ASSESSMENT OF THE CAUSE OF DEATH AND CHARACTERISTICS OF CHRONIC ILLNESSES IN ADDIS ABABA WITH EMPHASIS ON HIV/AIDS (A COMMUNITY BASED STUDY)

By
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DECLARATION

I, the undersigned, declare that this thesis is my original work, and has not been presented for the degree in any other university, and that all sources of material used for the thesis have been duly acknowledged.

Name:_____

Signature:_____

Date of submission_____

Confirmed by (principal advisor) _____

Signature:_____

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Acronyms

ART: Antiretroviral Treatment

CD: Communicable Disease

CI: Confidence interval

CMR: Crude Mortality Rate

CSA: Central Statistics Authority

CSMF: Cause specific Mortality Fraction

DHS: Demographic and Health Survey

EPHA : Ethiopia Public Health Association

HAPCO: HIV/AIDS prevention and Control Office

HH: Household

HIV: Human Immunodeficiency Virus

HPN: Hypertension

KK: Kifle Ketema

MOH: Ministry of Health

NCD: Noncommunicable Disease

OR: Odds Ratio

PMR: Proportional Mortality Ratio

RHD: Rheumatic Heart Disease

SSA: sub-Saharan Africa

TB: Tuberculosis

VA: Verbal Autopsy

VCT: Voluntary Counseling and Testing

WHO: World Health Organization

Abstract

Background: Information on causes of adult deaths is relatively scarce in developing countries where vital registration systems are often incomplete or nonexistent and many deaths occur at home.

Objective: To obtain a community based estimate of the specific causes of mortality and the burden of chronic morbidity in an urban adult population with major emphasis on determining the pattern of HIV/AIDS mortality in Addis Ababa.

Method: A cross sectional quantitative study was done from Dec. 2004-Jan. 2005 on 3600 randomly selected households in Addis Ababa. An appropriate VA tool and chronic morbidity assessment questionnaire were utilized for data collection.

Results: The crude death rate was 8.1 per 1000 population per year. The cause specific mortality fraction of AIDS/TB , noncommunicable disease and accidents were 44.3%, 15.3% and 11.2% respectively. Age and sex specific mortality picture of AIDS showed that at early adult age (20-29) years, females exhibited a very high death rate than their male counterpart, which is high at 29-34 years of age Seventy five percent of deaths were found to have occurred at home with health institution deaths accounting for only 21%. Hypertension, asthma, cardiac problem and psychiatric illnesses were the commonest chronic illnesses identified during the study. AIDS mortality fraction is still higher as compared to other causes of deaths in Addis Ababa. The burden of AIDS mortality is higher in the center of the city where socio-economic status is low and prostitution and sex marketing is high as compared to the outer city.

Conclusion and Recommendation: The proportional mortality due to AIDS is high as compared to other causes of deaths in Addis Ababa. At early adult age females exhibited higher AIDS specific mortality rate than males for which it is high at later age. Chronic non- communicable diseases are also posing significant health problems in terms of chronic morbidity and mortality in the city. Continuation of such community-based surveillance of cause of deaths is recommended.

Introduction

Information on levels of mortality and causes of death is critical for determining public heath policy, planning health programs, and evaluating health care activities and intervention results (1). Measuring cause-specific mortality and burden of chronic morbidity in developing countries is however problematic due to the fact those vital registration systems are often nonexistent and many deaths occur at home (2).

Because of the lack of reliable mortality and morbidity data from sub-Saharan Africa, mortality estimates are heavily based on assumptions and extrapolations that are never validated (3). Although shift in the patterns of mortality in sub-Saharan Africa are being increasingly recognized internationally, very few reliable data are available to substantiate that argument (4).

At present, conventional wisdom states that Non-communicable diseases (NCD) are not a high priority area for health research and development in the countries of sub-Saharan Africa. The estimates in the 1990 Global Burden of Disease study suggested that noncommunicable diseases accounted for only 14% of the total burden in sub-Saharan Africa, and for just under a third in adults aged 15-59 years (5). Nonetheless, in absolute terms the estimates also suggested that the probability of death from noncommunicable diseases is higher in sub-Saharan Africa than in established market economies (6, 7, 8).

This also applies to HIV associated morbidity and mortality. In Sub-Saharan Africa, where the extent of the current epidemic is very high many AIDS deaths occur at home

and health facility based data on HIV associated mortality are very limited (9). Similarly in Ethiopia, deaths that occur in the community are not registered. Thus causes of deaths are documented only if they occur in hospitals. Since the majority of deaths happen in the community, the extent and causes of death including the proportion of HIV/AIDS associated mortalities and morbidity is not known.

It is often stated that chronic diseases are so rare in developing countries that an investment in better services would not be justified. This seems to be a false impression, rather based on prejudices and incomplete data. People suffer from long standing pain and symptoms caused by incurable conditions like cancer, heart disease, diabetes, etc. (10). Recently AIDS patients have also joined this group alarmingly. Chronic illness, whether from AIDS, cancer, diabetes or cardiac disease has become one of the important causes of adults suffering and mortality which silently undermines their physical and mental health and weakens their socioeconomic status (11). It is expected to rise due to AIDS, especially with increasing availability of Anti Retroviral Treatment (ART).

Improved surveillance and study of causes of death and chronic morbidity is therefore needed in order to place communicable diseases such as HIV/AIDS and non communicable diseases properly within the context of the overall burden of the disease. The major challenge to do vital registration based surveillance is however the availability of limited resources and facilities in the developing countries.

Verbal autopsy (VA) has become an alternative approach, which is relatively simple and inexpensive to determine causes of mortality especially in developing countries where

there is no satisfactory registration and documentation system of deaths (2). The VA technique is based on the assumption that most causes of death have distinct symptom complexes, and these can be recognized and reported by lay respondents during the interview (2, 12, 13).

One of the main advantages of data collected through household surveys is that they provide person-or household-based health statistics. This is in contrast to the data collected through health services or disease registries that are episode or event based (14). Episode or event – based data are not representative, due to population heterogeneity in accessing health services and in health-seeking behavior, which usually leads to selection bias, and also due to uneven quality of data collected by the health services (15).

The purpose of this study was therefore to assess cause-specific mortality and chronic morbidity at household level in Addis Ababa with emphasis on HIV/AIDS using a standardized verbal autopsy tool and morbidity assessment questionnaires.

Literature review

Several recent reports have called attention to the process of health transition in the developing world. The aging of the population, reduction in fertility, improved preventive and therapeutic control of infectious diseases, and the westernization of life styles may all contribute to a decrease in the disease burden attributable to communicable disease and to an increase in that attributable to degenerative and man-made disease and injuries (16). A health transition can be regarded as the combined effect of a demographic transition, involving change in fertility and mortality pattern, and an epidemiological transition involving changes in the environment and lifestyle (17).

Murray and Lopez (18) developed criteria for a worldwide comparison of disease burden by classifying causes of morbidity and mortality into three major groups namely group I infectious, maternal and nutritional diseases, Group II Neoplasm and other non communicable diseases and Group III accidents. A practical application of this classification indicated that, in sub-Saharan Africa (SSA), communicable diseases such as HIV and malaria were still a major threat to health but that the burden of non communicable diseases and injuries could be expected to increase rapidly (16). Thus there is a double burden of disease in the developing world: the continuing burden of communicable diseases and the emerging burden of non-communicable diseases resulting from heath transition (17).

From the analysis of historical data on causes of death for the urban population of Banjul (The Gambia) for the period of 1942-97, Van der Sand et *al* reported that most adult

deaths were attributable to communicable diseases with the major causes of death being acute respiratory tract infections, tuberculosis, gastroenteritis and malaria among communicable diseases and cardiovascular diseases and malignancies from NCDs (16). It was also indicated that there was a shift in proportional mortality rate that the contribution of communicable disease declined and that of noncommunicable diseases and injuries increased.

Epidemiological data from at least two African countries suggest that in some areas, predominantly urban, the prevalence of diabetes and hypertension has increased markedly over the past years. Thus, estimates indicated that 5-10 % of urban population in Dar es Salam and in South African townships are affected with diabetes, while 20(33 %) have hypertension (based on blood pressure levels of $\geq$ 160/95 mmHg)(18**).**

The burden of noncommunicable diseases is likely to increase in the coming decades. The projections from the global burden of disease study suggest that by the year 2020 the proportion of the overall burden in sub-Saharan Africa due to non –communicable diseases will increase to somewhere between 26% and 34%, and among adults aged 15-59 years to between 37%-42%(19). The increase is mainly due to demographic change leading to older populations. However, for some conditions, such as diabetes and hypertension, age-specific rates are likely to increase with urbanization and changes in health-related behaviors (19).

This picture of high probability of death from noncommunicable diseases is supported by data obtained from the Tanzania demographic surveillance system of adult mortality and

morbidity project(7). The result showed that in at least three areas of the united republic of Tanzania, one of Africa's poorest countries, the probability of death from noncommunicable diseases were indeed higher than in established market economies (7, 8). Additionally, among adults, the age specific death rates from noncommunicable diseases are substantially higher in all age groups (i.e., 15-29 years, 30-44 years, and 45-59 years). On the other hand, noncommunicable disease accounts for 15-25 % of all deaths in persons aged 15-59 years (8).

