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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии
საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

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GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman (Кириллица)**, для текста на грузинском языке следует использовать **AcadNusx**. Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - <http://www.spinesurgery.ru/files/publish.pdf> и http://www.nlm.nih.gov/bsd/uniform_requirements.html В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректур авторам не высылаются, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or computer-printed on a single side of standard typing paper, with the left margin of 3 centimeters width, and 1.5 spacing between the lines, typeface - **Times New Roman (Cyrillic)**, print size - 12 (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf

In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

**Articles that Fail to Meet the Aforementioned
Requirements are not Assigned to be Reviewed.**

ავტორთა საქურაღებოლ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დაიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx**. შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შედეგის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფხიხლებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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FORECASTING THE POPULATION MORTALITY RATE FROM CARDIOVASCULAR DISEASES AS A CONDITION OF THE ECONOMIC SECURITY OF THE STATE

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Abstract.

The article analyzes the population mortality rate in Ukraine from cardiovascular diseases (for example of Sumy region). The structure and dynamics of mortality among the region residents as a result of these diseases during 2012-2019 are also considered. Prognostic assessment the population mortality rate in Ukraine from diseases of the circulatory system (regional aspect). We used analytical, statistical research methods, the method of systematic approach and comparative analysis. Statistical processing was performed in accordance with generally accepted methods of variation statistics using the software STATISTICA 8.0. On the basis of the data from annual statistical reports of medical institutions of the Sumy region, subordinate to the Ministry of Public Health of Ukraine (2012-2019), statistical yearbooks, the forecast of mortality of the population from cardiovascular diseases was made. It is predicted that the mortality rate of the population from cardiovascular diseases will slightly increase by 2025 (by 0.5%). This moderate growth will be achieved due to a slight decrease in the population mortality rate from cerebrovascular diseases. But mortality from other cardiovascular pathologies will increase by 2025. Also, the work carried out the forecast of the population mortality rate from various cardiovascular diseases in the territorial respect. The forecast showed that mortality from cardiovascular diseases will increase in 10 of 19 administrative-territorial units of Sumy region. Likewise, the results of forecasting of the population mortality from cardiovascular diseases by Ukraine's region can be used by local authorities to prevent the growth level of mortality of the population from this pathology and to prevent of morbidity increase.

Key words. Cardiovascular diseases, nosological class, morbidity, public health, economic security of the state.

Introduction.

Preservation of health and reducing of population mortality is one of the priority directions of the state policy of the European countries. Ukraine as a member of the United Nations (UN) joined the implementation of the Sustainable Development Goals by developing national strategic objectives, related to building a national public health system on ambushes of preventive (prophylactic) medicine and the development of primary health care. In Ukraine main responsible structure for monitoring the incidence of the population, preventing the risk of disease (prevention) and fighting epidemics is State Institution "Center for Public Health of the Ministry of Health of Ukraine", which was established in 2015. Prompt response to emergency events in public health at the regional level provides Interregional Public Health Laboratory Centers with Epidemiological Monitoring Laboratories.

The population mortality level is one of the most important demographic indicators of public health, characterizing the state of health of the population in terms of the spread of the most severe pathology [1,2]. During the years of independence (1991 - early 2020) Ukraine has lost more than 10 million people. In 2019 in Ukraine the rate of natural population decline was -272,3 thousand people (State Statistics Service of Ukraine, 2020). The socio-economic consequences of premature mortality are not only the loss of years of potential life, and a significant government economic loss (Hrebniak & Fedorchenko, 2016). In the structure of reasons of population mortality both the world and Ukraine, the first place is occupied by cardiovascular diseases (CVDs). Therefore, in modern conditions, the problem of population mortality by this nosology group is not purely medical, and now is in the field of view of a wide range of scientists, in particular geographers, economists, biologists, ecologists, etc. [3-6].

