Koltsov A. V.[1], Tyrenko V. V.[1], Sarana A. M.[2], Iazenok A. V.[3], Kogan E. I.[3], Chentsov D. V.[4]

[1] Kirov Military Medical Academy, St. Petersburg, Russia

[2] Health Committee of St. Petersburg, St. Petersburg, Russia

[3] St. Petersburg Medical Information and Analytical Center, St. Petersburg, Russia

[4] St. Petersburg Municipal Polyclinic #40, St. Petersburg, Russia

Prevalence of Heart Failure in a Megalopolis

Aim	To assess the prevalence of heart failure (HF) in St. Petersburg from 2019 through 2021 based on medical reports.
Material and Methods	Medical records of 146912 patients with HF who were managed in St. Petersburg from 2019 through 2021 were analyzed. Prevalence of HF was assessed using a standard ICD-10 I 50.x code for this disease. Also, expanded HF coding was used with ICD-10 codes I09.9, I11.0, I13.0, I13.2, I25.5, I42.0, I42.9, I43.0, I43.1, I43.8, I42.5, I42.7, and I42.8. An additional analysis was performed for mortality from cardiovascular diseases (CVD) as a whole and from HF in particular (n=192133).
Results	From 2019 through 2021, the number of both male and female patients with HF increased by 18.14%. The greatest number of HF patients was in the age group of 75–89 years in 2019–2020 and 60–74 years in 2021, with females prevailing. The HF incidence increased in the age group of 45–59 years with a peak morbidity at age of 60–74 for men and 75–89 for women, which was consistent with the life expectancy of each gender. The expanded coding allowed a more complete presentation of HF prevalence and also to take into account patients with HF caused not only by myocardial infarction or acute cardiac pathology but also by rheumatic heart disease, arterial hypertension, myocarditis, and cardiomyopathies. Cardiovascular mortality significantly increased by 20.1% during the period from 2019 through 2021. The HF prevalence for deceased patients also was steadily increasing during 3 years. Analysis of associated pathology in HF patients revealed, in most cases, hypertension, ischemic heart disease, cerebrovascular diseases, diabetes mellitus, and obesity.
Conclusion	The increase in HF prevalence and mortality draws attention and calls for managing measures to change the current situation in health care. A registry is required to characterize a typical patient with HF and to present an unbiased picture of HF prevalence. It is also necessary to develop programs for outpatient follow-up of patients in this category and for providing current, highly effective medicines. Education of patients and improving the knowledge of therapists in diagnosis and treatment of HF are most relevant for enhancing the quality and duration of patients' life and for reducing the number of hospitalizations and the HF mortality.

Keywords	Heart failure; prevalence; associated pathology; mortality; GIS "REGIZ"; Saint Petersburg
For citation	Koltsov A.V., Tyrenko V.V., Sarana A.M., Iazenok A.V., Kogan E.I., Chentsov D.V. Prevalence of Heart Failure in a Megalopolis. Kardiologiia. 2022;62(12):50–56. [Russian: Кольцов А.В., Тыренко В.В., Сарана А.М., Язенок А.В., Коган Е.И., Ченцов Д.В. Распространенность сердечной недостаточности в условиях мегаполиса. Кардиология. 2022;62(12):50–56].

Corresponding author Koltsov A.V. E-mail: Andrewkoltsov83@gmail.com

The incidence of heart failure (HF) progressively increases worldwide, which is associated with achievements in the treatment of the main diseases causing this pathology, such as hypertensive heart disease (HHD), ischemic heart disease (IHD), myocardial infarction (MI), atrial fibrillation, as well as the successful treatment of the syndrome itself. According to official statistics, the total population of in the Russian Federation was 146,171 thousand people in 2020, including 67,848 thousand men, 78,323 thousand women, 81,881 thousand working-age people. Mean life expectancy was 71.54, 66.49, and 76.43 years for the total population, men, and women, respectively [1]. The prevalence of chronic heart failure (CHF) was 8.2% in the general population and was 3.1% had severe clinical manifestations [2]. Thus, given available statistical data, we can assume that there were 11,693 thousand patients with CHF in the Russian Federation in 2020, including 4,385.1 thousand patients with CHF of higher functional class and severe clinical manifestations.

In 2020, total mortality amounted to 2,138.6 thousand cases, of which 938.5 thousand were due to circulatory diseases. The number of deaths due to circulatory diseases in active working age (16–59-year-old men and 16–54-year-old women) was 167.9 per 100 thousand people; 268.4 per 100 thousand men, 58.1 per 100 thousand women [1].