Community based studies on the magnitude of noncommunicable chronic illness are deficient in Ethiopia. A few health institution based studies on cerebrovascular diseases reported that hypertension was the single most important factor for patients admitted in Tikur Anbessa hospital for cerebrovascular accidents or stroke (20,21).

In making the prediction of a “huge increase” in noncommunicable diseases over the coming decades, one should consider the uncertainty posed by the HIV/AIDS epidemic in sub-Saharan Africa. Estimates indicate that in the year 2000 there were 3.8 million new cases of HIV infection in SSA, contributing to the estimated 25.3 million cases prevalent in this region, and the overall 8.8% of adults aged 15-49 years were infected(22).

AIDS has already caused 2 million deaths in Ethiopia, and this number may rise to more than 3.5 million by 2009 unless effective measures are taken. Because of AIDS the number of adult deaths has doubled and it would be also responsible for about ten years penalty on the life expectancy of the Ethiopian population by 2009(23). The immediate impact of HIV/AIDS is chronic morbidity or sickness and death to individuals. The

impact of HIV/AIDS however goes beyond sickness and death of individuals and affects families, institutions, sectors and society at large.

Meeting the challenges to improve the production of mortality and morbidity statistics in lower income countries will require new techniques, new technologies and new thinking about sustainable, representative, reliable systems for determining cause of death. One promising direction is to expand implementation of sample or sentinel mortality surveillance using VA methods. The technique of VA is becoming an increasingly popular and reliable method for the community diagnosis of major causes of death in developing countries where vital registration is lacking (24).

Studies on the Diagnosis of HIV related adult death using VA tools in Uganda indicated that 47% of deaths were classified as HIV- related with the overall specificity and positive predictive value of the VA tool were both 92%. The specificity for those aged 13-44 years were 85% and the result suggest that VA studies may assist in providing data on HIV associated mortality in the general population and may be useful as surveillance tools (1). Miraz *et a*l.(13) also reported that there was concurrence of diagnosis between the Hospital and VA derived diagnosis in 72 % of deaths.

A study done to test the diagnostic accuracy of VA tools in adult deaths that occurred in hospital in Tanzania, Ethiopia and Ghana disclosed that the most common causes of death were Tuberculosis/AIDS, malaria, meningitis and cardiovascular disorder with cause

specific mortality fraction of 18.6%, 10.7%, 8.3% and 8.2% respectively with specificity of and sensitivity of at least 80%(1).

Knowledge of the levels, causes, distribution and determinants of morbidity and mortality among adults in Ethiopia is extremely deficient compared with other countries. In Ethiopia, only a few hospital and burial based studies on the estimation of HIV/AIDS related mortality was done using standard VA instrument. A prospective study on HIV/AIDS related deaths based on lay diagnosis at burial sites in Addis Ababa disclosed that the major cause of death was TB/HIV/AIDS related diseases which accounted 48% of all adult deaths. Moreover when heath facility based and VA diagnosis methods were used to validate lay diagnosis methods they provided almost similar sensitivity and specificity results (25).

Another study done on the identification of cause of adult death in a predominantly rural population in Ethiopia (Butajira) using a simplified VA methodology revealed that major causes of death were acute febrile illness (25.2%), liver diseases (11.3%), diarrheal diseases (11.1%), tuberculosis (9.7%) and HIV/AIDS(7.4%) and concluded that the simplified approach to verbal autopsy diagnosis can produce useful date that can effectively guide priority health interventions in rural areas where routine information system is either very weak or non-existent(26).

Data on the burden HIV/AIDS related morbidity and mortality as compared to other causes of deaths and sickness in Ethiopia are scarce so that there is a great need to conduct an extensive study on a community basis to obtain reliable information on this area.

Objectives:

General Objectives

To determine the specific causes of death and estimate the magnitude of chronic disease (morbidity) in an urban adult population with emphasis on HIV/AIDS.

Specific Objectives:

1. To identify major causes of adult deaths
2. To determine cause and age specific adult mortality rates
3. To assess the magnitude of chronic illnesses including HIV/AIDS in adult population

Methodology

Study design:

The study utilized community based cross sectional design.

Study Area:

The study was conducted in Addis Ababa, which is the capital city of Ethiopia. Addis Ababa is located in the heartland of the country in an area of 540 sq km. It is situated 38 degrees East longitude in a plateau that stretches at the range of 2200-2800 meters of altitude above sea level. The projected total population of Addis Ababa for 2005 based on 1994 census was 2.8 million of which about 65 % are between the ages of 15-64 years(27). The average household (HH) family size is 5.3 with 32% of them below the age of 15, thus 3 out of 5 family members are adults over the age of 15 years and the crude death rate is 7.6 per 1000 population (28).

At the time of the study the city was divided into ten *Kifle Ketemas* (sub-cities) under which 100 kebeles (smallest administrative units) are included. Addis Ababa has the best health coverage in the country which is 88.25%. There are 24 hospitals, 23 health centers, and 456 clinics in the city. The low per capita income, sub standard housing condition, high infant and maternal mortality rate, poor sanitation, poor infrastructure and social related hazards characterizes the city population leading to high level of morbidity and mortality from communicable diseases such as TB &HIV/AIDS, nutritional problems and high rate of accidents often related to bad motor traffic(28).

According to the 2004 health indicators report of the MOH, the city documented IMR of 61/1000**,** MMR of 566/100,000, EPI coverage of 78% and contraceptive use prevalence of 30% (29,30).

Study Population:

The source of the study population was all adult (15-64) year old residents of the city of Addis Ababa.

Inclusion Criteria:

Mortality study: All deaths of permanent residents aged between 15 and 64, in the selected HH within the last one year (Sept., 2003 up to Aug., 2004) were included.

Chronic morbidity study: Those permanent adult residents in the selected HH having chronic health problem were considered and interviewed about their health problems using the prepared morbidity assessment questionnaire.

Exclusion Criteria:

Those who were below the age of 15 or above the age of 64 and also those who were not permanent residents of the selected Kebeles, were excluded from both mortality and morbidity study as well as from family demography data recording format.

Sample size determination:

Sample size was calculated using single population proportion with the following formula and assumptions

$$n = \frac{[z\alpha/2^2 \; p(1-P)]}{d^2}$$

Expected prevalence (crude death rate) = 0.8%

Desired precision (%)=3%

Confidence interval=95%
Non-response rate =10%
Sample Size = 4855+485=5340

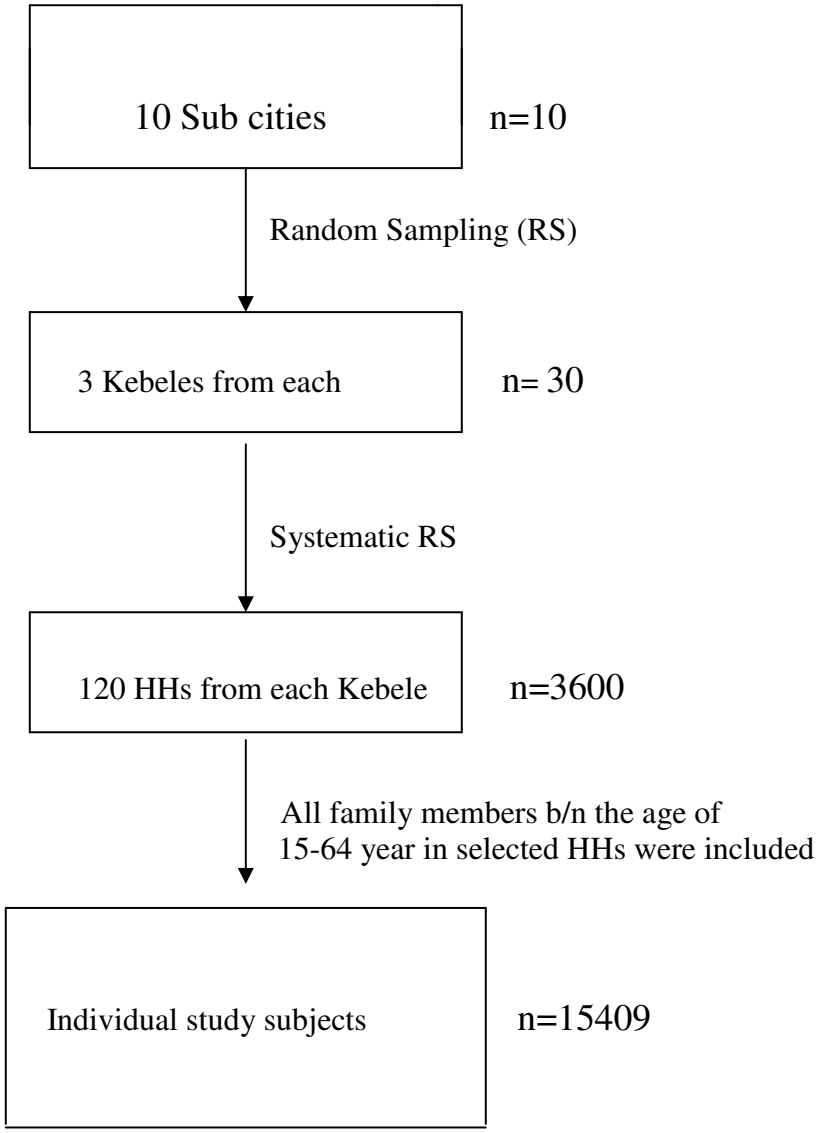
According to crude mortality rate (CMR) of the city indicated else where i.e 7.8 per 1000, the number of deaths that could be obtained from 5340 study population would be about 40 which is not enough to entertain mortality calculations. Thus, in order to get sufficient number of death cases (about100) for calculation of mortality indices, the total number of households to be studied need be then doubled, i.e 10,680, which makes the total study HH to be 3600 (with average adult family members of about 3 in each HH in the city).

