogwe DSS site?

1.4 Objectives

The main objective of this dissertation is to provide demographic information on the Korogwe DSS site. The specific objectives are:

i. To assess the quality of data and extent of coverage errors on the data collected from the Korogwe DSS site
ii. To assess the mortality levels and causes of deaths in the study site
iii. To assess the impact of HIV/AIDs using a model life tables
iv. To understand the patterns and characteristics of migrants in the study area
v. To estimate the levels and patterns of fertility of women aged 15-49 in Korogwe DSS site using fertility data collected in the study area.

1.4.1 Study area and population

The Demographic surveillance system in Korogwe was established in 2005 in 14 villages in Korogwe district, located in north-eastern Tanzania (Figure 1.1). Korogwe is one of the eight districts of Tanga region. The district is topographically stratified into lowland and highland zones, with altitudes ranging from 300-1200 metres, covering an area of 3,756 square kilometres.

It is made of four Divisions, 20 Wards, and 133 Villages, has an estimated total population of 261,004 and a population growth rate of 1.4 per cent per annum (National Bureau of Statistics 2002). During a baseline census conducted in October 2005 through the Korogwe DSS, a total of 25,264 individuals and 5,853 households were registered. As of 2007, there were 47 dispensaries, four health centres and two hospitals (Korogwe District Council 2007).

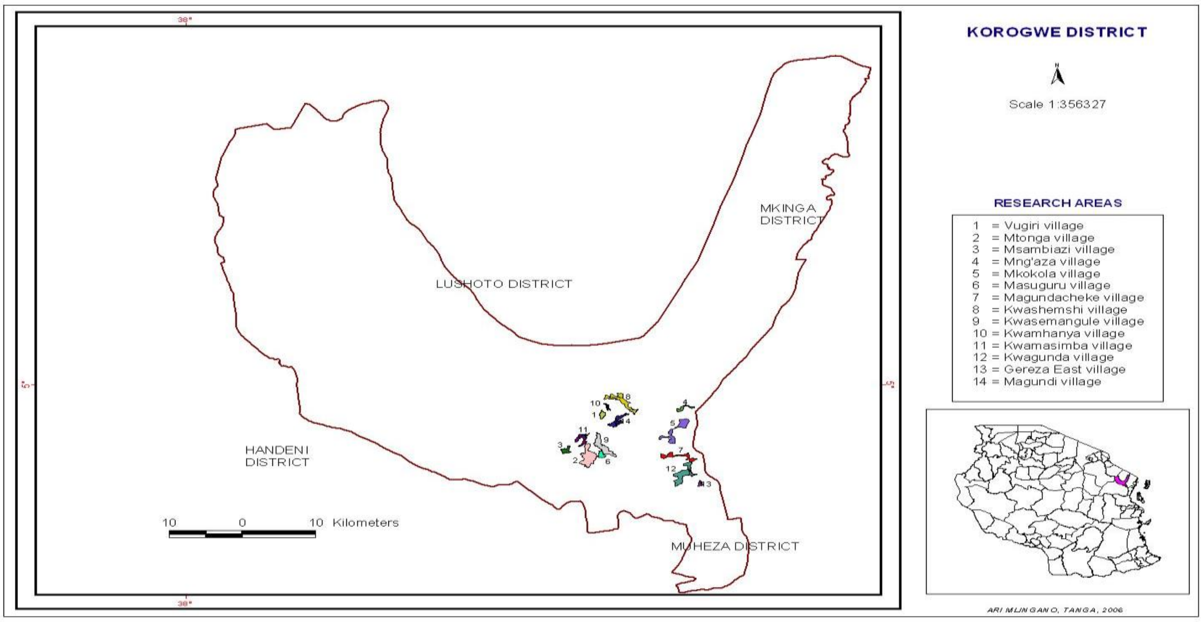
1.4.2 Site selection

The DSS site was established as a possible malaria vaccine trial site and to build capacity for conducting clinical trials. The DSS programme has been conducted in 14 villages in Korogwe district that surround the district hospital named 'Magunga' within different ranges of altitude. Before the start of the actual study, a team of three research scientists visited the district to select the villages to be involved in the study. The team obtained a list of all villages in the district from a project at Magunga hospital and identified the wards which surround the hospital. At each village, the altitude and geographical position were recorded. The geographical position was aimed at establishing the latitudes and longitudes of particular areas using Geographical Positioning System (GPS). An informal discussion was conducted with either or both of the (village chairperson and village executive secretary) to get an insight of the nature of the village and whether the village had participated previously in research projects conducted by National Institute for Medical Research (NIMR) or other collaborators. A total of 26 villages were identified among which 14 were selected based on the following criteria: proximity to Magunga (district) hospital; altitude (lowland, medium and highland); population and number of households in the village, accessibility to the health facility where the community accesses health services; and previous participation in research activities or anticipated cooperation from the community. The community meetings with the selected villages were held to obtain community consent for participation in the study.

1.4.3 Study design on the establishment of Korogwe DSS

The primary aim of the DSS was to generate health and population related information in an area where there was no routine collection of vital events. It also aimed to evaluate the impact of clinical trials undertaken using the DSS platform.

Figure 1.1 ***Map of Korogwe District indicating the villages under the DSS***



Prior to the setting up of the DSS site, 14 villages were selected based on the criteria required for the study as elaborated under section 1.2.2. This was followed by a baseline census conducted using field workers (enumerators) living in the study areas. The enumerators were trained on how to use the survey forms and conduct interviews. The baseline census helped to obtain the background information regarding the study population in establishing the longitudinal surveillance system. The information collected focused on the household composition (head of household, relation to head of the household), demographic data (date of birth, sex marital status, socioeconomic variables (education, occupation, type of hosing). Each of the houses visited was given a unique permanent registration number and each household member in the household was assigned a unique identification number.

Recruitment and training of field workers was done three weeks before the implementation of the actual DSS. Each household in the longitudinal surveillance system was visited three times per year to collect information on vital events. The information collected within each visit focused on births, or pregnancy outcomes, marital status (marriages, divorces, separations, and reconciliations), deaths, changes in household membership and in-migration and out-migration in the DSS site. In each village two persons were selected to report any vital events (births and deaths) occurring in their demarcated areas to ensure that all vital events are captured. Households with new births were visited by fieldworkers to complete the birth form. In the case of deaths, the fieldworkers were trained to conduct a verbal autopsy using a questionnaire. This questionnaire was adopted from INDEPTH-Network with minor modifications to ensure that it captured the information needed from the target study population. The fieldworkers had to visit the study households that had the event two weeks after the reported death.

Information collected on vital events was linked to the individual by at permanent unique identification number to allow estimates of the rates by dividing the number of events by the number of person-years of observation. The demographic and health information data collected were linked to provide a picture of health problems, impact of various health interventions and population at risk.

1.4.4 Recruitment and training of field workers.

Fieldworkers for the DSS were recruited in September 2005, one from each of the study villages (Table 1.1) to allow community participation and project ownership. The recruited fieldworker received their first training in October 2005. The training was divided into three modules. The first module, theory and practice, was intended to enlighten the trainees of the project. The two modules were on how to conduct the baseline census and how to collect demographic surveillance information. In these modules, the topics covered include malaria situation in Tanzania and the main activities to be executed by the project, introduction to DSS and baseline census. During the training, the trainees were involved in a pilot study to test baseline census survey forms. The pilot survey was conducted in Mkokola village and the sub-village of Kitopeni. After fieldwork, the trainees were asked to discuss and present reports of their visits. They were also involved in the process of reviewing and correcting the census instrument which enhanced their understanding on how to conduct the baseline census.

The fieldworkers received the second training in December 2005 which sought to familiarize them with the techniques of updating demographic information. It focused on the use of Household Registration Books (HRBs) which are special forms used to update demographic data and includes changes forms and vital event forms commonly used during DSS work. The training covered aspects such as the responsibilities of interviewers and supervisors, overview of HRBs and practical exercises on how to update demographic information using HRBs, filling changes forms as well as event forms. After the training, the trainees were allocated to their respective working stations before the commencement of the first round of DSS in January 2006. Weekly supervision and monthly meetings were conducted throughout to bring together all fieldworkers to share experiences and participate in solving the problems encountered in the field.

Table 1.1 Villages selected for NIMR-AMANET project in Korogwe District, 2002

Village	Population*	No.HH	Altitude (m ASL)	Ward
Mkokola	2,300	510	310	Kwagunda
Kwagunda	1,837	380	312	Kwagunda
Gereza East	954	275	313	Kwagunda
Magunga Cheke	1,600	260	313	Kwagunda
Msambiazi	2,000	540	350	Msambiazi
Mtonga/Kwamkole	2,010	450	357	Msambiazi
Mngaza	930	186	321	Kwagunda
Masuguru	2,210	221	344	Magunga
Kwasemangube	5,250	850	367	Magunga
Kwamasimba	1,700	380	629	Vugiri
Magundi	1,600	400	648	Vugiri
Kwamhanya	587	108	802	Vugiri
Vugiri	1,445	264	995	Vugiri
Kwashemshi	2,833	763	326	Vugiri
Total	**27,256**	**5,587**		

Note: * figures were obtained from village offices which were based on quick census conducted in 2002 by village executive officers

CHAPTER 2: DATA QUALITY ON POPULATION NUMBERS BY AGE AND POPULATION CHARACTERISTICS

2.1 INTRODUCTION

Data collected from censuses and surveys often contain errors, including age misreporting and differential completeness of coverage of the sexes. The aim of this chapter is to assess the quality of data and to determine the extent of coverage errors in the data from the Korogwe DSS site. The methods used to evaluate and assess the quality of the data include sex ratios and summary indices.

2.2 METHODOLOGY AND RESULTS

2.2.1 Baseline survey

The baseline population census was conducted from October to November 2005 in 14 villages. During this period, the total population in the study area was 25,350, this being lower by 8 per cent than the one obtained from village population records (Table 1.1) between 2002 and 2005. The difference observed might be associated with migration from rural to urban areas. Of the 25,350 people, 50.6 per cent were females, and children under-five years accounted for 14.7 per cent of the total population. The distribution of population by age, sex and place of residence for the DSS and Korogwe district in the national 2002 census are presented in Table 2.1. The age-sex structure of a population is a reflection of its past history of fertility, mortality and migration which in turn determine the current levels of births, death and migration rates.

According to the 2002 census (Table 2.1), the majority of the people in Korogwe live rural areas (82.9 per cent), and the sex distribution is equal with a higher proportion of both males (83.1 per cent) and females (82.7 per cent) in the rural areas, and smaller proportions of both males (16.9 per cent) and females (17.3 per cent) in the urban areas. Similar sex distributions were also observed in the 2005 DSS, although the difference in the proportions between rural and urban is smaller for both males (rural (56.7) versus. urban (43.7 per cent)) and females (rural (56.9) versus urban (43.1 per cent)). The baseline survey has almost equal representation of both rural (56.8) and urban (43.2) areas, which could be due to the selection criteria of the villages. This selection criterion was based on the proximity of the villages to the district hospital as explained in section 1.2.2.

Table 2.1 Population distribution by sex, place of residency and age groups, Baseline survey 2005 and 2002 census

	2005 BASELINE SURVEY			KOROGWE DISTRICT 2002 CENSUS		
	Males	*Females*	*Total*	*Males*	*Females*	*Total*
Place of Residence						
Urban	5,403 (43.3)	5,517 (43.1)	10,920 (43.2)	21,538 (16.9)	23,000 (17.3)	44,538 (17.1)
Rural	7,086 (56.7)	7,281 (56.9)	14,367 (56.8)	10,6115 (83.1)	109,586 (82.7)	215,700 (82.9)
Age Distribution						
0 – 4	1,961 (15.8)	1,865 (14.5)	3,826 (15.1)	19,528 (15.3)	19,438 (14.7)	38,966 (15.0)
5-9	1,719 (13.9)	1,754 (13.6)	3,473 (13.7)	18,391 (14.4)	17,828 (13.4)	36,219 (13.9)
10-14	1,751 (13.9)	1,638 (12.7)	3,389 (13.4)	17,721 (13.9)	16,850 (12.7)	34,571 (13.3)
15 – 19	1,362 (11.1)	1,137 (8.8)	2,499 (9.9)	13,067 (10.2)	12,320 (9.3)	25,387 (9.8)
20 – 24	746 (6.0)	888 (7.0)	1,634 (6.6)	8,900 (7.0)	11,783 (8.9)	20,683 (7.9)
25 – 29	782 (6.3)	929 (7.2)	1,711 (6.8)	8,990 (7.0)	10,914 (8.2)	19,904 (7.6)
30 – 34	707 (5.7)	838 (6.5)	1,545 (6.1)	8,124 (6.4)	9,198 (6.9)	17,322 (6.7)
35 – 39	646 (5.2)	725 (5.6)	1,371 (5.4)	6,674 (5.2)	7,004 (5.3)	13,678 (5.3)
40 – 44	580 (4.7)	593 (4.6)	1,173 (4.6)	5,467 (4.3)	5,819 (4.4)	11,286 (4.3)
45 – 49	416 (3.4)	511 (4.0)	927 (3.7)	4,196 (3.3)	4,646 (3.5)	8,842 (3.4)
50 – 54	378 (3.0)	427 (3.3)	805 (3.2)	3,912 (3.1)	4,279 (3.2)	8,191 (3.1)
55 – 59	325 (2.6)	406 (3.2)	724 (2.9)	2,820 (2.2)	2,727 (2.1)	5,547 (2.1)
60 – 64	282 (2.3)	286(2.2)	568 (2.2)	2,886 (2.3)	3,033 (2.3)	5,919 (2.3)
65 – 69	249 (2.0)	261 (2.0)	510 (2.0)	2,414 (1.9)	2,081 (1.6)	4,495 (1.7)
70 – 74	214 (1.7)	260 (2.0)	474 (1.9)	1,965 (1.5)	2,029 (1.5)	3,994 (1.5)
75 – 79	135 (1.1)	122 (0.9)	257 (1.0)	1,111 (0.9)	1,015 (0.8)	2,126 (0.8)
80+	148 (1.2)	223 (1.7)	371 (1.5)	1,487 (1.2)	1,621 (1.2)	3,108 (1.2)
Total	12,401	12,863	25,264	127,653	132,585	260,238

Table 2.2 shows the population distribution by age and sex and percentage change in 2007 (a full census was not done in 2007). The pattern of population shows the effect of undercount and this problem is very high and it affects significantly the population sizes. In general there was a reduction of 7 per cent of the population between 2007 and the statistics collected during the baseline study two years earlier. The percentage change among males and females aged 15-19 is highest relative to other age groups (Table 2.2). Generally, greater change (-9 per cent) was observed in females, indicating a much larger decrease between 2007 and 2005. Likewise females aged 15-34 attained a change of more than -10 per cent which might be associated with more deaths of females of this age group due to HIV/AIDS as illustrated in section 3.3.7. In addition, a greater proportion of males aged 55-64, 70-74 and 80+ were undercounted in 2005.

Table 2.2 Population distribution by age and sex, and their percent change from baseline

Age Group	2007 Male	2007 Female	2007 Total	Percent Changes Male	Percent Changes Female	Percent Changes Total
0-4	1,731	1,740	3,471	13%	-7%	-10%
5-9	1,718	1,683	3,401	0%	-4%	-2%
10-14	1,598	1,564	3,162	-10%	-5%	-7%
15-19	936	870	1,806	-46%	-31%	-38%
20-24	710	679	1,389	-5%	-27%	-16%
25-29	823	797	1,620	5%	-17%	-6%
30-34	750	749	1,499	6%	-12%	-3%
35-39	646	686	1,332	0%	-6%	-3%
40-44	561	562	1,123	-3%	-6%	-4%
45-49	475	505	980	12%	-1%	5%
50-54	407	406	813	7%	-5%	1%
55-59	392	391	783	17%	-4%	7%
60-64	254	272	526	-11%	-5%	-8%
65-69	252	253	505	1%	-3%	-1%
70-74	258	240	498	17%	-8%	5%
75-79	119	123	242	-13%	1%	-6%
80+	219	220	439	32%	-1%	15%
Total	**11,849**	**11,740**	**23,589**	**-5%**	**-9%**	**-7%**

There were some problems with the reporting of date and month of birth which were found in the baseline round. The following sections describe the extent of the problem and the remedy applied

2.2.2 Comparison of age distribution among those missing date of birth by sex and strata (urban and rural)

Forty six per cent of the people in the study area did not report their day and month of birth. Slightly more women (51 per cent) did not, as compared to 49 per cent of men. A higher proportion of people in urban areas (47.9 per cent), did not report their day and month of birth than reported by those residing in rural areas (45.8 per cent). This being unusual, the reason for this might not be explained. In both cases (sex and geographical strata) the proportion not reporting days and months of birth is observed to increase by age as shown in Figure 2.1 and Figure 2.2. The low level of the proportion of not reporting days and months among young ones might be associated with birth registration policy in place which is now common practice for parents of newborns in Tanzania.

Figure 2.1 Proportion of people who their respondents were not able report their days and months of birth in 2005, by sex and age

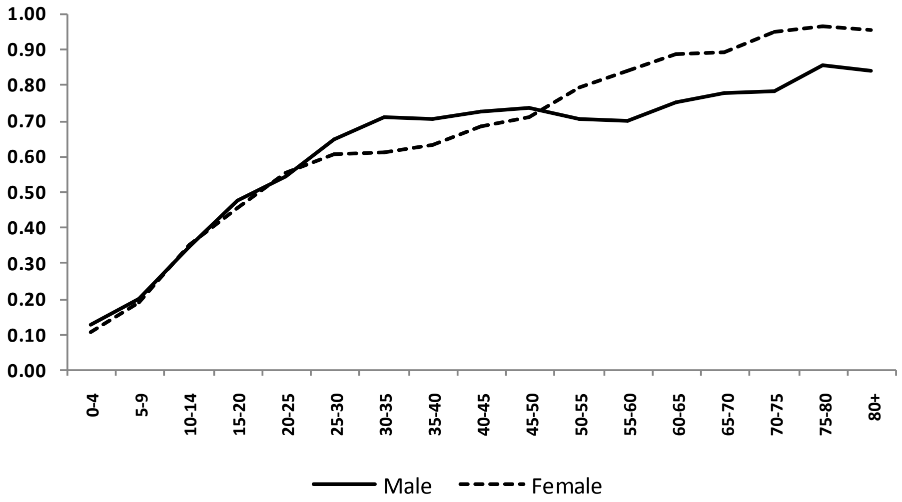
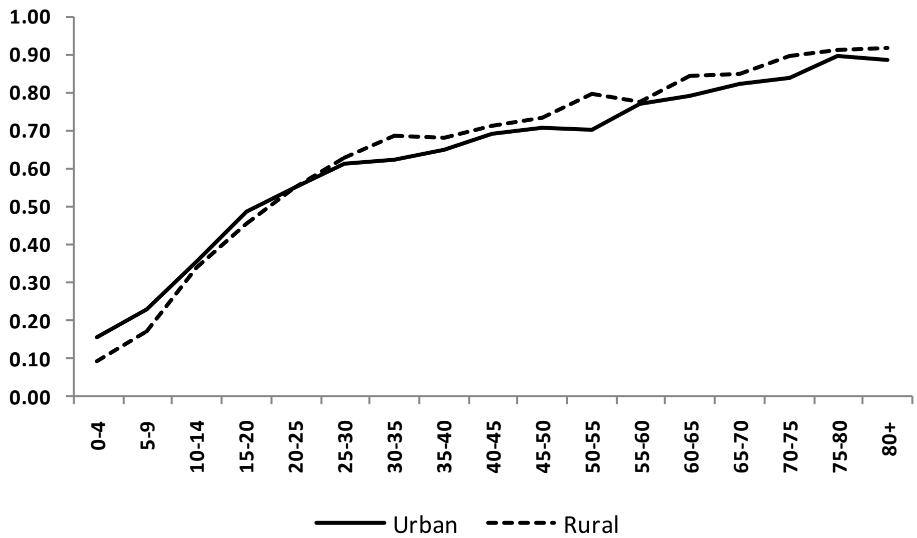


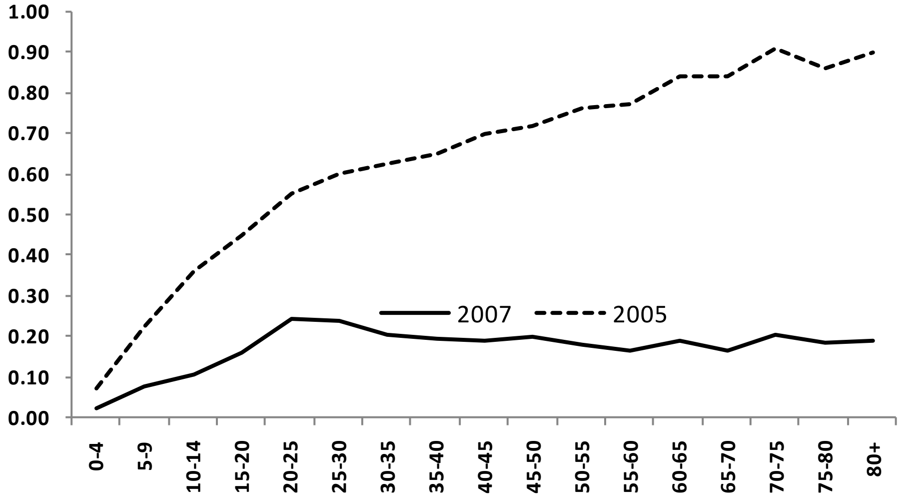
Figure 2.2 Proportion of people who their respondents were not able report their days and months of birth in 2005, by strata (urban and rural) and age



2.2.3 Comparison of age distribution among those missing date of birth by year 2005 and 2007

The proportion of people interviewed in 2005 who were not able to report the day and month of birth increases with age. Likewise, an increase by age in 2007 was noted to those individuals aged less than 25 years and thereafter it almost became constant as shown (Figure 2.3). There has been an improvement in the reporting of the day and month from 2005 to 2007 across all ages (Figure 2.3). The ratio of improvement in 2007 was more than 4 times among those aged above 50+ relative to that of 2005. This suggests that the observed improvement might be associated with awareness of the community towards the importance of keeping and providing correct birth information together with the confidence they have on the competent DSS field workers.

