

TOM LXXI, 2018, Nr 3 cz II

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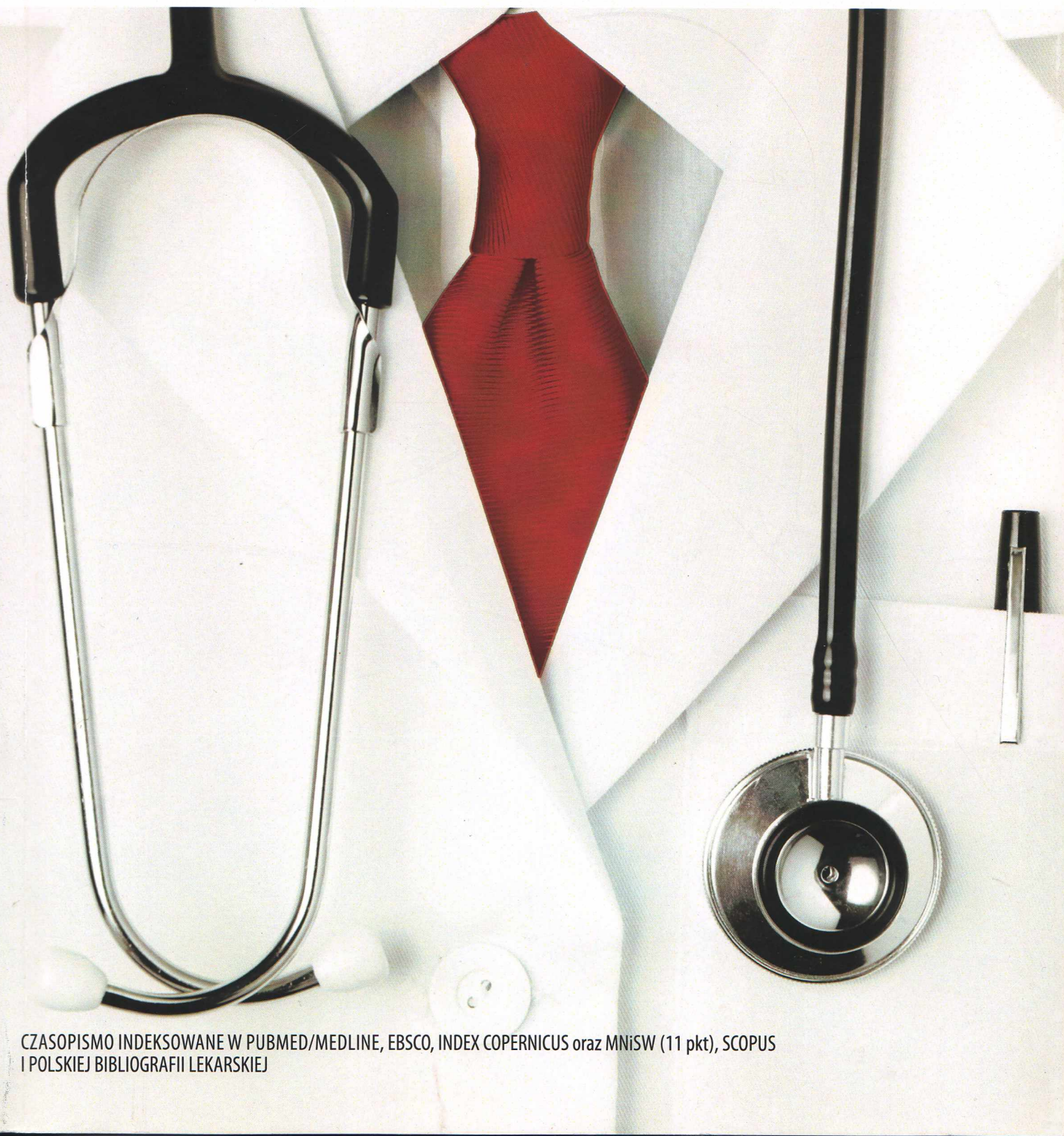
# Wiadomości Lekarskie



ISSN 0043-5147

Czasopismo Polskiego Towarzystwa Lekarskiego

Rok założenia 1928



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## BURDEN OF PREMATURE MORTALITY CAUSED BY FOUR MAIN NON-COMMUNICABLE DISEASES IN UKRAINE

### SKALA PROBLEMU PRZEDWCZESNEJ ŚMIERTELNOŚCI SPOWODOWANEJ CZTEREMA GŁÓWNYMI CHOROBYMI NIEZAKAŻNYMI NA UKRAINIE

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#### ABSTRACT

**Introduction:** The scale and socio-economic implications of the non-communicable diseases (NCD) epidemic are growing in Ukraine.