Sampling procedure:

In order to get fairly representative adult study samples from the city of Addis Ababa, all the 10 kifleketams (sub-cities) were included in the study. Random sampling procedure was then employed and three kebeles were randomly selected from each of the ten Kifleketemas, which makes the total number of kebeles studied to 30 out of 100 newly organized kebeles in the city. The selected kebele was then further divided based on the previous kebeles or small administrative sub-units (*ketena*) and 120 HH samples were distributed based on the number of HH found in each sub-unit.

Systematic random sampling was then employed and a total of 120 study HHs were taken from each kebele and all family members between the age of 15-64 years who were permanent residents in the selected HH were included in the study. The sampling procedure is illustrated in page 13.

The following flow chart shows the sampling procedure of the study subjects



Data collection

The document containing the distribution of kebeles in the newly organaized sub cities was obtained from the city administration office and letter was written from the city council to all sub city administration . Each sub city administration wrote a letter to the selected 3 kebeles to provide the necessary support needed in the process of the study. The principal investigator and supervisors made repeated contacts to the kebele administrators to get necessary information about the demarcations of the selected kebeles and the number of registered households in each kebeles.

Data regarding the circumstances of death for the last one-year were collected using verbal autopsy (VA) Questionnaire which was adopted from one used at the INDEPTH sites (31) Information on chronic health problems were collected using structured chronic illness assessment questionnaires. The demographic characteristics of all eligible household members regardless of the presence of death or chronic illnesses were also taken using the prepared demographic data collection format (denominator).

Ten female enumerators who were twelfth grade complete and two supervisors with a minimum qualification of college diploma were recruited and trained for three days. The principal investigator was responsible for the over all coordination of the survey. Before beginning the actual data collection, enumerators practiced the questionnaire by interviewing their close family members or neighbors having chronic health problems and necessary discussion and clarifications were made after wards.

Data acquisition from the selected HHs relied on three basic quantitative information collection instruments; The HH demographic data collection form(see Annex I), The VA questionnaire(Annex II) and the morbidity assessment questionnaire(see Annex III).

At the start of the interviews, respondents were informed about the purpose of the study. The interview was carried out at every selected household. Those permanent residents of the kebele living in the selected HH who had health problems for longer than one month, were eligible for the chronic morbidity study interview. Those HHs in which death of resident adult family member (between 15&64 years of age) occurred during 12 months of 2003/04 (from Sept.2003-August, 2004) were included in the mortality study. A

family member who was taking care of the deceased during the illness who knew very well about the circumstances of the deceased before his/her death was interviewed using the structured VA questionnaire. If that person was not around at that time another visit was made to interview him/her. If the person was not available in the second visit that HH was excluded from study. The demographic data collection format was filled for every HH included in the study.

The supervisors were responsible to supervise the data collectors, and collect the completed questionnaire every day and they checked inconsistencies and completeness before accepting forms. The principal investigator followed up the data collection process closely and rechecked the filled questionnaires. Data collection took 6 weeks from 9 December 2004 to 22 January 2005.

Outcome variable

Mortality and Morbidity

Independent Variable

Age, sex, marital status, place of living

Data Management & analysis:

Data were entered on to a computer using EPI Info version 6.04d. After cleaning, and editing, the data were exported to SPSS program for analysis. Further cleaning of data was done in SPSS program. Finally, analysis of the frequency distribution of dependent and independent variables was worked out. Diagnosis of the cause of death and chronic illnesses was made using the expert algorithm method. The algorithm was developed from existing clinical algorithms from local clinical experiences and published literatures and finally commented by senior physicians (Annex 4).

The morbidity prevalence rate for chronic health problems in the study population was estimated. The major causes of death, illness and, mortality rates such as age specific mortality rate, and proportionate mortality ratio of different causes of deaths such as HIV/AIDS of the study area was also determined.

$$\textbf{Prevalence of chronic illness} = \frac{\textbf{\# of people in the age group 15-64 with specific type of chronic illnesses}}{\textbf{Total population age 15-64}}$$

$$\textbf{Age specific mortality rate} = \frac{\textbf{\# of deaths in specific age group in a year}}{\textbf{Total population in the specific age group}}$$

Proportionate mortality ratio=# of deaths from a specific cause in a Specified period of time

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Total deaths in the same period

Kappa Statistics were done to compare the agreement between the algorithm-based diagnosis of chronic illness and the diagnosis reported by the relative as informed by heath workers. A binary logistic regression model was used to assess the association between outcome variable (mortality) and independent variables (gender, age, sub cities etc.).

Operational Definitions:

1. **Permanent Resident**: A dweller in the kebele for more than six months or an individual who has an intention to live in the area or all guests and visitors who stayed with the household at least for six months or house maids, guards, baby sitters, etc. who lived and ate with household even for less than six months(27).
2. **Adult**: Any individual whose age is between 15-64 years
3. **Chronic health problem**: Having a health problem for more than one month.

Ethical considerations:

Ethical clearance was obtained from the ethics committee of the Faculty of Medicine. All concerned administrative bodies were officially contacted through letters and the purpose of the study was explained to all levels of the Addis Ababa city administrations offices (city council, sub cities and Kebeles). Before an interview was carried out, the objective and the importance of the study were explained and informed verbal consent was obtained from each respondents. The respondents were informed that information collected would be kept confidential. An Anonymous questionnaire was used to protect the identity and confidentiality of the information obtained from individual participants.

RESULTS

Demographic characteristics of the study population:

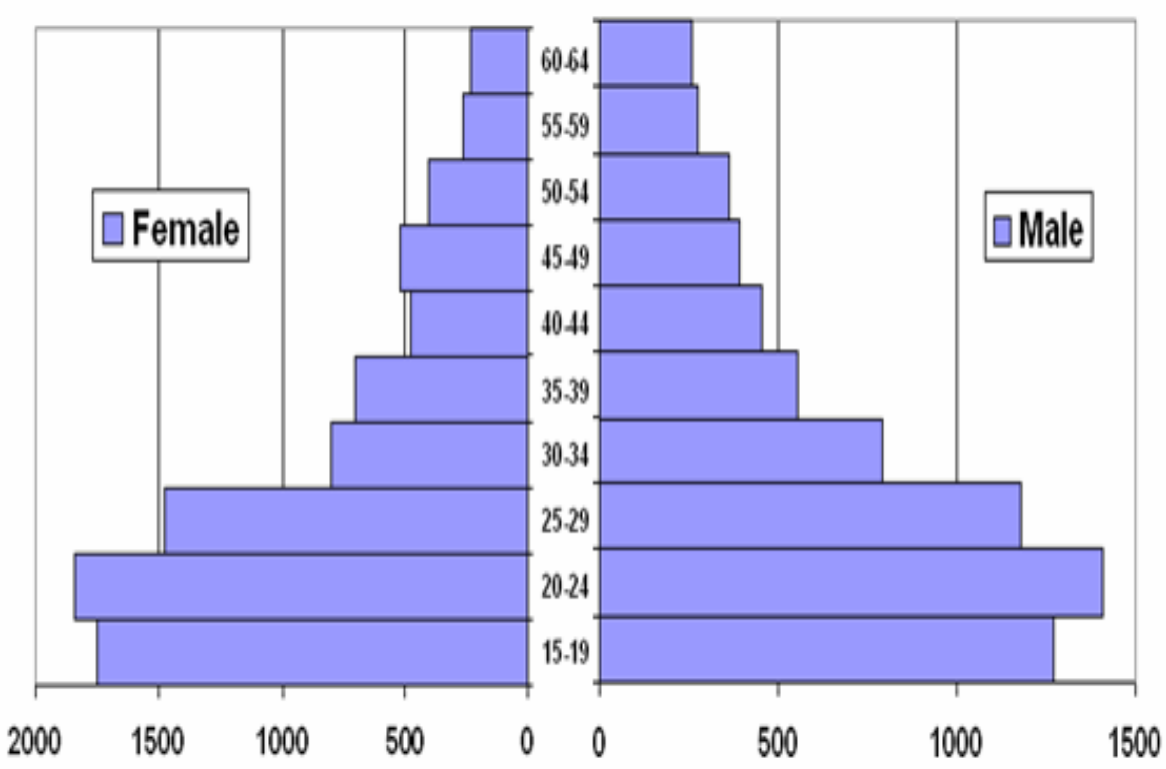
Of the calculated 3600 samples of HHs, 3590 (99.7%) HHs completed the appropriate questionnaires which makes the total number of adult study subjects included in the study 15409. The average household size in the age of 15-64 years was 4.34. Analysis was made based on 3590 demographic data collection questionnaires from each HHs comprising 15409 adult study subjects, 124 Verbal autopsy (VA) questionnaires and 688 morbidity assessment questionnaires.

