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Trends of diabetes mellitus and hypertension at Nigist Eleni Mohammed General Hospital, Hossana, Ethiopia (December 2010-January 2014): a five year longitudinal study

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Abstract

Background: The burden of chronic diseases is rapidly increasing worldwide. In 2005, at least 35 million people of all ages, nationalities, and socioeconomic levels died from heart disease, stroke, diabetes, respiratory disease, and other chronic diseases. It has been projected that, by 2020, chronic diseases will account for almost three-quarters of all deaths worldwide, and that 70% of deaths due to diabetes will occur in developing countries.

Methods: A five years medical records on diabetes mellitus and hypertension diseases was reviewed by using longitudinal study design. A total of 3393 cases (1907 hypertension and 1486 diabetes mellitus disease) were observed. A total of four data collectors were assigned in the data collection process. The study was conducted by using the standardized data collection tool (checklist) developed by the investigators. Data was coded and entered into a data base and analyzed using SPSS version 20.0. Descriptive and chi-square test a technique with a confidence level of 95% was used to determine the disease trend across the year.

Result: From the total of 1907 hypertension cases 1095 (57.4%) were male and 812 (42.6%) were females. In line with this the prevalence of hypertension was relatively higher among male than female in the same age categories. On the other hand, from the total of 1486 diabetes mellitus cases, 900(60.6%) were male and 586 (39.4%) were females. Moreover, the disease proportion was higher in males than females of the same age categories. The annual average increase of the diabetes mellitus was 5.4%, and this result was greater than the disease projections made by the international diabetes mellitus federations in 2012 (3.32%). However, the actual prevalence of diabetes mellitus in Ethiopia could be as high as 8% as suggested by some institution-based studies, aside from what is projected by the international diabetes mellitus federations. On the other hand, the annual average increase of the hypertension was 8%. This average rate of change was less when compared to the prevalence rate of 31% in selected hospitals in Addis Ababa and the prevalence rate of 10% in Butajira. The observed number of both the hypertension and diabetes mellitus cases in each year was statistically significant with the expected number of cases X^2 ($p < 0.05$).

Conclusion: The magnitude of hypertension and diabetes mellitus is higher in males than in females. This study also revealed that the observed trend of each disease is statistically significant with the expected trend of each disease across the year.

Keywords: Trend analysis, hypertension, diabetes mellitus

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Background

The burden of chronic diseases is rapidly increasing worldwide. It has been calculated that in 2001, chronic diseases contributed approximately 60% of the 56.5 million total reported deaths in the world and approximately 46% of the global burden of disease. The proportion of the burden of chronic non-communicable diseases (NCDs) is expected to increase to 57% by 2020 [1]. Almost half of the total chronic disease deaths are attributable to cardiovascular diseases; showing worrying trends, not only because they already affect a large proportion of the population, but also because they have started to appear earlier in life [1, 2].

It has been projected that, by 2020, chronic diseases will account for almost three-quarters of all deaths worldwide, and that 71% of deaths due to ischemic heart disease (IHD), 75% of deaths due to stroke, and 70% of deaths due to diabetes will occur in developing countries [3].

The number of people in the developing world with diabetes will increase by more than 2.5-fold, from 84 million in 1995 to 228 million in 2025 [4]. On a global basis, 60% of the burden of chronic diseases will occur in developing countries. Indeed, cardiovascular diseases are even now more numerous in India and China than in all the economically developed countries in the world put together [5].

Although human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), malaria and tuberculosis, along with other infectious diseases still predominate in sub-Saharan Africa and will do so for the foreseeable future, 79% of all deaths worldwide that are attributable to chronic diseases are already occurring in developing countries [5].

Chronic diseases are mostly characterized by: complex causality, multiple risk factors, long latency periods, a prolonged course of illness, and functional impairment or disability [6].