**The aim:** To determine the mode of mortality resulted from main non-communicable diseases in Ukraine, calculate and estimate the number of years of potential life lost (YPLL) due to premature mortality from them.

**Materials and Methods:** The information base of the study was official data of the State Statistics Service of Ukraine on the distribution of the deceased by gender, age groups and causes of death in 2016 and World Health Statistics 2016 data. The method of potential demography was used to estimate demographic losses.

**Review:** The years of potential life lost for Ukrainian men is more than twice as high as that of women. For each case of death in the range of 30-69 years, an average of 10.3 years of potential life is lost. The group at the working age limit 55-59 years gives the most significant loss in terms of the contribution in the range of 30-69 years. The structural share of the contribution of main NCD to the burden of premature deaths gradually increases with age and accumulation of chronic pathology.

**Conclusions:** As a result of the deaths caused by four main NCD in the range of 30-69 years in Ukraine in 2016, 1572.793 thousand of person-years or almost 56% of losses due to all causes of death at the same age were lost in Ukraine.

**KEY WORDS:** non-communicable diseases, premature mortality; years of potential life lost, person-years

Wiad Lek 2018, 71, 3 cz. II, 728-732

#### INTRODUCTION

The scale and socio-economic implications of the non-communicable diseases (NCD) epidemic are increasing both in Ukraine and in the world. NCD often cause illness, disability and mortality that can be prevented. Four main types of non-communicable diseases (cardiovascular diseases, cancer, diabetes and chronic respiratory diseases) account for 38 million deaths annually or almost 70% of all deaths in the world [1].

The Agenda for Sustainable Development for the period up to 2030, adopted by 193 countries (including Ukraine) under the auspices of the United Nations entered into force in January 2016. A reflection of the perceived risk of an increase in the prevalence of non-communicable diseases [2] is the following: the achievement of health-related Objective 3 "Promoting a healthy lifestyle and contributing to everybody's well-being at any age" anticipates specific targets directed to fight NCD and their risk factors (first of all, tobacco smoke and alcohol abuse). The global monitoring system includes among other such indicator as the likelihood of death in the age of

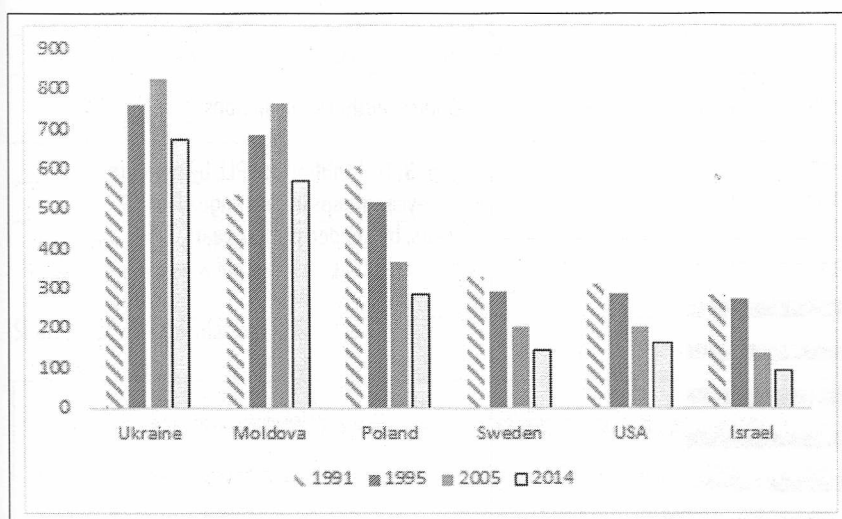
30-70 years from cardiovascular diseases (CVD), cancer, diabetes or chronic respiratory disease [3].