The social and economic damage caused by HF was presented in the article by academician of RAS O. M. Drapkina et al. «Social and economic damage caused

ISSN 0022-9040. Kardiologiia. 2022;62(12). DOI: 10.18087/cardio.2022.12.n2294

by chronic heart failure in the Russian Federation» [3]. The authors took into consideration the costs of medicine provision, the cost of hospital treatment, disability social benefits, and the damage associated with the death of patients. Total costs amounted to 81.86 billion rubles, of which medical costs were 18.6 billion rubles, including 13.7 billion rubles spent on hospital treatment of patients. Direct non-medical costs (social benefits, disability pensions) amounted to 47.1 billion rubles, and indirect costs caused by the death of active-working-age patients were 16.2 billion rubles. The costs associated with care giving to patients with heart failure was calculated additionally and amounted to 72.4 billion rubles. The data obtained were based on the results of the EPOCH-CHS trial and medical registers – REKVAZA (Ryazan), REKVAZA FP (Kursk), REKVAZA FP (Moscow), REKVAZA FP (Yaroslavl), REGION-PO (Ryazan), REGIONLD (Ryazan), REGION-Moscow and REGATA (Ryazan).

However, the published data and applied registers do not capture the actual clinical situation associated with the prevalence of HF. There is no generally accepted all-Russian register of HF patients, which could show the true picture of this disease.

Objective

Analyze the prevalence of HF in St. Petersburg and evaluate the health care burden of this category of patients from 2019 to 2021.

Material and methods

The study was conducted using the database of the St. Petersburg State Information System «Regional fragment of the unified state health care information system». Medical records (n = 146,912) included in the registry system in 2019–2021 were selected. The study included patients from 18 years and older with HF of any origin. In this article, the term HF combines cases of chronic HF and acute decompensated HF. The prevalence of the disease was assessed by patients who were assigned a serial number rather than by medical care encounters. All patients signed a standard form of consent of the data subject. The prevalence of HF was estimated based on the standard ICD-10 code I50.x. Moreover, advanced heart failure coding was used: ICD-10 subcodes I09.9, I11.0, I13.0, I13.2, I25.5, I42.0, I42.9, I43.0, I43.1, I43.8, I42.5, I42.7, I42.8. An additional analysis of the cardiovascular mortality in general and due to HF in particular was carried out (n = 192,133). The study was performed following of the Declaration of Helsinki.

Results

The demographic composition of the St. Petersburg population was as follows in 2019–2021. In 2019, the total population of St. Petersburg [4–6] was 5,383,890 people, including 2,437,926 men and 2,945,964 women. The age distribution showed the predominance of the male population in the under-working-age and working-age group with a sharp decrease in the number of men in the over-working-age group, which included more women (Figure 1). However, women's life expectancy is much higher than that of men, which is 79.85 and 71.34 years, respectively. In 2020, there was an increase in the St. Petersburg population to 5,398,064 people, which was 0.26%, and it was 5,384,342 people in 2021. The annual mortality tended to increase: 53,025 people died in 2019, 66,468 people in 2020, and 72,640 people in 2021, i.e., 3-year mortality increased by 36.99%.

Thus, based on the data obtained from the EPOCH-CHF trial [2], in which the prevalence of CHF in the general population was 8.2%, and the number of patients with severe clinical manifestations was 3.1%, then the absolute number of patients with HF would be 441,651 of whom 166,914 patients would have severe clinical manifestations.

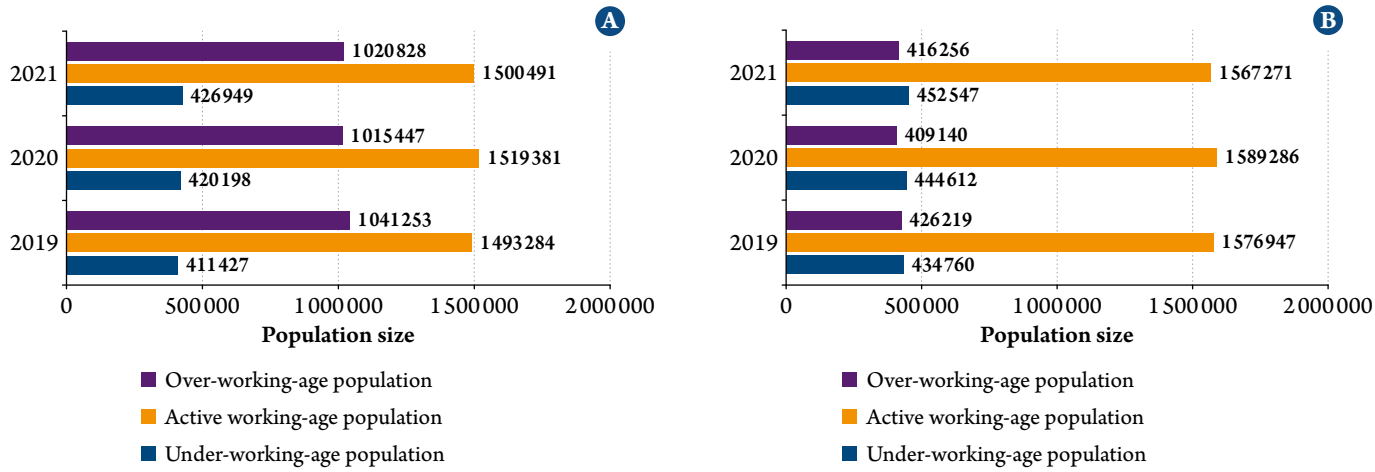
However, an analysis of the database of patients with HF based on the standard ICD-10 code I50.x showed the following results. In 2019–2021, there was an 18.14% increase in the number of patients (male and female) with HF (Figure 2). The largest number of patients was registered in the age group of 75–89 years old in 2019–2020 and the group of 60–74 years old in 2021, with more female patients than male patients. The incidence of HF increases in the group of 45–59 years old with a peak incidence among 60–74-year-old men and 75–89-year-old women, which is natural given the mean life expectancy of each sex (Figure 3). This trend continued throughout the observation.