Despite accounting for around 60% of all deaths worldwide, chronic diseases are surprisingly neglected on the public health agendas of most nations and regions, particularly in low and middle-income countries (LMICs). Existing data on mortality, years of life lost (YLL), and Disability Adjusted Life Years (DALYs) reveal a 10% rise in the global burden of disease due to chronic diseases in LMICs from 1990 to 2001 [1, 7].

Though chronic diseases are believed to be problem of affluent societies, in reality they represent an under reported and neglected burden on health in the developing countries and one that is ever-increasing. In absolute numbers, deaths from chronic diseases are higher in sub-Saharan Africa than the other regions in the world [8, 9].

World Health Organization (WHO) estimated in 2011 that 34% of the Ethiopian population is dying from non-communicable chronic diseases, with a national cardiovascular disease prevalence of 15%, cancer and chronic obstructive pulmonary disease prevalence of 4% each, and diabetes mellitus prevalence of 2% (http://www.EthiodemographyAndHealth.org) [10].

Some of the common risk factors for major chronic diseases are tobacco use; physical inactivity; harmful use of alcohol; unhealthy diet, obesity, which are driven by social and economic determinants such as poverty, globalization, trade, education, urbanization, climate change, employment conditions and gender disparities [11].

Hypertension is found to affect 25–35% of adult and 60–70% of elderly population above the age of 70 years both among the population of developed and developing countries. Studies on the epidemiology of hypertension revealed substantial effect of age, gender, body mass index, smoking, high alcohol intake, insulin resistance and also diet with high intake of salt, and low intake of potassium and calcium [12, 13].

High blood pressure is a very common problem among adults in Africa, which reports the world's highest prevalence of hypertension (38.1% among males, 35.5% among females) with some countries (e.g. Cabo-Verde, Mozambique, Niger, Sao Tome and Principe) reporting prevalence rates of 50% or higher [11, 14].

There were approximately 80 million adults with hypertension in sub-Saharan Africa in 2000 and projections based on current epidemiological data suggest that this figure will rise to 150 million by 2025. Furthermore, there is evidence indicating that complications of hypertension, particularly stroke and heart failure, are becoming increasingly common in sub-Saharan Africa [13, 15].

By the year 2030, more than 80% of the 366 million diabetic patients will be in developing countries [1]. The most common type of diabetes is type 2, which accounts for about 90% of all diabetes and is largely the result of excessive weight/obesity and physical inactivity. The usual childhood form of diabetes (type 1 diabetes) is caused by an absolute lack of insulin. Without insulin, type 1 diabetes is rapidly fatal [16].

Cardiovascular disease mortality among persons with diabetes is estimated at about 75–80%, with markedly worse results for men [1]. The prevalence of diabetes is projected to increase over 50% in the next 20 years, reaching 438 million people, or nearly 8% of the adult population. The most at-risk individuals are those suffering from dysglycaemia, or the disturbance of blood-sugar regulation [17].

The adoption of a common risk-factor approach to chronic disease prevention is a major development in the thinking behind an integrated health policy. Sometimes chronic diseases are considered communicable at the risk factor level [18].

The 1992 International Conference on Nutrition specifically identified the need to prevent and control the

increasing public health problems of chronic diseases by promoting appropriate diets and healthy lifestyles [19].

The need to address chronic disease prevention from a broad-based perspective was also recognized by the World Health Assembly in 1998 [20] and again in 1999 [21]. In 2000, the World Health Assembly passed a further resolution on the broad basis of the prevention and control of non-communicable diseases [22], and in 2002 adopted a resolution that urged Member States to collaborate with WHO to develop "… a global strategy on diet, physical activity and health for the prevention and control of no communicable diseases based on evidence and best practices with special emphasis on an integrated approach…" [23].

In Ethiopia, national data on trend, prevalence and incidence of diabetes and hypertension are lacking. However, patient attendance rates and medical admissions in major hospitals are rising [24].