Figure 2.3 Proportion of people who their respondents were not able to report their birth date in 2005 and 2007



2.2.4 Editing of dates of births for persons with unknown date and month of birth

During data collection, the people who were unable to report their day and/or month of birth were recorded in the questionnaire as '07' for the month (July) for those who did not report on their month of birth and '17' for day for those who are not able report on their date of birth. The distribution of day and month of birth as collected are shown in Figure 2.4 and Figure 2.5. Such a high proportion of people who did not report the day and month of their birth would certainly lead to biased estimates of demographic measures derived from information on the date of birth such as the estimation of person-years lived and calculation of exposure to risk. To address this problem, the people who were unable to report their date of birth have been allocated a new date randomly generated using STATA. The information on the date of birth was separated into three new variables namely day, month and year of birth. The total number of the individuals in the study population was obtained. Likewise, the number of those who were unable to report their date and month of birth was also obtained. The expected number of people born on a given day was obtained by dividing the total number of the individuals in the study by the total number of days in a year assuming a uniform distribution of births. The excess number of births to be redistributed was obtained by subtracting the expected number of births per day from the total number of those who were unable to report their date and month of birth. Thereafter, the proportion of cases to be redistributed was calculated, and this proportion was set as the threshold. Then, random numbers (days between 1 and 31) were generated and allocated to the population members who did not report their date of birth. A similar procedure was also applied to those who did not know their month of birth, on the assumption that there was no seasonality of births. No adjustment was done for missing year of birth, since most of the people were able to report their year of birth.

Figure 2.4 Proportion of the population by day of birth before and after random allocation of days of birth among those who did not know their birth date

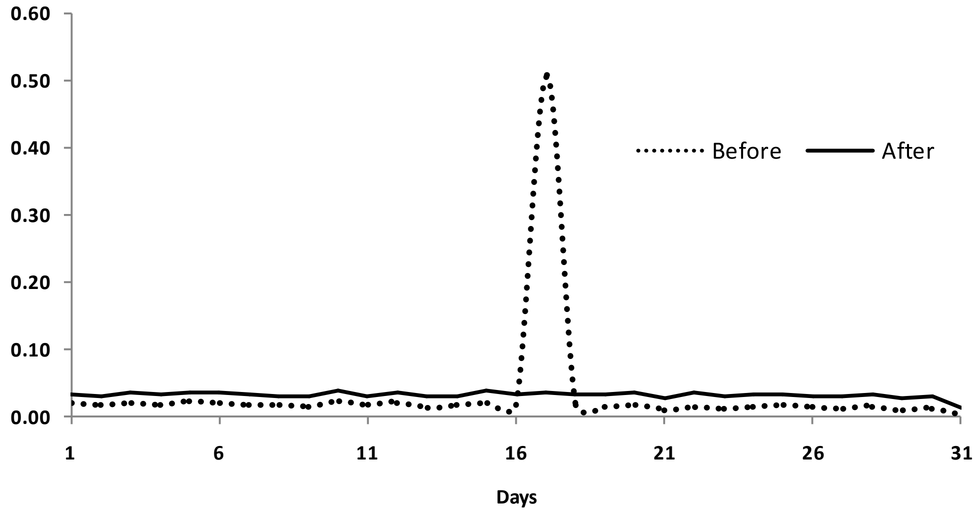
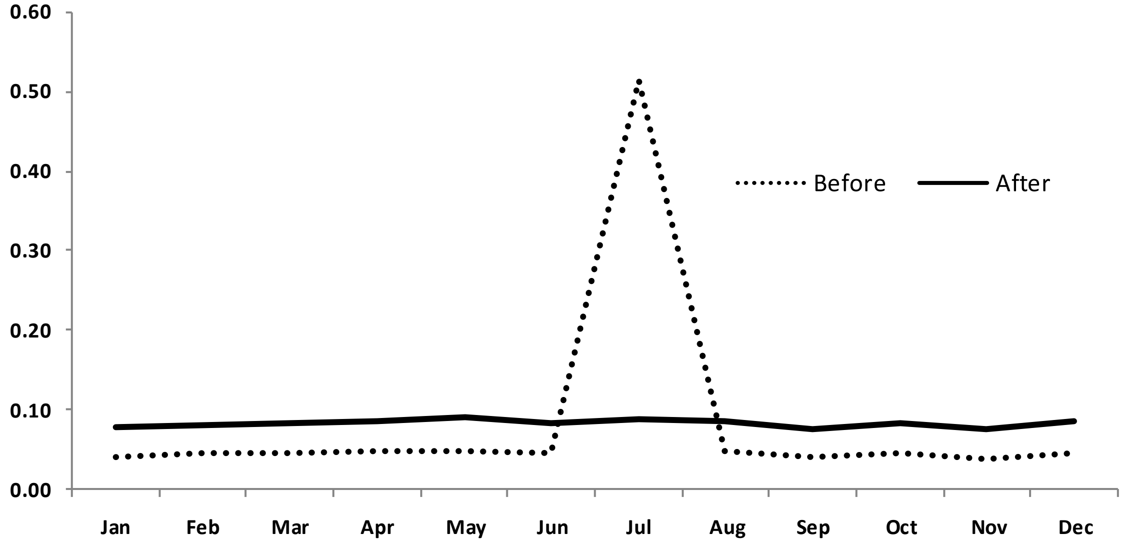


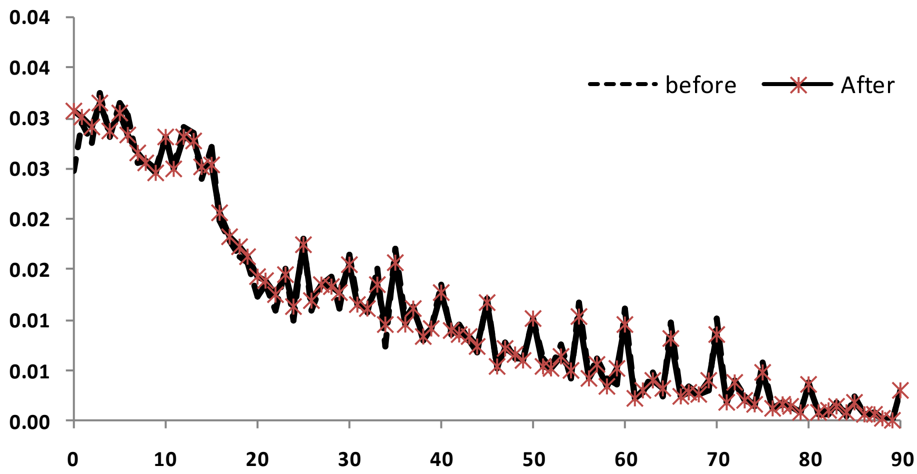
Figure 2.5 Proportion of the population by month of birth before and after random allocation of months of birth among those who did not know their birth date



2.2.5 Comparison of age distribution before and after adjustments (2005)

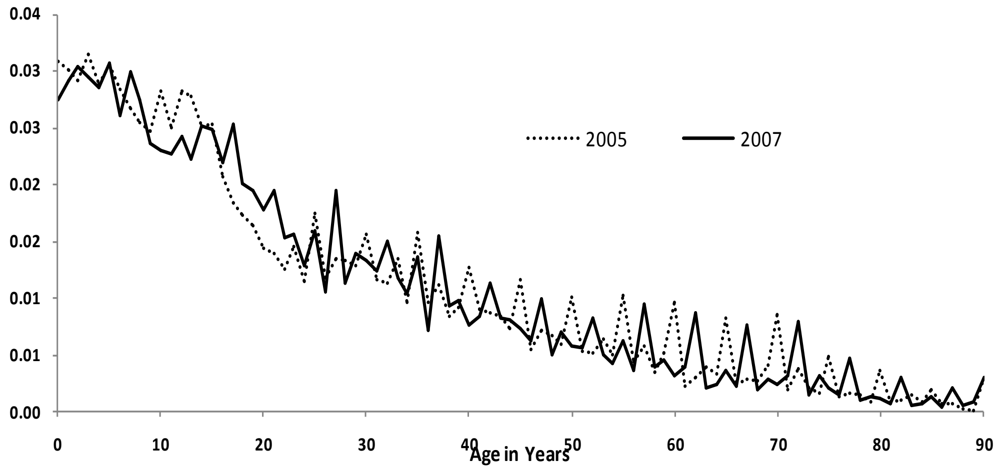
The age distribution of the population is similar before and after the reallocation of the birth dates as shown in Figure 2.6 not least since reported year of birth had not been adjusted. There is no significant change of the distribution of population by age.

Figure 2.6 Distribution of population by age before and after random allocation of date and month of birth, 2005 Baseline study



The heaping of ages (digit preference) that is evident in the baseline data manifests itself too in the data collected in the 2007, exactly two years apart since 2005, as seen from Figure 2.7.

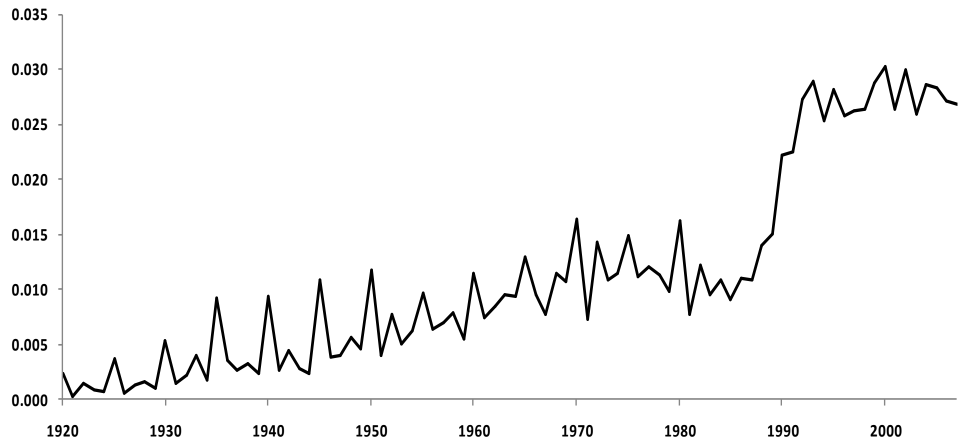
Figure 2.7 Population proportion by single years of ages, 2005 and 2007 after adjusted, Korogwe DSS



The patterns of age distribution are similar in 2005 and 2007 among adults aged 25 years and above. However, at the youngest ages there is no severe heaping, possibly since there is an implementation of birth registration policy in the country (unlike many years in the past), thus increasing the accuracy and reliability of the age reporting system. In 2007 the heaping shows a shift of two years, which was expected since this is a follow-up study and the same people were interviewed after 2 years after 2005, the baseline reference year. The proportion of children less than one year of age in 2007 is markedly lower than that of 2005. This is almost certainly due to underreporting of children less than one year of age in the 2007 round. However, other possible, but less likely, reasons could be either low proportion of births in 2007 relative to the total population, or undercount of infants.

Figure 2.8 shows the age heaping by the reported year of birth, indicated a terminal digit preference of digits 0 and 5 among those born before 1980's.

Figure 2.8 Distribution of population by their year of birth



In order to draw conclusive information on the age heaping and terminal preference, summary indices which include the Myer's index are presented in section 2.2.6 to assess the quality of age reporting at baseline data and two years after the study.

2.2.6 Myers' Blended Index

Major problems associated with demographic data that could affect demographic estimation include the accuracy of reporting of the respondents' age. One of the common features of ages distortion in censuses in developing countries is heaping of ages on digits ending with 0, or 5. Myers' Blended Index (Myers 1940) has been used to assess the quality of age reporting at baseline data and two years after the study. This index gives a magnitude of the excess or deficit of people in ages ending in any of the 10 digits. On the assumption of a uniform distribution of ages, the deviation from 10 per cent of the proportion of the population at age ending in each digit was calculated. The larger the deviation in percent distribution in terminal digits indicates the larger the preference for digits. The sum of all terminal digits divided by half yields a summary index for all terminal digits. Values close to 0 indicate excellent age reporting. The age range used is 10 – 89 years old, given that the numbers change rapidly by age in a non-linear way at the young and old ages. The Index provided a summary index of 10.53 in 2005 after adjustment of date of birth not reported. The index value indicates the presence of terminal digits preference among individuals in the study population. The extent of terminal digit preference before and after adjustment for date birth not reported is not significantly different. There is significant heaping at digits 0 (14.5 per cent) and 5 (13.4 per cent)

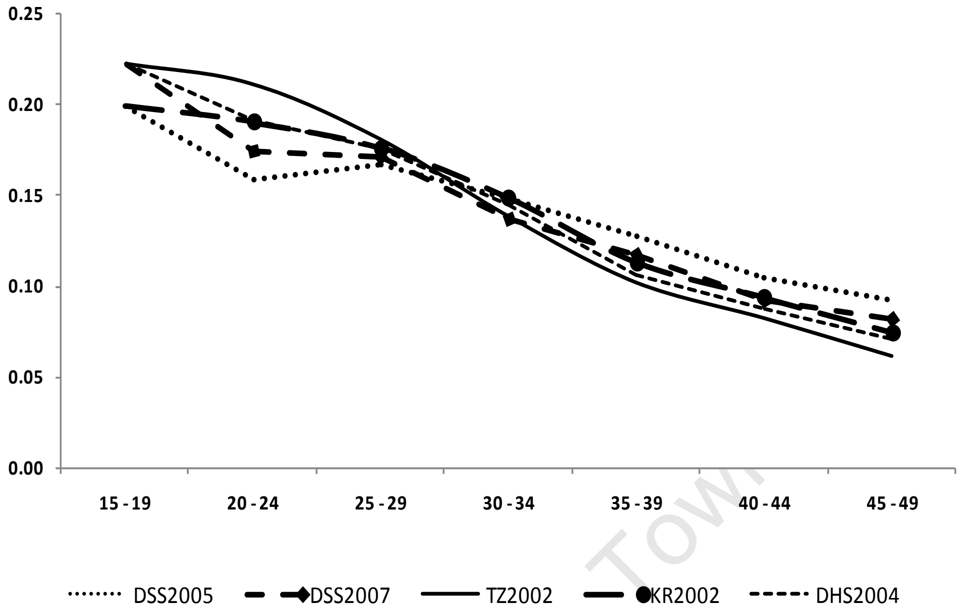
Table 2.4 Preference Indexes for Terminal Digits by Myers Blended Method

2005					
Terminal digit	**Population with terminal digit**	**Percent distribution**	**Blended population**	**Percent distribution**	**Deviation from 10 %**
0	2,613	14.50	173,613	15.33	5.33
1	1,773	9.90	105,095	9.28	0.72
2	1,862	10.30	106,786	9.43	0.57
3	1,987	11.00	119,830	10.58	0.58
4	1,640	9.10	94,630	8.35	1.65
5	2,419	13.40	165,729	14.63	4.63
6	1,422	7.90	85,638	7.56	2.44
7	1,544	8.60	102,075	9.01	0.99
8	1,355	7.50	87,471	7.72	2.28
9	1,379	7.70	91,955	8.12	1.88
Total	**17,994**		**1,132,822**		**21.07**
Myers' Blended					**10.53**

2.2.7 Age distribution of women of childbearing age

The age distribution of women of childbearing age (15-49) collected in the DSS (2005 and 2007) was assessed relative to the 2002 census and the 2004 Demographic and Health Survey (DHS). The aim was to assess reliability of Korogwe data for estimating age specific fertility rates and total fertility rates using both retrospective and prospective analysis. Figure 2.9 shows the per cent distribution of women of childbearing age in the 2002 census, 2004 DHS and the DSS (2005 and 2007). There are fewer women aged 20-24 in the DSS for both years and this could be due to out-migration as a result of marriage or employment reasons, or age misreporting or an undercount of the 20-24 age groups. The proportion of women under 25 years in the 2002 census is higher for the whole country than indicated from Korogwe and this difference could be due to variation in age composition for the whole country and for Korogwe district. It is not possible to explain whether there is an improvement in the coverage and reporting in the 2007 DSS compared to the 2005 DSS for the age groups below 25 years, due to the fact that a proportional increase in any quantity does not imply anything in particular. Generally, there are wider variations in age reporting for younger women for than to the older ones, in both the census and DSS, although both of them show a decline in the proportions of women with age. There were fewer older women in the 2007 DSS than in the 2005 DSS which could be brought about by the age distribution.

Figure 2.9 Distribution of women of child-bearing age for 2002 census, DHS 2004 and 2005-2007 DSS



2.2.8 Sex ratio

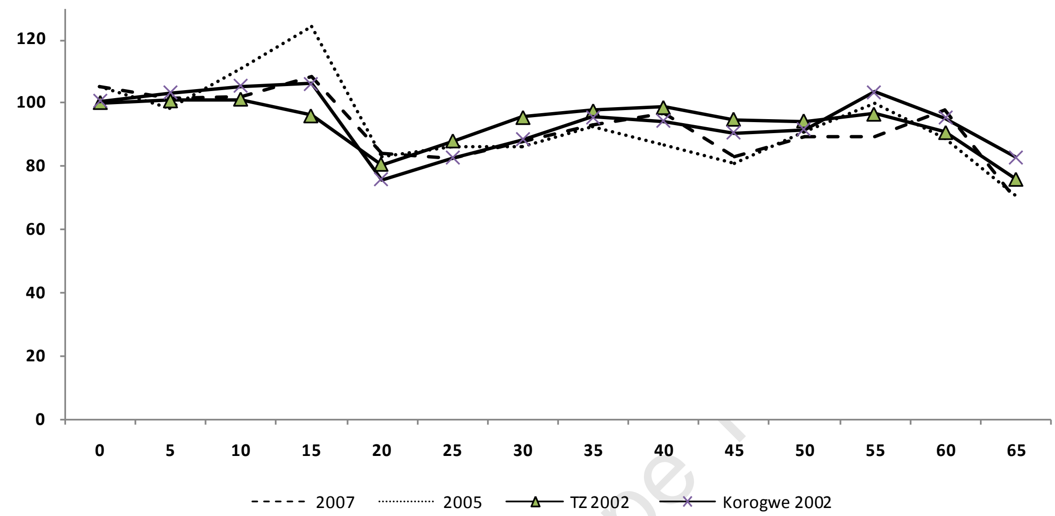
The sex ratio is defined as the ratio of males to females multiplied by 100 (Rowland 2003). The sex ratio at birth is usually greater for males than females (105 males per 100 females) as reported by Rowland (2003), although other data from Africa have shown a significantly lower sex ratio of 1.03 (Garenne 2002) as that of the world reported early. The sex ratio has been used in examining the equality between males and females in a society and is an important social indicator of the balance of the sexes in the population. Table 2.5 shows the overall sex ratio for 2005 and 2007 DSS site, and for Tanzania and Korogwe census 2002. The overall sex ratios in the DSS area, Korogwe district and nationally indicate more females than males.

Table 2.5 Overall sex ratio, DSS 2005 & DSS2007 and Tanzania 2002 census

	Sex ratio
Tanzania census 2002	95.6
Korogwe census 2002	96.3
DSS 2007	95.6
DSS 2005	97.6

The age patterns of the sex ratio in 2005 and 2007 are generally similar (Figure 2.10). In order to avoid the problem of age exaggeration at older age the computation of sex ratio was up to 65+. The sex ratio is higher for those aged 15-19 years in 2005 than those in the same age group in 2007 and 2002 census data for Korogwe. The national census data for 2002 shows a smaller number of males in this age group 15-19 years. The reasons for a high proportion of males among those aged 15-19 in 2005 might be due to a high rate of out-migration of females in need of jobs (e.g. house maids or bar maids) in cities and towns, or marriages. There is a drop in the 20-24 years for all the surveys which could be due to out-migration of men or mortality of men in this age group despite the latter being unlikely. Thereafter, the pattern was the same as expected, that, more females than males for those aged 20 years and older, since females outlive males.

Figure 2.10 Sex ratio for 2005, 2007, Korogwe district in 2002 and National 2002 census



2.2.10 Levels of education attained

Classification of education status in the study population shows that 4.6 per cent of males and 13.7 per cent of females above the age of 7 did not have any formal education in 2005. According to the national education policy (Tanzania), every child aged more than seven years should be enrolled at a formal school. In 2007, 4.6 per cent of males and 15.7 per cent of females did not have formal education.

Table 2.6 Education level by sex among people aged above 7 years, in 2005 and 2007

	2005		2007	
	Male	**Female**	**Male**	**Female**
No formal Education	362 (4.6)	1,095 (13.7)	398 (4.6)	1,395 (15.7)
Schooling	3,944 (50.4)	3,589 (47.7)	4,339 (49.8)	3,946 (44.4)
Completed Primary	3,118 (39.9)	3,041 (38.1)	3,504 (40.2)	3,228 (36.3)
Completed Secondary & advanced	401 (5.1)	258 (4.2)	476 (5.5)	313 (3.5)
Total	7,825	7,983	8717	8,882

The high proportion of females with no formal education in 2007 might be partially associated with early marriage of girls (United Republic of Tanzania 1971) and out-migration. Furthermore, it might also be associated with the delay of females to enrol in formal schools as illustrated in the Table 2.6 whereby the proportion of people who were still in studying in year 2007 was higher for females by 44.4 per cent while the males had a significantly higher mean years of schooling (6.4 years) than females (6.0 year), as shown in Figure 2.11 (p=0.001)

Figure 2.11 Mean years of schooling males and females, in 2007

2.2.11 Dependency ratio

The dependency ratio is the number of individuals aged below 15 or above 64 divided by the number of individuals aged 15 to 64, expressed as a percentage. The dependency ratio in 2007 was 92 per cent. The youth dependency ratio and the old age dependency ratio were 81 per cent and 11 per cent, respectively. This suggested that for every 100 individuals aged 15-64 years, 92 individuals need to be looked after. This ratio is higher than that reported at national level which is 84 per cent in 2006 (Tanzania 2006; The World Bank 2006).

2.2.12 Socio-economic status of the study population

During year 2007, a social and economic survey was conducted, focusing on the ownership of property, bicycles, farms, TVs and radio: occupations of head of household and spouse; access to sanitation and source of water, and use of cooking fuel. Other information collected pertain to housing characteristics; number of rooms, and building materials. In assessing the social economic status (SES) of the study population, a SES Index is often used and is produced using Principal Component Analysis (PCA). According to Seema and Kumaranayake (2006) "this is used to reduce the number of variables in the data set into a smaller number of dimensions". Both quantitative (continuous) and quality (categorical) variables are included in a PCA model. Before being included in the model in relation to the present study, all categorical variables are recorded as binary variables. This was due to the fact that data in the categorical data were not suitable for PCA. Then descriptive analyses were carried out for all variables to obtain the frequencies and means that could help in exploring the nature of the data and in identifying missing values (Cortinovis, Vella and Ndiku 1993; Montgomery, Gragnolati, Burke *et al.* 2000). The variables and the index score of the PCA are presented in Table 2.7. A total of 5,422 households were included in the determination of the SES index.