Thirty-seven individuals refused to give information about their health status and 4 individuals did not want to give information regarding the death circumstances of the deceased relative which made the overall response rate for HHs demographic data format, for morbidity assessment questionnaire and VA instrument to be 99.7%, 99.8 and 97.0%, respectively. Out of 15409 adult study subjects 8473(54.98%) were females and 6936(45.02%) were males. The number of study subjects in the age group 20-24 was higher than all the other groups including 15-19 years in both sexes. The age and sex distribution of the study subjects is indicated in Fig.1.

Mortality study:

The total population of the sample surveyed in ten sub cities was 15409 and the total death events reported in the last one year was 124 yielding a crude death rate of 8.1 per 1000 adult (15-64) population per year in 1996 E.C(95%CI 7.7,8.5). Of the total number of deaths reported 65(52%) were males and 59(48%) were females. As far as marital status of the

Fig 1. Age and sex distribution of the study subjects



deceased is concerned, unmarried, married and divorced/widowed accounted for 65(52%), 48(39%) and 11(9%), respectively.

Over all death rates as well as AIDS specific mortality rate for each sub city were also calculated and presented in Fig.2. The higher overall mortality rate i.e. 14 per 1000 was found in Arada sub cities followed by A.ketema, Gullele and Lideta. A low mortality rates however were recorded from Kolfe Keranyo and Yeka sub cities. Similarly AIDS specific mortality rate was high in Arada, Lideta , and Nefas Silk Lafto sub cities. Where as in K. Keranyo and Yeka it was very low(Fig.2).

When the 15-19 year age group was taken as a reference, statistically significant differences in mortality rate were observed in all other age groups except in 20-24 years. It was also found that Arada, Lideta, Gullele, N. Silk Lafto, Kirkos, and Addis ketema sub cities had significantly higher overall mortality rates when K. Keranyo sub city was taken as reference.(see Table 2). There was no statistically significant difference between the number of deaths of female and male study population (Table1 &2).

The adult age specific mortality rates of the study population were also determined based on the mortality rates of all causes of deaths occurring at different sex and age groups in 1996 E.C. (Fig. 4). The mortality rate of females at earlier age (15-29) was comparatively higher than that of males at the same age intervals. At later age however the age specific mortality rate of males progressively become higher than females, particularly after 29-39 years of age at which, the female mortality rate showed a decline (Fig 4.).

Fig 2. **The distribution of overall mortality rate as well as AIDS/TB mortality rate of adult study population by sub cities in Addis Ababa, 1996 E.C(2003-04).**

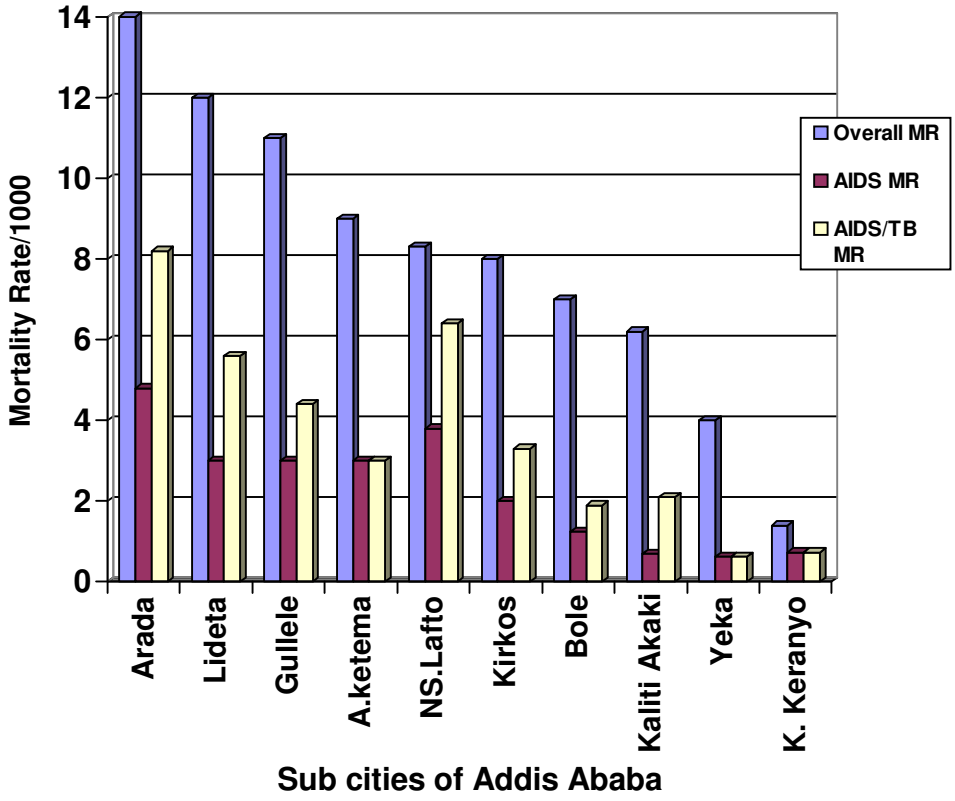
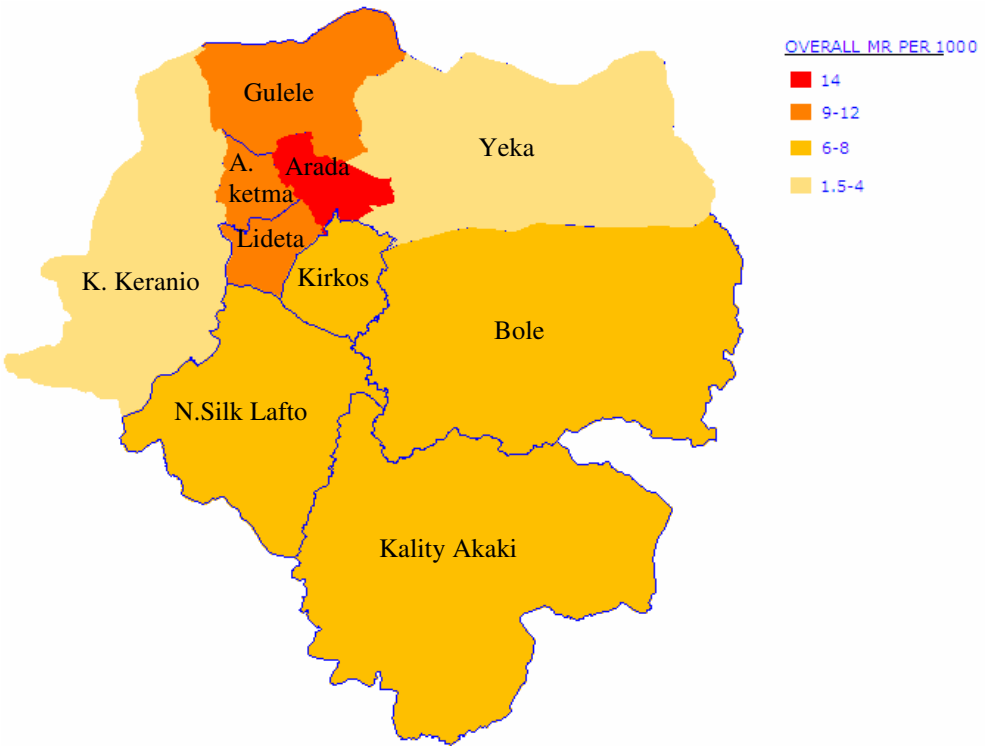


Fig 3. **The distribution of overall (a) and AIDS(b) mortality by sub cities in Addis Ababa, 1996 E.C. (2003/04).**

a).



b)

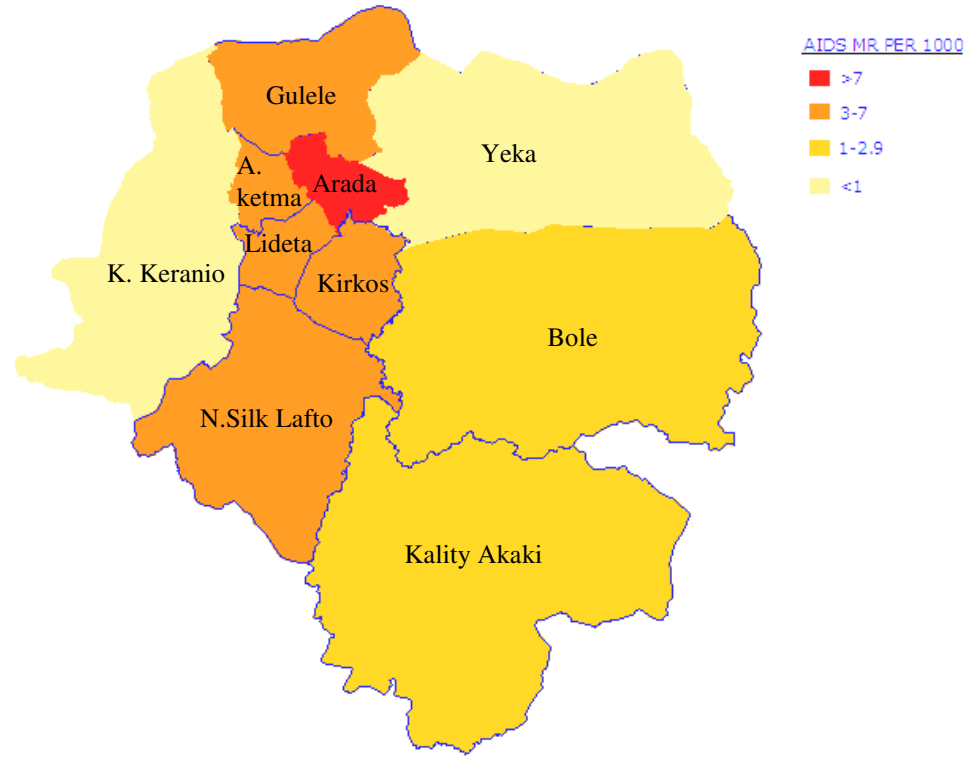


Table 1**. Characteristics of adult deaths in Addis Ababa with selected variables,**