Moreover, In Ethiopia, studies on the cardiovascular risk factors and complications of diabetes and hypertension are lacking [24]. However a retrospective study in Tikur Anbesa Hospital showed that cardiovascular diseases (CVDs) were responsible for 16% of deaths among diabetic admissions 2nd to acute complications and infections that caused 18% of deaths [12].

In Ethiopia declining mortality rates, rising life expectancy and increasing urbanization have been observed. As a result, Ethiopia is likely to be in a transition period with respect to the epidemiology of chronic non-communicable diseases like hypertension and diabetes mellitus (26).

However, due to the lack of data showing the real burden of such diseases in the developing world in general and in Ethiopia in particular, there is no clear ground and guidance for policy makers to plan and implement intervention strategies.

Therefore, this study was conducted in order to determine the magnitude and trends of the hypertension and diabetes mellitus at a Hospital level to be a basis for decision making and policy formulations. Moreover, this study will serve as a baseline information for further studies.

Methods

Study area and period

The study was conducted from May to June, 2015 at Nigist Eleni Mohammed general Hospital, which is located at Hossana town. The town is the capital of Hadya zone located about 232 km far from Addis Ababa (the capital of Ethiopia) in South West direction and 168 km far from the regional city (Hawassa) in North West. The area of the town is 693.64 Hectare or 3978.14 Karemeter and 2350 feet above the sea level. Based on the 2007 census report, its total population was estimated to be 92,733 in 2011 with a total number of 45,875 males and 46,858 females and a total number of under five children is 14,466 (Zonal report,2007). It has weinadega climatic conditions and the average temperature of the town is 17.05°c. It has annual rainfall of 1172.75 mmHg. It has three sub cities namely Gofer Meda, Sechduna and Addis Kifleketema with 8 kebeles and has 3 health centers, one zonal Hospital, 16 non-governmental clinics & 22 total non-governmental pharmacies.

Study population: A total of 3393 medical records on diabetes mellitus(1486 cases) and hypertension(1907 cases) registered from 2010 to 2014 were included in this study

Study design: longitudinal study design was employed

Study variables

Dependent variables: Hypertension and diabetes mellitus

Independent variables: The time series on which both cases were registered

Data collection tool/instrument

Medical records were reviewed by using a checklist. Both the inpatient and outpatients records were reviewed during the study. The disease recording system of the hospital made the record review process easier. This was mainly because the hospital used the International Classification of Diseases to record data.

Eligibility criteria

Records available before 2010 were not included in the study

Records which are vague and incomplete were not included in the study

Operational definitions of terms

Diabetes mellitus includes both insulin-dependent diabetes and non-insulin dependent diabetes in which the level of glucose in the blood is poorly regulated; it is often too high, but may also fall too low.

Hypertension indicates blood pressure level for an individual whose systolic pressure is greater than 140 mmHg and the diastolic pressure is greater than 90 mmHg.

Trend analysis aspect of a technical analysis that tries to predict the future movement of a hypertension and diabetes mellitus based on an existing data.

Data quality assurance

The selection of data collectors was based on the educational level and with possible familiarity in medical cards review. A one day's training was given for 4 data collectors and 2 supervisors about the objectives of the study and process of the data collection. Strict supervision was

assumed, mean while any doubts in the questionnaire/checklist was clarified.

Data processing and analysis

Data was coded, cleaned and entered into a computer data base and analysed by using Spss version 20.0. A descriptive statistics was performed, and also a chi-square test techniques with confidence interval at 95% confidence level was used to determine the relationship between the observed and the expected trends of the disease in each year.

Ethical consideration

Prior to data collection, appropriate ethical clearance was obtained from the ethical clearance committee of Hosanna college of health sciences. Formal letter of permission was produced from administrative bodies of the hospital and then to the respective medical wards. Moreover, name of the cases wasn't mentioned and also confidentiality was assured for the information provided.

Limitations of the study

Since the source of data is secondary, the quality issue is always the question leading to certain disorganization of the required information. Because of the lack of registered records the study couldn't address other common risk factors other than the age and sex of the patients.