The indicators of durable asset ownership revealed that the majority of households owned a radio while a few owned mobile phones. The majority of households kept chickens for household subsistence. A greater proportion had access to toilets within their residence. Most households own a piece of land with variations in size ranging between one and more than 4 acres. Firewood seemed to be the main source of lighting while piped water was the main source of water for households. In Table 2.9, positive index scores are associated with higher social economic status of households.

The social economic status scores were divided into five categorical groups. The overall mean-economic score by quintile were as follows: poorest (-1.64), second (-1.05), middle (-0.41), fourth (0.66) and richest (2.68). The mean difference is higher between the richest and the next richest group than any other adjoining quintile. It is observed that ownership of radios, bicycles and mobile phones increased by socio-economic groups. The proportion of households reported as having domestic animals such as, donkeys, goats, sheep and chickens, decreased with socio-economic groups except for cattle and pigs. The availability of toilets in the dwellings did not show a significant difference in relation to variations with the social economic of particular groups. It was noted that none in the poorest or second poorest group had reported using electricity as the source of lighting and cooking energy. The mean social economic statuses by village varied from -1.073 to 1.566. All the villages located in the highland strata (Magundi, Kwamhanya, Vugili and Kwamasimba), and one village in lowland rural strata (Mng'aza), fell in the poorest category entirely. On the other hand, the richest villages were located in the lowland urban area, namely Mtonga and Masuguru.

2.3 CONCLUSION

Efforts to improve the quality and usability of DSS data are evidently shown by the reduction in the proportion of people who did not report their date and month of birth (missing entity) from the DSS 2005 and 2007. Cross-validations were done to check the consistency of the DSS data with other sources. All the indices used to validate the quality of the data in terms of age and sex reporting indicate that the DSS data is of acceptable and usable quality. The proportion of men completing higher education is found to be significantly higher than that of women in both the

2005 and 2007 DSS. Men are found to have a higher mean of years spent in education compared to women. The reason for the low proportion of females with formal education might be associated with the national (Tanzanian) law which allows girls aged as young as 15 to be married with parental consent (United Republic of Tanzania 1971). The dependency ratio for Korogwe DSS (92 per cent) is found to be above national average (84 per cent) in 2007. This could be explained by the out-migration of the economically active people relative to the number of their dependants.

Table 2.7 Ownership of durable assets and housing characteristics by means SES quintile

Variable Description	Mean	Index score	Poorest	Second	Middle	Fourth	Richest
Ownership of durable asset							
Radio	0.36	1.22	0.15	0.16	0.2	0.23	0.26
Bicycle	0.73	0.42	0.04	0.09	0.21	0.28	0.37
Mobile phone	0.24	2.16	0	0.02	0.09	0.25	0.64
Domestic animals							
Cows	0.12	0.45	0.16	0.18	0.17	0.21	0.28
Donkey	0	-0.48	0.47	0.26	0.05	0.05	0.16
Goats	0.17	-0.51	0.27	0.2	0.21	0.19	0.13
Sheep	0.02	-0.6	0.32	0.19	0.18	0.18	0.13
Chickens	0.66	-0.29	0.26	0.21	0.19	0.18	0.17
Pigs	0.03	0	0.31	0.17	0.12	0.17	0.23
Housing and Sanitation facility							
Toilets	1	0.01	0.2	0.2	0.2	0.2	0.2
Wall material of toilet- brick	0.35	2.01	0	0.02	0.13	0.34	0.51
Wall material of house –brick	0.46	1.32	0.02	0.09	0.22	0.29	0.38
Sources of Lighting							
Electricity	0.07	4.59	-	-	0	0.02	0.97
Kerosene lamp with glass	0.19	2.07	-	0	0.05	0.37	0.58
Kerosene lamp without glass	0.74	-0.95	0.27	0.27	0.26	0.17	0.03
Sources of Cooking							
Electricity	0.01	2.3	-	-	0.03	0.24	0.74
Woods	0.87	-0.65	0.23	0.23	0.23	0.22	0.09
Other	0.12	4.46	-	-	-	0.02	0.98
Source of water supply							
Piped	0.59	0.84	0	0.2	0.24	0.26	0.3
Open well	0.11	-1.3	0.49	0.22	0.16	0.1	0.03
River	0.28	-1.13	0.49	0.19	0.14	0.11	0.08
Others	0.02	-1.46	0.45	0.35	0.13	0.04	0.03
Ownership of land							
One acre	0.5	0.26	0.15	0.19	0.22	0.22	0.23
Three acres	0.35	-0.56	0.31	0.23	0.17	0.16	0.14
At least four acres	0.15	0.41	0.14	0.17	0.2	0.23	0.26

CHAPTER 3: MORTALITY LEVELS AND CAUSES OF DEATH

3.1 INTRODUCTION

Information on mortality levels and causes of death is important for the development of national and district health policies regarding prevention and control of diseases. This information is routinely collected in Korogwe Demographic and Surveillance Site (DSS). An assessment of mortality levels and causes of deaths in the study site was done using longitudinal analysis of data collected on deaths from household visits in each round. Furthermore, verbal autopsy questionnaires were administered to the parents or close relatives (next of kin) of the deceased in households that experienced a death in order to ascertain the causes of death.

3.2 METHODOLOGY

3.2.1 Mortality rates

Vital events pertaining to all members of the household were recorded in each round of the DSS. These routinely collected data were used to determine deaths that occurred in the household since the previous visit. The information collected on individuals in the study site was stored in an electronic database known as the Household Registration System (HRS) programme (Phillips, MacLeod and Pence 2000) provided by Population Council (Population Council 2005). For analysis, the data were converted to STATA programme format. In order to obtain the age specific mortality rates, the first step was to calculate the numerator (number of deaths) and the denominator as the Person Years Lived (PYL) from 1 January 2006 to 31 December 2007. The person-years of exposure are defined as the contribution of time lived by each member in a household from the beginning of the follow-up period to the point when an event (death) occurred or the date of the next round of the survey.

The variables in the dataset have a unique identification number assigned to each individual, the date of birth, sex, the date enrolled in the DSS and date of death of the deceased persons. The PYL for each individual was calculated using the survival method. The data were firstly declared in the STATA memory using the *stset* STATA commands, so that the programme can run the data in the survival analysis mode. The variables declared in STATA memory were: individual unique identification number, date of birth, date of enrolled in the DSS, and the date of death. The age was categorized into the following age groups; 0, 1-4, 5-9, 10-14, 15-19….80-84, 85+. The PYL and number of deaths by age group were produced using the *strate* STATA command for each sex and age group. The age-specific mortality rates were calculated using the equation below.

$$_{n}M_{x} = {_n}D_{x} / {_n}PYL_{x}$$

Where: $_nM_x$=Mortality rates

$_nD_x$= Number of deaths in the age range x to x+n

$_nPYL_x$=Number of person-years lived in the age range x to x+n

Mortality levels among resident and migrant populations were estimated. Separate analysis was done to find out whether there was a significant difference in death rates between the two groups. In this context a resident was defined as a member of a household who normally lives at the same bounded structure as the household while a non resident member does not. Migration was defined as the change in residency recorded at 4-monthly visits. The migrants were assumed to be exposed to the same age-specific mortality rates as the permanent residents. In addition, the level of mortality among urban and rural areas by age was also estimated. Deaths with missing age were excluded from further analysis.

3.2.2 Life tables

Abridged life-tables for the population of the Korogwe DSS site for the period of 2006-2007 have been constructed for males and females. A hypothetical cohort (radix) of 1,000 live births was considered. We use observed age-specific central deaths ($_nM_x$) as estimates of the life table death rate ($_nm_x$) to obtain the probability of dying in the interval.

$$_{n}q_{x} = \frac{n \times {_n}m_{x}}{1 + (n - {_n}a_{x})\,{_n}m_{x}}$$

Where $_na_x$ = Mean number of person-years lived in the interval by those dying in the interval

n= Interval

$_nm_x$=Death rates

The total number of years lived in the interval was obtained as follows:

$$_{n}L_{x} = n \times l_{x+n} + {_n}a_{x} \times {_n}d_{x}$$

Where: l_{x+n} = Number of survivors to age x in the cohort

$_nd_x$ = Number of deaths in the cohort between ages x and x + n

The total number of person years lived above age x (T_x) and the expectation of life at age x were obtained using the formulae below

$$T_x = \sum_{a}^{\infty} {}_nL_a$$

$$e_x = T_x / l_x$$

With the exception of the youngest and oldest ages, it is assumed that people dying in the interval will have lived half way through that interval i.e. ${}_na_x = n/2$. For age groups 0 - 1 and 1–4 years, we used the ${}_na_x$ values from Coale and Demeny (Coale, Demeny and Vaughan 1983),were used as shown in Table 3.4. The use of these values was based on the absence of other information for calculating mortality for very young ages. For the open-ended interval, the probability of dying is 1. The open age interval includes ages greater or equal to 85 years, closed by letting ${}_nL_{85}$ equal the ratio of l_{85} to ${}_\infty M_{85}$. The calculated value for ${}_1m_0$ for males is 0.063 and for females is 0.052 among non-migrant population of Korogwe DSS site.

Table 3. Values of ${}_na_x$ for use below age 5.

	Males	Females
Values of ${}_1a_0$		
If ${}_1m_0 \geq 0.107$	0.33	0.35
If ${}_1m_0 < 0.107$	$0.045 + 2.684 * {}_1m_0$	$0.053 + 2.800 * {}_1m_0$
Values of ${}_4a_1$		
If ${}_1m_0 > 0.107$	1.352	1.361
If ${}_1m_0 < 0.107$	$1.651 - 2.816 * {}_1m_0$	$1.522 - 1.518 * {}_1m_0$

Source: (Preston, Heuveline and Guillot 2001a)

The last age group (85 and above) has an open-ended interval and requires specific assumptions. The probability of death in this group (${}_\omega q_{85}$) is equal to 1, since everyone in that age group must ultimately die. The life expectancy at the open-ended interval was calculated as the reciprocal of the mortality rate in the open-ended interval, thus is

$$e_\omega = 1 / {}_\omega m_x$$

The analyses have been also improved by an attempted to fit the INDEPTH model life table pattern 2, given that the tables include HIV mortality and is closer to the situation of HIV epidemic in Tanzania. The value of α and β were derived from the Brass relationship using the information of under-five mortality data from Korogwe DSS site.

$$logit(l_1) = \propto + \beta ogit(l_{sl})$$

The use of these values of α and β together with Korogwe and standard (Pattern 2) mortality in formula below provided the estimated survivorship function.

$$l_x = \frac{1}{\gamma_x(1 + e^{2(\alpha+\beta \ln\left(\frac{1-l_{sx}}{l_{sx}}\right))})}$$

Whereas $\gamma_x$is the factor that corrects for the upward and downward tilt of the derived survivorship function(INDEPTH Network 2004).

3.2.3 Evaluation of causes of death using verbal autopsy questionnaire

Verbal autopsy (VA) is an indirect method of ascertaining causes of death based on the information on symptoms and circumstance which occurred before death as described by well-informed close relatives or guardians of the deceased. This method has been useful in estimating causes of deaths among children, adult and maternal related mortality. Despite technical problems associated with VA such as low sensitivity and moderate specificity for identifying deaths especially malaria(Anker, Black, Coldham *et al.* 1999; Snow, Armstrong, Forster *et al.* 1992), the method has been adopted and proved to be useful in studies conducted under different settings including in DSS sites within the INDEPTH network (Abdullah, Adazu, Masanja *et al.* 2007; Adjuik, Smith, Clark *et al.* 2006) and other projects (Kamugisha, Gesase, Mlwilo *et al.* 2007; Kitange, Machibya, Black *et al.* 1996).

Data collection on causes of deaths involved households that lost one or more members, which were identified during follow-up after initiation of the DSS. Further, identification of such households has been going on during the routine activities of the DSS. Verbal autopsy questionnaires were administered to parents/close relatives of the deceased by trained fieldworkers. Two physicians independently reviewed the responses and if the results were discordant, a third physician according to the standard protocol further reviewed them (Chandramohan, Maude, Rodrigues *et al.* 1998; Chandramohan, Rodrigues, Maude *et al.* 1998; Kahn, Tollman, Garenne *et al.* 2000). The data collected were double entered in Microsoft Access database by data entries, with consistency checks followed by validation and cleaning by data manager and statistician.

3.3 RESULTS AND DISCUSSION

3.3.1 Direct estimation of mortality

A total of 496 deaths occurred in the areas during the period under consideration. Of these, 464 were permanent residents (Table 3.1). In both groups more deaths were recorded in males than in females, although the difference was not statistically significant.

During the period under study, a total of 43,872.9 person years lived were observed among the study population. Likewise, a total 496 deaths and 58,182.4 person years lived were observed among the population among whom were the migrants. A crude death rate among the population who did not migrate during the study period was 10.5 per 1,000 person years lived, indicating the overall level of mortality. Overall, mortality rates among the population who did not migrate, for males and females were 11.2 and 9.8 per 1,000 person-years, respectively.

Deaths of infants (0-11 months) and children less than five years old (<5 years) accounted for 22.6 per cent of all deaths among the population that did not migrate during the period under the study. Adult deaths for those aged between 15 and 60 years accounted for 40.4 per cent of the same population (Table 3.2). There was no difference in the proportion of deaths among the population that did not migrate and the one that migrated in for adults aged 15-60 years, children <5 years and adults aged 60 years and above.

Table 3.1 Crude death rate by sex for resident population and population with migrants

	Population resident	Population with migrants
Overall		
Person years lived (PYL)	43,872.9	58,182.4
Deaths	464	496
Male		
Person years lived (PYL)	21,910.5	28,494.8
Deaths	247	258
Female		
Person years lived (PYL)	21,962.4	29,687.6
Deaths	217	238
Crude death rate		
Overall	10.5	8.5
Male	11.3	9.1
Female	9.9	8.0

Table 3.2 Percentage of deaths by sex among population with and without migrants

	Resident population			Population with migrants		
	Male	***Female***	***Total***	***Male***	***Female***	***Total***
<5 yrs (Under five children)	56 (23.9)	50 (23.0)	104 (22.6)	60 (23.3)	52 (21.8)	112 (22.6)
Adult aged 15-60 yrs	94 (37.6)	94 (43.7)	186 (40.4)	101 (39.1)	105 (44.1)	206 (41.5)
Adult aged 60+ yrs	82 (38.1)	64 (29.8)	146 (31.7)	82 (31.8)	71 (29.8)	153 (30.8)

3.3.2 Age–specific mortality rates by sex

The distribution of deaths and their corresponding death rates (per 1,000 person-years) by age at death and sex were shown in Table 3.3. Male infant mortality rate is 63.9 deaths per 1,000 live births, and that of females is 52.0 deaths per 1,000 live births. Meanwhile, the central mortality rate lay between 5 and 10 years of age ($_5m_5$) is 1.9 and 3.4 per 1,000 for males and females, respectively.

Mortality rates for both sexes, dropped at age groups 10-14 and 15-19 years, as shown in Figure 3.1 and 3.2. Figures 3.1 and 3.2 presented in log scale shows a comparison of age-specific mortality rates by sex. By comparison, 5-9 and 10-14 years males have a higher mortality rate than that for females. In the mid twenties, the mortality of males was slightly higher than that of females. After age 40 and above years, mortality was higher than that of females. Figure 3.3 shows the age-specific mortality rate among the population who did not migrate and those who migrated. The mortality rate is higher among the population who did not migrate during the period than to the population who migrated. Possibly the difference could be associated with data issues.

3.3.3 Age–specific mortality rates by place of residence

Figure 3.4 shows age specific mortality rates by place of residence among the population who did not migrate. The mortality rates were higher in rural areas among those aged below 25 years were high in the rural than in the urban areas of the DSS site. This could be due to differences in environmental exposure to the risk of various infections as well as coverage of public health interventions. Disparities in under-twenty five years mortality between urban and rural areas may be reflective of the variations in socioeconomic development between the two areas. Basic services such as health care tend to be more accessible in urban areas. On the one hand, mortality for adolescents in rural areas is higher than in urban areas, probably due to lower ages at marriages since fewer years were spent in school, and early onset of sexual activity, which exposes them to the risk of HIV/AIDS. However, from the mid twenties to mid-forties, urban mortality is higher than mortality in rural areas. The difference observed might have happened by chance due to small sample size or probably due to higher HIV prevalence in urban areas. In addition, most of the productive and reproductive age groups were mainly in urban areas. At age 60 years and above, urban areas had a higher mortality.

Table 3.3 Mortality rates by age group among males and females for the resident population and population with migrants, Korogwe DSS, 2005-7

Age Group	Resident Population						Population with Migrants					
	Male			Female			Male			Female		
	Deaths	Person Years Lived	Mortality per 1000	Deaths	Person Years Lived	Mortality per 1000	Deaths	Person Years Lived	Mortality per 1000	Deaths	Person Years Lived	Mortality per 1000
< 1	37	581.9	63.6	30	577.1	52.0	38	778.8	48.8	31	733.1	42.3
1-4	19	2565.4	7.4	20	2412.4	8.3	22	3482.6	6.3	21	3366.8	6.2
5-9	11	3235.3	3.4	6	3134.2	1.9	11	3986.7	2.8	7	4002.2	1.7
10-14	4	3243.0	1.2	3	2929.8	1.0	4	3744.8	1.1	3	3586.2	0.8
15-19	4	2359.5	1.7	2	1563.4	1.3	4	3344.4	1.2	2	2947.7	0.7
20-24	3	1108.6	2.7	5	1160.1	4.3	3	2045.8	1.5	6	2326.5	2.6
25-29	12	1177.4	10.2	11	1410.0	7.8	12	1816.5	6.6	12	2245.4	5.3
30-34	18	1284.1	14.0	16	1461.4	10.9	21	1723.4	12.2	19	1955.8	9.7
35-39	18	1152.0	15.6	17	1354.0	12.6	17	1482.3	11.5	19	1620.6	11.7
40-44	10	1081.8	9.2	15	1168.1	12.8	13	1292.7	10.1	16	1351.7	11.8
45-49	9	796.8	11.3	12	995.4	12.1	9	961.3	9.4	14	1137.1	12.3
50-54	11	718.1	15.3	8	847.7	9.4	11	823.8	13.4	8	960.9	8.3
55-59	9	637.9	14.1	8	783.4	10.2	11	746.1	14.7	9	870.8	10.3
60-64	10	537.1	18.6	7	577.4	12.1	10	636.5	15.7	7	657.0	10.7
65-69	9	439.3	20.5	5	516.8	9.7	9	505.6	17.8	6	588.8	10.2
70-74	22	432.0	50.9	13	485.1	26.8	22	489.7	44.9	15	592.9	25.3
75-79	13	289.3	44.9	6	201.3	29.8	13	322.1	40.4	6	263.7	22.8
80-84	9	133.8	67.3	11	193.4	56.9	9	151.2	59.5	12	230.5	52.1
85+	19	137.1	138.6	22	191.3	115.0	19	160.4	118.4	25	249.9	100.0
Total	247	21910.5		217	21962.4		258	28494.8		238	29687.6	

Figure 3.1 Observered mortality among resident population by sex, from baseline survey - 2007, in Korogwe

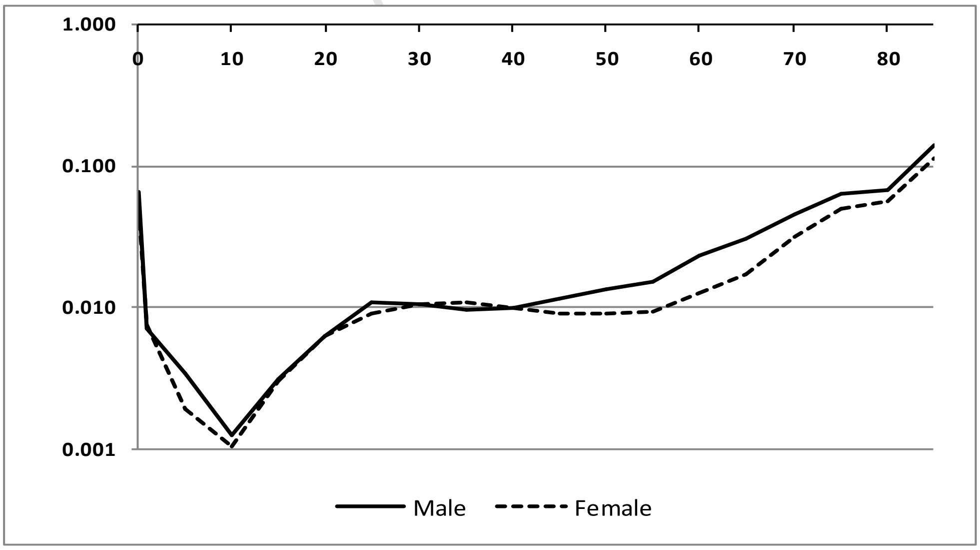


Figure 3.2 Observered mortality among population with migrants by sex, from baseline survey - 2007, in Korogwe DSS

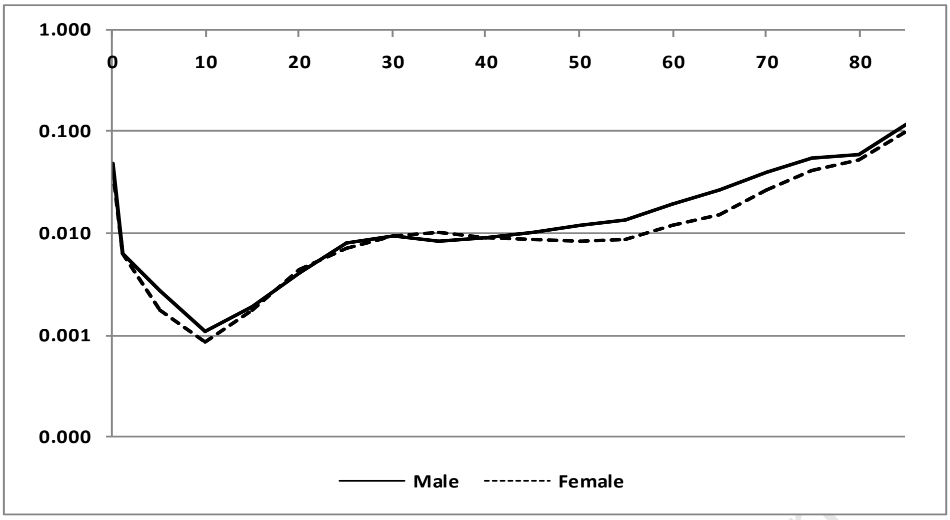


Figure 3.3 Observered mortality among population with and without migrants from baseline survey - 2007, in Korogwe