1996 E.C.(2003/04) .

	No. of Deaths (1996 E.C)	n	Prevalence %	95% CI
Sex				
Male	65	6936	0.94	0.71, 1.17
Female	59	8473	0.70	0.52, 0.88
Total	124	15409	0.81	0.77, 0.85
Age group				
15-19	4	3023	0.2	0.04, 0.36
20-24	12	3247	0. 4	0.18, 0.62
25-29	23	2657	0. 9	0.54, 1.26*
30-34	22	1589	1.4	0.82, 1.98*
35-39	15	1259	1.2	0.61, 8.00*
40-44	10	934	1.1	0.43, 1.77*
45-49	18	910	2.0	1.09, 2.91*
50-64	20	1790	1.1	0.62, 1.58*
Total	124	15409		
Kifle Ketemas				
Arada	20	1464	1.4	0.8, 2.0
Gullele	17	1582	1.1	0.59,1.61
Lideta	19	1600	1.2	0.67,1.73
A. Ketema	14	1604	0.9	0.44,1.36
Yeka	7	1626	0.4	0.10,0.70*
Bole	11	1621	0.7	0.30,1.10
Kirkos	12	1514	0.8	0.35,1.25
K. Keranyo	2	1375	0.15	0.00,0.30*
N.silk Lafto	13	1566	0.8	0.36,1.24
Akaki Kaliti	9	1457	0.6	0.21,0.99
Total	124	15409		

* Statistically significant

Table 2. Logistic regression of adult deaths in Addis Ababa after adjusted for sex, age and sub cities. 1996 E.C(2003/04).

	No. of Deaths (1996 E.C)	n	Crude OR 95% CI	Adjusted OR 95% CI
Sex				
Male	65	6936	1.35 (0.93-1.95)	1.49 (0.98,1.91)
Female	59	8473	1.00	1.00
Age group				
15-19	4	3023	1.00	1.00
20-24	12	3247	2.80 (0.40,10.28)	2.74 (0.88,8.50)
25-29	23	2657	6.59 (2.16,22.49)	6.56 (2.27,19.00)*
30-34	22	1589	10.60 (3.46,36.31)	11.04 (3.80,32.11)*
35-39	15	1259	9.10 (2.83,32.46)	9.14 (3.03,27.61)*
40-44	10	934	8.17 (2.36,30.91)	8.52 (2.66,27.25)*
45-49	18	910	15.23 (4.83,53.25)	14.90 (5.03,44.19)*
50-64	20	1790	8.53 (2.75,29.47)	8.52 (2.95,24.99)*
Kifle Ketemas(sub cities)				
K. Keranyo	2	1375	1.00	1.00
Arada	20	1464	9.51 (2.15-58.94)	8.87 (2.07,38.04)*
Gullele	17	1582	7.46 (1.66-46.77)	6.99 (1.6,30.36)*
Lideta	19	1600	8.25 (1.86-51.32)	8.05 (1.87,34.64)*
A. Ketema	14	1604	6.04 (1.31-38.84)	5.83 (1.32,25.73)*
Yeka	7	1626	2.97 (0.57-20.67)	2.72 (0.56,13.10)
Bole	11	1621	4.69 (0.98-30.66)	4.41 (.98,19.95)
Kirkos	12	1514	5.48 (1.17-35.51)	5.20 (1.16,23.27)*
Akaki Kaliti	9	1457	4.27 (0.86-28.61)	4.09 (.881,18.97)
N.silk Lafto	13	1566	5.75 (1.24-36.90)	5.65 (1.27,25.12)*

* Statistically significant

Fig 4. **Age Specific mortality rate of adult population (15-64) of Addis Ababa by sex, 1996 E.C.(2003/04)**

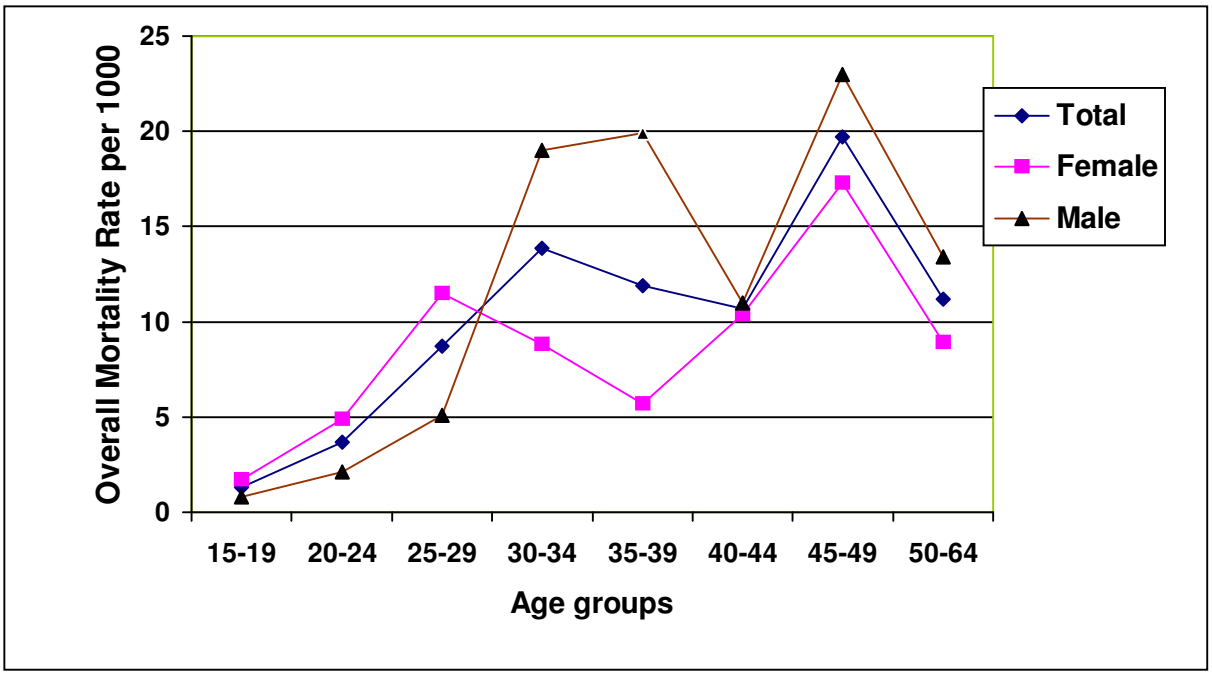


Fig 5. **AIDS Specific mortality rate by age and sex in adult population of Addis Ababa, 1996 E.C.(2003/04).**

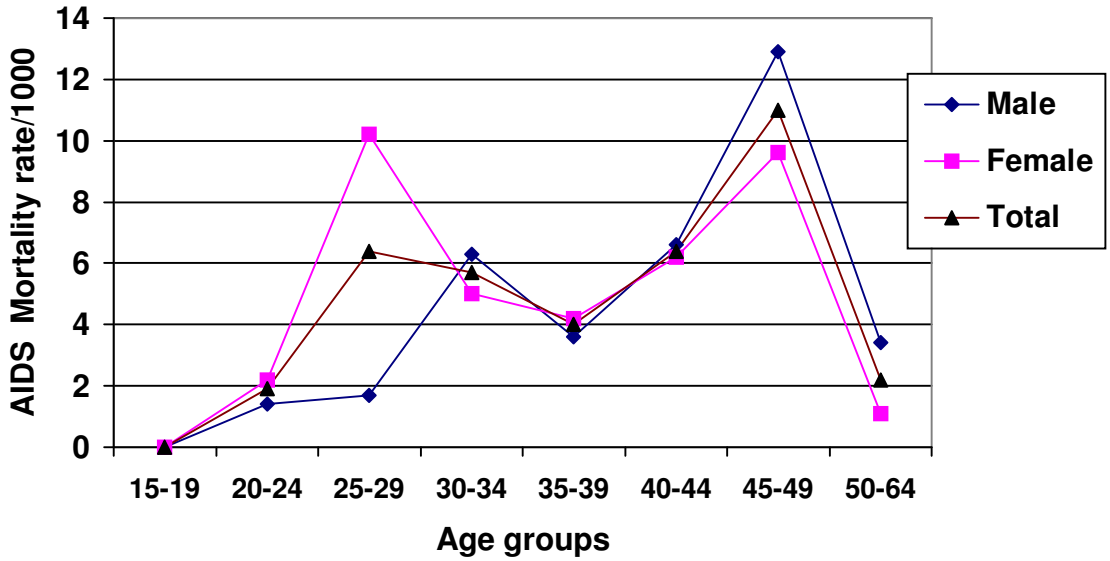


Fig.5 shows age specific death rate of AIDS by sex in the total sample. AIDS death rate showed a sharp increase at early adult age in females (20-29) than males. Slight increase of death rate was shown in males between 25-29 years of age. Around the age of 40 up to 49 years however males exhibited higher mortality than females.