Strengths of the study

The study clearly indicated sex and age-standardized difference of the conditions among the patients. Moreover, this study was able to analyse a five years longitudinal data to depict the trend of hypertension and diabetes mellitus across the years.

Result

I Descriptive characteristics of the study subjects

A longitudinal study was conducted among a total of 1907 hypertensive patients and 1486 diabetes mellitus patients registered at Hossana Nigist Eleni Mohammed general hospital (NEMGH) from December 2010 to January 2014. From the total of 1907 hypertensive cases, 1095 (57.4%) were male patients and 812 (42.6%) female patients. On the other hand, from the total of 1486 diabetes mellitus patients 900 (60.6%) were male patients and the rest 586 (39.4%) were female patients.

Of the total 1095 male hypertensive patients, 367 (33.5%) and 335 (30.6%) were in the age category of 55 and above and 45–54 years, respectively. Similarly, of the total 812 female hypertensive patients, 262 (32.3%) and 232 (28.6%) were in the similar age category as male patients did (Fig. 1).

On the other hand, from the total of 900 male diabetes mellitus patients 303(33.7%) were in the age category of 55 and above and 265 (29.4%) were in the age category of 45–54 years. In line with this, of the 586 female diabetes mellitus patients, 190 (32.4%) were in the age category of 55 and above and 156 (26.6%) were in the age category of 45–54 years (Fig. 2).

II Trend analysis

As we can see on the figure below trends of the hypertension and diabetes mellitus shows ups in one year and then down in the other year (Fig. 3). Generally, the study

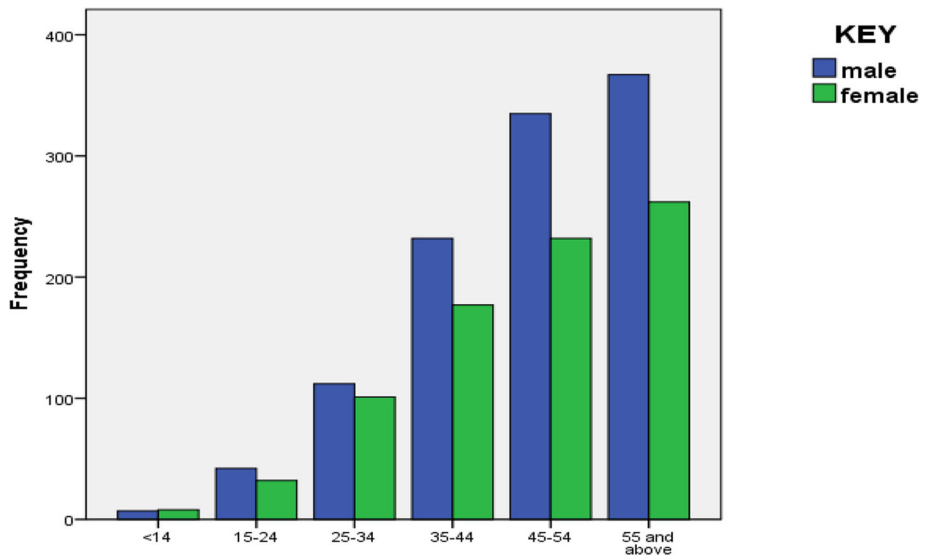

Fig. 1 Magnitude of Hypertension in different age category, Nigist Eleni Mohammed general Hospital, Hossana (December 2010- January 2014)