However, when advanced coding is used, the prevalence of this disease is larger than when data are analyzed using the standard ICD-10 code I50. The number of patients with this code was 52,949 in 2019. In 2020–2021, the number of patients tended to decrease to 46,857 and 47,106, respectively. The age distribution of patients showed the highest prevalence in the 60–74 year old group, and the peak incidence was at the age of 45–59 years (Figure 4). Advanced coding allows revealing the most complete picture of the prevalence of HF and takes into consideration patients with HF caused by rheumatic heart disease, arterial hypertension, myocarditis, and cardiomyopathies as well as MI or acute cardiac pathology.

Thus, our findings do not match the calculated expected data from the EPOCH-CHS register. It can be assumed that there are much more patients with HF than shown in the figures. HF is not an underlying in most of them and is not coded by health care providers, some of these patients do not seek medical care and are not aware of their disease.

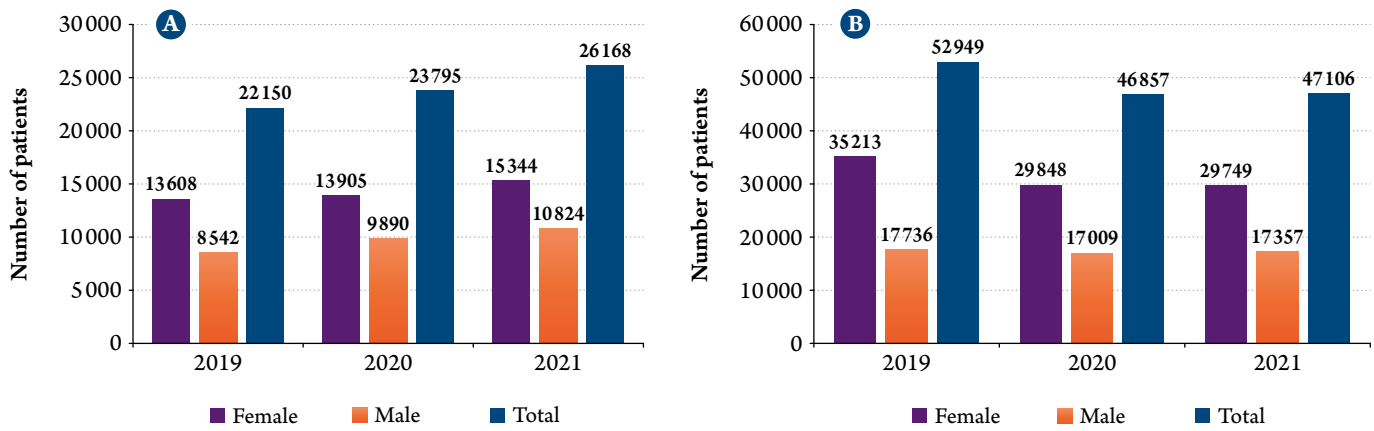
Cardiovascular mortality tended to increase in 2019–2021. The increase was 20.1% (31,041 people died due to CVDs in 2019, 37,846 people – in 2020, 37,279 people – in 2021). The analysis of mortality due to HF (I50.x) had contradictory

Figure 1. Demographic composition of the population of St. Petersburg from 2019 to 2021



A – female population; B – male population.

Figure 2. Prevalence of heart failure in St. Petersburg from 2019 to 2021



A – based on the standard ICD-10 code I50.x; B – advanced heart failure coding.

