

ORIGINAL ARTICLE

GLOBAL BURDEN OF DISEASE DUE TO AMBULATORY CARE SENSITIVE CONDITIONS, 1990-2019

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ABSTRACT

The aim: To evaluate the long-term dynamics of health losses caused by ambulatory care sensitive conditions (ACSCs) to justify the priorities of public policy regarding this group of diseases.

Materials and methods: The data used were obtained from the Institute of Health Metrics and Evaluation, the European database "Health for All", for 1990-2019. The study was conducted using bibliosemantic, historical and epidemiological study methods.

Results: Disability-adjusted life years (DALYs) due to ACSC over 30 years in Ukraine averaged 5145.4 years per 100,000 population (95% CI 4731.1 -5559.7), which is approximately 14% of DALYs of all reasons without a clear trend of change - compound annual growth rate (CARG) of 0.14%. These five causes – angina pectoris, chronic obstructive pulmonary diseases (COPD), lower respiratory infections, diabetes, and tuberculosis – account for 90% of the disease burden associated with ACSCs. There was an increasing trend in DALYs (CARG varied for different ACSCs in the range of 0.59-1.88%), except for COPD, where the decrease in CARG reached -3.16%.

Conclusions: This longitudinal study found a small trend toward increased DALYs due to ACSCs. State measures to influence modified risk factors to reduce the burden of losses from ACSCs proved to be ineffective. To significantly reduce DALYs, a more clear and more systematic healthcare policy regarding ACSCs is needed, which includes a set of primary prevention measures, and organizational and economic strengthening of the primary health care.

KEY WORDS: disability-adjusted life years, public policy, primary health care

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INTRODUCTION

The concept of Ambulatory care sensitive conditions (ACSCs) provides for the possibility of hospitalization prevention of patients with a certain group of diseases through a timely and effective provision of outpatient, and first of all, primary health care (PHC) [1]. Hospitalization occurs when a course of these diseases is exacerbated due to the ineffectiveness of outpatient treatment. This leads to worse outcomes (a disability or death) and financial losses, especially in countries of the world with the lowest level of healthcare expenses. In Ukraine, the group of ACSCs for the adult population include 16 chronic, acute, and vaccine-managed diseases with a total volume of preventable hospitalization of about 50% [2]. At the same time in European countries, for the most significant ACSCs, this indicator can reach 80% with some variation [1].

Generalized information on the quantification of health losses due to mortality and disability is provided by the Global Burden of Disease (GBD), which combines years of life lost due that premature mortality and years of life lost due to that time lived in states of less than

full health - Disability-adjusted life years (DALYs) [3]. Data on GBD are used to evaluate the effectiveness and efficiency of healthcare initiatives [4]. The study of health loss due to diseases, injuries, and risk factors is coordinated by the Institute for Health Metrics and Evaluation (IHME) which is an independent global center for health research at the University of Washington in Seattle (USA). However, a separate study of the burden of disease caused by ACSCs has not been conducted in Ukraine.

THE AIM

To assess the long-term dynamics of health losses caused by ACSCs to substantiate the priorities of public policy regarding this group of diseases.

MATERIALS AND METHODS

The database IHME was used to study DALYs associated with ACSCs [5] which covers information on premature death and disability from diseases and injuries in 195

countries throughout the 1990 to 2019 period, the information on age-standardized DALYs per 100,000 population of relevant or closely related ACSCs in Ukraine was selected. For a detailed description of the situation, the profile of Ukraine regarding GBD was also analyzed. Additional research information was obtained using materials from WHO Europe "HFA-DB" database [6].

Bibliosemantic, historical and epidemiological methods were used in the study. Statistical processing of the results was carried out using the software program STATISTICA 6.1 (StatSoftInc., serial number AGAR909E-415822FA) and Excel-2010 using methods of parametric and non-parametric statistics, analysis of dynamics series; arithmetic means (M), 95% confidence interval (CI), Spearman correlation coefficients (r_s) were calculated. The critical value of the level of statistical significance was accepted at the level of $p < 0.05$ (5%).

Compliance with the principles of bioethics and medical deontology was confirmed in the conclusion of the biomedical ethics commission of the Dnipro State Medical University (protocol No. 6 dated 15.02.2023).