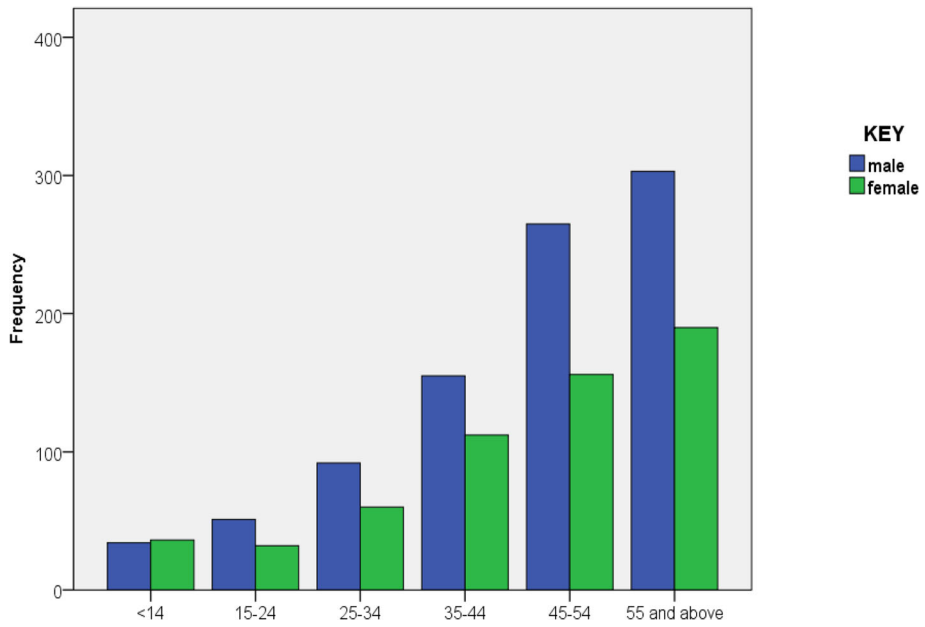

Fig. 2 Magnitude of diabetes mellitus in different age category, Nigist Eleni Mohammed general Hospital, Hossana (December 2010 - January 2014)

revealed that there was a slight increase in magnitude of both cases.

Diabetes mellitus disease among different age groups in both sexes showed slight ups and down trends. Fore instances, there was a highest record of the disease first in 2010 in the age group of 25–34 years, 35–44 years, 45–54 years and 55 and above followed by the slight decrements up to 2013. Then after a slight increment was also recorded again in 2014. On the other hand, the trend of this disease among the age group of <14 and 15–24 years didn't show any ups and downs from 2010 up to 2011. However, later it showed a

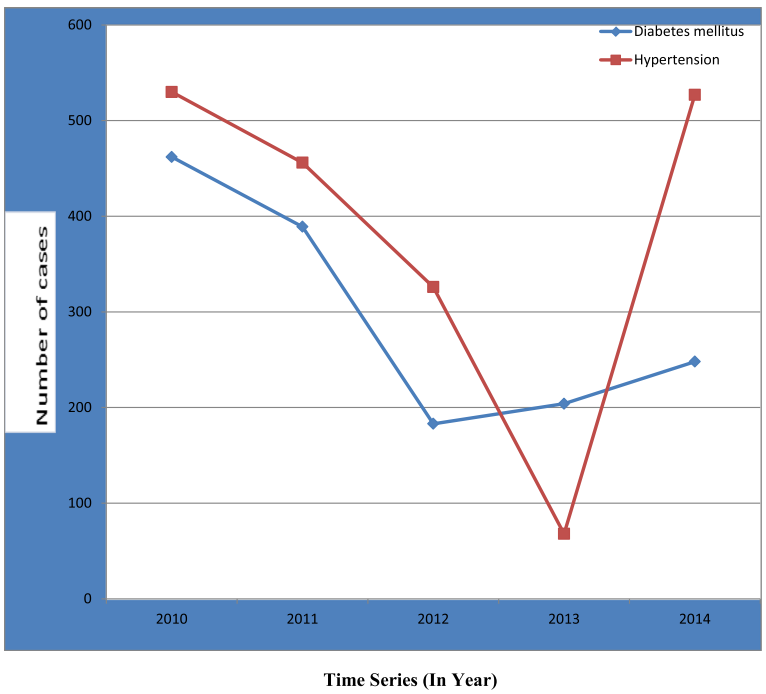

Fig. 3 Trends of Hypertension and Diabetes mellitus, Nigist Eleni Mohammed general Hospital, Hossana (December 2010 - January 2014)

sharp rise from 2012 to 2013 and then dropped in 2014 (Fig. 4).