Another important information obtained from the present study is the extent of deaths that have occurred at home compared with that of health institution. This is obviously a function of health care delivery and utilization system in the city. Place of death of the deceased in the study house holds was identified for 2003/04(1996 E.C.) and presented in Figure 6. It was found that the majority of deaths (75%) occurred at home and deaths at health institutions accounted for only about 21 %. Other places where deaths have been reported include holy water places and along roads.

Among major causes of deaths investigated, chronic communicable diseases notably HIV and TB accounted for 44.3 % of deaths followed by non-communicable diseases causing 20.1% of the deaths. Accidents of all types contributed for 11.2 % of deaths, other acute illnesses and unidentified causes accounted for 24.4% of all deaths(Fig.7). Based on the expert algorithm diagnosis, the cause specific mortality fraction (CSMF) of HIV/AIDS alone was 29%.

Of all accidents causing death in Addis Ababa, car accidents was the major one (36%) followed by falls and violence contributing 21% each (Fig.8).

Fig.6. **Distribution of death by the place of occurrence, Addis Ababa, 2003/04(1996 E.C.).**

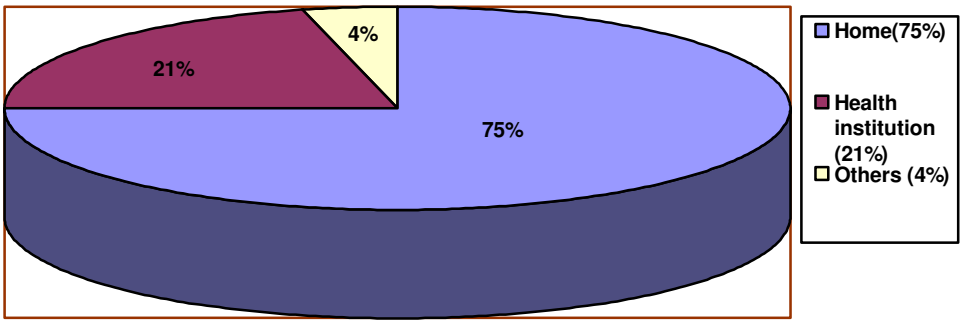


Fig.7 **Cause specific mortality rate and fraction of chronic communicable & Non-communicable diseases, accidents and other causes of deaths in Addis Ababa,**1996 E.C.(2003/4)

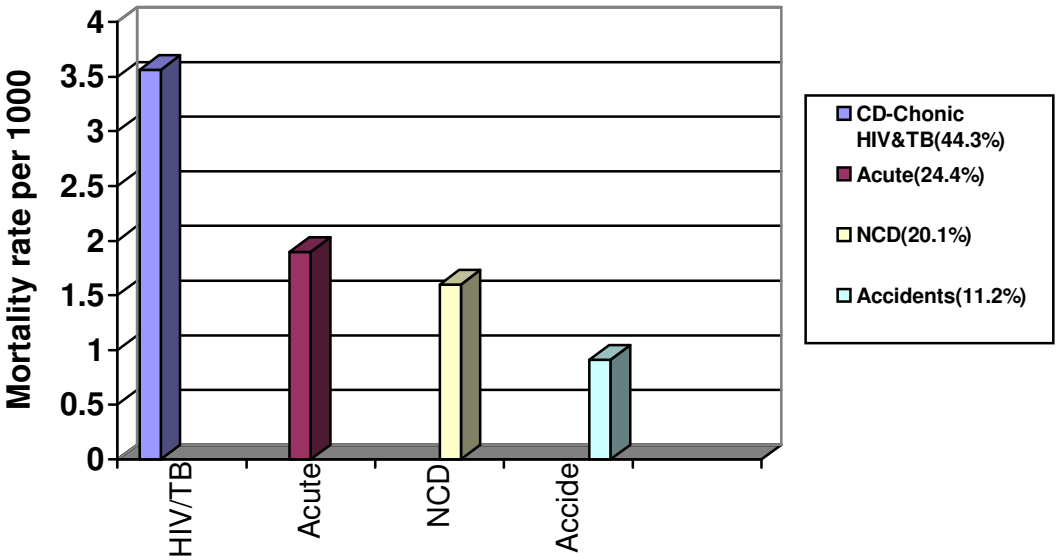
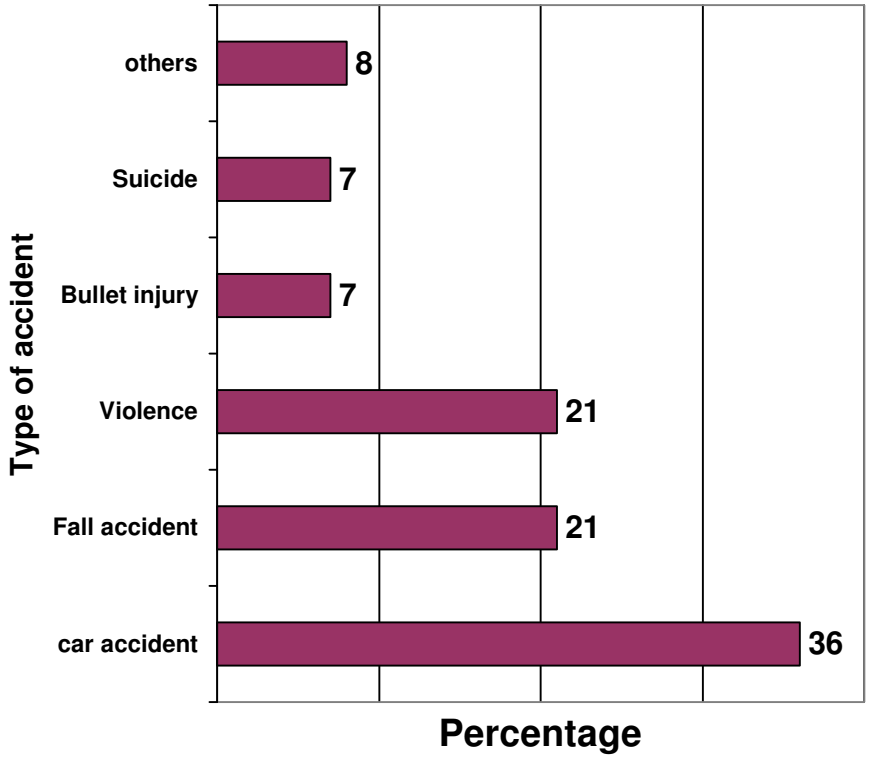


Fig. 8. Proportion of deaths caused by different types of accidents 1996 E.C.(2003/4) in Addis Ababa.



The magnitude of cause specific deaths and chronic morbidity for Addis Ababa population can be estimated based on the following formula.

Total population x prevalence = Number of cases

Based on this assumption, Addis Ababa had 22440 adult deaths in 1996 E.C.(2003/4) out of which 9874 adult deaths were due to HIV/AIDS . Non-communicable chronic illnesses and accidents were contributed 3366 and 2468 of adult deaths respectively. Of the total deaths due to accident, car accident accounted 889 adult deaths in the same year.

Morbidity study:

Of the 15409 adult study population, 688 of them reported having chronic diseases of any type for at least one month. The prevalence of chronic health problems was calculated based on Kifle ketemas (sub cities) of Addis Ababa and presented in Table 3. Among those Sub cities, Arada sub city was found to have the highest prevalence (10.9 %) of chronic illnesses. The lowest prevalence was found in Kolfe Keranio sub city (1.9 %).The overall prevalence when all sub cities were combined was 4.5 %.

As was mentioned in the methodology section of this study, expert algorithm was used to identify the specific causes of chronic health problems from the information collected by chronic illness assessment questionnaire. As the same time information regarding history of diagnosis and treatment in health institution was also collected and used for comparison of the expert algorithm based diagnosis of the specific health problems with that of the clinical diagnosis given to the respondent at a modern health care delivery institutions. The Kappa

statistic; an index which compares the agreement against that which might be expected by chance was calculated. Tuberculosis, psychiatric illness, Asthma, hypertension and Epilepsy exhibited relatively high kappa value of o.98,0.90, 0.87, 0.74 and 0.67, respectively. The result is presented in Table 4.

Relatively high agreements were obtained between expert algorithm and history of clinical diagnosis given to the respondents in the case of Tuberculosis, asthma, and hypertension. AIDS and Diabetes were found to have a low kappa values whereas Epilepsy, chronic liver disease and cardiac problem had moderate Kappa values (Table 4). Among the chronic illnesses identified, those with relatively large numbers of cases and high kappa value namely hypertension, asthma and cardiac diseases were selected and their prevalence were calculated against age groups (fig.9).

The reported case prevalence of major chronic illnesses showed that all the three diseases increased in prevalence with age up to forty. Hypertension increased constantly with age whereas cardiac diseases and asthma declined after forty and again started to go up after 55 years of age through 64.

With 4.5 % over all prevalence of chronic disease morbidity in 1996 E.C.(2003/4), 126225 people in the city were estimated to be suffering from chronic morbidity of communicable as well as non-communicable diseases.