In recent years, health care in Ukraine (as well as health services in other countries with middle and low income) has experienced a strong overload due to increased need for treatment of main non-communicable diseases. International experts accentuate that the health care system in many countries is simultaneously weakened due to their concentration on a model focused on the treatment of diseases and mainly on inpatient care. In the center of this model, there are often hospitals that provide assistance to a minority of citizens, mainly those with severe health problems. Hospitals consume significant resources: more than half of the health budget is spent on inpatient services. As a result, a significant proportion of people at high risk of developing NCD are left out of attention, and their diseases are not detected. Some of those diagnosed often do not have satisfactory access to treatment at the primary level of health care. It has been proved that two thirds of premature deaths from NCD, in particular CVD, can be prevented through primary prophylaxis, and another third – by im-

**Table I.** Mortality caused by four main NCD, a standardized indicator per 100 000, 2014

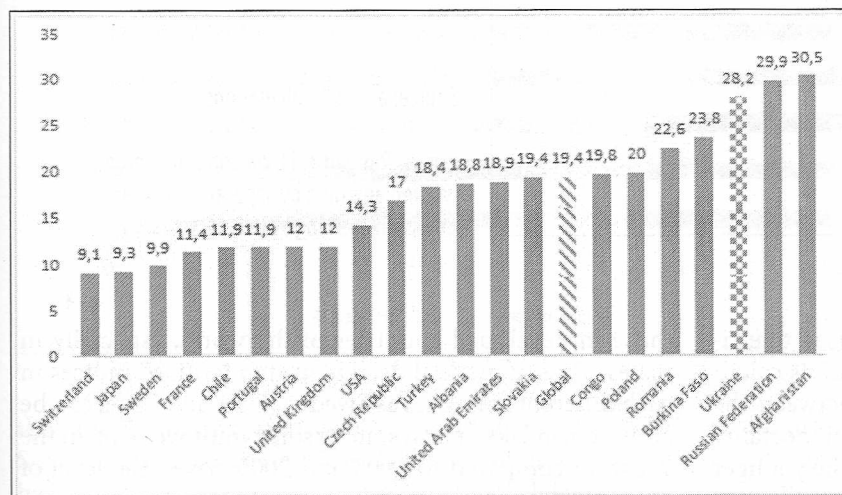
|                                    | Ukraine | Sweden* | Poland |
|------------------------------------|---------|---------|--------|
| Diseases of the circulatory system | 506.4   | 115     | 216.4  |
| Neoplasms                          | 120.3   | 107.4   | 149.0  |
| Chronic lower respiratory diseases | 10.3    | 11.2    | 8.6    |
| Diabetes mellitus                  | 2.9     | 8       | 9.2    |

Source: WHO Mortality Database Last Access: 28.03.2017 <http://apps.who.int/healthinfo/statistics/mortality/whodpms/> \*data 2015



Source: WHO Mortality Database Last Access: 28.03.2017 <http://apps.who.int/healthinfo/statistics/mortality/whodpms/>

**Fig. 1.** Age-specific mortality rate of the circulatory system diseases in selected countries of the world, men, 1991, 1995, 2005, 2014, standardized indices per 100 000 of people



Source: World Health Statistics 2016: [http://who.int/entity/gho/publications/world\\_health\\_statistics/2016/en/index.html](http://who.int/entity/gho/publications/world_health_statistics/2016/en/index.html)

**Fig. 2.** Likelihood of death due to four main NCD in the age range of 30-70 years in the world, %

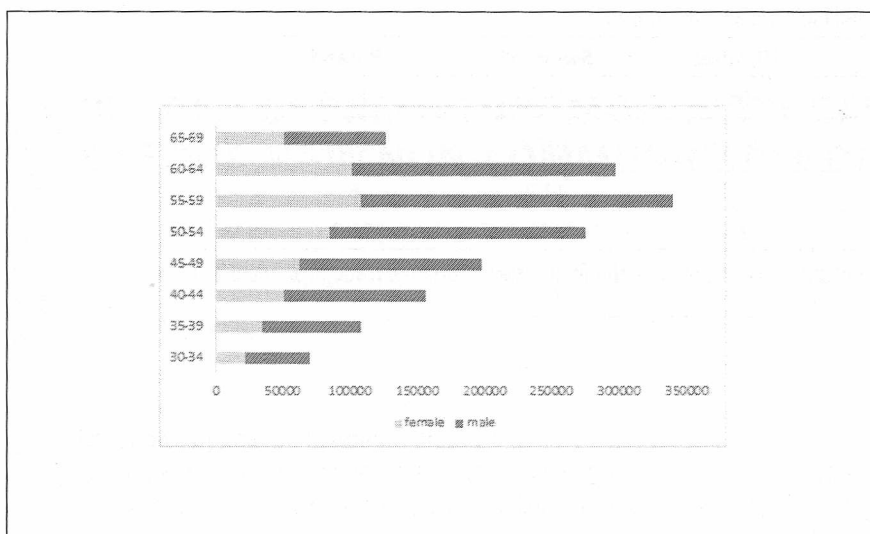
proving health systems, increasing their effectiveness, and equality in meeting the needs of patients in health care [4]. The adoption of a thematic Roadmap became the continuation of the collective decision of world leaders to reduce premature mortality from NCD by one third by 2030 in the framework of the United Nations Sustainable Development Agenda. In autumn 2017, the governments of the world approved the Montevideo Roadmap in the area of fighting against NCD in 2018-2030 as a priority task for sustainable development [5]. The extent of the harm caused, the volume and structure of the losses should be clearly understood for a purposeful effective fight against the NCD epidemic in Ukraine, a country with limited financial capacity, due to the ongoing socio-economic and political crisis.