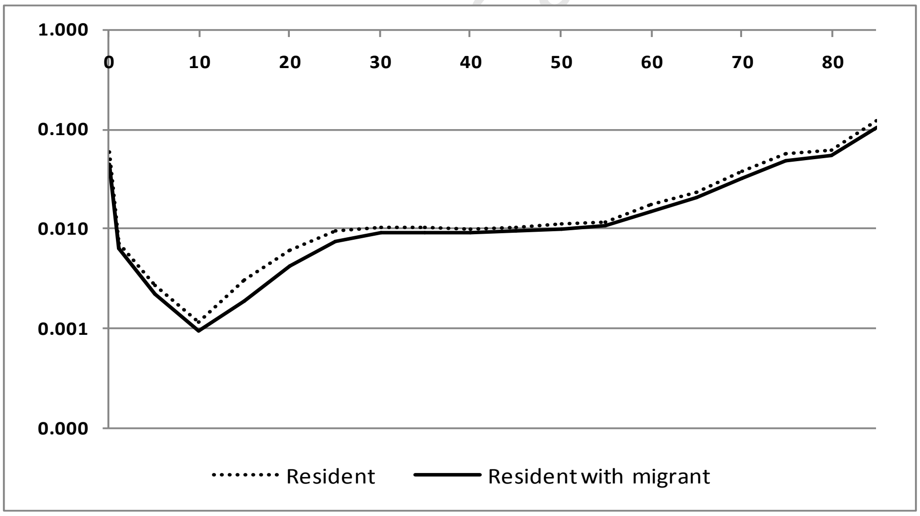
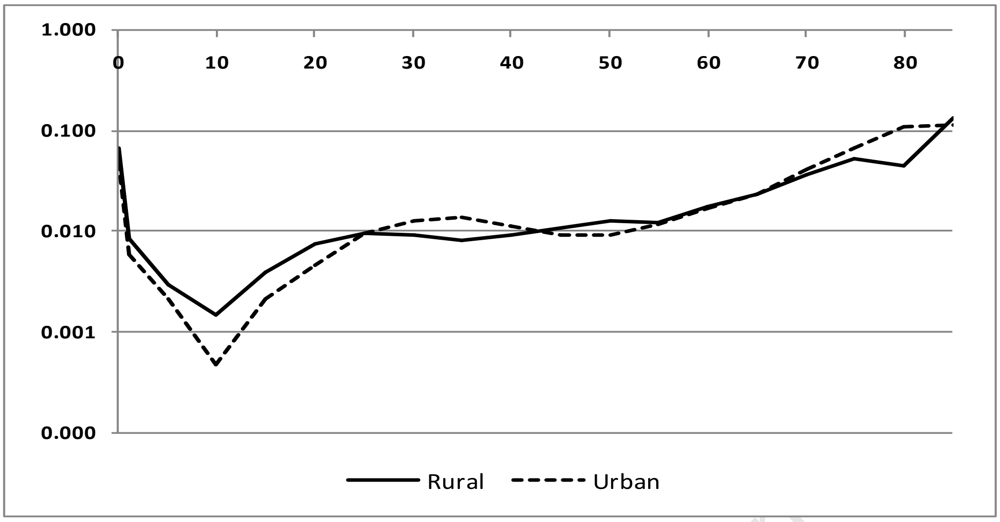


Figure 3.4 ***Age-specific mortality rates among urban and rural residents, in Korogwe DSS site 2007***



3.3.4 Patterns and level of mortality from other DSS sites in Tanzania

The data from the other DSS sites in Tanzania (Table 3.4) referring to a decade ago indicates that the under five-mortality we calculated was low in Korogwe DSS. This might be due to the fact that the data for other sites refer to a decade ago whilst the one for Korogwe is quite recent so the different might be a time factor. Under-five Mortality Rate (U5MR) was quite high in the mid to late 1990's due to the higher incidence of diseases. In recent years, there has been a dramatic decrease in the prevalence of diseases such as malaria (United Nations Development Programme 2009) which is the first ranked among the top most cause of death in children in Tanzania (Ministry of Health 2004).

Table 3.4 ***Mortality rates in the population and under five mortality (U5MR) in DSS sites***

	Total PYL	Total Deaths	Crude Mortality Rates/1000	PYL <5 years	Total Deaths <5 yrs	Crude death rate/1000 < 5yrs
Korogwe (2006 -2007)*	43872.9	464	10.58	6136.8	106	17.3
DSM (1995 -1999)**	354842.0	4515	12.72	49109.0	1246	25.4
Hai (1995 -1999)**	746865.0	8106	10.85	106807.0	1876	17.6
Ifakara (1997 -1999)**	159639.0	1812	11.35	25917.0	746	28.8
Morogoro (1995 -1999)**	538284.0	9548	17.74	70037.0	2772	39.6
Rufiji (1999)**	70563.0	1060	15.02	11518.0	376	32.6

Source: * Authors calculation from raw data files
** Extracted from (INDEPTH Network 2002)

The Under five morality rate (U5MR) in Tanzania showed a declining in trend between 1960 and 2000, as estimated from census and DHS data (Hill and Amouzou 2006). Also, a 24 per cent drop in under-five mortality rate was reported in the country between 2000 and 2004(Masanja, Savigny, Smithson *et al.* 2008; United Republic of Tanzania 2006). The under-five mortality rate obtained from Korogwe DSS site was low for both males and females. This may be due to two possible explanations. The first reason might be the under reporting of deaths which results in underestimation of child deaths. The second possible reason could be the gain in the well-being of the study population resulting from improvements in public health services. Thirty-seven per cent of the population in study sites reside in urban settings and these areas are in the proximity of the District Hospital, namely Magunga. Meanwhile, in rural areas where there were no health facilities the project launched a health post manned by Community Resources Person (CORPS) where early and prompt management of malaria within 24 hours is being done. Proximity to the health facility enables the resident to have easy access to health services.

It has been reported in a study on the burden of diseases (Adult Morbidity and Mortality Project-AMMP) conducted in other DSS sites from 1994-1999 that the infant mortality rates (IMR) ranged from 74 to 131 per 1,000 live births. Another study done in 1999-2002 found the IMR ranging from 65 to 116 per live births (Hemed 2004). Malaria in Tanzania is a major public health problem and it is ranked the top most cause of death among children under the age of five years old (Ministry of Health and Social Welfare 2008). Recently, studies have shown a significant decline in the prevalence rates of malaria (Kamugisha, Msangeni, Beale *et al.* 2008; Mmbando, Segeja, Msangeni *et al.* 2009; United Nations Development Programme 2009). This decline is associated mainly with malaria control intervention programmes such as mass distributions of free bed nets to pregnant women and children under five and use of intermittent preventive treatment during pregnancy (IPTp). The programme was aimed at having 60 percent of both pregnant women and children sleeping under mosquito bed nets by the end of 2007. Also, use of prophylaxis drug (intermittent preventive treatment) by pregnant women has been aimed at reducing the effects of malaria for pregnant women as well as improving their pregnancy outcomes (Ministry of Health and Social Welfare 2008)

Figures 3.5 and 3.6 show the ratios of age-specific mortality rates for both females and males from six DSS sites in Tanzania (INDEPTH Network 2002) compared to those obtained from Korogwe DSS. The ratios show a similar pattern for all the sites despite the Rufiji site having a higher ratio for infants in both figures. At the adult ages (above 75 years), Morogoro and Dar-es-salaam have high ratios compared to other DSS. This could be attributed to the data errors in reporting deaths at older ages as it was revealed from the life table (section 3.3.5) that more than 20 per cent of males and 30 per cent females were still alive at older age (85 years and above). This indicates the problem of either underreporting deaths or age exaggeration in older ages in the Korogwe DSS site. The lower mortality rates estimated from Korogwe compared to other DSS sites for the older ones, implying an even greater underestimate since it is well know that the DSS underestimate mortality at old age. This was also noted in section 3.3.6, the old age mortality from Korogwe were low by more than half of those of UNDP and WHO. Nevertheless, the observed general patterns provide some evidence of the reasonableness of the rates observed in Korogwe DSS site.

Figure 3.5 Ratios of observed age specific mortality rate for females in areas under DSS sites to Korogwe

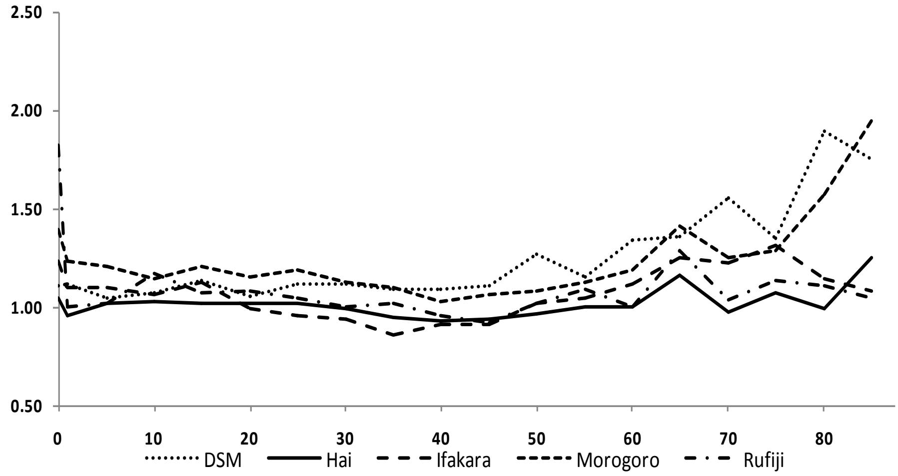
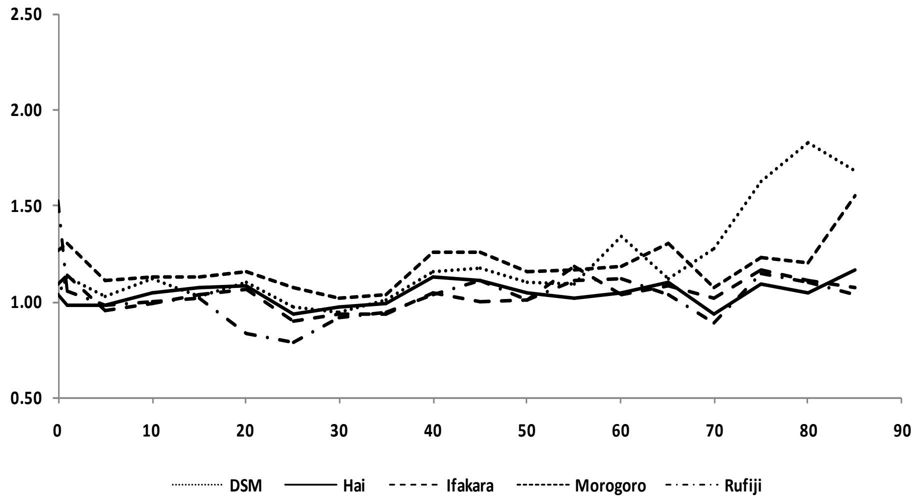


Figure 3.6 Ratios of observed age specific mortality rate for males in areas under DSS sites to Korogwe



3.3.5 Life table

Infant mortality ($_{1}q_{0}$) and under-five mortality ($_{5}q_{0}$), are used as measures of a population's well being by the Millennium Development Goals (MDGs), and these two rates were computed from the generated life table. The probability of a 15 years old dying between ages 15 and 60 years ($_{45}q_{15}$) for males and females was calculated from the life table. Furthermore, the life expectancy at birth for the population by sex has been computed from the same life table.

Table 3.5 and 3.6 show the abridged life tables for males and females from the Korogwe DSS site, for the period 2006 to 2007 among the non-migrant population. Females were observed to have higher survivorship than males particularly at the oldest age groups as shown in Figure 3.7. It was also noted from Table 3.5 and 3.6 that 20.1 per cent and 30.5 per cent of adults survived from birth to age 85+. These high values from Korogwe might be associated with the problem of under reporting of death at older ages, more detailed on the problems of under reporting of deaths are explained in section 3.3.6.

In the study population, the average number of years a person is expected to live from birth was estimated at 58.6 for males and 63.3 for females. The expectation of life at age 85 and above is 7.2 years for males and 8.7 years for females. These years of expectation of life at age 85 are too higher than that reported in the national life table (e_{85+} male=4.17 and female=4.12) estimated for Tanzania in 1999 (Lopez, Ahmad, Guillot *et al.* 2003). The above values of e_{85+} might be affected by under reporting of deaths, and/or due to over-reporting of age, either of which might positively contribute to the increase in life expectancy at birth. Table 3.8 and 3.9 shows the age specific life expectancy for DSS sites in Tanzania. All site life expectancy at age 1 is more than at age 0 which indicates a high level of infant mortality. In 1999 the life expectancy at Morogoro DSS site was noted to be low (Tables 3.8 and 3.9). For Rufiji DSS the life expectancy at birth has increased from 53 years in 1999 to 62.1 years in 2003 (Ministry of Health 2004).

Table 3.5 Males abridged life table among non-migrants population, 2006-2007

Age	$_na_x$	$_nq_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	0.216	0.06057	100,000	6,057	95,250	5,857,610	**58.6**
1-4	1.472	0.02908	93,943	2,732	368,867	5,762,360	**61.3**
5-9	2.500	0.01686	91,211	1,538	452,213	5,393,494	**59.1**
10-14	2.500	0.00615	89,674	551	446,991	4,941,281	**55.1**
15-19	2.500	0.00844	89,122	752	443,732	4,494,290	**50.4**
20-24	2.500	0.01344	88,370	1,188	438,882	4,050,558	**45.8**
25-29	2.500	0.04970	87,183	4,333	425,082	3,611,676	**41.4**
30-34	2.500	0.06771	82,850	5,610	400,225	3,186,594	**38.5**
35-39	2.500	0.07519	77,240	5,807	371,681	2,786,369	**36.1**
40-44	2.500	0.04517	71,433	3,227	349,096	2,414,688	**33.8**
45-49	2.500	0.05493	68,206	3,746	331,663	2,065,592	**30.3**
50-54	2.500	0.07377	64,459	4,755	310,410	1,733,930	**26.9**
55-59	2.500	0.06814	59,704	4,068	288,352	1,423,520	**23.8**
60-64	2.500	0.08895	55,636	4,949	265,809	1,135,168	**20.4**
65-69	2.500	0.09745	50,687	4,940	241,087	869,359	**17.2**
70-74	2.500	0.22585	45,748	10,332	202,908	628,272	**13.7**
75-79	2.500	0.20198	35,415	7,153	159,194	425,364	**12.0**
80-84	2.500	0.28796	28,262	8,138	120,964	266,170	**9.4**
85+	0.000	1.00000	20,124	20,124	145,206	145,206	**7.2**

Source: * Authors calculation from raw data files

Table 3.6 Female abridged life table among non-migrants population, 2006-07

Age	$_na_x$	$_nq_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	0.676	0.05112	100,000	5,112	98,341	6,332,435	**63.3**
1-4	1.443	0.03247	94,888	3,081	371,672	6,234,093	**65.7**
5-9	2.500	0.00953	91,806	875	456,845	5,862,421	**63.9**
10-14	2.500	0.00511	90,932	464	453,498	5,405,576	**59.4**
15-19	2.500	0.00638	90,467	577	450,895	4,952,078	**54.7**
20-24	2.500	0.02132	89,891	1,916	444,662	4,501,183	**50.1**
25-29	2.500	0.03826	87,974	3,366	431,456	4,056,521	**46.1**
30-34	2.500	0.05328	84,608	4,508	411,771	3,625,065	**42.8**
35-39	2.500	0.06087	80,100	4,875	388,312	3,213,294	**40.1**
40-44	2.500	0.06221	75,225	4,680	364,425	2,824,982	**37.6**
45-49	2.500	0.05851	70,545	4,128	342,406	2,460,557	**34.9**
50-54	2.500	0.04610	66,417	3,062	324,432	2,118,151	**31.9**
55-59	2.500	0.04979	63,356	3,154	308,892	1,793,719	**28.3**
60-64	2.500	0.05884	60,201	3,542	292,151	1,484,827	**24.7**
65-69	2.500	0.04723	56,659	2,676	276,606	1,192,675	**21.0**
70-74	2.500	0.12558	53,983	6,779	252,968	916,069	**17.0**
75-79	2.500	0.13867	47,204	6,546	219,656	663,101	**14.0**
80-84	2.500	0.24901	40,658	10,124	177,980	443,446	**10.9**
85+	0.000	1.00000	30,534	30,534	265,465	265,465	**8.7**

Source: * Authors calculation from raw data files

Figure 3.7 Survivorship for males and females in the study population (2006-2007)

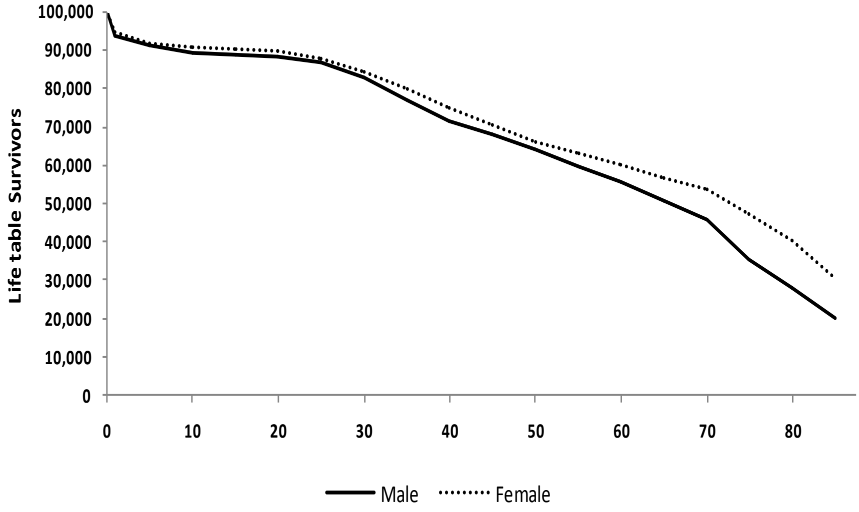


Table 3.7 Life expectancy for males in six DSS in Tanzania

Age Group	Korogwe (20006-07)	DSM (1995-99)	Hai (1995-99)	Ifakara (1997-99)	Morogoro (1995-99)	Rufiji (1998)
0	58.1	50.4	55.7	55.6	44.6	53.1
1-4	60.8	52.9	58.7	59.1	48.8	61.2
5-9	59.1	52.0	56.9	58.5	49.2	59.9
10-14	55.1	48.0	52.7	54.2	45.6	55.8
15-19	50.4	43.5	48.1	49.5	41.1	51.1
20-24	45.8	38.9	43.7	45.0	36.8	46.6
25-29	41.4	34.8	39.6	40.8	32.9	41.8
30-34	38.5	31.3	36.0	37.0	30.1	37.4
35-39	36.1	27.9	33.1	33.9	27.2	34.1
40-44	33.8	25.1	30.5	30.8	24.5	31.1
45-49	30.3	22.2	27.8	27.4	22.4	27.7
50-54	26.9	19.4	25.1	23.9	20.4	25.0
55-59	23.8	16.4	22.3	20.7	17.9	21.8
60-64	20.4	12.9	18.9	18.4	15.0	19.0
65-69	17.2	11.0	15.8	15.1	12.4	16.5
70-74	13.7	7.4	12.9	12.0	10.3	13.2
75-79	12.0	5.5	10.3	10.0	8.2	10.3
80-84	9.4	4.1	7.9	8.1	6.0	8.5
85+	7.2	3.2	5.4	6.3	3.6	6.7

Source: Authors calculation from raw data files and extracted from (INDEPTH Network 2002)

Table 3.8 Life expectancy for females in six DSS in Tanzania

Age Group	Korogwe (20006-07)	DSM (1995-99)	Hai (1995-99)	Ifakara (1997-99)	Morogoro (1995-99)	Rufiji (1998)
0	62.9	49.4	62.2	57.9	46.2	51.8
1-4	65.3	52.0	65.0	62.5	50.9	61.7
5-9	63.9	51.1	63.3	61.9	51.1	60.3
10-14	59.4	46.8	59.0	57.9	47.5	55.9
15-19	54.7	42.1	54.3	53.4	43.0	51.7
20-24	50.1	37.7	49.7	49.1	38.9	47.2
25-29	46.1	33.7	45.9	45.0	35.5	43.6
30-34	42.8	30.9	42.7	41.4	33.4	40.7
35-39	40.1	28.5	39.9	38.0	31.4	37.9
40-44	37.6	26.0	36.8	34.1	29.3	35.4
45-49	34.9	23.3	33.5	30.4	26.3	32.2
50-54	31.9	20.3	29.9	26.6	23.2	28.5
55-59	28.3	17.7	26.0	22.8	19.7	24.9
60-64	24.7	14.3	22.3	19.2	16.3	21.6
65-69	21.0	11.7	18.5	15.9	13.1	17.8
70-74	17.0	8.3	15.0	12.6	10.3	15.0
75-79	14.0	7.1	11.7	10.6	7.8	12.1
80-84	10.9	4.2	8.6	9.0	4.8	9.6
85+	8.7	3.4	5.6	7.4	3.0	7.9

Source: Authors calculation from raw data files and extracted from (INDEPTH Network 2002)

3.3.6 Assessing the problems of undercount of death in Korogwe DSS

The life table for the Korogwe DSS can be compared with the estimated life tables for Tanzania in 2006 developed by the United Nations (World Population Prospects 2008) and WHO (World Health Organisation 2010), under the assumption that the rates of WHO and UN are not over-inflated. Figures 3.8 and 3.9 compare the level of age specific mortality observed from UN, WHO and Korogwe DSS site. In both figures Korogwe DSS had a low death rate across the age groups, except for males aged between 20 to 35 years. More severe cases of underreporting of deaths has been noted in adults aged above 40 years for both males and females which is of course consistent with the life expectancies and values of lx derived in section 3.3.5.