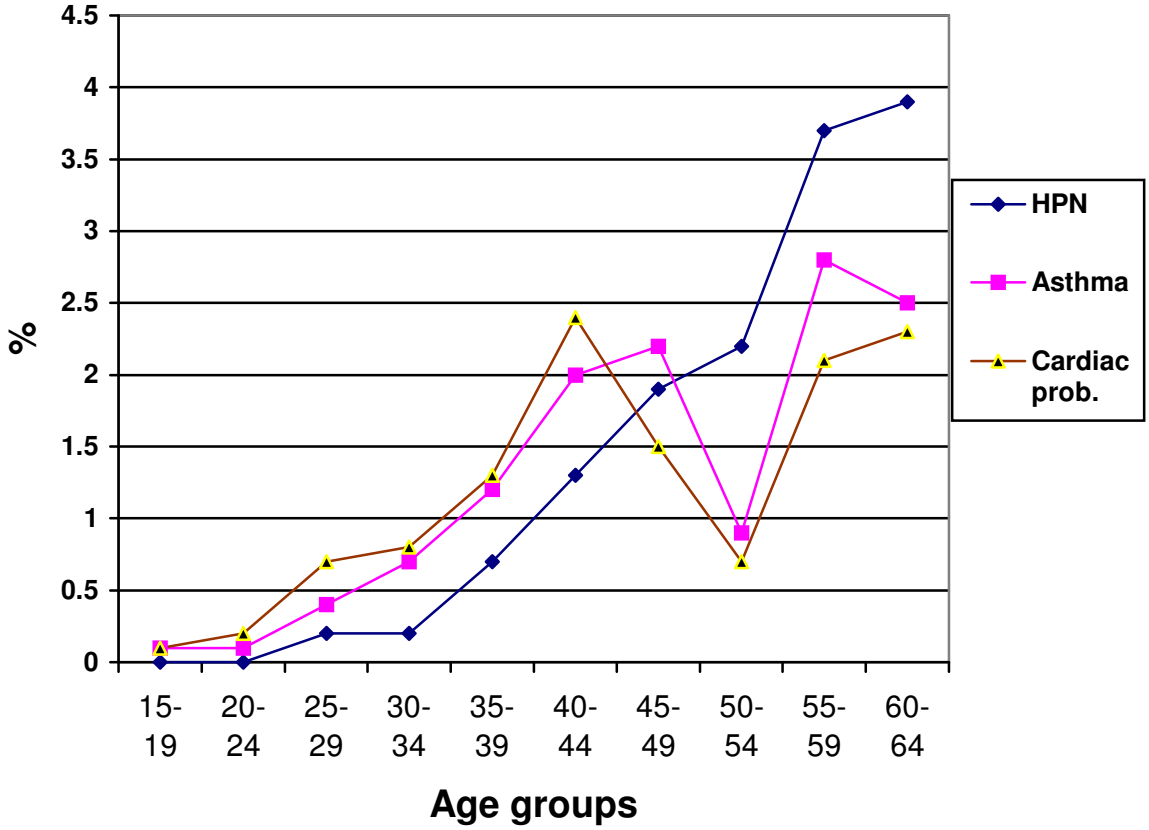
Table 3. Reported case prevalence of chronic illnesses (both communicable and non-communicable) by *Kifleketemas (*sub-cities) in Addis Ababa, 2004.

No.	Kifle ketema (sub cities)	Study subjects (n)	No. of cases	Prevalence %	95% CI
1	Arada	1464	160	10.9	9.30-12.50
2	Gulele	1582	73	4.6	3.57-5.63
3	Lideta	1600	77	4.8	3.75-5.85
4	Addis Ketema	1604	62	3.9	2.95-4.85
5	Yeka	1662	57	3.5	2.62-4.38
6	Bole	1621	41	2.5	1.74-3.26
7	Kirkos	1514	69	4.6	3.54-5.66
8	Kolfe Keranyo	1375	26	1.9	1.18-2.62
9	Nifas Silk	1566	60	3.8	2.85-4.75
10	Akaki -Kaliti	1457	63	4.3	3.26-5.34
	Total	**15409**	**688**	**4.5**	**4.17-4.85**

Table 4. Measure of agreement between expert algorithm and health professional clinical assessment based diagnosis of specific cause of chronic illness using kappa statistics.

Causes of chronic illness	Number of cases		
	Expert algorithm	Clinical diagnosis	Kappa value (Measure of agreement)
AIDS	64	15	0.39
Tuberculosis	67	65	0.98
Asthma	114	141	0.87
Hypertension	102	158	0.74
Diabetes	21	95	0.32
Cardiac problem	121	45	0.50
Psychiatric illness	37	33	0.90
Epilepsy	16	27	0.67
Chronic Liver disease	26	11	0.59

Fig.9. **Reported cases of hypertension, asthma and cardiac disease by age group in Addis Ababa, 2004**.



Discussion:

This study attempted to identify the major causes of death and magnitude of chronic illnesses among the residents of Addis Ababa using VA methods. In this study, the large sample size that included all sub cities in Addis Ababa increased the external validity. There was also a higher response rate than was expected which would improve the internal validity of the work. Since the study was done based on household survey, those deaths and illnesses that have occurred among homeless individuals in the city were not included. Thus the result may not address major causes of deaths and health problems of homeless adult individuals in the city.

Both overall mortality and AIDS specific mortality rates were higher in the center of the city of Addis Ababa. The cause specific mortality fractions of AIDS/TB, noncommunicable disease and accidents were 44.3%, 20.1% and 11.2% respectively. Logistic regression analysis showed that there was a statistically significant increase in OR of mortality among study age groups of 25-29 and above compared to 15-19 age group. Among sub cities, significantly higher mortality rate were identified in Arada, Gullele, Addis Ketema, Kirkos, Lideta and Nifas Silk Lafto sub cities when compared to Kolfe Keranyo sub citity. Seventy five percent of deaths were found to have occurred at home with health institution deaths accounting only for 21 % . Hypertension, Asthma, Cardiac problem and psychiatric illnesses were the commonest chronic illnesses identified during the study.

The proportion of male study subjects were 45.2% and females account 54.8% which is also in agreement with the CSA, 2004 statistical report on basic population, that 45.7%

of the Addis Ababa population between the age of 15and 64 were males(27). The calculated crude death rate of the specified adult age group of study population was 8.1 per 1000 population. The national adult (15-49 years of age) male and female mortality rate is 8.0 and 6.67 per 1000 respectively(29). The crude mortality rate of Addis Ababa population reported to be 7.6 per 1000(30).

The average household size between 15-64 years of age found in this study was 4.3. The census data from 1994 indicated that the average household size of Addis Ababa is 5.3 of which 3.7 is between 15-64(27,30). This difference might be due to the influx of dependent adults to their close relatives living in the capital since the time of the census.
Among Kifleketemas (subcities) in Addis Ababa the highest death rate (8-14) was found in Arada, Gulele, Lideta, Addis ketema and Nifas Silk Lafto sub cities.

The proportional mortality ratio (PMR) as well as the mortality rate due to AIDS were higher in Arada sub city. Both the crude death rate, and PMR and AIDS mortality rate trend were high at the center of the city and decreased in the periphery of Addis Ababa. This finding is consistent with the study result done by Ethiopian-Netherlands AIDS Project(ENARP) that HIV prevalence among adults of the inner city was higher than among adults of the outer city with marginal significance(inner city, 8.2%;95% CI, 6.2-10.2% versus outer city 5.3%; 95%CI,4.1-6.6%)(32). This might be attributed to the relatively low socio-economic status, and high activities of prostitution at the center of the city.

The present study is in agreement with previous studies, disclosing that age specific mortality was higher for females at early age notably between 15-29 years of age(33). This is due to biological and socioeconomic vulnerability of females for HIV transmission at early age than males, in that female initiate sexual activity at younger age and partnership with older males already infected with HIV (32). Since AIDS/TB took large proportion of deaths reported in this study (44%), higher death rate of young females is attributable to AIDS. Similar trends are also reported by MOH in 2003: that HIV prevalence is to be higher in females than males between the age of 15 -29(32, 34). At later age however as males become highly involved in sexual activities and also in high-risk duties, the age specific death rate becomes higher in males compared to females.

The Age specific death rates determined using prospective surveillance of burials in 2001 in Addis Ababa also disclosed that mortality differences were most prominent in the age group 25-39 years for women and 30-44 years for men (33). Another study done on HIV prevalence in urban community settings in Addis Ababa also reported that the peak prevalence for both sexes was in the 25-29 year age group (32). In sub-Saharan Africa, the impact of AIDS on mortality has been documented in many community surveillance studies. In Tanzania , AIDS was the leading cause of death in both sexes aged 15-59 years and in two municipal areas in Dar es Salaam, the 1995-1999 peak mortality was highest between ages 25-29 for women and between ages 35-39 for men(34).

The second highest peak of age specific mortality was observed between 39-49 years for females and between 45-49 years for males and between 39-49 years of age in both

sexes for AIDS specific mortality. This might be due to acquiring HIV by both couples after marriage due to extra-marital sexual behavior and /or failure to utilize Voluntary counseling and testing (VCT) service before marriage or before first sexual intercourse. Studies done in Uganda on this regard stated that men are twice as likely as women to bring HIV infection in to a marriage, presumably through extra-marital sexual activity and lack of utilization of pre-marriage VCT. The study finally recommends that couples should be encouraged to attend HIV counseling together so that sero-discordant couples can be identified and advised accordingly (35).