### THE AIM

To determine the differences in mortality rates from four main types of non-communicable diseases in Ukraine in comparison with other countries, to calculate and estimate the number of years of potential life lost (YPLL) due to premature mortality from them.

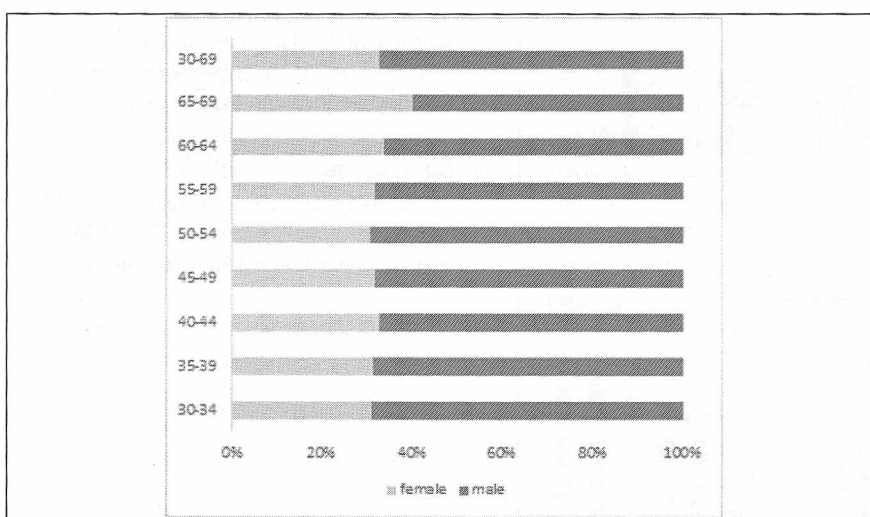
### MATERIALS AND METHODS

The information base of the study was the official data of the State Statistics Service of Ukraine on the distribution of the deceased by gender, age groups and causes of death in 2016 and World Health Statistics 2016 data. The ICD codes to be included in the calculation are: cardiovascular disease: I00-I99, Cancer: C00-C97, Diabetes: E10-E14, Chronic respiratory disease: J30-J98.



Source: author's calculations

**Fig. 3.** Distribution of YPLL by separate five-year groups in the range of 30-69 years, by gender, person-years



Source: author's calculations

**Fig. 4.** Ratio of YPLL contribution among women and men by separate five-year groups in the range of 30-69 years, %

The method of potential demography was used to estimate demographic losses. The number of YPLL is calculated as the sum of the differences of years between the threshold values of the death age and the actual mortality age of all persons who died during the year at the younger than the threshold age intervals [6]. The calculations were carried out for the age range of 30-70 years, the values of years of potential life lost for both sexes and women and men separately were calculated. The relative indicator, or the number of years of potential life lost per one mortality case, was also calculated.

**REVIEW**

In Ukraine, as well as in other countries, cardiovascular pathology among four main NCD makes the essential contribution to both real and potential life losses. However, the gap in the mortality rates between them and the next component in its significance – tumor formation constitutes about 4.5 times, whereas in Poland it does not reach one and a half, and in Sweden, the rates are almost identical (Table I).

Both the magnitude and the dynamics of the mortality rate due to CVD in Ukraine are strikingly different from

those in developed countries of the world, especially in males. Thus, if gradual decline in standardized indices in such different countries as Sweden, USA and Israel can be observed, in Ukraine, in spite of some improvement, in the situation compared to 1995 and 2005 crises, the level of male cardiovascular mortality was not even able to return to 1991 levels. The situation in neighboring Moldova is similar, while the western neighbor – Poland managed to return a trend line similar to that of Western European countries (Fig. 1).