The trend of hypertension disease among both sexes and especially in the age group from 35–44, 45–54 and 55 years and above showed a sharp rise first in 2010 and then fall up 2013 followed by the sharp rise again in 2014. On the other, the disease trend among the age group of 15–24 and 25–34 years showed slight rise in 2011 and down from 2012 to 2013 followed by the slight increase again in 2014 (Fig. 5).

Chi-square test for the trend data

Hypothesis

***H0*:** The distribution of the observed number of the cases for each year does not differ significantly from an expected number of the cases in each year.

***H1*:** The distribution of the observed number of the cases for each year differs significantly from an expected number of the cases in each year.

For purposes of conducting the test, these hypotheses translate into

$$H0 : Oi = Ei$$
$$H1 : Oi \neq Ei$$

where; Oi; observed number of cases of hypertension and diabetes mellitus in each year

Ei; expected number of cases of hypertension and diabetes mellitus in each year.

The chi-square test result revealed that the distribution of observed number of the hypertension and diabetes mellitus cases for each year differs significantly from an expected number of the cases in each year. That means it was found that there is no equal distributions of hypertension and diabetes mellitus cases across the year $X^2(p < 0.05)$ (Tables 1 and 2).

Discussion

In Ethiopia, although diabetes mellitus and hypertension are recognized among the major non-communicable diseases, the exact prevalence, progress, and associated complications are not well documented and updated regularly 25].

A five year longitudinal study was conducted to analyse the trend of diabetes mellitus and hypertension at Nigist Eleni Mohammed general Hospital, Hossana. A total of 1486 diabetes mellitus and 1907 hypertension cases recorded from December 2010 to January 2014 were reviewed. According to the study, the annual average increase of the diabetes mellitus was 5.4%. This result is greater than 3.32% that was projected by the international diabetes mellitus federations in 2012. The actual prevalence of diabetes mellitus in Ethiopia could be as high as 8% as suggested by some institution-based studies, aside from what is projected by the international diabetes mellitus federations [25].

On the other hand the annual average increase of the hypertension was 8%. This average rate of change is less when compared to the prevalence rate of 31% in selected hospitals in Addis Ababa and prevalence of 10% in Butajira. This difference might be due to the sample size aside from the urbanization and other socio-economic factors [24].

In one study conducted in the Adankwame community of Ghana showed a significant variation in an estimated average prevalence rate of hypertension (35%), that was obviously higher than the estimated average prevalence rate of hypertension observed in our study (8%). This study also found the prevalence rate of diabetes mellitus (7.7%) to be only slightly higher than the estimated average prevalence rate found in our study (5.4%) [26].

On the other hand an estimated average prevalence rate of hypertension in Canada, Egypt and China was