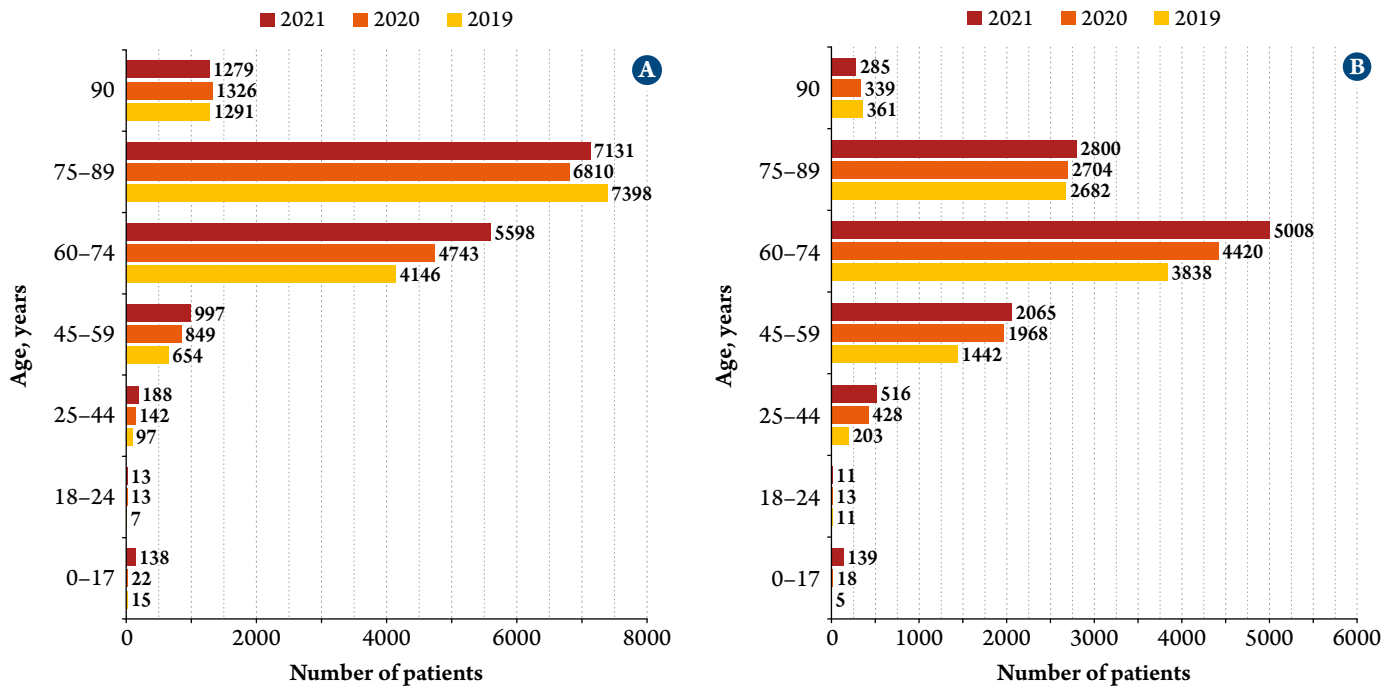
results, which was probably due to the peculiarity of coding, since HF is considered a complication of the underlying disease and is not considered in most cases as the underlying cause. At the same time, the assessment of mortality due to HF (advanced coding) has a revealing finding. In 2019–2021, there was a significant increase by 101.7%, which may be due to lower availability of medical care for this category of patients in the COVID-19 setting. Assessment of the incidence of HF in deceased patients showed a steady increase in 3 years. The increase was 129.4% (CHF I50.x was diagnosed in 4,277 patients in 2019 and 9,812 patients in 2021). The data are shown in Figure 5.

The analysis of combined pathology in patients with HF (both standard and advanced coding) was performed. The presence of HHD, IHD, cerebrovascular diseases, diabetes mellitus prevailed in most cases (Table 1 and Table 2).

The analysis of the health care burden was conducted using the standard code I50.x. The total frequency of hospitalizations for HF was 2.29‰, 3.37‰, and 3.71‰ in 2019, 2020, and 2021, respectively. The number of outpatient visits recorded in 2019 was 130,680 and decreased to 114,348 in 2020, which can be attributed to the COVID-19 pandemics and restricted access to outpatient clinics due to the strict anti-epidemic regime. As the situation stabilized and restrictions were lifted, the number of visits to outpatient clinics increased to 157,698 in 2021. Thus, the appealability increased by 20.67%. Analysis of the number of ambulance calls showed the following changes: 16,282 calls (using the standard ICD-10 I 50.x code) were recorded in 2019, this indicator increased to 25,811 calls in 2020, which is an 58.52% increase. The result can be explained by fewer visits to the outpatient clinics due to the strict anti-epidemic regime and the need for specialized medical care. In 2021, the number of ambulance calls decreased 23,111 cases (–10.46%). The analysis of the health care burden using advanced heart failure coding had a similar structure (Figure 6).