Accordingly, the gap in male mortality rates in Ukraine and Sweden has increased, reaching more than 4.5 times in 2014 (*differentiation is less noticeable for women*).

To a greater extent, extremely high mortality rates due to CVD in Ukraine have also led to a higher likelihood of death in the range of 30-70 years due to death caused by all four main NCD.

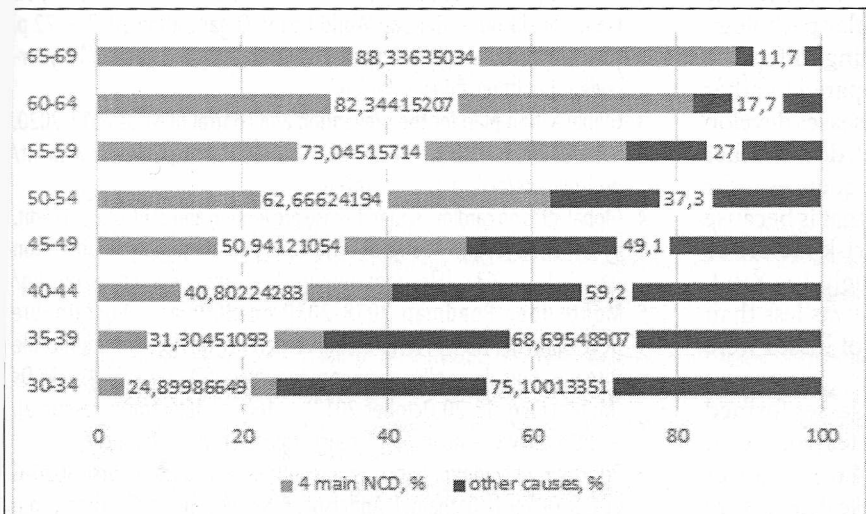
While comparing the likelihood of dying at the age of 30-69 from four main NCD in the countries of the world, it turns out that in Ukraine this index is one of the worst in the European region. It exceeds not only the likelihood of death in economically developed countries, but even

BURDEN OF PREMATURE MORTALITY CAUSED BY FOUR MAIN NON-COMMUNICABLE DISEASES IN UKRAINE

Table II. Years of potential life lost as a result of death from four main NCD in the age range of 30-69 years, Ukraine, 2016

|  | Age interval, years |         |       |       |       |       |       |       | 30-69  |
|--|---------------------|---------|-------|-------|-------|-------|-------|-------|--------|
|  | 30-34               | 35-39   | 40-44 | 45-49 | 50-54 | 55-59 | 60-64 | 65-69 |        |
| Number of years unspent in the age group up to 70 years, number of years | 37.5                | 32.5    | 27.5  | 22.5  | 17.5  | 12.5  | 7.5   | 2.5   | Sum    |
| Number of YPLL, thousands of person-years:                               |                     |         |       |       |       |       |       |       |        |
| due to all causes, total;  | 280.88              | 346.548 | 382.6 | 388.5 | 439.5 | 466.2 | 361.4 | 143.6 | 2809.1 |
| due to 4 NCD, both sexes   | 69.9                | 108.5   | 156.1 | 197.9 | 275.4 | 340.5 | 297.7 | 126.9 | 1572.8 |
| women  | 21.9                | 34.1    | 51.1  | 62.9  | 84.6  | 108.3 | 101.0 | 51.0  | 514.8  |
| men  | 48.0                | 74.4    | 105.0 | 135.0 | 190.8 | 232.2 | 196.7 | 75.9  | 1058.0 |
| Predominance of men's losses caused by 4 NCD, times                      | 2.2                 | 2.2     | 2.1   | 2.1   | 2.3   | 2.1   | 1.9   | 1.5   | 2.1    |

Source: author's calculations



Source: author's calculations

Fig. 5. Changes in the contribution share of four main NCD to an array of YPLL due to mortality from all causes by separate age groups, %

the same in many countries of Africa (Fig. 2). Thus, if in Switzerland or Japan only less than one out of ten people has a risk to die due to these four pathologies, globally – one out of five, then in Ukraine the likelihood of death from four main non-communicable diseases of the population aged 30-70 years is 28.3%, that is, the probability of this increases to almost every third.