Because of high rates of population mortality, the problem of CVDs has acquired a global scale. According to WHO [7] every year from pathologies of this group in the world dies 17.5 million people. The most widespread among CVDs are coronary heart disease and cerebrovascular disease; their percentage in the structure of population mortality in Europe is 35%. It should be noted, that in high-income countries human mortality due to CVDs constantly declining, instead in Ukraine it remains high and is much higher, than in neighboring European countries. So, in Poland the population mortality from CVDs in comparison with Ukraine is by 2.3 times lower, in Sweden – almost by 4 times, in Great Britain – by 4.6 times, in France – by 6 times [8,9].

According to forecasts, by 2030 coronary heart disease and cerebral strokes will be the leading causes of population death and disability in the world, and mortality rate from them will increase to 23 400,000 people per year [10,11]. In Ukraine in 2017 most deaths (62%) were caused by CVDs. Moreover, from a demographic and life point of view most of these deaths were premature. Premature mortality in Ukraine is much higher, in accordance with other European countries, and among men it is twice as high as among women [12]. The foregoing indicates the need to predict population morbidity and mortality, which is related to problems of prediction and planning socio-economic processes and development of society as a whole. After all, without a preliminary forecast of morbidity/mortality it is impossible to determine the prospects of development of the health care system, social insurance and social security, medical education, etc. [13,14].

Today in world have been developed and used various forecasting techniques and models for modeling of various diseases and mortality by them. Computer analysis makes it

possible to process a large set of statistics on morbidity and mortality data as well as forecasting the further development of these events. The forecast is needed not only to find out the death rate in the future, and to develop the effective ways to overcome or stabilization of an unfavorable situation and to ensure the national security. Therefore, forecasting the level of population mortality from CVDs, as well as forecast estimates population morbidity by these pathologies is relevant and timely, especially at the regional level [3,15-19].

Materials and methods.

On the basis of the data from annual statistical reports of medical institutions of the Sumy region, subordinate to the Ministry of Public Health of Ukraine (2012-2019), statistical yearbooks (State Statistics Service of Ukraine, 2019), the forecast of mortality of the population from CVDs was made. The study is based on the data about the following nosofoms of CVDs: coronary heart disease, acute myocardial infarction, cerebrovascular diseases, cerebral strokes and strokes with hypertension. To create the forecast of the population mortality of Sumy region before 2025 was taken time series of observations during 2012-2019. Forecast of mortality rate from CVDs was based on a linear relationship of the form $a+bx$, where,

$$a = \bar{y} - b\bar{x}(1)$$

and

$$b = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sum(x-\bar{x})^2}(2)$$

where y – years of observation, x – mortality rates.

All calculations and computation, as well as graphic constructions were obtained using the capabilities of a computer program Microsoft Excel 2016. The research was performed according to the World Medical Associations Declaration of Helsinki and Council of Europe Protocol of the Convention on Human Rights and Biomedicine, approved by the Ethics Committee of Sumy State Pedagogical University named after A. S. Makarenko. This work was carried out within the framework of the scientific research topic of the Department of Public Health and Medical and Biological Foundations of Physical Culture, Sumy State Pedagogical University, named after A. S. Makarenko.

Results and Discussion.

As known, the forecast begins with a study of the current state and retrospective analysis of the forecasted object, in our case the mortality from CVDs. These diseases, as already indicated, are among the top three in terms of morbidity, prevalence and are the leading cause of death of the inhabitants of Ukraine. During 2018 in Ukraine about 400 000 persons was by these diseases (or 996.6 cases per 100 000 people, among of them 171 511 or 937.6 deaths per 100 000 men and 220 549 or 1 048.0 deaths per 100 000 women). Among the urban inhabitants in 2018 registered 234 397 deaths (874.5 cases per 100 000 people) from CVDs, incl. among men – 104 886 deaths (852.8 cases per 100 000 people), and among women – 129 511 deaths (893.1 cases per 100 000 people). The mortality rate among

rural inhabitants was 157 663 deaths (1 231.4 cases per 100 000 people), including among men – 66 625 deaths (1 096.2 per 100 000 people), and among women – 91 038 deaths (1 353.3 per 100 000 people) cases.