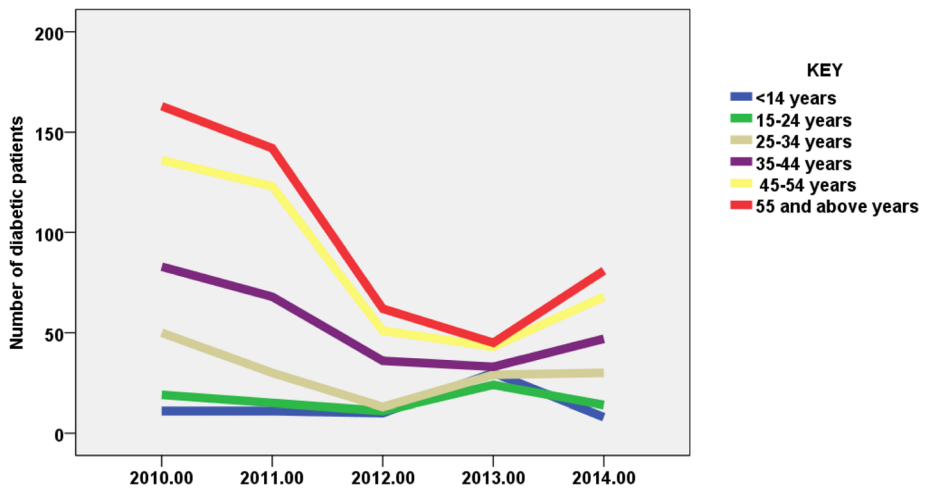

Fig. 4 Diabetes trends among different age categories of both sexes, Nigist Eleni Mohammed general Hospital, Hossana (December 2010 - January 2014)

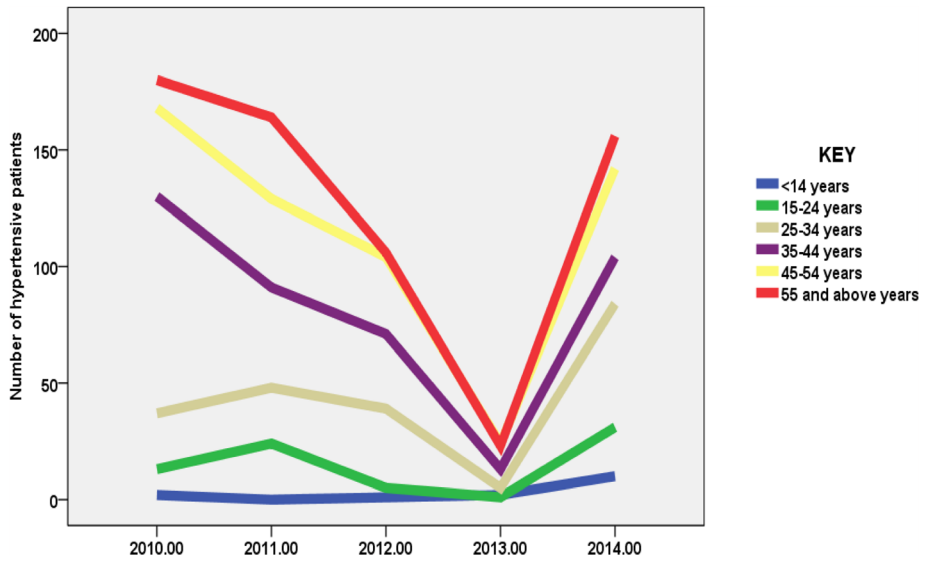

Fig. 5 Hypertension trends among different age categories of both sexes, Nigist Eleni Mohammed general Hospital, Hossana (December 2010- January 2014)

22%, 23.6% and 13.5%, respectively. These findings were much more greater than the estimated average increase rate of hypertension recorded in our study (8%). The variation might be due to the difference in sample size of the study population and socio-economic development of the country.

Besides, our study was not nationally representative of the trends of hypertension and diabetes mellitus. This is mainly because study was conducted in a single general hospital which has been serving a definite set of population, as yet there are over 56 nations, nationalities and peoples in southern regional state of Ethiopia, and over 80 nations, nationalities and peoples in Ethiopia.

The distribution of diabetes mellitus and hypertension between male and female cases, shows variations in different studies. Some studies indicated proportional distribution, where as in others the proportion seems more decreased or increased to either one of the sexes.

In this study male dominates females in disease distribution of both the diabetes mellitus and hypertension almost in all age categories. For instance, male distribution accounts for 60.6% and that of the female distribution accounts for 39.4%. However, when we see the sex distribution of diabetes mellitus in the study conducted at Addis Ababa from 1976–1983, male and female percentage distribution was 49.8% and 50.2%, respectively [25].