According to our calculations, the deaths due to four main NCD in the age range of 30-69 years in Ukraine led to 1572.793 thousand person-years loss that constituted almost 56% of losses due to all causes of death at the same age (2809.123 thousand person-years). There is a significant difference, depending on sex – the years of potential life lost in men is more than twice as high (Table II). An average of 10.3 years of potential life is lost for each case of death in the range of 30-69 years.

The most significant contribution to the loss in the range of 30-69 years is observed in the group at the working age limit 55-59 years (Fig. 3). It was in this group that the maximum

proportion of the losses was among men (190.785 person-years).

The prevalence of men's losses due to four main NCD in the entire age range is 2.1 times, ranging from the biggest difference in age of 50-54 years (2.3 times) to the smallest – only one and a half in the oldest (Fig. 4).

The structural share of the contribution of NCD to the burden of premature deaths is gradually increasing with age and accumulation of chronic pathology, even despite the fact that the number of unused years to the 70-year limit decreases. In the youngest group of this interval there is only a quarter of YPLL due to four chronic NCD, in the oldest one – more than 88% (Fig. 5).

## DISCUSSION

The death occurring before 65 years of age is usually considered to be premature death (although the threshold of 70 years is used in the developed countries, in particular, by the Organization for Economic Cooperation and De-

velopment). Taking into consideration that the development of NCD occurs at a relatively old age, 70 years limit is considered premature death boundary for this reason. But we take into account that in Ukraine, where since the beginning of independence, the life expectancy of men has not yet reached this limit (according to the State Statistics Committee of Ukraine, 66.73 years in 2016), part of the representatives of the strong sex simply does not live till the possible death due to NCD. Exogenous pathology (tuberculosis, HIV/AIDS, external causes) leads to earlier death more often than in European countries.

According to calculations based on official statistics, the lion's share of losses is stipulated by cardiovascular pathology and tumors, and two other pathologies account for a very small part. Thus, the proportion of deaths from chronic respiratory diseases was only 2% of deaths among men and 0.8% of deaths among women in the total number of all deaths due to four main NCD, and diabetes mellitus constituted even less – 1.2% among women and 0.6% among men. In our opinion, this illustrates not the best situation with regard to these diseases, but rather the routine practice of determining cardiovascular pathology as the cause of death, which leads to a striking difference in the structure of mortality in Ukraine compared to other countries. In addition, chronic respiratory diseases develop slowly, and the lives of some Ukrainians break down earlier than such a disease can lead to lethal consequences – for example, because of a stroke or lung cancer, that is because of diseases, determined by such common risk factors as tobacco smoking or alcohol abuse. Accordingly, the YPLL proportion, due to the last two pathologies, was less than 1.5%. Consequently, the absolute majority of losses were due to cardiovascular diseases and tumors.

According to our calculations, these two classes formed in 2013 38.5% of all losses due to mortality rates from birth to the age of 65 years (23.9% – CVD and 14.6% – cancer pathology). Of course, until the age of 30, these diseases are less likely to cause death, so their proportion in the range of 30-69 is expected to be higher.

It can be assumed that the leveling of sexual disproportion with age is primarily stipulated by an increase of mortality rate among older women due to postmenopausal CVD, determined in its turn, by a termination of cardio-protective effect of estrogenic hormones.

YPLL index or the number per population of the corresponding age was not deliberately used in the calculations of relative indices. This is caused by insufficiently correct population statistics due to the long time that has passed since the last census (2001), incomplete registration of migrations (including forced ones) in the country and abroad; lack of data from governmentally uncontrolled territories, etc.

One can confidently predict that the spread of non-communicable diseases and the mortality due to them will increase in Ukraine in the nearest decades, regarding to the progressive aging of the population.

## CONCLUSIONS

A threatening situation with regard to the high mortality rate due to four main types of non-communicable diseases is observed in Ukraine compared to other countries, primarily at the expense of excessive deaths due to circulatory system diseases.

As a result of the deaths caused by four main NCD in the range of 30-69 years in Ukraine in 2016, 1572.793 thousand of person-years or almost 56% of losses due to all causes of death at the same age were lost in Ukraine. The years of potential life lost among Ukrainian men is more than twice as high as that of women, which defines men as a target group for preventive interventions.

On average 10.3 years of potential life per one case of death is lost in the range of 30-69 years.

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**Received:** 10.03.2018

**Accepted:** 14.05.2018