In 2018 the Sumy region by the level of population mortality from CVDs among other regions of Ukraine occupied 8th place with mortality rate 1 037.7 cases per 100 000 people, which is higher than the average Ukrainian mortality rate – 996.6 deaths per 100 000 people (State Statistics Service of Ukraine, 2019). The level of primary morbidity and prevalence of CVDs among the population of Sumy region we considered in (Kornus et al., 2020). As in Ukraine as a whole, in Sumy region CVDs are occupy a leading position for primary morbidity and prevalence of diseases and is main cause of disability inhabitants of region. In 2019 the mortality of the region population from CVDs traditionally has been in the first place, although the number of deaths due to this reason has decreased as compared to 2018 (Fig. 1). It should be noted, that during the study period the mortality rate of Sumy region from different CVDs, except cerebral strokes, was the largest in 2015-2016 (percentage of cerebral strokes, as cause of death, increasing during all observation period).

The results of analysis of the actual mortality rates became the basis for calculating the prognostic indicator of the population mortality level due to pathologies of cardiovascular system. Given the length of the time series of actual observations (time series of mortality statistics) we have limited the forecast range by 2025. Our result showed a slight increase of mortality by CVDs from 1037.7 cases per 100 000 people to 1043.8 cases per 100 000 people by 2025 (Fig. 2a). At the same time, the limits of 95 % confidence interval of the forecast indicator admitted as a reduction of mortality by 7.4 % (or to level 966.3 cases per 100 000 people), and its growth by 6.9 % (or to 1121.3 cases per 100 000 people).

As can be seen from Fig. 1, most of the regional population dies from coronary heart disease. Most deaths from this reason were recorded during 2015-2016. Since 2017 the mortality from coronary heart disease started to decrease – for period 2017-2019 it was decreased by 8.8 %. However, forecast of Sumy

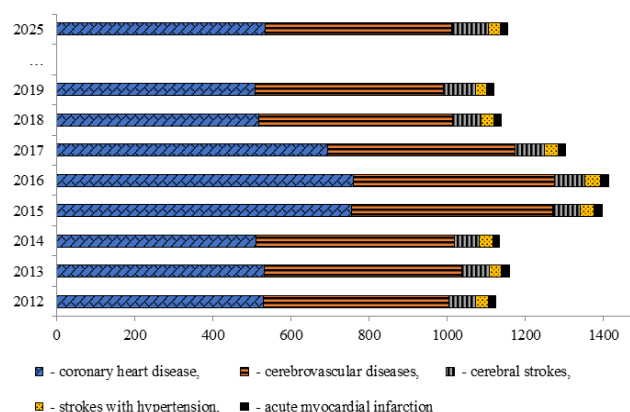


Figure 1. Dynamics of structure of mortality of the population of Sumy region from CVDs during 2012-2019 and its forecast by 2025 (deaths per 100 000 people).

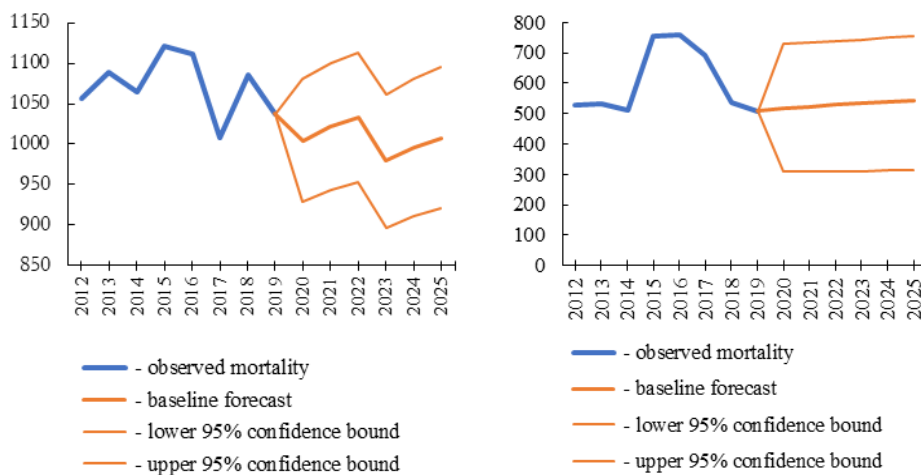


Figure 2. The forecast of mortality rate of the population of Sumy region by 2025: a) from all CVDs, b) from coronary heart disease (per 100 000 people).