RESULTS

Age-standardized DALYs rates in patients with ACSCs for the period 1990-2019 in Ukraine ranged from 4,578.4 to 5,826.3 years per 100,000 population; the average level over 30 years of follow-up was 5145.4 years per 100,000 population (95% CI 4731.1-5559.7) (Fig. 1).

In general, the dynamics of DALYs due to ACSCs did not reveal a clear tendency to change - the compound annual growth rate (CAGR) was 0.14%. Significant changes in the indicator ($p < 0.01$) with a CAGR of 5.28% took place in the period 1990-1995, and subsequently,

multidirectional fluctuations without significant deviations were observed. The forecast age-standardized DALYs rates calculated by the method of exponential smoothing shows that in the absence of intensive interventions, DALYs rates due to ACSCs during the next 10 years will virtually not change and will amount to 4859.1-4921.1 per 100,000 population in 2024-2029, respectively.

A strong direct relationship between DALYs rates due to ACSCs and DALYs due to all causes was revealed ($r_s = 0.89$; $p < 0.01$). During the observation period, the share of losses by ACSCs was quite stable and on average was 13.56% (95% CI 12.97-14.14) of losses from all causes.

In the structure of GBD associated with ACSCs, during the entire observation period (Fig.2), almost half of all DALYs are due to angina pectoris (AP) - 50.7% (95% CI 46.1-55.3). The second and third places are shared due to chronic obstructive pulmonary disease (COPD) and lower respiratory infections (LRI) - 13.7% (95% CI 8.2-19.2) and 11.2% (95% CI 10.2-12.2) respectively. The fourth and fifth places belong to diabetes type II (7.9%; 95% CI 7.4-8.4) and tuberculosis (6.5%; 95% CI 5.1-7.9). Together, these 5 diseases account for 90% of all DALYs due to ACSCs. The contribution of other ACSCs (hypertensive heart disease - HHD, asthma, upper respiratory infections - URI, iron-deficiency anemia - IDA, peptic ulcer disease - PUD, bacterial skin disease - BSD) was insignificant and together amounted to about 10%.

The dynamics of DALYs rates due to individual ACSCs had a multidirectional character (Fig.3, Table I). During the entire period of observation, the highest DALYs were due to AP (2643.0 per 100,000 population; 95% CI 2323.2-2962.7). The maximum CAGR was found in 1990-

Table I. Compound annual growth rate of DALYs are ACSCs-related for the period 1990-2019 (in %)

ACSC	1990-1995	1995-2000	2000-2005	2005-2010	2010-2015	2015-2019	1990-2019
AP	6.77	0.60	2.03	-3.46	0.89	-1.21	0.93
HD	3.02	-0.46	1.25	-1.37	2.45	-0.86	0.66
COPD	2.49	-4.91	-5.90	-8.14	-2.19	0.10	-3.16
LRI	5.83	0.73	-1.11	-5.97	7,11	-1.97	0.67
ULI	0	0.02	0	-0.22	0.40	-0.32	-0.02
Asthma	0.53	-3.63	-4.14	-3.26	-1.09	1.94	-1.63
Tuberculosis	12,12	5.90	3.55	-8.75	2.49	-2.74	1.88
Diabetes	4.99	-0.66	-0.14	-1.28	0.25	0.48	0.59
IDA	1.90	-2.02	-2.23	-3.96	-0.47	-0.37	-1.21
PUD	6.23	-3.90	-0.30	-2.96	6.49	-2.23	0.47
BSD	1.48	-0.87	1.30	1.22	9.51	-1.02	1.88

Note. See markings Fig. 2.