Figure 3.8 Mortality rates for males from UN, WHO and Korogwe life table (residents)

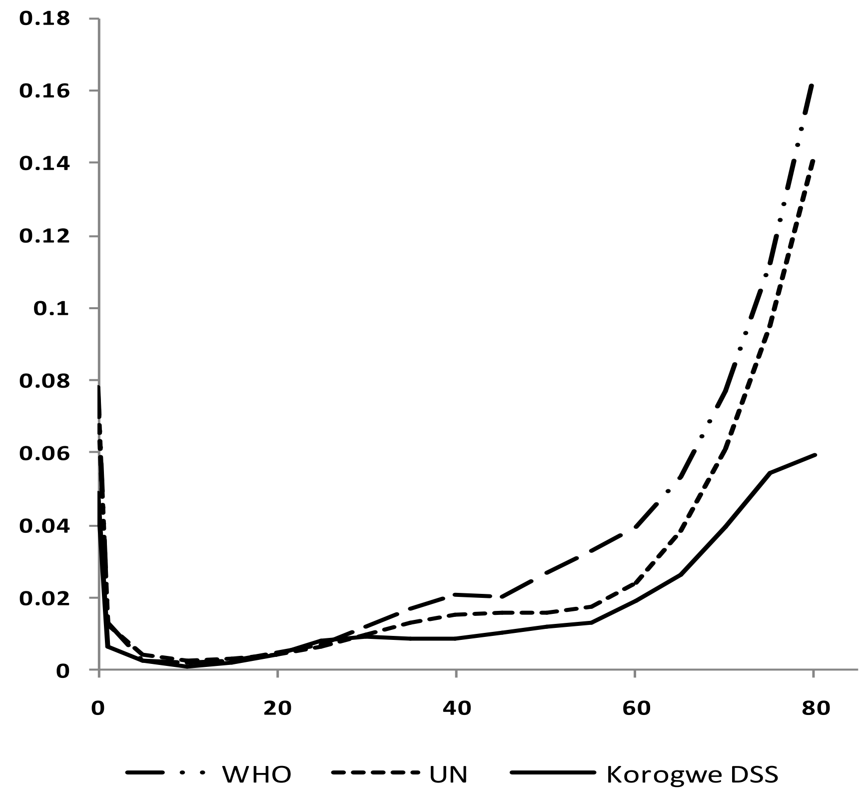


Figure 3.9 Mortality rates for females from UN, WHO and Korogwe life table (residents)

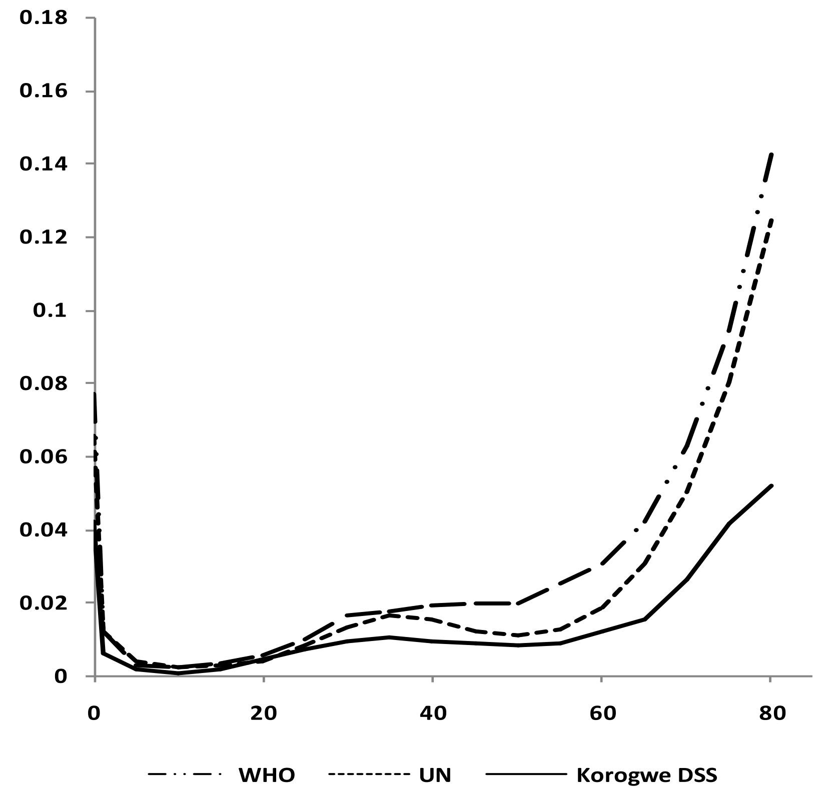


Figure 3.10 Ratios of mortality rates (Korogwe DSS: Tanzania 2006(WHO)) among males and females

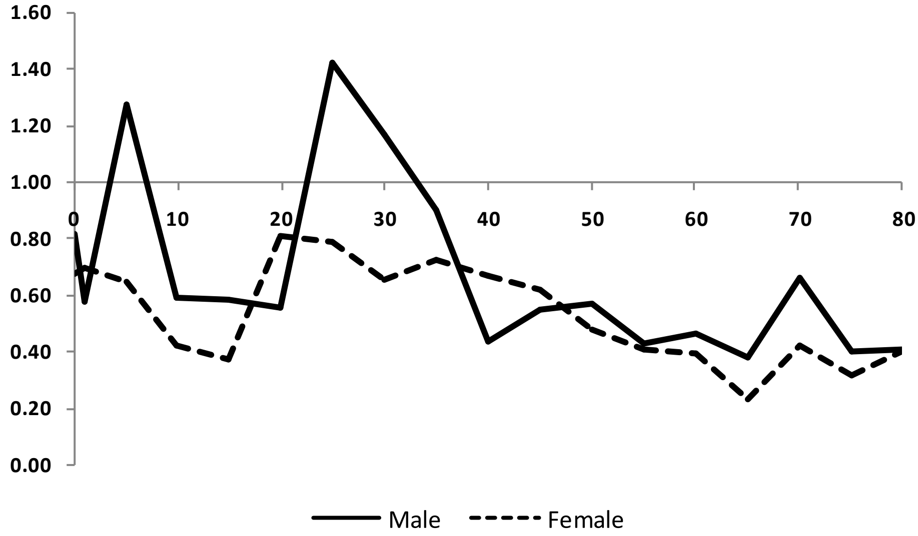


Figure 3.10 shows that there were more male deaths aged 5-9 and 25-34 years. The problem of under reporting appears to be worse in female than men. Table 3.10 shows the expected undercount obtained by comparing the observed mortality from Korogwe DSS with the WHO Tanzania 2006 life table. The under-reporting of deaths appears to get worse with age. By the age of 80 years, deaths were about 40 per cent less than they should be. The completeness of death in Korogwe DSS was generally much worse for women (55 per cent) than men (63 per cent).

Table 3.9 Mortality rates, ratios and undercount of deaths among males and females

	Male		Female		Deaths-Korogwe DSS 2007		Ratio	
Age goup	Tan 2006 (WHO)	Korogwe 2007	Tan 2006 (WHO)	Korogwe 2007	Male	Female	Male	Female
< 1	0.078	0.064	0.077	0.052	37	30	0.814	0.674
1-4	0.013	0.007	0.012	0.008	19	20	0.574	0.697
5-9	0.003	0.003	0.003	0.002	11	6	1.278	0.651
10-14	0.002	0.001	0.002	0.001	4	3	0.588	0.424
15-19	0.003	0.002	0.003	0.001	4	2	0.586	0.372
20-24	0.005	0.003	0.005	0.004	3	5	0.556	0.813
25-29	0.007	0.010	0.010	0.008	12	11	1.425	0.789
30-34	0.012	0.014	0.017	0.011	18	16	1.168	0.656
35-39	0.017	0.016	0.017	0.013	18	17	0.903	0.728
40-44	0.021	0.009	0.019	0.013	10	15	0.437	0.668
45-49	0.021	0.011	0.019	0.012	9	12	0.549	0.622
50-54	0.027	0.015	0.020	0.009	11	8	0.571	0.480
55-59	0.033	0.014	0.025	0.010	9	8	0.427	0.410
60-64	0.040	0.019	0.031	0.012	10	7	0.466	0.395
65-69	0.054	0.021	0.042	0.010	9	5	0.382	0.230
70-74	0.077	0.051	0.063	0.027	22	13	0.660	0.425
75-79	0.112	0.045	0.095	0.030	13	6	0.400	0.315
80-84	0.166	0.067	0.143	0.057	9	11	0.406	0.399
Total					228	195		
		Completeness of death					63%	55%

3.3.7 Comparison of ${}_nq_x$s from Korogwe life table and North model life table

The life table obtained as shown in Table 3.5 was matched with Coale-Demeny model life tables. The matching was based on the age where range of AIDS mortality is minimal (Reniers, Araya and Sanders 2006). The aim of matching empirical life table with Coale-Demeny model life table was to assess the impact of AIDS mortality on the study site based on the recorded deaths. The North model life table represents non-AIDS mortality. The North model life table was used in this case because of the lack of evidence on the mortality pattern in Korogwe DSS site and it fit well the data. Furthermore, the North model life table represents a population with higher under-five mortality (United Nations 1983a). The parameter used for selecting a fit, or matching life table from North model was the probability of dying between ages 10 and 15 (${}_5q_{10}$). The selection of this age band was based on the assumption that AIDS mortality is low in this age group and it is not likely to be affected by age misreporting.

The values of ${}_5q_{10}$ from the life table for both females and males are 0.005 and 0.0061 respectively. The matching was obtained at level 20.6 of North model life table for females and males after interpolation process. The Figure 3.11 and 3.12: below clearly show humps suggestive of HIV/AIDS mortality in females aged between 15-60 years and males aged 10-70 years. The observed lower mortality levels for both males and females above 70 years might be due to the under-reporting of deaths in older ages or the effect of age misreporting and exaggeration in this age group can prompt one to assume that AIDS mortality is not significant above age.

Figure 3.11 Probability of dying for males in both Korogwe life table and NMLT level 20.6

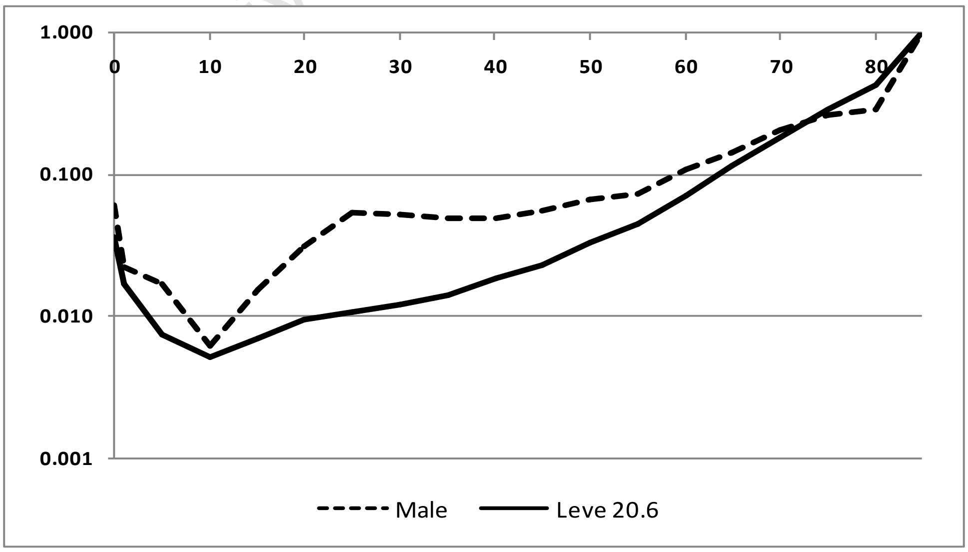


Figure 3.12 Probability of dying for females in both Korogwe life table and NMLT level 20.6

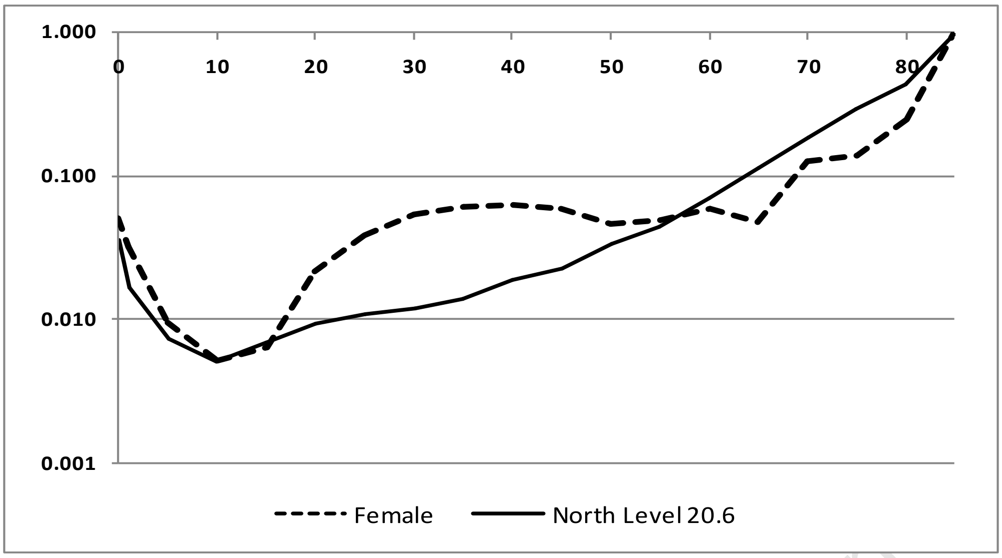


Table 3.10 below presents values of $_{5}q_{0}$, $_{30}q_{20}$ and $_{45}q_{15}$ for males and females obtained from Korogwe life table and the corresponding Coale-Demeny North model life table.

The probability of dying in adulthood ($_{30}q_{20}$) in Korogwe DSS for males is 2.0 times more than computed from non-AIDS life tables. Likewise, the probability of dying in adulthood among females was 2.4 times more than that the computed from non-AIDS life tables, indicating excess deaths due to AIDS in the early adult ages. The higher ratio of rates of females dying at adulthood observed than that of males is an indication of the effects of AIDS mortality affecting women at an early age in the life than men and this is consistent with other studies (Dorrington, Bourne, Bradshaw *et al.* 2001)

Table 3.10 Mortality levels for Korogwe life table and North model life table

	Male	Female	NMLT-Male	NMLT-Female	Ratio	
	(1)	(2)	(3)	(4)	(1)/(3)	(2)/(4)
5q0	0.08789	0.08194	0.06239	0.05211	1.4	1.6
30q20	0.35979	0.32767	0.18104	0.13892	2.0	2.4
45q15	0.45214	0.40506	0.24464	0.18941	1.8	2.1

The values of α and β obtained after fitted Korogwe and INDEPTH mortality is shown in Table 3:11.

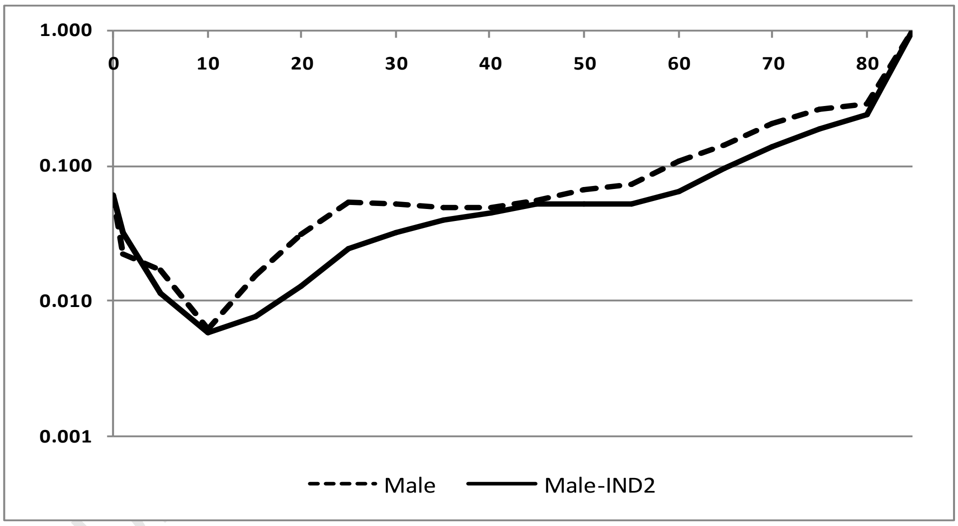
Table 3:10b Observed and INDEPTH estimates of the females and males survivorship function for Korogwe DSS

	FEMALE			MALE		
Age Group	Observed	Pattern 2	INDEPTH estmates	Observed	Pattern 2	INDEPTH estmates
0	100,000	100,000	100,000	100,000	100,000	100,000
1-4	94,888	92,240	94,749	93,943	92,160	93,833
5-9	91,806	87,660	91,452	91,211	87,340	90,857
10-14	90,932	86,170	90,352	89,674	85,600	89,819
15-19	90,467	85,390	89,771	89,122	84,710	89,293
20-24	89,891	84,260	88,923	88,370	83,540	88,604
25-29	87,974	81,740	87,004	87,183	81,580	87,458
30-34	84,608	77,200	83,450	82,850	77,880	85,304
35-39	80,100	72,050	79,265	77,240	73,150	82,544
40-44	75,225	67,460	75,395	71,433	67,650	79,285
45-49	70,545	63,570	72,008	68,206	61,800	75,713
50-54	66,417	59,710	68,547	64,459	55,660	71,793
55-59	63,356	56,230	65,339	59,704	50,060	68,013
60-64	60,201	52,290	61,602	55,636	45,070	64,436
65-69	56,659	47,590	56,996	50,687	38,890	60,254
70-74	53,983	41,620	50,902	45,748	32,210	54,472
75-79	47,204	33,790	42,476	35,415	24,630	46,931
80-84	40,658	26,040	33,623	28,262	17,300	38,175
85+	30,534	16,570	22,074	20,124	10,920	28,955
Alpha		-0.2				-0.4
Beta		1.0				1.0

Figure 3:13 shows that the probability of dying for females observed in Korogwe life table was slightly high among those aged 15-50 and lower among those less than 15 years old relative to the estimated from INDEPTH Pattern 2. In case of males (Figure 3:14) the excess mortality was noted on the Korogwe life table in relative to INDEPTH estimates among those aged above 10 years. In both case this is likely that reflects HIV/AIDS related excess mortality.

Figure 3.13: ***Probability of dying for females in both Korogwe life table and INDEPTH estimates***

Figure 3.14 ***Probability of dying for males in both Korogwe life table and INDEPTH estimates***



3.3.8 Causes of death based on verbal autopsy

A total of 333 verbal autopsy (VA) questionnaires were reviewed by a physician and the remaining causes of death of 127 deceased are still under review. The probable causes of deaths have been established in 84 per cent of the cases. Of all deaths assessed, 20.4 per cent involved children less than 5 years of age.

Table 3.11 Causes of death by sex for children under 5 years in Korogwe DSS site

	Males	Females	Total
Communicable diseases			
Severe or complicated malaria	22(61.1)	14(43.8)	36(52.9)
Other infectious diseases	9(25.0)	14(43.8)	23(33.8)
Non-Communicable diseases			
All non-communicable diseases	3(5.6)	1(3.1)	3(4.4)
Injuries			
Injuries	2(5.6)	1(3.1)	3(4.4)
Ill-defined			
Ill-defined	1(2.8)	2(6.8)	3(4.4)
Total	36(100)	32(100)	68(100)

Communicable diseases accounted for 88.7 per cent of all the deaths in children under-five years, as shown in Table 3.11. The major causes of deaths for children under-five years were malaria (52.9 per cent). The main cause of death among those aged 5 years and above is communicable diseases, and males accounted the high proportion as compared to females.

Communicable diseases together with maternal and nutritional deficiencies accounted for 40.6 per cent of the deaths as shown in Table 3.12. The major causes of deaths were malaria (17.5 per cent) and HIV/AIDS (8.7 per cent), and 61.9 per cent occurred in urban areas and 81.0 per cent involved women. Cardiac disorders (congestive cardiac failure and stroke accounted of 7.4 per cent of all deaths) were the main causes of death among the non-communicable diseases (NCDs). Majority of the deaths caused by NCDs (43.0 per cent) occurred in urban areas.

For HIV/AIDS, 90.5 per cent of the deaths involved individuals aged 15-45 years, although the percentage of male deaths attributed to HIV/AIDS is too low. The reason for this low rate for males could not be explained. HIV and AIDS has been reported as the tenth top leading cause of death among adults aged 15-45 years in Tanzania (Ministry of Health and Social Welfare 2008), the prevalence of HIV and AIDS in the country is estimated to be more than 7.8 per cent (Tanzania Commission for AIDS (TACAIDS) 2005). The effect of HIV and AIDS has contributed to a substantial increase in mortality among adult men and women in their most productive and reproductive years in the area.

Table 3.12 Causes of death by sex in villages under DSS for population aged 5 years and above

	Males	Females	Total
Communicable diseases**			
Severe or complicated malaria	21(15.1)	25(20)	46(17.5)
HIV/AIDS	3(2.5)	20(15.5)	23(8.7)
Pulmonary Tuberculosis	10(7.6)	7(5.5)	17(6.6)
Septicaemia	2(1.7)	2(1.8)	5(1.7)
Severe dehydration	2(1.7)		2(0.9)
Pneumonia	3(2.5)		3(1.3)
Maternal deaths		2(1.8)	2(0.9)
Other infectious diseases	5(3.4)	3(2.7)	8(3.1)
Non-Communicable diseases			
Congestive cardiac failure	5(3.4)	15(11.8)	20(7.4)
Stroke	12(8.4)	8(6.4)	20(7.4)
Cancer of the cervix	0(0)	5(3.6)	5(1.7)
Liver cirrhosis	3(2.5)	2(1.8)	6(2.2)
Epilepsy	3(2.5)	1(0.9)	5(1.7)
Oesophageal cancer	1(0.8)	3(2.7)	5(1.7)
Intestinal obstruction	2(1.7)	1(0.9)	3(1.3)
Peptic ulcer disease	2(1.7)	1(0.9)	3(1.3)
Other NCDS	23(16.8)	8(6.4)	31(11.8)
Injuries			
Drowning secondary to epilepsy	1(0.8)	1(0.9)	2(0.9)
Motor traffic accidents	2(1.7)		2(0.9)
Snake bite	1(0.8)		1(0.4)
Others	3(2.5)	1(0.9)	5(1.7)
ILL- Defined	30(21.8)	20(15.5)	50(18.8)
Total	138(100)	127(100)	265(100)

**Communicable diseases together with maternal, prenatal conditions and nutritional deficiencies

3.4 CONCLUSION

The target of the Millennium Development Goal number four (MDG 4) is to reduce infant and under-five mortality by two-thirds within 15 years (1990 – 2015). From the present study analysis the observed infant mortality rate was 63.6 deaths per 1,000 live births for males and 52 deaths per 1,000 live births for females while the rate for the same age group for males was 87.9 per 1,000 live births and 81.9 per 1,000 live births among non-migrant population. The under-five mortality rate in Korogwe DSS site was less than that of Muheza district (Salum, Wilkes, Kivumbi *et al.* 1994) which shared the same border, and other DSS sites in Tanzania(INDEPTH Network 2002). On one hand, the reduction might be attributed to the improvements in public health services which have also resulted in gains in the life expectancy. This can be justified by recent studies in Tanzania that have shown an improvement in child survival by 24 per cent between 1994 and 2004 (Janson 2007; National Bureau of Statistics 2005). The reduction in child mortality shows some progress towards the achievement of the MDGs by 2015. On the other hand the low rate of under five mortality might be associated with underestimation of ${}_5q_0$.