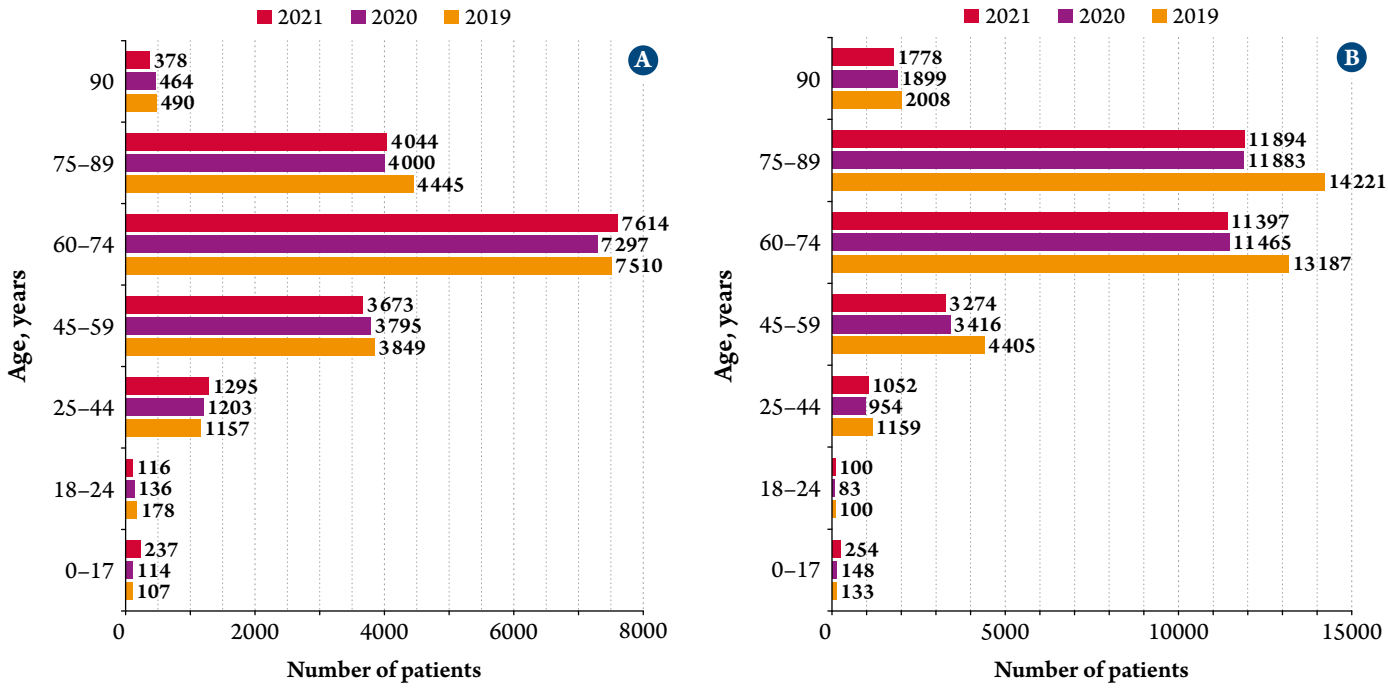
ISSN 0022-9040. Kardiologiia. 2022;62(12). DOI: 10.18087/cardio.2022.12.n2294

Figure 3. Prevalence of heart failure according to age based on the standard ICD-10 code I50.x, in St. Petersburg from 2019 to 2021



A – female population; B – male population.

Figure 4. Prevalence of heart failure according to age based on the advanced heart failure coding, in St. Petersburg from 2019 to 2021



A – male population; B – female population.

Discussion

The incidence HF increases progressively. According to the results of the analysis of the current situation, the number of patients observed in the primary health care setting and treated in hospitals consistently increases. Above all, this may be due to longer life expectancy of patients with CVDs, associated with the improved quality of medical care, including high-tech medical care, and also to more effective drug therapy, which is increasingly used in this category of patients.