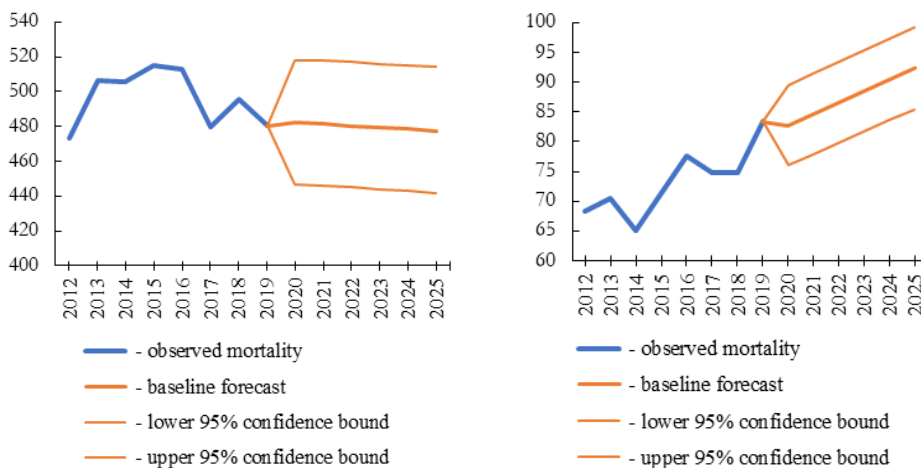


Figure 3. The forecast of mortality rate of the population of Sumy region by 2025: a) from cerebrovascular disease, б) from cerebral strokes (cases per 100 000 people).

region population mortality by coronary heart disease is adverse, – by 2025 we expecting its increase by 7% – to 544 cases per 100 000 people. Lowest and upper values of 95 % confidence bound indicate possible variations in the level of mortality of the population by coronary heart disease from 313.6 to 754.5 deaths per 100 000 people (Fig. 2b).

The 2nd place in structure of mortality of the population from CVDs takes cerebrovascular disease. Compared to 2012, in 2019 mortality from them increased by 1.55 % (Fig. 1). However, our forecast points to an insignificant (0.58 %) decrease in its percentage in the structure of reasons, causing mortality of the inhabitants of Sumy region. Possible variations of the predicted mortality rate as a result of cerebrovascular disease are in the range from 442.06 to 514,13 cases per 100 000 people (Fig. 3a). The 3rd place among CVDs which conditioning mortality of the population of Sumy region is occupies cerebral strokes. During the observation period, the mortality from them increased by 22.3 %. We expecting an increase of deaths due to cerebral strokes predicted in the future, and we suppose that the population death rate in the region from cerebral strokes by 2025 will increase by 10.7 % (Fig. 3b). Its absolute values can

range from 85.47 to 99.25 deaths per 100 000 people.

The 4th place in the structure of causes of death of the inhabitants of Sumy region from CVDs, takes mortality from strokes with hypertension. Although for the period from 2012 to 2019 mortality from them decreased by 14.3 %, our forecast shows an increase of mortality due to this pathology by 2025 by 7.15 % (Fig. 4a). According to the optimistic forecast the mortality rate from strokes with hypertension will be 24.16 cases per 100 000 people and 37.56 cases per 100 000 people – for the pessimistic forecast.

Acute myocardial infarction takes 5th place among CVDs causing death of the population of Sumy region. By level of morbidity by acute myocardial infarction fluctuates noticeably from year to year, but compared to 2012, in 2019 it grew by 4.4 % (Fig. 4b). Our forecast shows a further increase of mortality from acute myocardial infarction by 7 % by 2025. At the same time, the bounds of 95% confidence interval of the population mortality from acute myocardial infarction allow to expect both its decrease 16.7 % (or to level 15.66 cases per 100 000 people), and its increase by 30.6 % (or to level 24.55 deaths per 100 000 people).