Under reporting of deaths was noted in Korogwe DSS. The problem was more severe among adults. The proportion of survived to 85+ as shown in Korogwe life table were higher than that estimated for Tanzania life table 2006 using WHO and UN. The problem of under reporting of death among adult was noted to be 40 per cent high than what they should be. This show that more caution should be taken when interpreting findings based on deaths. Likewise, urgent measures are needed to review and improve the death recording system in Korogwe DSS.

The results from the present evaluation have shown higher ratio of rates of mortality attributed to HIV/AIDS among females than males as similarly observed before in Tanzania as a whole (Tanzania Commission for AIDS (TACAIDS) 2005)), and elsewhere (Dorrington, Bourne, Bradshaw *et al.* 2001).

A Comparison of the observed mortality pattern in Korogwe DSS and the Coale-Demeny Model life tables shows that the rate of deaths at the oldest ages (above 60 years for males and 55 for females) is too low, most possibly due to age exaggeration. Although these was not a case on the comparison between Korogwe life table and the INDEPTH estimated mortality.

CHAPTER 4: FERTILITY

4.1 INTRODUCTION

This chapter estimates levels and patterns of fertility of women aged 15-49 in Korogwe DSS site using data on fertility collected in the study area. The questions asked in the survey regarding children ever borne provide estimates of lifetime fertility, while the questions asked on the number of births in the last twelve months preceding the survey provides data on current fertility. The chapter begins by describing the characteristics of women who were interviewed in the survey and then presents an evaluation of the quality of data used. Moreover, estimates of period and cohort fertility as well as those derived from variants of the Brass P/F method are also presented.

4.2 METHODOLOGY

This section describes the methods applied to the children ever borne and births in the last year data to derive estimates of fertility levels and patterns.

4.2.1 Descriptive analysis

Data on maternity histories collected from women aged between 15 to 49 years, residing in villages under the Demographic Surveillance System in Korogwe District were used to determine the distribution of women in the study grouped into quinquennial age bands. Available information collected from the DSS includes age, education, marital status, occupation and children ever borne. Each woman in the survey was asked to give details on her parity status in terms of the number of children born, their sex, how many of them died, and how many were still alive. Furthermore, women were asked to show their child's Maternal and Child Health (MCH) clinic cards or birth certificates for verification of dates of birth. In the case of any death of a child being reported, information on the date of death was recorded from their mothers.

4.2.2 Data quality

Examination of Korogwe maternity histories data on age of women was compared with that of 2004 Tanzania DHS. Age heaping was examined in the two data sets. Comparison was also made on the age-specific fertility rates derived from Korogwe DSS and those obtained from TDHS 2004.

4.2.3 Estimates of current fertility by age group

The maternity histories data collected in April 2008 was used to obtain estimates of fertility rates in the three years preceding the survey. Age-Specific Fertility Rates (ASFRs) indicate shifts or changes in fertility trend by age, and these rates were used to obtain period Total Fertility Rate (TFR). The TFR has an advantage of not being affected by the age structure of the population as is the case for the Crude Birth Rate (CBR). The age-specific fertility rate is defined as the total number of births in the period 0 to T to women aged *x* to *x+n* divided by the total number of women-years spent in the period 0 to T by women aged *x* to *x+n*.

The calculation of the age-specific fertility by a short method for 5-year age groups was based on the following formula.

$$ASFR_i = \sum_{i=1}^{7} \frac{B_i}{P_i}$$

Where: The subscript i represents 5-year intervals such as 15 to 19, 20 to 24, and 45 to 49 years. B_i is the number of live births registered during the year to mothers of the age group i. P_i is the person years lived by women of the same age.

The TFR measures the average number of births a group of women would have by the time they reach the age of 50 if they were to give birth at the current age-specific fertility rates, could be determined based on the following formula:

$$TFR = 5 \times \sum_{i=1}^{7} \mathrm{ASFR_i}$$

Births and the person-years lived of women aged 15-49 are counted.

4.2.4 Estimation of the number of births and person-years lived by women aged 15-49 years in Korogwe DSS

The estimation of the number of births and person-years lived was done by converting the variable to century month code (CMC). The converted variable in CMC of year of survey used to create variables for lower age (lower bound) and higher age (upper bound) to define the window of observation. It was assumed that exposure starts at 36 months before the survey or when the woman turns 15 years old. If the month of women turning 15 years is greater than the lower bound, the lower bound is replaced to be equal to women turning 15. The variable is dropped if the lower bound is greater than the upper bound. A separate record for each age is created using the *stsplit* STATA command; since a woman during the widow period of observation may contribute events and exposure to up to four different ages. The person-years of exposure during the three years preceding the survey by women aged 15-49 were generated by subtracting the lower bound plus one month from the upper bound in months. All births that occurred 1 to 36 months before the survey/year of interest to women at the time of the birth were counted

4.2.5 Parity Progression Ratio

Parity is the number of live births a woman has had. Parity Progression Ratio (PPR) is a measure of the proportion of women who have progressed to a specific parity from the one they are at. (The probability that a woman who has had birth to her i^{th} child will ever proceed to the $[i+1]^{th}$ child in her reproductive age). This is expressed in the formula below as given by Preston et al (2001b)

$$PPR_{(i,\,i+1)} = \frac{\text{No. of Women at parity i} + 1 \text{ or more}}{\text{No. of Women at parity i or more}} = \frac{P_{i+1}}{P_i}$$

This measure is applied to women aged 45-49 years who are at the end of their childbearing period. These women have almost complete maternity histories. However, the average parities calculated from this age group can be distorted by either misplacing women by age group or misreporting the children ever born (United Nations 1983b). Despite this shortcoming, the aim of calculating the parity progression ratios is to provide information on the patterns of fertility-limiting behaviour in the population and to forecast population growth; in addition, PPRs are more robust to errors in reporting of dates than ASFRs (Brass, Juárez and Scott 1997).

4.2.6 Projected parity progression ratios and Indices of relative change

In addition to the Parity Progression ratios, Projected Parity Progression Ratios (PPPRs) method derived by Brass and Juárez (1983) were also calculated for Korogwe DSS site. These measures were obtained from the proportions of women in two adjacent cohorts at parity i, and have progressed to parity i+1. Births to women in the older cohort which occurred 5 years prior to the survey date were truncated to make the two cohorts comparable. Likewise, the index of relative change, which measures the degree of change between the adjacent cohorts after truncation, was calculated. It was obtained as a ratio of the population of the younger cohorts to the older cohorts who have been truncated. An index greater than 1 (one) means that the fertility of the younger cohorts has increased compared to the older cohort. Whilst an index less than one means the fertility of the younger cohort has fallen compared to the older cohorts in the preceding 5 years period.

The PPPRs were obtained by multiplying the Pi values by the index of relative change between the adjacent cohorts, starting with the age group 45-49. The Pi value for the age group 45-49 cohort was also the PPPR for this cohort. The multiplication procedure is done from the oldest successively to each younger age group. The assumption made in this processes is that the rate of fertility change between each pair of cohorts differs by the same amount in the future as in the past.

4.2.8 Parity/Fertility (P/F) Ratio method of estimating fertility

The P/F ratio method compares cohort fertility to cumulated current fertility. The assumptions made were that; the fertility has remained constant for sometime in the past, the fertility of women who die is the same as that of those who survive, and there was a constant age distribution of the fertility. The method used combined information from current fertility and lifetime fertility to estimate adjusted current fertility. Maternity history data collected during 2008 was used with the P/F Ratio methods to estimate fertility.

4.2.8.1 Brass P/F ratio method

The method uses ratios of average parities (P) to the estimated parity equivalent (F) calculated at each age group of women in childbearing ages 15-49 years. The deviation of a P/F ratio from one is an indication of the presence of error in the data.

The parity equivalents for a period (F) are estimated by interpolation using ASFR and cumulated ASFR values. The interpolation equation used is:

$$F(i) = \phi(i-1) + a(i)f(i) + b(i)f(i+1) + c(i)\phi(7)$$

The set of coefficients a(i), b(i) and c(i) developed by Brass, and also with Coale and Trussell are given in (United Nations Department of International Economic and Social Affairs 1983). According to Brass *et al* (1967) and also demonstrated by Moultrie and Dorrington (2008), women in the age group 20-24 years are less likely to have recall error in reporting the number of children ever born (CEB) since they only have a small number of births which have occurred in recent years.

Some of the shortcomings of the P/F method are related to the assumptions made which might not hold in some settings. One of these shortcomings is that it is meant for settings where fertility could be assumed to be constant over time, however, in reality most of the developing countries have been experiencing changes in fertility. Changes in the level of fertility are reported by Moultrie and Dorrington (2008) to be a greater contributor to errors in the Brass P/F ratio method. The advantage of the P/F method over the relational gompertz model discussed before is that, it is not affected by parity data of all age group included in the model.

4.2.8.2 Brass Relational Gompertz model

The relational gompertz model (RGM) of fertility modified by Brass (1981) aims at improving the fit of observations for women in reproductive ages for both early and late ages. Zaba (1981) reported that the advantage of the relational gompertz model of fertility is on its provision of a simple tool for adjusting and correcting fertility distributions derived from reports of births in the last year and children ever born. More detail on the model is explained elsewhere (SIAP 1994; Zaba 1981). The method has the key advantage of being able to correct for errors in age patterns and levels of fertility.

4.3 RESULTS AND DISCUSSION

4.3.1 Descriptive analysis

A total of 2,755 mothers aged 15-49 years were interviewed. The median age of these women was 28 years. More than half (55.5 per cent) of the women in the study population were married. The majority (80.17 per cent) of the women have had at least one birth. A total of 7,362 children were born among the mothers who reported their birth history; 50.4 per cent were males and 3.4 per cent of them were twins. Out of the total 2,755 mothers, 614 reported to have lost at least one child. Of these, 394 (64.2 per cent) reported having lost one child in their life time.

The distribution of Korogwe women of reproductive age by background characteristics are shown in Table 5.1 below. In summary, almost four fifths were involved in self-employment projects (farmers) and more than two thirds had primary education as their highest level of education. The percentages of women in Table 5.1 decreases with age. The majority of the women (20 per cent) were in the 15-19 age group and fewer women (5 per cent) were in the 45-49 age group. There is an indication that the survey interviewed fewer women aged 20-24 than those aged 25-29, as shown in Table 4.1.

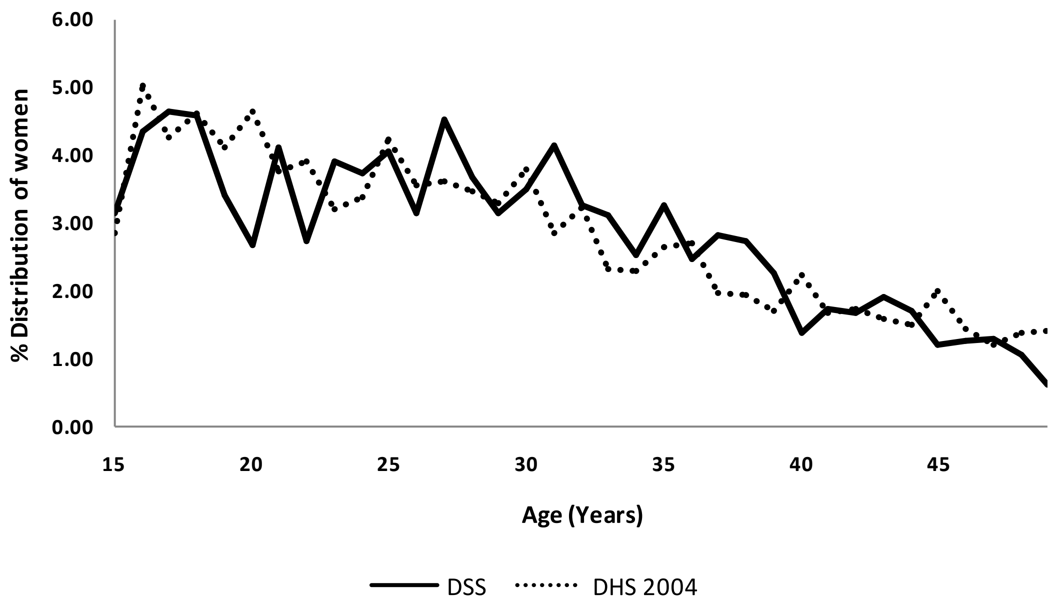
4.3.2 Data quality

The retrospective data on births from the survey suffers from non-sampling errors. These include accuracy of the respondent's age, and the quality of maternity histories data which could affect fertility estimates. The age distribution of women participated in birth history survey in the Korogwe DSS (2008) by single age is shown in Figure 4.1 below. There is some heaping of ages at digits ending with 0, 5 as shown below. Although, heaping though is not severe caution should be taken when analysing data involving women's age.

Table 4.1 Background characteristics of women aged 15-49 in the Korogwe DSS site, in birth history survey, 2008

Background characteristics	Percent	Number (N)
Age		
15-19	20.1	553
20-24	17.2	473
25-29	18.6	512
30-34	16.6	456
35-39	13.6	373
40-44	8.4	232
45-49	5.4	147
Occupation		
Farmer	79.84	2,190
Employee	1.42	39
Petty cash	2.22	61
Student	1.75	48
Others	14.55	399
Marital Status		
Married	55.05	1,516
Widow	2.29	63
Divorce	2.83	78
Separated	1.78	49
Cohabit	8.64	238
Single	29.41	810
Education		
No education	27.5	758
Primary	67.1	1849
Secondary	5.4	148

Figure 4.1 Percentage distribution of women by current age in single years in Korogwe DSS 2008 and DHS 2004



The above problem of heaping could be partly mitigated by grouping women in five-year age groups as demonstrated in Figure 4.2 below. A marked difference can be observed between Figures 4.1 and 4.2, as the age distortions have been largely smoothened out.

Figure 4.2 Per cent distribution of women by five-year age groups

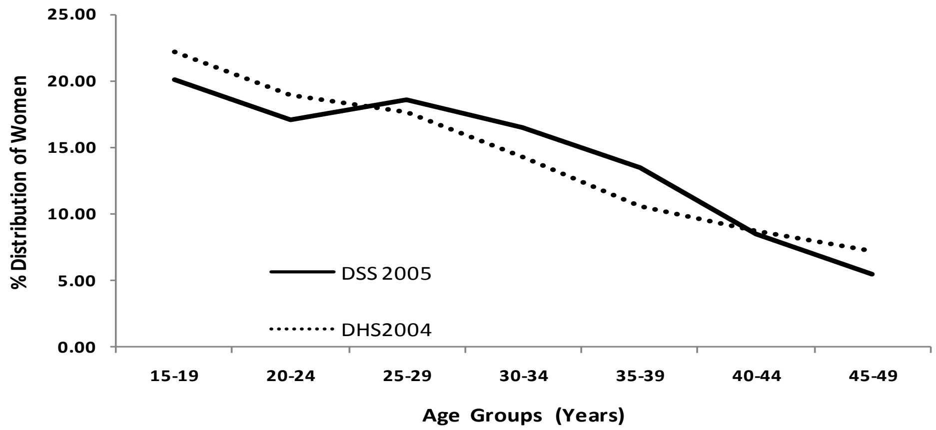
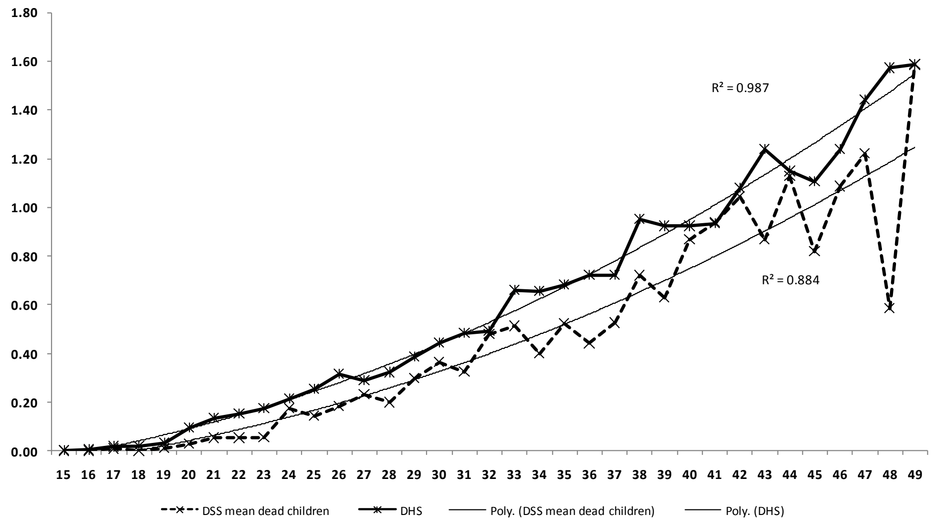


Figure 4.3 also compares the DSS (2008) and the 2004 Tanzanian DHS on the proportions of children ever born that have died. As shown in Figure 4.3, the DHS (2004) gives a best fit with 98.7 per cent of the data being explained by the model, while for Korogwe DSS only 88.4 per cent have been explained by the model. The data from Korogwe DSS did not fit as well, presumably because they have more fluctuation in them, indicating that DSS (2008) were more likely to omitted dead children given what we know from mortality investigation.

Figure 4.3 Mean dead children for women, DSS and Tanzanian DHS



It was also noted that 2.65 per cent of the women aged 44-49 in Korogwe DSS were childless.

The proportions of childless women aged 40-49 are a bit higher than for age group 30-39, as shown in Table 4.2, but the reason for this could not be explained, either random effects or age misstatement. Slightly more than 21 per cent of women aged 15-19 years old had had at least one child. The DHS (2004) data showed a monotonic decrease in proportion of childless by age. It noted that the in all but oldest age groups the DHS 2004 reported significantly higher percentages than the DSS.

Table 4.2Proportion of women by ages that are childless at the time of survey

Age Group	DSS2008	DHS 2004
15-19	78.38 (435)	82.72 (1900)
20-24	14.35 (68)	26.71 (523)
25-29	2.73 (14)	9.72 (178)
30-34	2.41 (9)	5.38 (80)
35-39	2.40 (7)	3.55 (39)
40-44	3.02 (7)	2.54 (23)
45-49	2.65 (4)	1.73 (13)

4.3.3 Estimates of lifetime fertility by age group

Table 5.3 below show estimated mean numbers of children ever borne (CEB) by women by age groups. The estimated mean lifetime fertility from DSS is shown in Figure 5.2 below. The mean number of children ever borne increases monotonically with age until the old ages for both Korogwe DSS and DHS 2004. There is some flattening out of the trend in mean (CEB) from age groups 40-44 and 45-49 in Korogwe DSS. It is exactly what one would expect if fertility is lower in the age group 45-49 than in the 40-44 age groups.

Table 4.3 Estimates of mean number children ever born

	DSS 2008			**DHS 2004**		
Age Group	*Mean children ever borne (CEB)*	*Mean living children*	*Mean dead children*	*Mean children ever borne (CEB)*	*Mean living children*	*Mean dead children*
15-19	0.25	0.25	0.00	0.19	0.18	0.01
20-24	1.44	1.37	0.08	1.37	1.22	0.51
25-29	2.44	2.23	0.21	2.61	2.30	0.31
30-34	3.52	3.11	0.41	4.03	3.50	0.53
35-39	4.39	3.82	0.57	5.32	4.53	0.78
40-44	5.31	4.34	0.97	6.22	5.17	1.05
45-49	5.76	4.74	1.02	6.92	5.56	1.36

4.3.4 Estimates of current fertility by age group

4.3.4.1 Age-specific fertility rates

Table 5.4 below shows the age-specific fertility rate of women in Korogwe DSS site.

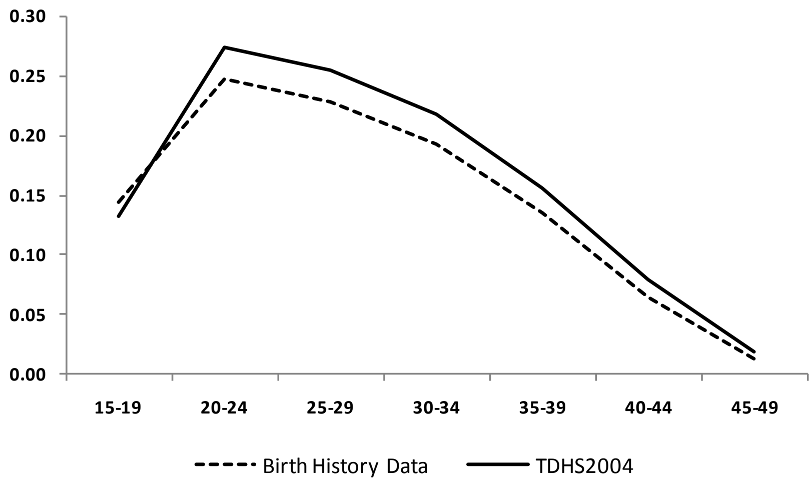
Table 4.4 Current age specific fertility rate

Age Group	Exposure	Births	ASFR
15-19	1544.3	222	0.1438
20-24	1535.2	380	0.2475
25-29	1509.5	344	0.2279
30-34	1239.8	239	0.1928
35-39	889.5	121	0.1360
40-44	642	41	0.0639
45-49	234.2	3	0.0128
TFR			**5.12**

4.3.4.2 Shape of fertility distribution

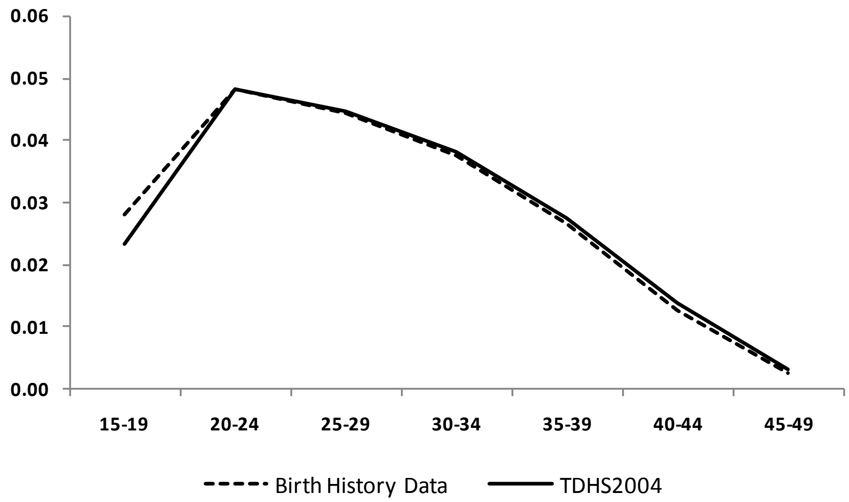
The age specific rates for Korogwe DSS in April 2008 and Tanzania DHS 2004 are shown in figure 4.4 below.