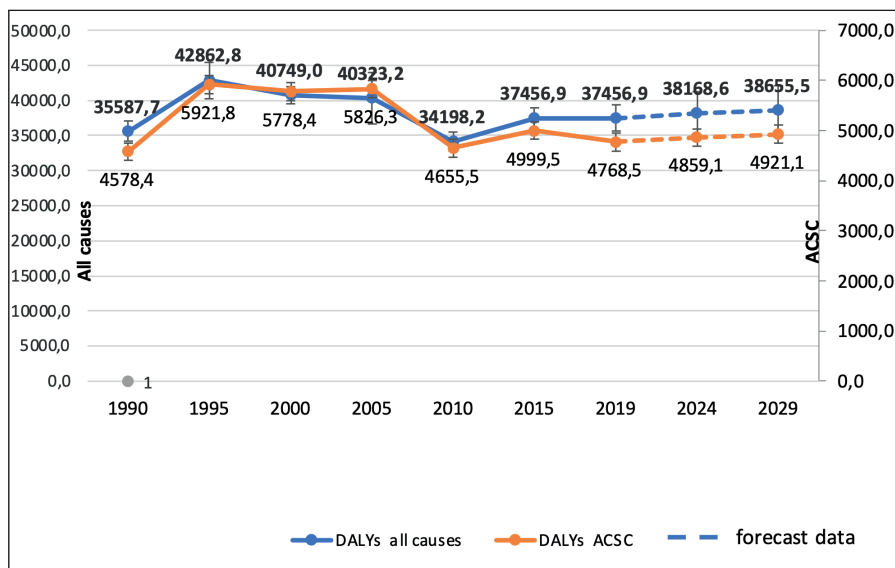


Fig. 1. The dynamics of age-standardized DALYs in Ukraine due to all causes and due to ACSCs (1990-2019 per 100,000 population) with a forecast of their scale for a 10-year period (until 2029).

Source: Calculated according to [5].

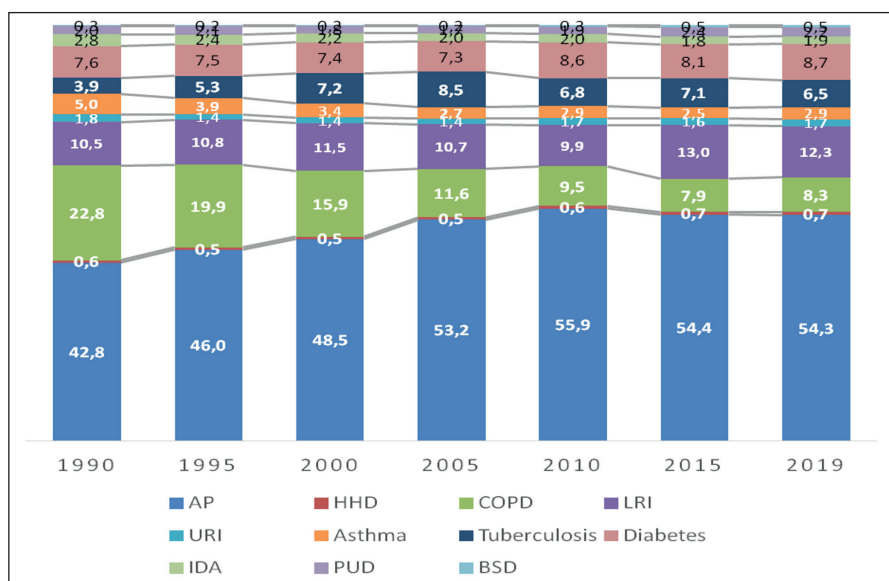


Fig. 2. The structure of the burden of diseases caused by various ACSCs in Ukraine during 1990-2019 (in %)

Note. HHD - hypertensive heart disease, AP - angina pectoris; COPD – Chronic obstructive pulmonary disease; IDA - Iron deficiency anemia; LRI - Lower respiratory infection; URI - Upper respiratory infection; BSD - Bacterial skin disease; PUD - Peptic ulcer disease