On the other hand, the study conducted at Addis Ababa from 2005–2009, and other similar study conducted at Jimma in 2008 depicted more males distribution of diabetes mellitus than females [7, 25], which was actually parallel with the findings of this study. This finding is also similar with the finding of the study conducted in India which clearly shows males dominance (20.7%) over females (17.8%) in its distribution [27].

The same is true for hypertension, that is age-standardized difference between male and female

Table 1 Chi-square test result of trends of hypertension across the time series, Nigist Eleni Mohammed general Hospital, Hossana (December 2010- January 2014)

Year	Observations	Sum of ranks
2010	530	140715
2011	456	345876
2012	326	374737
2013	68	91562
2014	527	866388
Total	1907	

$X^2 = 42.63$ df = 4 p <0 .05

Table 2 Chi-square test result of trends of diabetes mellitus across the time series, Nigist Eleni Mohammed general Hospital, Hossana (December 2010- January 2014)

Year	Observations	Sum of ranks
2010	462	106953
2011	389	255573
2012	183	172569
2013	204	231846
2014	248	337900
Total	1486	

$X^2 = 39.14$ df = 4 p <0 .05

hypertensive patients was clearly observed in this study. The distribution of hypertension among all the age group of males was 57.4% and in females it accounted for 42.6%. Similar age-standardized distribution of hypertension between male and female was also observed in one of the study conducted in India. In this study, the age-standardized distribution of hypertension among males and females was 33.3% and 28.1%, respectively [27]. Moreover, Similar age-standardized distribution of hypertension between males and females was also observed in another study conducted in Cameroon. In this study, the age-standardized distribution of hypertension among all other chronic non-communicable diseases in males and females accounts for 39.6 and 37.2%, respectively.

Conclusions and recommendations

Conclusions

Generally the magnitude of the hypertension disease is found higher in males than in females. Similarly the magnitude of diabetes mellitus is also higher in males than in females. On the other hand, it is observed that the age difference matters the relationship of the disease trend under the study. That is there is relationship between the age of the patient and hypertension and diabetes mellitus diseases. Although males have more probability of acquiring of the hypertension and diabetes mellitus, there was no any relationship between the sex and trend these diseases. Although there is no difference between the observed and expected trend of the hypertension and diabetes mellitus, the annual average increase of the hypertension was slightly higher than the annual average change of the diabetes mellitus.

Recommendations

To Nigist Eleni Mohammed General Hospital

1) 1) There were still some problems regarding the recording systems of the chronic diseases and their common risk factors at the hospital. Therefore, it's better to improve the recording systems of chronic disease and their risk factors at this setting as much as possible to make the information accessible for anyone in need of the data.
2) The trends of hypertension and diabetes mellitus is increasing at the hospital. Therefore, it's better for the hospital to reevaluate the plan and strategies set to address such chronic diseases.

Abbreviations

BP: Blood pressure; CNCDs: Chronic non-communicable diseases; CVD: Cardiovascular diseases; DALYs: Disability adjusted life years; HBV: Hepatitis B virus; HCV: Hepatitis C virus; HIV/AIDS: Immuno deficiency virus and acquired immunodeficiency syndrome; HP: Helicobacter pylori; HPV: Human papilloma virus; IHD: Ischemic heart disease; LMICs: Low and middle-income countries; NEMGH: Nigist Eleni Mohammed General Hospital; WHO: World health organizations; YLL: Years of life lost.

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Availability of data and materials

Please contact author for data requests.

Authors' contributions

RD and TD participated in data collection, analysed the data and drafted the paper. DH wrote and approved the proposal, analysed the data and revised subsequent draft of the paper and prepared the paper for publication. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable to this submission.

Ethics approval and consent to participate

I confirm that we have been formally granted ethics approval for the study described in the manuscript. Even though the study doesn't include certain human samples such as blood sample, urine, tissue and the like, patient cards and registries were reviewed and data was collected. Therefore, since the study still includes data from human subjects, the consent for participation was designed by the investigators and approved by the ethical committee of the college.

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