Figure 5. Death rate in St. Petersburg from 2019 to 2021

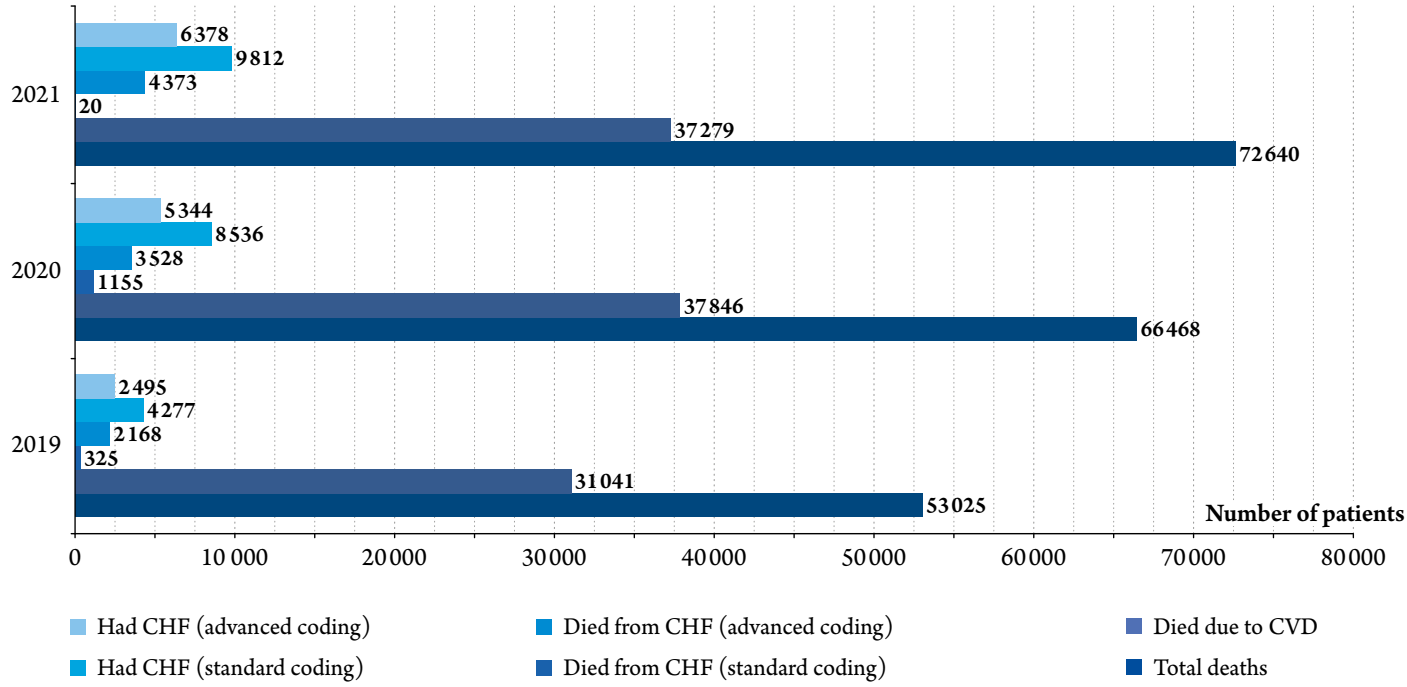
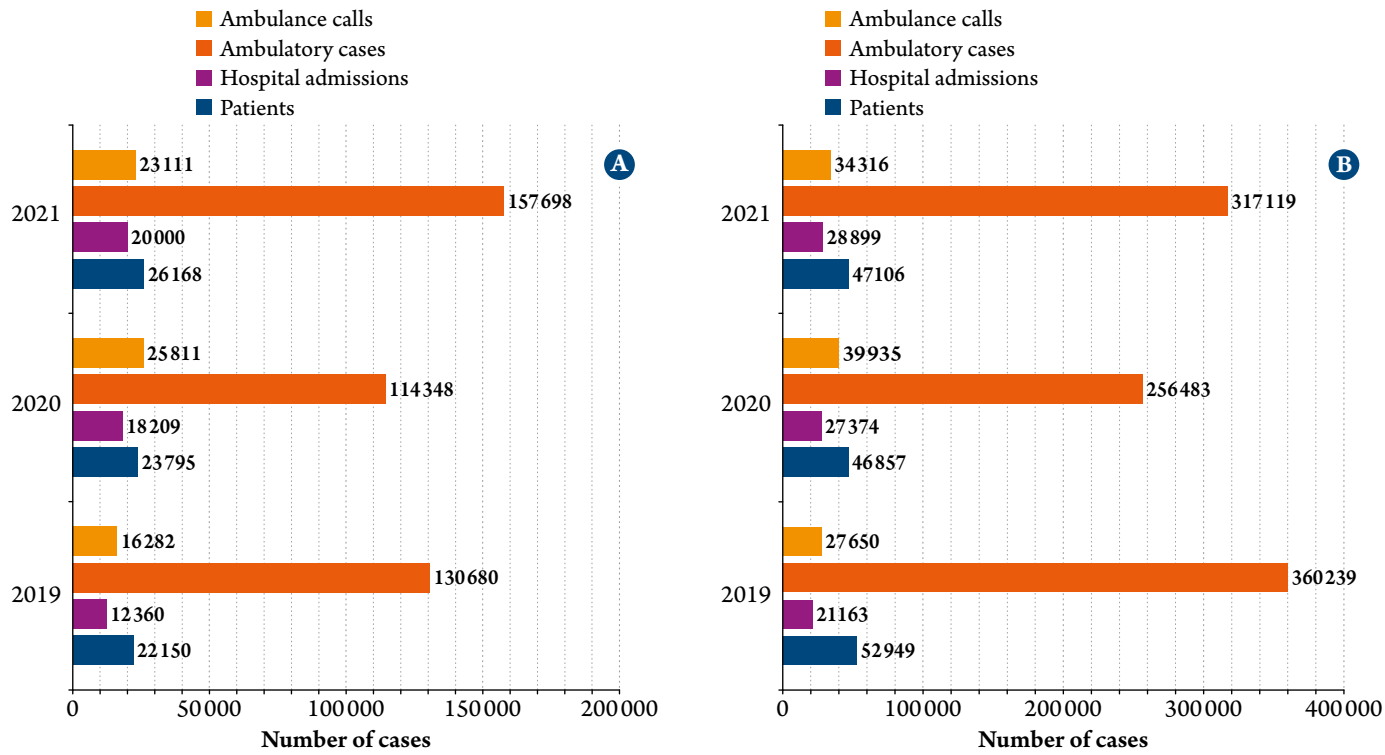