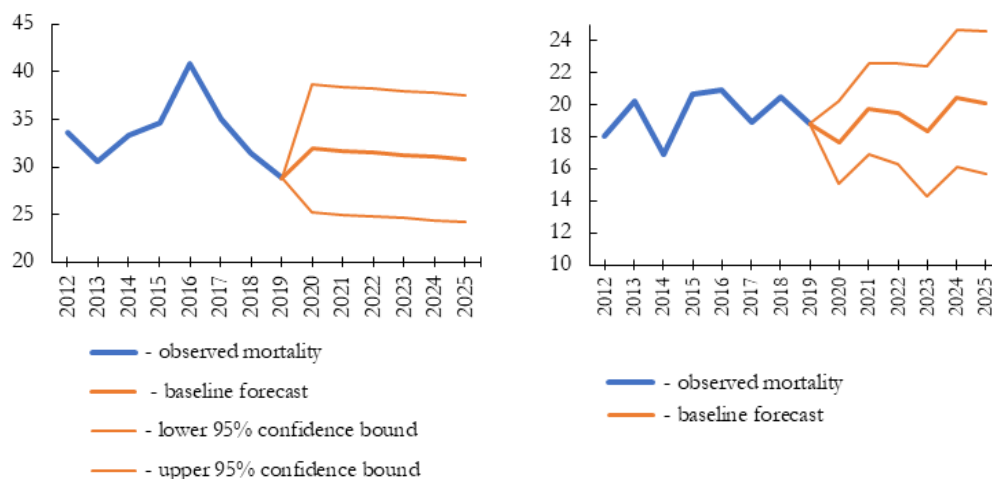


Figure 4. The forecast of mortality rate of the population of Sumy region by 2025: a) from strokes with hypertension, b) from acute myocardial infarction (cases per 100 000 people).

Forecasting of the population mortality rates by administrative districts of Sumy region showed that by 2025 in 10 of 19 administrative-territorial districts the mortality of inhabitants from CVDs will increase. The greatest of population mortality increasing by diseases of this nosological class is expecting in Velyka Pysarivka, Okhtyrka (increase by 11.2 %) and Seredyna-Buda (by 9.8 %) districts. At the same time for districts with high mortality rates from CVDs its decline is projected. It will be most significant in Krasnopillia (by 13.5 %), Putyvl' (by 7 %), Sumy (by 6 %) and Trostyanets (by 5.9 %) district. According to our forecasts, by 2025 among all CVDs the highest mortality will be by strokes. In 15 of 19 districts the mortality rate from them will increase significantly. A particularly unfavorable situation is forecasted in Hlukhiv (increase by 88 %), Seredyna-Buda (by 86.6 %) and Lebedyn (by 82.3 %) districts [20].

Conclusion.

CVDs are leading cause of death and disability of the population of Sumy region and Ukraine. Today Sumy region occupies 8th place among others Ukraine's regions of by level of population mortality from CVDs. Established that the level of the population mortality from CVDs by 2025 will increase slightly – by 0.6%. This slight increase will be achieved due to so reduction in mortality from cerebrovascular diseases. But mortality from others pathology CVDs by 2025 will increase (from ischemic heart disease – by 5.0 %, from cerebral strokes – by 10.7 %, from strokes with essential hypertension – by 7.1 %, from acute myocardial infarction – by 6.9%). Forecast of population mortality from CVDs by 2025 in territorially attitude showed that in 10 of 19 administrative-territorial districts of Sumy district mortality will increase. According to the study results by nosologies it was found that the mortality from cerebral strokes will increase most intense. Particularly unfavorable situation with the increase of mortality due to cerebral strokes by 2025 predicted in Hlukhiv, Seredyna-Buda and Lebedyn districts. These administrative-territorial districts require more attention from the central government and local authorities, the purpose of which should be to reduce the morbidity by this pathology and stabilize the level of the population mortality.

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