Figure 4.4 Age-specific fertility rates, maternity history data Korogwe DSS 2008 and TDHS 2004



The Figure 4.4 above shows that the shapes of the age distributions of fertility are the same for the 2004 TDHS and the DSS. This is characteristic of developing countries with a peak in fertility schedule at ages 20-24, followed by a decline up to the older ages. It is also evident that fertility is lower at all ages from 2004 to the time of the baseline data collection in the DSS. However, there is increase in fertility in the youngest age groups (15-49) due to dissimilar data sources much cannot be explained.

Figure 4.5 Standardised age-specific fertility rates, maternity history data Korogwe DSS 2008 and TDHS 2004



Standardising the two sets of ASFRs shows consistence in the shape of the ASFRs derived from maternity histories data collected in Korogwe and those computed from TDHS 2004 data (Figure 4.5). The age-specific fertility rates for the young age groups differ, although nothing can be explained due dissimilar data sources.

4.3.4.3 Differentials in age-specific fertility rates by place of residence

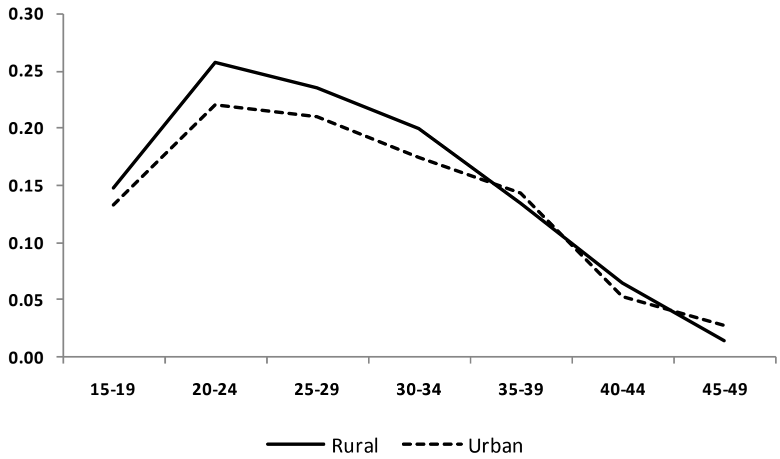
Rural areas have a higher TFR of 5.3, whilst the urban areas have a TFR of 4.8. This shows that fertility in the rural areas is higher than in urban areas.

Table 4.5 Differentials in age-specific fertility rate by age and place of residence

Age Group	Rural	Urban
15-19	0.1487	0.1333
20-24	0.2582	0.2212
25-29	0.2367	0.2104
30-34	0.1999	0.1757
35-39	0.1355	0.1444
40-44	0.0662	0.0530
45-49	0.0152	0.0276
TFR	5.3	4.8

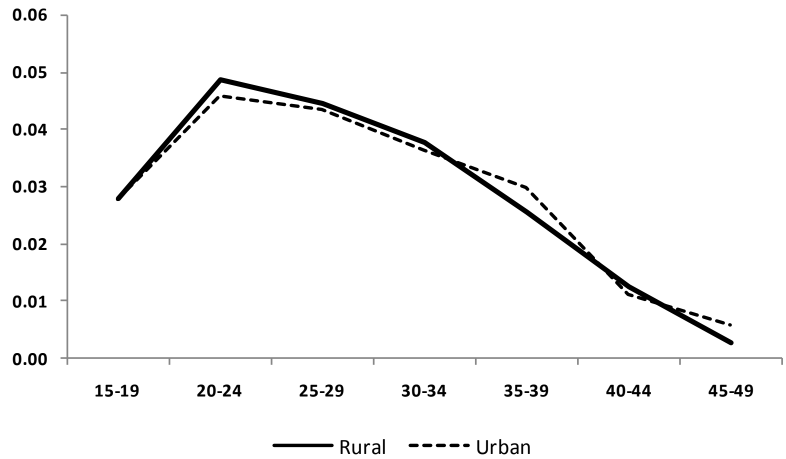
The ASFR pattern is shown in Figure 4.6 below. The age-specific fertility pattern is consistently higher at the younger ages in the rural areas than in urban areas, though this trend is less evident at the older ages. The older ages might be affected by sampling bias.

Figure 4.6 Age-specific fertility rates, rural and urban, Korogwe DSS 2008



The standardised ASFRs for the rural and per-urban areas are shown below. The two figures have the same shape; however, the standardised fertility schedules show a narrower gap between the rural and urban ASFRs at the younger ages. Between the ages 15-34, the ASFRs are higher for the rural as compared to that of urban areas. The possible reason might be exposing to family planning among urban women than rural ones.

Figure 4.7 Standardised age-specific fertility rates, Rural and Urban, Korogwe DSS 2008



4.3.5 Parity progression ratio (PPR)

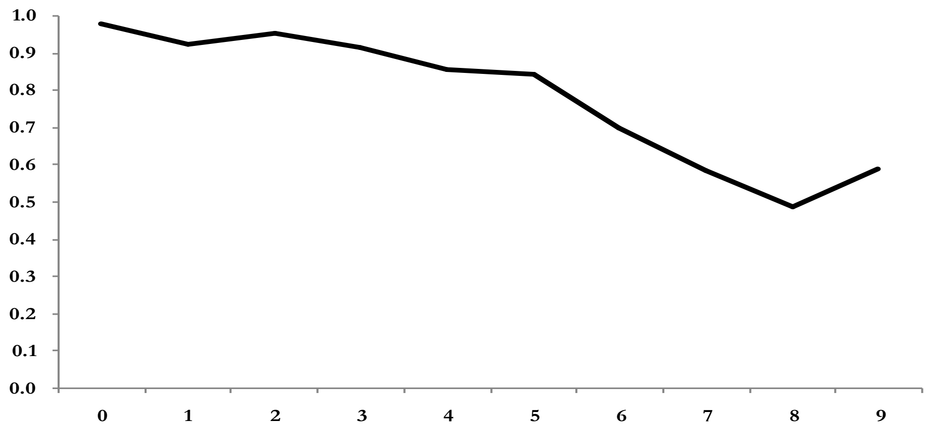
Table 4.6 below presents the parity progression ratios and the cumulated parity calculated from women age 45- 49 years in Korogwe DSS site. The data show that the lifetime fertility in 2007 Korogwe DSS was on average of 5.6 children per woman.

Table 4.6 Parity progression ratios and cumulated parity progression ratio for women aged 45-49

Parity(i)	PPR(i,i+1)	PPR(0,i)
0	0.9800	
1	0.9252	0.9800
2	0.9559	0.9067
3	0.9154	0.8667
4	0.8571	0.7933
5	0.8431	0.6800
6	0.6977	0.5733
7	0.5833	0.4000
8	0.4857	0.2333
9	0.5882	0.1133
10	0.0000	0.0667
11		0.0000

There is a decline in the proportion of women progressing to subsequent higher parities as shown in the Figure 4.8. There is however, an increase in the proportion of women moving from the first to the second parity. Women with their first child prefer to have a second one. Likewise, the linear trend in the observed results provides information on the possible decline in fertility levels due to the increase in fertility control. There is a rise in PPRs on parity 9 and above, probably this reflects the effect of recall bias among women on their ever born children, and might also be due to miscount of children ever born or children living outside the household. When the last point is removed, the data fitted well (R^2=0.98) which indicates that 98 per cent of the data are explained by fitted data.

Figure 4.8 Parity Progression Ratio of women aged 45-49 years, Korogwe DSS



4.3.6 Projected parity progression ratio

The projected Parity Progression Ratios (PPRs) give the picture of future fertility at the end of the childbearing period. Table 4.7 show the un-truncated and truncated parity progression ratios. This table indicates PPRs for cohorts of younger women. The truncated cohort is excludes births in the last 5 years by age group of mother. The ratios of truncated and un-truncated PPRs for cohorts yield indices of relative change. These indices of relative change are used to measure trends in fertility at equivalent ages and parities for two different cohorts. The indices are above 1 and indicate increase in fertility in the respective current cohorts relative to the older cohorts.

The projected parity progression ratios generally show a future reduction in fertility and higher parity births among women living in the Korogwe the DSS site. The projected parity progression ratios show that for age group 20-24, women in DSS site will have 1.2 children per woman at the end of childbearing. The majority of them will proceed to have a first and second birth (79 per cent) while only 36 per cent will proceed to have a third and fourth birth (Table 4.7). Women aged 25-29 will have 2.2 children at the end of their childbearing period. Majority of them will proceed to have a first and second birth (92. per cent). More than two-thirds (74.4 per cent) will proceed to have a second and third birth. Only 2 per cent will proceed to have a seventh and eighth birth. For those aged 30-34 they will have 3.3 children at the end of their childbearing period, 94.46 per cent will proceed to have a first and second child. Only 8.8 per cent will proceed to have a seventh and eighth birth.

Women in age group 35-39 will have 4.2 children at the end of their reproductive period. The majority, 95.9 per cent, will proceed to have a first and second birth. Slightly less than half (47 per cent) will proceed to have a fourth and fifth child. The average number of children of women in age group 40-44 will be 5.2 children at the end of their childbearing period. Majority, 97 per cent, will proceed to have a first and second birth. About 16.7 per cent will proceed to have a seventh and eighth birth. More than half, 64.2 per cent will proceed to have a fifth and sixth birth. Women aged 45-49, will have 5.6 children at the end of their childbearing period. A majority of them, 98 per cent will proceed to have a first and second birth. Two-thirds (68 per cent) will proceed to have fifth and sixth birth. It can be observed that 11.3 per cent of women in this cohort will proceed to have a nine to tenth birth at the end of their reproductive period.

Table 4.7 Truncated and projected parity progression ratios by age group, 2007 Korogwe DSS site

Age group	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10+
Parity Progression by age group										
15-19	0.216	0.108								
20-24	0.856	0.519	0.214	0.356	0.188	0.333				
25-29	0.867	0.561	0.337	0.655	0.764	0.952	0.975			
30-34	0.976	0.924	0.808	0.684	0.476	0.306	0.606	0.35	0.286	0.5
35-39	0.976	0.942	0.921	0.82	0.68	0.545	0.417	0.4	0.438	0.286
40-44	0.97	0.951	0.939	0.91	0.82	0.693	0.673	0.557	0.359	0.357
45-49	0.98	0.925	0.956	0.915	0.857	0.843	0.698	0.583	0.486	0.588
Truncated Parity progression										
20-24 (t)	0.986	0.897								
25-29 (t)	0.998	0.92	0.553	0.386	0.321	0.115	0.333			
30-34 (t)	0.995	0.942	0.814	0.684	0.476	0.306	0.606			
35-39 (t)	0.992	0.95	0.924	0.822	0.68	0.545	0.417	0.4	0.438	
40-44 (t)	0.987	0.951	0.944	0.91	0.82	0.693	0.673	0.557	0.359	0.357
45-49 (t)	0.98	0.932	0.956	0.915	0.857	0.843	0.698	0.583	0.486	0.588
Indeces of Relative change										
15-19 / 20-24 (t)	0.219199	0.120833								
20-24 / 25-29 (t)	0.85831	0.563548	0.387755	0.921811						
25-29 / 30-34 (t)	0.975187	0.88831	0.629228	0.556183	0.674668	0.377622	0.55			
30-34 / 35-39 (t)	0.984032	0.972348	0.87446	0.83157	0.70014	0.560185	1.454545	0.875		
35-39 / 40-44 (t)	0.988941	0.990971	0.976285	0.900239	0.829035	0.786713	0.619048	0.717949	1.21875	
40-44 / 45-49 (t)	0.989756	1.021046	0.982602	0.994607	0.956284	0.822326	0.964744	0.955102	0.739065	0.607143
Projected parity progression ratios										
15-19	0.173182	0.055059								
20-24	0.79007	0.455665	0.195643							
25-29	0.920495	0.808564	0.504554	0.379078	0.320988	0.115385	0.333333			
30-34	0.943917	0.910227	0.801861	0.681571	0.475771	0.305556	0.606061			
35-39	0.959234	0.936112	0.916978	0.81962	0.679537	0.545455	0.416667	0.4	0.4375	
40-44	0.96996	0.944641	0.939252	0.910448	0.819672	0.693333	0.673077	0.557143	0.358974	0.357143
45-49	0.98	0.92517	0.955882	0.915385	0.857143	0.843137	0.697674	0.583333	0.485714	0.588235

Table 4.8 Estimated TFR by age group, 2007 Korogwe site

Age Group	15-19	20-24	25-29	30-34	35-39	40-44	45-49
TFR	*	*	*	*	4.23	5.17	5.61

*

= TFR where excluded because you cannot interpret the data for young women

Table 4.9 Proportion of women proceed to have a next birth, 2007 Korogwe DSS site

Age Group	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10+
15-19	0.173								
20-24	0.790	0.360							
25-29	0.920	0.744	0.376	0.142	0.046	0.005	0.002		
30-34	0.944	0.859	0.689	0.470	0.223	0.068	0.041		
35-39	0.959	0.898	0.823	0.675	0.459	0.250	0.104	0.042	0.018
40-44	0.970	0.916	0.861	0.784	0.642	0.445	0.300	0.167	0.060
45-49	0.980	0.907	0.867	0.793	0.680	0.573	0.400	0.233	0.113

4.3.7 Comparison of fertility levels estimated using various methods

The values of TFR rate estimated using different P/F methods is presented in Table 4.10.

Table 4.10 Adjustment of Age-Specific Using P/F Methods, Korogwe DSS 2008

Age Group	Mean Parity P(i)	Period Fertility f(i)	Cumulated Parity Q(i)	Estimated Parity F(i)	P/F Ratio	Adjusted ASFR *
15-19	0.2396	0.1438	0.7188	0.3296	0.7270	0.1671
20-24	1.4376	0.2475	1.9564	1.4515	0.9904	0.2444
25-29	2.4180	0.2279	3.0959	2.6539	0.9111	0.2231
30-34	3.4781	0.1928	4.0597	3.6977	0.9406	0.1861
35-39	4.3405	0.1360	4.7399	4.4926	0.9661	0.1286
40-44	5.1983	0.0639	5.0592	4.9542	1.0493	0.0562
45-49	5.6133	0.0128	5.1233	5.1082	1.0989	0.0094
TFR		5.12				5.07
Differnce between Observed and adjusted TFR						1%
*	K= P2/F2					

The P/F values increase with age. The P/F for women aged 20-24 is higher than those women aged 25-29, 30-34 and 35-39. The completed family size is higher by 10 per cent than the directly calculated estimate from maternity histories survey conducted in 2008. This indicates that fertility is falling or there is both fertility decline as well as underreporting of current fertility, as shown in Table 4.10. It has been argued that there is no obvious choice of scaling factors to be applied to the observed data (Moultrie and Dorrington 2008). The observed TFR and the TFR adjusted using P/F for women aged 20-24 are closely similar to each other (differ by 1 per cent). On the other hand, the TFR adjusted for average of P/F for those aged 25-29 and also those women aged 24-34 are low by almost 5 per cent. A recent study on errors and biases in the P/F ratio method found that using P/F ratio for women aged 20-24 to adjust the reported fertility schedule is more accurate(Moultrie and Dorrington 2008)

Table 4.11Summary of fertility estimates by using various methods

Method	TFR
Observed BH Survey 2008	5.12
Complted family size	5.61
P/F Ratio Methods	5.07
Ralational Gompertz Model	
Fitted to current data based on	
20-24	5.26
25-29	4.81
30-34	4.95
35-39	5.04

*NB: BH=Birth history survey

As shown in the Table 4.11 above, the estimates of TFR for Korogwe DSS site derived using different methods are quite close ranged. The reported TFR is 5.12 and the adjusted one using

Brass P/F methods is 5.07 for women aged 20-25. The relational gompertz model gives a TFR varies from 4.81 to 5.26. The P/F ratio and reported from birth history survey are close and lie in the middle of the range of the relational gompertz estimates.

4.4 CONCLUSION

The Parity Progression Ratios (PPRs) show a decline in the proportion of women at a certain parity progressing to subsequent parities. A decline in both lifetime and period fertility has also been observed in this study. The data collected from the DSS produce reasonable estimates of fertility, which is consistent with estimates derived from the 2004 TDHS. Overall, it is evident from the declining projected PPRs for women with higher parities that Korogwe DSS women desire smaller completed family sizes. The TFR for the Korogwe is lower than the national level estimated four year earlier. The lifetime and period fertility estimates are 5.6 and 5.1 children per woman respectively, indicating that fertility has decreased in the recent past in Korogwe DSS. The declines in fertility in the Coastal region, in which Korogwe DSS is, have been reported TFR from 1991, 1996, 1996 and 2004 of 5.7, 4.9, 4.3 and 4, respectively, as calculated from Tanzania Demographic and Health Survey (Macro International Inc 2009).

CHAPTER 5: MIGRATION

5.1 INTRODUCTION

Population migration is an important aspect of concern for both district and national planners. The movement between areas has an impact on the changes in the size and composition of the populations. This might result in increased need for services including health, social work, and education. Knowing the migration characteristics in the study area may help stimulate further research on this aspect in the country and region at large. This chapter presents the findings from the analysis of migration patterns in Korogwe DSS for the period 2006 to 2007. The main focus is on the crude migration rates, age specific migration rates, and age profile measures.

5.2 METHODOLOGY

This section presents the methods used to estimate the number of people who moved in and out of Korogwe district during the study period. The term 'migration' as defined by Rees *et al* (2000) refers to "the change of usual residence by an individual or group of individuals over a defined time interval" and this has been adopted in Korogwe DSS site. Migration rates include in-migration rate, out-migration rate and age-specific migration rate that were computed for Korogwe DSS site. Moreover, the net and gross migrations were calculated.

5.2.2 Documentation of migrants in Korogwe DSS site

The DSS tracks changes of residence from one homestead to another, as well as arrivals into and departures from the DSS. A tracking team is responsible for ensuring the quality of migration and membership data. Migration can be coded singly (for individual members) or as a household, whereby all members of the household experience a change the place of residence on or around the same period. Migration can also be classified as internal which refers to residency changes within the DSS site or external referring to movements either into or out of the DSS site.

The following information has been collected on all household members in order to identify migrants: number of nights spent in the household in the last 4 months, last night spent in the household, and the pattern of nights spent (most nights, month ends, holidays). An out-migrant is defined as a person originally listed in a DSS round as a resident, or a person who became a resident after the round by birth or immigration, who subsequently moved out of the DSS area permanently. An in-migrant is an individual neither recorded in the last round nor born or lived in the DSS area after the round who has permanently moved into the surveillance area. Changes in residency are self-reported by the individual or a proxy informant and the start date of residency is recorded. When an individual reported to be a non-resident, spends more than 4 months in a household, they are registered as residents. The converse is applied for people who have migrated out.

5.3 RESULTS AND DISCUSSION

5.3.1 Descriptive analysis

A total of 10,632 people migrated during 2006 – 2007 (Table 5.2). These could be identified and classified as in-migrants or out-migrants and disaggregated by age and sex. Sixty per cent were out-migrants and these females were more (56.8 per cent) than males. Females also accounted for more than half (55.4 per cent) of the in-migrants, while 28.7 per cent of all in-migrants were individuals who moved from one village within the DSS area to the other. The mean age of out- and in- migrants were 21.6 and 20.3 years, respectively (Table 5.1) and this indicates that people who were moving out during the study period were older than those who were moving in (p=0.001).

Table 5.1 ***Mean age of population migrated by sex***

Variable	Total Number	Mean Age	Statistic Test
Overall			
In migration	4251	20.3	p-value= 0.001
Out Migration	6381	21.6	
Females			
In migration	2412	21.1	p-value = 0.1
Out Migration	3522	21.7	
Males			
In migration	1839	19.2	p-value= 0.001
Out Migration	2859	21.5	

5.3.2 Crude migration rates

The crude in- and out- migration rates were 71.6 per 1,000 and 107.4 per 1,000, respectively. This indicates that the rate of people who were moving out of the study site by the end of year 2007 was 1.5 times more than that of people who are moving into that area in the same period.

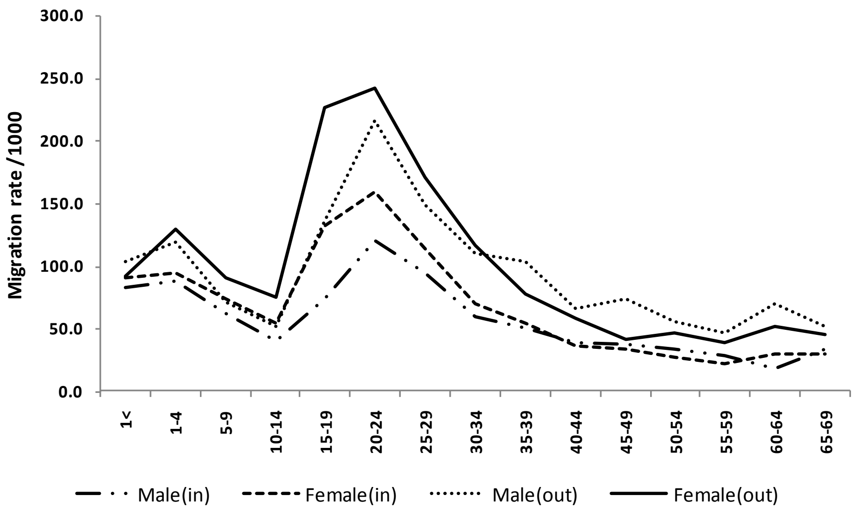
5.3.4 Patterns of migration rates by age and sex

Generally, all the migration streams show a similar pattern of migration characterized of higher rates at the youngest ages, lower rates at the 10-14 age groups, a peak at the 20-24 ages, and a gradual decline up to the oldest ages (Figure 5.1). The rate of out-migration is greater than the rate of in-migration for both males and females at all ages. Females tend to be more migratory or dominating both streams, as their rates are higher than those of males, except above 30 years (out-migration) and 40 years (in-migration). The rate of in-migration is higher for females than males below 40 years and above 65 years, whilst male in-migration is higher between 40 and 60 years.