Figure 6. Health care burden in St. Petersburg from 2019 to 2021



A – standard heart failure coding; B – advanced heart failure coding.

The current profile of a patient with HF can be presented by the following characteristics. Female patients prevail over male patients. The peak incidence falls on the age of 60–74 years in male patients and 75–89 years in female patients. In most cases, patients have concomitant pathology: IHD, HHD, cerebrovascular diseases, diabetes mellitus, obesity, chronic obstructive pulmonary disease. At the same time, every such patient required a mean of one ambulance call and hospitalization and up to 6 visits in the outpatient clinics within a year. Assessment of the prevalence of HF in deceased patients showed a steady increase in 3 years. The increase was 129.4% (CHF I50.x was diagnosed in 4,277

ISSN 0022-9040. Kardiologiia. 2022;62(12). DOI: 10.18087/cardio.2022.12.n2294

Table 1. Combined pathology among patients with heart failure (standard coding)

Combined pathology ICD-10	2019	2020	2021
Patients with HF (standard coding)	22 150	23 795	26 168
I10–I15 Hypertensive diseases	14 604	15 312	15 971
I20–I25 Ischemic heart diseases	16 314	17 626	19 551
I32 Pericarditis	6	5	5
I39 Endocarditis	6	7	9
I41 Myocarditis	1	2	8
I43 Cardiomyopathy	121	80	42
I60–I69 Cerebrovascular diseases	11 052	11 855	13 041
E00–E07 Disorders of thyroid gland	2141	1742	2062
E10–E14 Diabetes mellitus	3999	4415	5155
E65–E68 Obesity	1063	1108	1284
J44 Chronic obstructive pulmonary disease	1255	1290	1375
J45 Asthma	793	719	934

Table 2. Combined pathology among patients with heart failure (advanced coding)

Combined pathology ICD-10	2019	2020	2021
Patients with HF (advanced coding)	52 949	46 857	47 106
I10–I15 Hypertensive diseases	43 437	36 724	34 849
I20–I25 Ischemic heart diseases	29 181	26 544	27 399
I30–I52 Other forms of heart disease	27 710	28 593	31 424
I32 Pericarditis	7	5	7
I39 Endocarditis	9	8	9
I41 Myocarditis	6	7	13
I43 Cardiomyopathy	192	156	94
I48 Atrial fibrillation	7152	7045	6916
I60–I69 Cerebrovascular diseases	23 681	20 783	20 842
E00–E07 Disorders of thyroid gland	6426	4373	4632
E10–E14 Diabetes mellitus	8323	7590	8023
E65–E68 Obesity	2902	2290	2301
J44 Chronic obstructive pulmonary disease	1923	1878	1914
J45 Asthma	1805	1423	1572

patients in 2019 and 9,812 patients in 2021). This situation may be due to reduced availability of medical care in patients of the observed category in the COVID-19 setting, which is indirectly confirmed by fewer outpatient visits and more ambulance calls resulting from the conversion of medical hospital.

Conclusion

In conclusion, it should be noted that the management of patients with heart failure should be regular and systematic, using all up-to-date methods of examination and treatment, primarily at the outpatient stage. The main directions include increasing patient compliance, for which it is necessary to develop follow-up care of this contingent and preferential provision with modern drugs. It is necessary to develop and implement a management program for patients with heart failure in medical facilities of St. Petersburg in order to achieve this objective. Good example is emerging from the work of the Russian register PRIORITET-CHF, the objective of which is to study the epidemiology and clinical and demographic characteristics of patients with heart failure, and to assess treatment and its compliance with the clinical guidelines. It is necessary to develop new rate of the territorial compulsory medical insurance fund for the treatment of patients with heart failure. All these measures will help to fulfill the decree of the President of the Russian Federation No. 474 «On the national development goals of the Russian Federation for the period up to 2030» as of July 21, 2020, the main tasks of which are to reduce the all-cause mortality of the population to 11.5 cases per 1,000 of population and increase life expectancy to 78 years.