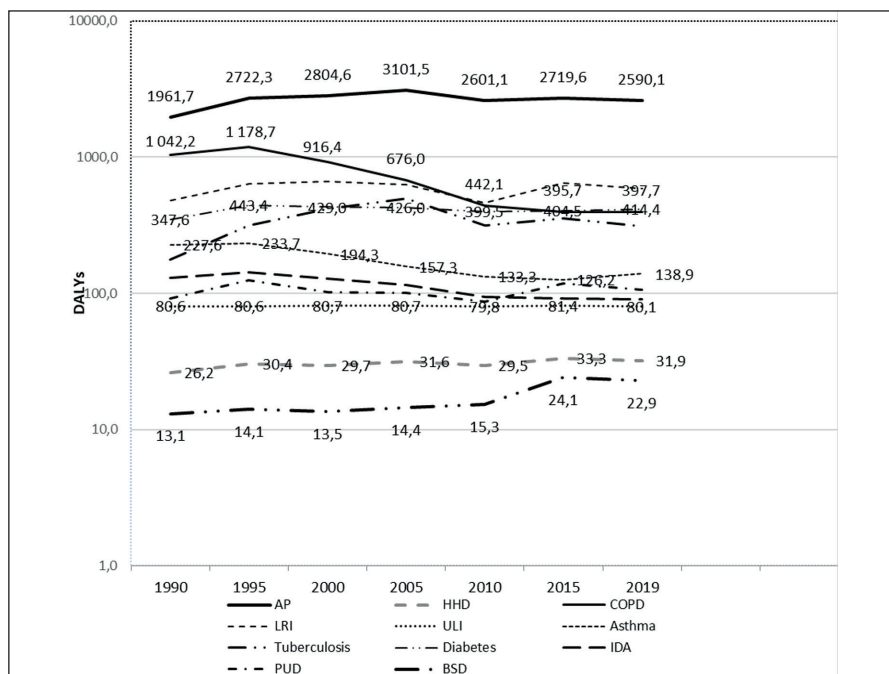


Fig. 3. Dynamics of DALYs due to various ACSCs in Ukraine for 1990-2019 (logarithmic graph per 100,000 population)

Note: see markings Fig. 2.

1995 (6.77%), and the increase in the level of losses in patients with AP albeit at a lower rate continued until 2005 with multidirectional fluctuations in subsequent periods and a total CAGR of 0.93%.

A significantly lower DALYs rates were COPD-related (721.2; 95% CI 419.0 - 1023.5), LRI (586.3; 95% CI 509.9-662.7), diabetes mellitus type II (409.2; 95% CI 380.5-437.9) and tuberculosis (341.1; 95% CI 248.6 - 433.5) with different change trends. In patients with COPD after the year 1995 DALYs rates declined with an overall negative CAGR of -3.16% for 1990- 2019. DALYs rates attributable to LRI had a slight overall upward trend (CAGR 0.67%) with sharp increases in 1990-1995 and 2010-2015 (CAGR 5.83% and 7.11%, respectively) and a sharp drop in 2005-2010 (-5.97%), which could be due to the consequences of the influenza epidemic situation in Ukraine at the time. After rising in 1990-1995 with a CAGR of 4.99%, the DALYs due to diabetes showed no clear dynamics; overall CAGR was 0.59%. The highest CAGR of age-standardized DALYs due to tuberculosis was registered in 1990-1995 (12.12%), growth at a lower rate continued until 2005, after which a long-term trend towards a decrease in losses from this disease was observed (CAGR for the period 2005-2019 was -3.11%), although in 2019 the DALYs rates due to tuberculosis were still higher than in 1990. Among other ACSCs with relatively small average DALYs rates due to asthma (173, 0; 95% CI 131.2-214.9) and IDA (112.8; 95% CI 93.1-132.6) show a steady downward trend: CAGR for 1990-2019 -1.63% and -1.21%, respectively; DALYs rates due to HHD and PUD in the presence of ups and downs in different years essentially did not change during the entire observation period and DALYs rates due to BSD (16.8; 95% CI 12.5 - 21.1) increased with a CAGR of 1.88%.

DISCUSSION

For the first time, a longitudinal 30-year study (1990-2019) of the burden of disease caused by ACSCs that are significant for Ukraine was conducted. Two key findings emerged from this study: 1) DALYs due to ACSCs were significant; 2) improving the efficiency of outpatient care for patients with ACSCs could reduce the level of hospitalization for these diseases and also prevent more negative consequences (such as mortality and disability) and ineffective financial losses, which is especially relevant during the crisis periods of the COVID-19 pandemic, the war of the Russian Federation against Ukraine and the post-war period.

The results of the study show that in Ukraine the DALYs share due to ACSCs averaged at around 14%, and the levels of age-standardized DALYs due to ACSCs as

well as the GBD from all causes had a very small trend to growth during the observation period (CAGR 0.14% and 0.17% respectively), which is close to the growth rates of DALYs due to all causes in the same period in Eastern Europe – 0.13% [5].

The greatest DALYs rates due to ACSCs fall on AP with a certain tendency towards its growth. A moderate downward trend was shown by DALYs due to COPD and asthma. No clear changes in DALYs of diabetes-related are noted. A turning point in the negative dynamics of tuberculosis-related DALYs was achieved only in the middle of the first decade of the 21st century, but their rates remain significantly higher compared to 1990 [7]. DALYs due to other ACSCs despite the multidirectional trends of changes in individual diseases remained insignificant during the entire observation period.