There are a number of approaches used to measure cause specific mortality. The most appropriate approach suggested in a country like Ethiopia has been VA. This has been clearly justified by the present study that 75% deaths reported by the respondents occurred at home. Only 21% of deaths happened at health institutions. The validity and reliability of VA estimates of the cause -specific mortality depend on several factors such as the true underlying distribution of cause of death in the population, the age and sex of the respondents and her/his relation to the deceased, the specific VA tools and the data collection process (2).

In the population we studied HIV has become the most common health problem and cause of death. The sign and symptoms of HIV associated diseases such as chronic diarrhea, TB, weight loss, Herpes zoster are easy to remember and reported by respondents. This should in principle contribute to a high sensitivity of the study method.

Despite all the drawbacks, VA seems to be the most promising way of establishing cause of death when most deaths take place at home with out medical attention (2,26,36). The simplified approach to VA diagnosis can produce useful data that can effectively guide priority health interventions in rural areas where routine information system is either very weak or non-existent (26).

The share of AIDS/TB death in this study was 44.3% with the understanding it might be difficult to differentiate between HIV/AIDS and TB using the VA method. The algorithm for AIDS diagnosis seems more specific and has relatively low sensitivity because of the sign and symptom combination used. HIV/TB mortality can be taken as a worst case scenario for estimation of AIDS deaths, considering that TB alone may not necessarily cause death or it is uncommon phenomena of TB to bring about adult death in urban environment where anti tuberculosis treatment is available unless it is associated with AIDS. Previous studies have also disclosed that lung disease such as TB has high specificity (90%) and relatively high sensitivity to estimate the share of AIDS deaths (36).

Similarly burial based lay diagnosis estimates of AIDS attributable mortality was reported from Addis Ababa by Araya *et.al* that 48% adult deaths and 68% of deaths in the adult population of age 20-54 were due to HIV/AIDS(25, 36).The slightest decrease in the CSMF of AIDS in the present study might be due to the epidemic maturity in the city that most people are becoming aware and taking precautions to prevent the transmission. The Anti retroviral treatment services being implemented in the country might have also contributed its own part for the decline of AIDS related mortality in the city.

In this study Non-communicable disease (NCD) accounted for cause specific mortality fraction of 20.1% of adult deaths which is in agreement with the estimate of 1990 global burden of disease study which suggested that NCD accounted for only 14% of the totalburden in Sub Saharan Africa(19) . On the other hand, NCD contributed 15-25% of all adult deaths (i.e persons aged 15-59 years) in Tanzania demographic surveillance study (7). Another study done in Addis Ababa to monitor AIDS mortality by lay diagnosis reported that about 60% of the adult deaths were classified under communicable diseases, with non-communicable diseases comprising 25%(36).

Among chronic NCD, those causing the majority of deaths were chronic liver disease, cardiac disease, hypertension and psychiatric illness, contributed for 4.8%, 4.0%, 3.2% and 2.4% percent of the overall deaths, respectively. The percentage of mortality attributable to Diabetes was 2.0%. The contribution of hypertension to the overall mortality in developing countries such as Nigeria and Mali was 2.5% and in South Africa, infectious disease accounts for 28 % of years of lives lost while chronic disease account for 25%(37).

The contribution of accidents to the total deaths was about 11% of which car accident accounted for 36%. This was consistent with the study done in 1999 on the trauma registry in Tikur Anbessa hospital, indicated that road traffic injuries accounted for over 41% of all injuries and 93% of these victims were pedestrians (38). Ethiopia is one of the countries with the highest traffic death rates accounting to 180/10,000 vehicles compared to less than 2/10,000 for most developed nations (39).

Mortality due to accidents was studied in The Gambia and the largest specified cause was traffic related accident, accounting for 127/814(15.6%) of deaths, which had increased over the decades (16).

The pattern of road traffic injuries in low and middle-income countries is very different from those in high-income countries, since there are a much larger proportion of vulnerable road users or pedestrians in lower and middle-income group. Moreover governments in developed countries have spent a great deal of effort in establishing road safety agencies, standards and research activities that is not commonly done in developing nations (40).

A relatively high prevalence of chronic illnesses such as Asthma in the Arada sub cities might be explained in terms of the living condition of the community in this area, where it is mostly characterized by crowded, unhygienic and polluted living environment with low socio-economic status. Low prevalence of Hypertension and cardiac diseases in the Bole, Kirkos and Yeka sub cities might be attributable to the life style change such as dietary and physical activities and other preventive precautions that are being taken by the relatively well to do population section of the city. Recent estimates indicate that 5 % urban adult populations in Dar es Salaam (Tanzania) are affected by Diabetes while 20 % have hypertension (8). The prevalence of hypertension studied long a go in one of the rural Ethiopian communities reported to be 1.8%(41).

High kappa value was calculated for Tuberculosis, Asthma, hypertension and psychiatric disorders. The low kappa value of AIDS despite a clear clinical presentation of the disease however might be due to failure of the respondents to tell the actual illness they have and the

diagnosis they were told by health workers for fear of stigma and discrimination. HIV/AIDS is often believed to be soaked in an atmosphere of taboo and denial and it is true that many people are reluctant to explicitly label AIDS deaths or illness as such and they often refer to symptoms or opportunistic infections associated with AIDS (36).

A Low kappa value was also found for diabetes. The algorithm used for this particular disease may not have performed well because of difficulty of citing symptoms specific to it or because most of the patients had the disease with out having sign and symptoms of the illness (42).

The reported cases of the three major non-communicable diseases, namely hypertension, asthma and cardiac diseases showed typical patterns of age and disease distribution in that hypertension had a positive correlation with age as it is an already well established clinical as well as epidemiological based fact regarding its association (43).

Cardiac disease however started at earlier age and continue increasing up to the age of 40 up to 44 and then declined until it goes up again after 50-54 years of age. This is might be attributed to Rheumatic heart disease (RHD) which is the predominant type of cardiac problem at young age in Ethiopia and also an important risk factor for among stroke in the young (21). The absence of RHD among older patients may be due to an early death of the patients because of its aggressive course in developing countries (44).

Since surgical intervention services to cure patients with rheumatic heart disease are not available in Ethiopia, most patients die before the age 35-40 which results in low numbers of cases after this age. The increase of cardiac cases after 55 year of age can be attributed to age related cardiac illnesses such as coronary heart diseases, myocarditis, and cardiomyopathies. This can be substantiated by the findings of the hospital based study on the pattern of cardiovascular diseases among adults in Ethiopia that rheumatic heart disease was the leading form of cardiac problem accounting for 49% of all heart diseases followed by cardiomyopathy, syphilitic heart disease and ischemic heart problem accounting for 8.8%, 7.9% and 7.4% respectively (45).

Asthma occurs at all age but predominantly in early life. About one half of cases develop before 10 years of age, and another one-third before the age of 40(43). Similar trend of increasing asthma at later age like cardiac disease might be due to other age related chronic obstructive pulmonary disease such as chronic bronchitis, broncheostasis and emphysema, which were classified as asthma cases due to their similar manifestations.

It can be estimated that the impact of 126225 people with chronic illnesses in Addis Ababa on health service utilization as well as the economic cost in terms of medication and loss of work days could be very huge.

Conclusion:

- The AIDS mortality fraction among adult population is high compared to other causes of deaths in Addis Ababa. The Age and sex specific mortality picture of AIDS showed that females exhibited high death rate at early adult age (20-29), than males.

- The burden of AIDS mortality is relatively higher in the center of the city of Addis Ababa where socio-economic status is low and prostitution and sex marketing is higher.

- Since most deaths (>75%) in this study occurred at home, a VA based study of mortality and cause of death is justifiable and appropriate.

- Non- communicable diseases are posing significant health problems in terms of chronic morbidity and mortality in the city. Among all non-communicable diseases, Hypertension, Asthma, cardiac problems and psychiatric illness were the most important conditions.

Recommendations:

- Awareness creation activities for prevention of HIV transmission should begin before early adult age.

- Special attention should be given to the central part of the city where the AIDS specific mortality rate is high by concerned government as well as non-government organizations working on HIV prevention and control activities.

- Since large proportions of deaths have occurred at home, provision of appropriate home care should be strengthened and promoted by concerned bodies. The reason of having high proportion of deaths occurring at home should be further investigated

- Set up and strengthen national NCD control program. Programs promoting public awareness and life style changes to prevent Non-communicable diseases need to be promoted.
- VA and morbidity assessment questionnaires need to be further improved for future surveillance work.

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- Repeated survey of such type regularly can help to monitors the trends of cause specific mortalities of important diseases such as HIV/AIDS.

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Annex 4.

Algorithms used for diagnosis of cause of death, and chronic morbidity in Addis Ababa, 2004.

Algorithm	Diagnosis
Injuries (intentional or unintentional)	Accidents
Anti TB treatment, No diarrhea and Herpes zoster	Tuberculosis
Anti TB treatment, Weight loss, Diarrhea, Herpes zoster(any 3)	AIDS
Nuchal pain, vertigo, Headache	Hypertension
Palpitation, Dyspnea, leg edema	Cardiac problem
Cough, Shortness of breath, wheeze	Asthma
Polys (polydypsea, polyphagia, polyuria), weight loss	Diabetes
Ascites, Jaundice	Chronic liver disease
Brief attack of loss of consciousness, frozing of saliva, contraction of muscles of extremities	Epilepsy
Abnormal or bizarre behavior	Psychiatric illness