Acknowledgement

The authors thank associates of the St. Petersburg Medical Information and Analytical Center, T.V. Gorbacheva, A.V. Lukovsky, and S.D. Plotnikova for their assistance in data processing.

Funding

No funding was received for this study.

No conflict of interest is reported.

The article was received on 16/09/2022

REFERENCES

1. Federal State Statistics Service. Health in Russia. 2021. Statistical book. -M.: Rosstat;2021. - 171p. [Russian: Федеральная служба государственной статистики. Здравоохранение в России. 2021. Статистический сборник. - М.: Росстат, 2021. - 171с. Доступно на: https://rosstat.gov.ru/storage/mediabank/Zdravoohran-2021.pdf]
2. Polyakov D.S., Fomin I.V., Belenkov Yu.N., Mareev V.Yu., Ageev F.T., Artemjeva E.G. et al. Chronic heart failure in the Russian Federation: what has changed over 20 years of follow-up? Results of the EPOCH-CHF study. Kardiologiia. 2021;61(4):4–14. [Russian: Поляков Д.С., Фомин И.В., Беленков Ю.Н., Мареев В.Ю., Агеев Ф.Т., Артемьева Е.Г. и др. Хроническая сердечная недостаточность в Российской

Федерации: что изменилось за 20 лет наблюдения? Результаты исследования ЭПОХА -ХСН. Кардиология. 2021;61(4):4-14]. DOI: 10.18087/cardio.2021.4.n1628
3. Drapkina O.M., Boytsov S.A., Omelyanovskiy V.V., Kontsevaya A.V., Loukianov M.M., Ignatieva V.I. et al. Socio-economic impact of heart failure in Russia. Russian Journal of Cardiology. 2021;26(6):81-9. [Russian: Драпкина О.М., Бойцов С.А., Омельяновский В.В., Концевая А.В., Лукьянов М.М., Игнатьева В.И. и др. Социально-экономический ущерб, обусловленный хронической сердечной недостаточностью, в Российской Федерации. Российский кардиологический журнал. 2021;26(6):81-9]. DOI: 10.15829/1560-4071-2021-4490
4. Department of the Federal State Statistics Service for St. Petersburg and the Leningrad Region (Petrostat). Age and sex composition of the population of St. Petersburg as of January 1, 2019: statistical bulletin. - Sankt-Peterburg: Petrostat, 2019. - 57p. [Russian: Управление Федеральной службы государственной статистики по г. Санкт-Петербургу и Ленинградской области (Петростат). Возрастно-половой состав населения Санкт-Петербурга на 1 января 2019 года: статистический бюллетень. - Санкт-Петербург: Петростат, 2019. - 57с. Доступно на: https://petrostat.gks.ru/storage/mediabank/Возраст-пол нас СПб 2019.pdf]
5. Department of the Federal State Statistics Service for St. Petersburg and the Leningrad Region (Petrostat). Age and sex composition of the population of St. Petersburg as of January 1, 2020: statistical bulletin. - Sankt-Peterburg: Petrostat, 2020. - 57p. [Russian: Управление Федеральной службы государственной статистики по г. Санкт-Петербургу и Ленинградской области (Петростат). Возрастно-половой состав населения Санкт-Петербурга на 1 января 2020 года: статистический бюллетень. - Санкт-Петербург: Петростат, 2020. - 57с. Доступно на: https://petrostat.gks.ru/storage/mediabank/AIGiIB1i/Возрастно-половой состав населения Санкт-Петербурга на 1 января 2020 года.pdf]
6. Department of the Federal State Statistics Service for St. Petersburg and the Leningrad Region (Petrostat). Age and sex composition of the population of St. Petersburg as of January 1, 2021: statistical bulletin. - Sankt-Peterburg: Petrostat, 2021. - 57p. [Russian: Управление Федеральной службы государственной статистики по г. Санкт-Петербургу и Ленинградской области (Петростат). Возрастно-половой состав населения Санкт-Петербурга на 1 января 2021 года: статистический бюллетень. - Санкт-Петербург: Петростат, 2021. - 57с. Доступно на: https://petrostat.gks.ru/storage/mediabank/14000721.pdf]

ISSN 0022-9040. Kardiologiia. 2022;62(12). DOI: 10.18087/cardio.2022.12.n2294