Positive changes in the scope of DALYs due to ACSCs can be achieved by affecting the risk factors that shape them. In Ukraine, the leading risk factors associated with global DALYs throughout the observation period remained: 1) metabolic factors: high systolic blood pressure (attributable risk in 2019 was 21.1%); high LDL (low-density lipoprotein) cholesterol (14.4%); high body-mass index (-13.4%); high fasting plasma glucose (6.9%) and 2) behavioral factors: dietary risks (17.3%); tobacco (14.7%); alcohol use (9.8%), which corresponds to similar characteristics for the countries of Eastern Europe overall [8] and are risk factors for ACSCs with the highest DALYs. So, for example, the attributive risk of high blood pressure, which is defined in Ukraine as DALYs due to ischemic heart disease (IHD)/ AP, is 57.6%; high LDL cholesterol - 49.7%, tobacco - 26.1%, which practically coincides with the data on the impact of these factors on DALYs of IHD worldwide [9] Attributable risk of smoking, which is considered the main risk of mortality worldwide [10], for DALYs due to COPD accounted for 55.0%, asthma - 13.4%, tuberculosis - 36.1% [5].

All of these risk factors are amenable to some correction through lifestyle modification and pharmacotherapy if necessary. It has been proven that the widespread use of antihypertensive medications makes it possible to keep the global average blood pressure at a stable level [10].

In Ukraine, separate measures are aimed at reduction of the impact of modifiable risk factors. Since 2005, the state policy has been actively implemented in the fight against smoking [11], the result of which can be considered a decrease in the age-standardized prevalence of tobacco use from 37.7% in 2000 to 26.2% in 2019 [6], however, this did not have a significant impact on the amount of ACSCs-related DALYs. The high cost of medications for outpatient treatment of the population is an obstacle to effective treatment and further reduction of ACSCs-related DALYs. The state program "Affordable Medicines" [12], which has been operating

in Ukraine since 2017, aims to increase the accessibility and to a certain extent the continuity of treatment at the level of primary health care. It provides for the cost reimbursement of a specified list of medications prescribed for patients with cardiovascular diseases (primarily antihypertensive drugs and drugs for dyslipoproteinemia, diabetes type II, and asthma. The short period of implementation of the program does not provide an opportunity to assess the effectiveness of its impact on the outcome. However, it has already been established at this stage that without reinforcement by systemic organizational measures, it will be difficult to expect a good result. For example, due to the poor organization of health screening and monitoring of compliance with drugs, 33.6% of people do not know that they have hypertension, and only 14.4% manage and control it effectively [13].

The inadequacy of measures to reduce DALYs due to ACSCs is indirectly evidenced by the materials of a global study of the index of effective coverage of health services [14], which for Ukraine in 2019 was equal to 57% with average annual changes for 1990-2019 of 0.2% (95% CI 0.4-0.6), which is lower compared to both Eastern European countries and global world data (66.5% and 60.3% respectively; average annual rates of change during 1990-2019 were 0.7- 0.9%). Attention is drawn to the catastrophically low (only 2%) coverage index for patients with ischemic heart disease.

OUR STUDY HAS SEVERAL LIMITATIONS, INCLUDING THE FOLLOWING:

- 1) Data on GBD by ACSCs in Ukraine may have certain deviations from the true values due to differences in the classification used by the IHME and the International Classification of Diseases of the 10th revision. In the study, DALYs due to LRI were estimated as mainly caused by pneumonia, URI - by influenza; AP - as 35.5% of IHD [15].
- 2) ACSCs in Ukraine are defined for adults, while the work used age-standardized DALYs for the entire population. It should be noted that the shift in the obtained data was insignificant since the highest DALY rates are caused by diseases that the vast majority of adults suffer from - AP, COPD, diabetes, tuberculosis, etc.

CONCLUSIONS

This longitudinal study revealed a slight tendency to increase the DALYs rates due to ACSCs. State measures to influence modifiable risk factors to reduce ACSCs-related DALYs were ineffective. To significantly reduce DALYs, a clearer and more systematic public policy in the field of public healthcare regarding ACSCs is needed, including a set of primary prevention measures, and organizational and economic strengthening of primary health care.

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Conflict of interest:

The Authors declare no conflict of interest.

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