Table 5.2 Number of out-migration and in-migration by age and sex, Korogwe 2007

	Migrate outside DSS site				Total Number of In and Out-Migrants			
	Male		Female		Male		Female	
Age group	In	Out	In	Out	In	Out	In	Out
< 1	96	89	80	73	134	132	114	115
1-4	172	303	194	308	284	420	325	449
5-9	163	194	179	257	254	290	294	365
10-14	96	128	99	165	155	195	199	273
15-19	181	389	262	536	242	443	386	653
20-24	175	360	231	426	228	406	363	554
25-29	118	234	158	283	174	280	248	380
30-34	74	158	72	166	102	190	134	223
35-39	44	118	48	91	74	153	90	129
40-44	32	66	30	55	49	81	49	80
45-49	26	61	27	35	36	72	41	47
50-54	18	37	12	34	28	48	26	47
55-59	14	29	10	28	21	35	19	34
60-64	6	37	13	28	11	43	19	33
65-69	10	20	10	18	17	26	18	26
70-74	10	14	15	38	16	18	29	49
75-79	6	10	16	18	9	12	27	26
80-84	2	6	6	10	3	7	12	15
85+	1	7	12	16	2	8	19	24
Total	1244	2260	1474	2585	1839	2859	2412	3522

Figure 5.1 Age-specific migration rates of outward and inward migration among males and female in Korogwe Demographic Surveillance site, 2006-2007



The higher rate of female out-migration at the youngest ages (15-19) could be due to early marriages outside the villages. Higher migration rates at the youngest ages are expected since children are likely to migrate together with their parents. The peak at 20-24 ages is also expected since at this age people tend to migrate in looking for green pastures. Males become more migratory during their early to mid 20s probably due to labour reasons as they leave rural areas in search of employment elsewhere. The out-migration at this age could also be for educational reasons since the opportunities in rural areas are limited and as such males move out to look for higher education in urban areas (Macharia 2003). Men in their twenties have also been reported by communities in the DSS site to outmigration from Korogwe area for economic reasons. These include the role of men as the breadwinners in households. Such roles may explain further why there are likely to be more men aged 30 and above migrants than women

Figure 5.2 examines net migration which considers the difference between in-migration and out-migration. The net migration rate measures geographical mobility of population. A positive net migration indicates that more migrants entered the area than left it during the period. A negative net migration means that more migrants left the area than entered it. There is net out migration at all ages from the DSS site, although the rate is lower at younger and oldest ages. The net out-migration rate for females is higher than that of males from 0 to 20 years and thereafter the out-migration rate for males becomes higher than for females (Figure 5.2). The net out-migration rate is highest at 15-19 year age group (females) and 20-24 (males). Thus, the net outflows show that people prefer to move out of the area which offers very few employment opportunities.

Figure 5.2 Age-specific net migration in Korogwe Demographic Surveillance site, 2006-2007

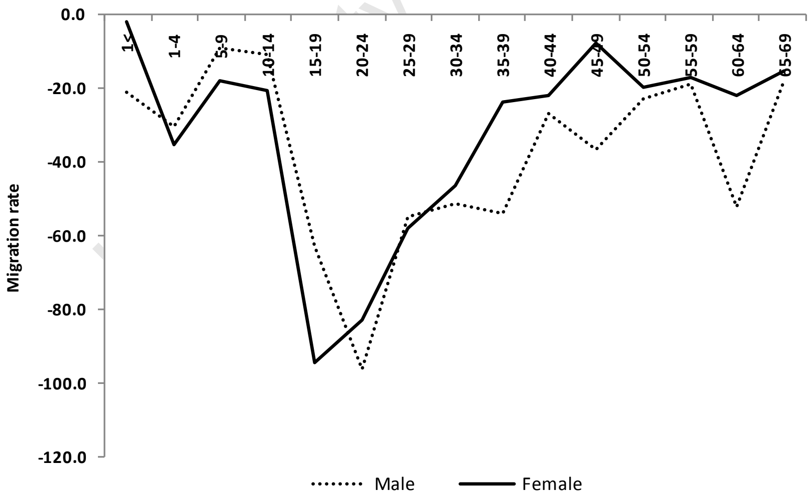
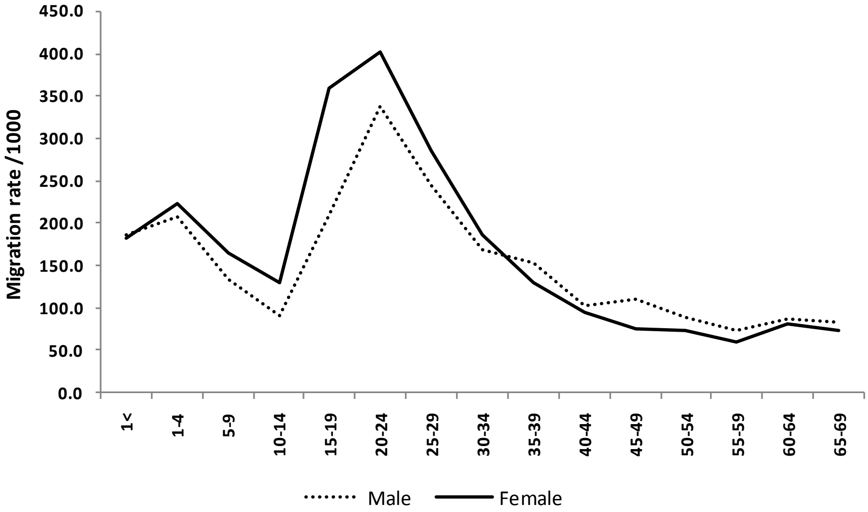


Figure 5.3 Age-specific gross migration rates in Korogwe Demographic Surveillance site, 2006-07

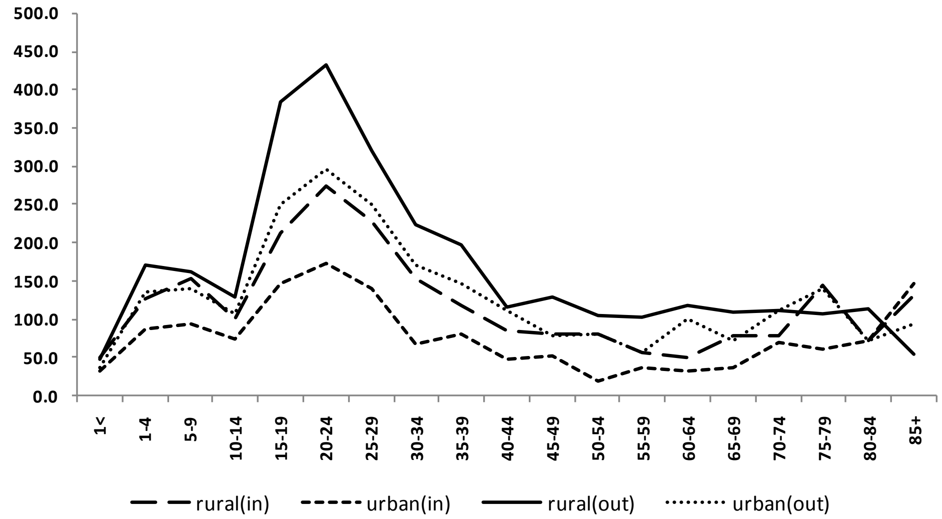


The gross migration, which gives the total amount of migration in and out of the area, is examined in Figure 5.3 above. The bi-modal distribution of age commonly found for migrant populations can be seen in Figure 5.3, characterized by a primary peak of young adults and a secondary peak of young children migrating with their parents. Between childhood and 35 years of age, women migrate more than men, whilst above this age, men migrate more than women (Figure 5.3). At the oldest ages (above 70 years) women migrate more than men. There is a large in- and out-migration of children in the DSS site, and there is no difference in the migration patterns or rates between boys and girls. The reason for the higher migration rate of the females may be due to marriage customs that the woman usually moves into her husband's household/home in patriarchal societies and becomes a new member in that household. Studies have reported that women migrate to obtain better education and experience life with more autonomy (Kahn, Collinson, Tollman *et al.* 2003). Likewise, other studies done in rural areas of Varanasi in India have shown a high migration rate of males(Sharma 1986). These findings give us a picture on the characteristics migration varies with sex and location.

5.3.5 Patterns of migration rate by geographical strata (urban and rural)

The rural in-migration rate is lower at all ages than the out-migration rate. The rural out-migration rate is higher than the urban one (Figure 5.5). However, the net out-migration rate is higher in urban than rural areas, and this might be due to international or interregional migration.

Figure 5.4 Age-specific migration rates of inward and outward migration urban and rural strata in Korogwe Demographic Surveillance site, 2006-2007



The rural in-migration rate is also higher at the older ages probably due to older people moving to the rural areas for retirement or failure to secure prospects in the urban areas. Out-migration rates from the urban areas might also be due to ill-health with people deciding to go to stay in the rural areas. The higher rate of out-migration observed from Korogwe DSS sites might result in rapid urbanisation which will lead to the over-urbanisation phenomena (Gugler 1982)

5.3.6 Patterns of migration rates by season, 2006 -2007

Figure 5.5 shows the percentage of in migrants by month. There is a peak of in-migrants between May and July during 2006 while the peak for 2007 is between June and August. The reason for this peak might be data error, and this raises a need for further exploration on the differences in season patterns between 2006 and 2007.

The percentage of out-migrants (figure 5.6) is high during the beginning and the end of each year. This percentage starts to increase during the month of December reaching a peak in January after which it starts to decline. The higher percentage of migrants is most likely related with people moving out of the villages during the end of year holiday or festive season. The percentage of migrants is generally constant for the other months of the year.

Figure 5.5 Proportion of in migration, Korogwe district, 2006 and 2007

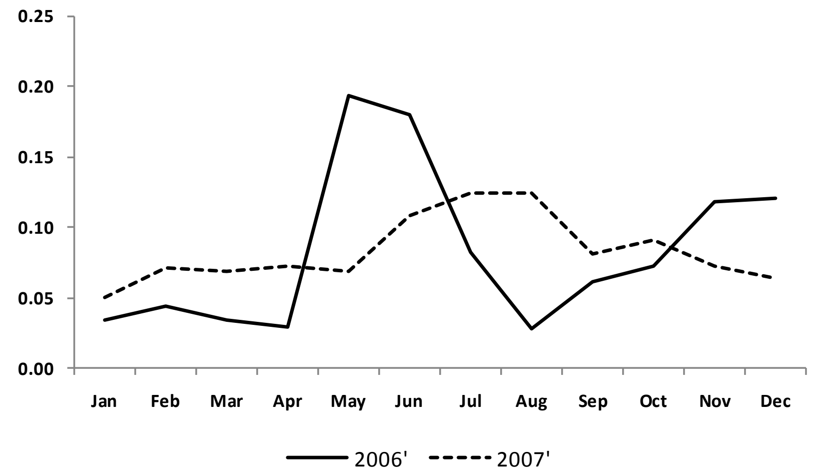
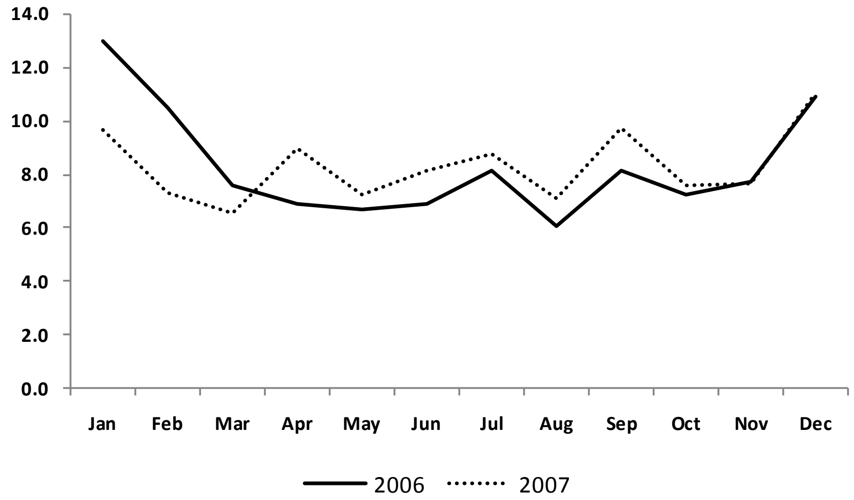


Figure 5.6 Proportion of out migration, Korogwe district, 2006 and 2007



5.4 CONCLUSION

Most of the governments in the African continent have been paying much of their attention to the development plans for urban as compared to rural areas which resulted in an urban biased form of development (Lipton 1977), wherefore, creating the pushing factors for most people to migrate from rural to urban areas. There are many push factors from the rural to urban areas, including search for better opportunities, employment, and also for better services, to mention a few.

The present study findings shows that there have been more number of males and females moving out of Korogwe DSS rural areas and also a more number of those moving in. People moving into rural areas have been noted to be a higher risk group for HIV and AIDS infection (Coffee, Garnett, Mlilo *et al.* 2005; Mmbaga, Germana, Akhtar *et al.* 2008; Nunn, Wagner, Kamali *et al.* 1995; Nyanzi, Nyanzi and Kalina 2003) in both SSA and Asia. Among the reasons behind this happening is their higher exposure to a number of multiple partners

(Collinson, Tollman, Kahn *et al.* 2003).This indicates the effect of in-migrants in the spread of disease in rural areas. Likewise, rural-urban migration is reported as a conduit for HIV transmission between rural and urban areas (Nyanzi, Nyanzi and Kalina 2003).

CHAPTER 6: DISCUSSION AND CONCLUSION

This thesis has highlighted certain basic findings with respect to the quality of data regarding mortality, fertility and migration levels in Korogwe Demographic Surveillance System (DSS), collected between 2005 and 2007. To study population dynamics, routine demographic surveillance systems and population census have become the major source of information. Since the establishment of DSS site in Korogwe district information was being routinely collected on the deaths, migrations and socio-economic statuses of the study communities/population. For reliable estimation of population growth and changes, it was found important to assess whether or not the data being used are of reasonable quality since, in DSS, errors occur at all stages of the operation (Fottrell, Byass and Berhane 2008; INDEPTH Network 2002; Kirkwood and Sterne 2003). In present thesis, the evaluation of data quality was done using several standard statistical and demographic methods. Careful checks were done to interrogate and validate the quality of data in terms of age and sex reported. Furthermore, cross-validations were done to check the consistency of the DSS data with other sources. The findings on assessment of quality of data in terms of age and sex reported indicated that the data were of acceptable and usable quality. It was also observed that there has been a tremendous improvement of data quality on the reporting date and month of birth by respondent with time. One of the possible reasons for this improvement is the awareness (or realisation) of the community on the importance of keeping and providing correct birth information together with their the confidence on the competence of the DSS field workers. Thus, the information derived from Korogwe DSS site data provide reasonable demographic estimates of levels of mortality, fertility and migration.

Mortality studies are widely undertaken in many countries to assess the fate of population change, particularly whether and the extent to which it has grown, or failed to survive or stagnated. The estimates of mortality in Korogwe DSS were obtained from the information on the deaths that had occurred during 2005-2007 period. The percentage of deaths was noted to be high among adult aged 15-60 years and this accounted to 40.4 per cent of all deaths. Male infant mortality rate was 63.6 and female infant mortality rate was 52. per 1000 live births among resident population. The overall death rate among resident males and females were 11.3 and 9.9 person-years, respectively. The low levels of mortality among infants observed in Korogwe DSS site was almost similar to that of 68 death per 1000 live births, therefore, this has gone down from 99 per 1000 live births recorded in 1999(DFID 2007; UNICEF 2010). The infant mortality rate has been used as a measure of both current health status of a population and a basis for predicting the health status of the next generation (NCHS 2010; Reidpath and Allotey 2003). Thus, from the present study findings, it has been noted that there has been is a dramatic improvement in people's health in Korogwe, despite problems of under reporting of deaths noted earlier.

A study of mortality risks needs information from age-specific morality rates for males and females. The age patterns of mortality in the population are widely described by a model life tables that record the mortality experience of the group of persons born during a given period. Abridged life table of Korogwe DSS for males and females were constructed based on the data from the observed populations. The expectation of life at birth was higher for females than that of males that is 63.3 versus 58.6 years respectively. The superiority of the female expectation of life over male observed might be linked with a combination of factors that include biological and occupational (Abbott 1973). In general the expectation of life in Korogwe DSS is higher than those reported by INDEPTH (2002) from other DSS sites within the country, also higher than the country estimate (Lopez, Ahmad, Guillot *et al.* 2003). An important contribution on the high level of expectation of life noted might be made by the reduction in mortality from diseases such as malaria that has been reported to decrease in the study site (Mmbando, Vestergaard, Kitua *et al.* 2010), and for that reason, adoption of feasible measures in prevention and cure will make it possible for the improvement of life expectancy in Tanzania.

The age-specific mortality in Korogwe plotted on log scale against the estimated age-specific rates using INDEPTH pattern 2, gives a similar pattern for adults aged above 30 among female and those aged above 40 years among males. A slight hump noted on the probability of death estimated from Korogwe DSS reflects excess of HIV/AIDS related mortality. The probability of dying for males and females aged 15-60 years were 376 and 334 per 1000 population respectively in 2007. The disparity in mortality has been explained elsewhere as a combination of both biological and socio-economic factors (Gjonça, Tomassini and Vaupel 1999). Assessment of death data shows that there has been a problem of underreporting of deaths especially among adults aged 40 years and above. The problem of underreporting of deaths raised an urgent need to develop strategies for collection of death events. Currently, Korogwe DSS has introduced a new system for collecting vital events using village reporters, and new tools for collection of information on the cause of death adopted from INDEPTH have been implemented.

The impact of HIV/AIDS on the age patterns of mortality in Korogwe was examined by comparing the probability of deaths observed and that on Caole-Demeny North model life table. The ratio of the probability of deaths among adults aged 20-50 years in Korogwe relative to

Coale-Demeny North model life table level 20.6 for males and females were 2.0 and 2.4 respectively, hence this reflecting that HIV/AIDS has had a huge impact on adult mortality in the district. Despite its shortcomings, the methodology used that relies on assumptions that AIDS mortality is lower among 10-15 age group used match with Korogwe life table, provides useful information on the magnitude of the epidemic. The approach of the North Model Life Table used in the present analysis needs to be improved and extended to other DSS sites in-order to provide estimates of the HIV/AIDS burden in the country.

According to the United Nations (1973), fertility is one principal components of population dynamics. Therefore, in the present analysis, evaluation of the fertility data was done by using several indirect methods (P/F ratio method and Relational Gompertz models) in order to overcome the problems of under-reporting of births and omission of children ever born. Nevertheless, it has been reported that indirect estimation has the weakness that models do not reflect reality precisely and can become sources of error themselves if the underlying assumptions are violated (Muhwava and Timæus 1996). The value of TFR estimated from P/F method of 5.1 is within the range of the RG estimates of 4.8 to 5.3 and indicates a closely corresponding value of the derived total fertility rate. The lifetime and period fertility estimates were 5.6 and 5.1 children per woman respectively, indicating that fertility transition has been experienced in the DSS site. Analysis based on projected parity progression ratio shows 94.4 per cent of women aged 30-34 expected to proceed to have a first and second child, and the same group of women will have parity 3 to 4 at the end of their childbearing. The proportion of women in Korogwe DSS with higher parities is declining as compared with those aged 45-49 years. These findings provide an important insight on the decline of the fertility and also indicate that completed family size for younger women cohorts are smaller. The reason for the decline might be associated with family planning programmes in the country established in 1992.

The concept of population migration has been noted to be something more than just mobility of people, as it includes force that deeply changes the conditions of life. The changes of the conditions of life mean reshaping social and economic structures of individuals and the communities at large. Migration situation in the study area is characterized in different ways. People migrate from their family ties due to the number of reasons, some of which include change in marital status (marriage, separation and divorce), seeking better sources of income, education, and to various environmental disasters. Taking advantage of rich information of longitudinal data, the characteristic of migration in Korogwe DSS were examined, and it was observed that overall, the in and out migrations were 71.6 and 107.4 per 1000, respectively. Also, the age-specific migration rates of out-migration were greater than in migration rates for both males and females. The higher rate of out-migration was noted among females aged 15-19 years. Marital changes and obtaining better education among females in this age group might be the possible reasons for out-migration. It was also reported elsewhere that females in this age group migrate in order to experience life with more autonomy (Kahn, Collinson, Tollman *et al.* 2003). Similar migration streams were observed being characterized by higher rates amongst the youngest ages, lower rates at the 10-14 age groups, a peak at the 20-24 ages, and a gradual decline up to the oldest ages. The rural in-migration rate was found to be lower at all ages than the out-migration rate. The low rates of people coming back to their villages is an evidence of people moving to urban settings looking for better life and that is why the population in Korogwe DSS in 2007 was 7 per cent less relative to the baseline population in 2005. Evidently, the urban population growth in Eastern African region have experienced very high rates since 1960 to 2005 as compared to the rest of African regions(Zlotnik 2006). Consequently, there is a need for further research in this area in order to explore the socio-economic determinants affecting migration in study site.

In conclusion, it is expected that in future, expansion of the DSS area and strengthening the collection of demographic indices will help to obtain better estimates of mortality and other demographic parameters. The analysis presented in the present thesis was based on DSS data from 2005 to 2007, and general observation indicates an improvement in the quality of data over time. It is evidently convincing that re-analyzing the data from 2005 to 2010 may provide better estimates of mortality, fertility and migration based on the findings obtained from 2005 to 2007. Also, comparing of the population dynamics of Korogwe based on DSS with other districts' DSS (particularly in the INDEPTH Sites) using a same/similar methodology as used in this thesis will assist in the evaluation of the impact of health programmes in the sites and provide a means of monitoring various forces of population change over time. Furthermore, if sufficient information could be obtained, one could determine cause specific mortality and compare it with other sites and sources. Furthermore, analysis of the data from Korogwe site to incorporate multi-state life table (MLT) in the estimation of mortality would be much more useful.

The present study analysis provides findings that will be used by the District authorities as input for health and other development planning purposes, including setting crucial priorities.

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