ORIGINAL ARTICLE

CONTENTS

The regional burden of acute pancreatitis in Ukraine: current trends in incidence, etiology, morbidity, gender distribution and mortality

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ABSTRACT

Aim: The aim of the study was to analyze trends in incidence, etiology, gender distribution, morbidity and mortality for acute pancreatitis and to determine whether they correspond to the world trends and to identify changes in trends under the influence of the circumstances of recent years, in particular the COVID-19 pandemic and the full-scale war unleashed by Russia on the territory of Ukraine.

Materials and Methods: The retrospective study of the prospectively maintained data base of the incidence rate dynamics, mortality, age and gender distribution of AP at the regional level in the period from 2011 to 2022 was done. The data were obtained from the statistics services of the regional healthcare department and two clinical hospitals, Vinnytsia, Ukraine.

Results: Over the past 12 years, 18715 patients with AP have been treated at the regional level. Annually, 1559±259 people require inpatient treatment for this pathology, with an average annual length of hospital stay of 10850±856 days. The incidence rate of AP in 2022 consisted 134,4 cases/100000 population. During the studied period, the population of the region decreased by 8,02%. On the other hand, there is an increase in cases of AP, namely, in 2022, the number of patients with acute pancreatitis reached 177,83% from the level of 2011. There was also an increase in overall mortality from AP from 1,7% to 2,2%.

Conclusions: During the 12-year period under study, against the background of a decrease in the average population at the regional level, there was a tendency for the incidence and mortality of AP to increase.

KEY WORDS: acute pancreatitis, etiology, incidence rate, age distribution, gender distribution

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INTRODUCTION

Acute pancreatitis (AP) remains an urgent problem of modern medicine. Total mortality in acute pancreatitis ranging from 3,9% to 9,7% [1,2]. Mortality in sever acute pancreatitis is significantly higher and reaches up to 30% in patients with infected necrosis [3,4]. Despite the global trend towards a constant increase in the incidence of acute pancreatitis in the world, there are differences between the incidence rates of this pathology both between continents and within the continent [5-8].

Understanding the geographical features of the burden and trends in different countries of the world will help to develop effective preventive methods. There is an increasing number of studies showing the impact of socio-economic, ethnic, and cultural differences on various factors in the development of pancreatitis [9-11].

A 2022 meta-analysis, which included the results of 34 studies, demonstrated a steady increase in the incidence of acute pancreatitis over the past 56 years in most countries of the Western world [12]. For the countries of North America, the incidence rate of acute pancreatitis is high and is 34 cases of acute pancreatitis per 100000 population per year, for Europe the overall incidence rate is 29 cases of acute pancreatitis per 100000 population, which varies in different countries [13], and according to the 2016 meta-analysis in Europe, this indicator was 33,7 cases of acute pancreatitis per 100000 population [14]. In the 10-year literature we analyzed, we did not find clear data on the incidence of acute pancreatitis among population of Ukraine.

However, in our opinion, the influence on many factors, including epidemiological factors related of the COVID-19 pandemic, long-term restrictions on the moment of associated with lockdown, the full-scale war caused by the Russian Federation in Ukraine, internal migration of population, related with this are significant influencing factors on the

general incidence rates of many diseases, including acute pancreatitis.

AIM

The aim of the study was to analyze trends in incidence, etiology, gender distribution, morbidity and mortality for acute pancreatitis and to determine whether they correspond to the world trends and to identify changes in trends under the influence of the circumstances of recent years, in particular the COVID-19 pandemic and the full-scale war unleashed by Russia on the territory of Ukraine.

MATERIALS AND METHODS

At the first stage of our research the retrospective study of morbidity, mortality, gender distribution, etiology of acute pancreatitis for 12 years at the Vinnytsia region, Ukraine, was carried out on the basis of the data from the statistics department of the regional health care department of the Vinnytsia region.

At the second stage of our study, an analysis of data on incidence, etiology, gender distribution, and mortality in acute pancreatitis was conducted based on a prospectively maintained database. This database includes medical records of hospitalized patients who received treatment from 2017 to 2022 in two medical institutions of the city. These institutions belong to secondary and tertiary healthcare centers, providing medical care to the majority of the city's patients. In total 677 patients were treated for acute pancreatitis in the period from 2017 to 2022 on the basis of the Vinnytsia city clinical emergency hospital and Vinnytsia regional Pirogov memorial clinical hospital and were prospectively included in the study. All patients in hospitalization gave their consent to the processing of personal data and data obtained during their examination and treatment. The diagnosis of acute pancreatitis was formulated in accordance with the recommendations of Atlanta 2012, the diagnosis of acute postoperative pancreatitis was formulated in accordance with the criteria of the International research group on pancreatic surgery (ISGPS) 2022 [15].

The patients data were entered in tabular form divided into several groups: demographic (age, gender, place of residence), etiological (the reason for the development of AP was indicated), anamnestic (how much time it took from the moment of the first symptoms to hospitalization in a hospital), the main vital indicators during hospitalization (pulse rate, blood pressure, saturation, heart rate, body temperature, diuresis), laboratory indicators, which were determined on the day of hospitalization, as well as on the 3rd, 5th, 7th, 9th, and 11th days of hospital stay, imaging methods (esophagogastroduodenoscopy, ultrasound examination of the abdominal organs and chest, radiological examination of the abdominal organs and chest, computer tomography of the abdominal organs and chest), clinical indicators (severity of the disease, the presence of complications of AP, the presence of concomitant pathology, the treatment performed). Among the laboratory indicators, routine indicators were determined: hemoglobin, blood sugar, leukocyte level and leukocyte formula, hematocrit, erythrocyte sedimentation rate, total protein level, total bilirubin level, serum/urine amylase, urine diastase, amylase/diastase of drainage fluid, electrolytes (sodium, potassium, calcium, chlorine), alanine aminotransferase, aspartate aminotransferase, urea, creatinine, platelet level, prothrombin index, plasma fibrinogen/fibrin.

Determination of the etiological factor of AP was carried out on the basis of a carefully collected anamnesis. When drinking alcohol on the eve of the disease, the genesis of the disease was interpreted as alcoholic. The biliary etiology of AP does not have a specific biochemical marker, so it was interpreted with the visualization of calculi in the gallbladder and/or ducts, the presence of biliary colic attacks in the anamnesis, dysfunction of the sphincter of Oddi. In the modern generally accepted classification of AP according to the recommendations of Atlanta 2012, there is no alimentary genesis of AP. This may be due to the fact that nutritional factors closely interact with other etiological factors, such as alcohol or metabolic disorders, which makes it difficult to classify them separately. However, we consider that this etiological form of AP is important, so we signled it separately. Therefore, the consumption of a large amount of fatty, fried, spicy food on the eve of the disease was interpreted as an alimentary factor. If in the anamnesis the patients noted the simultaneous consumption of alcohol and fatty/fried food, in such a case the etiological factor was interpreted as alimentary-alcoholic. Postoperative pancreatitis was treated according to the classification system proposed in 2022 by the international study group on pancreatic surgery (ISGPS). In patients with polytrauma, the development of AP was interpreted as post-traumatic. A rare cause of AP was the taking of certain medications by patients. The presence of a stress factor in the absence of all other causative factors was interpreted as the psychoemotional genesis of AP. In the absence of visible causative factors in the anamnesis, the etiological factor was interpreted as of unknown etiology.

All patients underwent a comprehensive clinical and laboratory examination, esophagogastroduodenoscopy, X-ray examination of the chest and abdominal organs, and computerized tomography of the abdominal and chest cavities, if necessary. Among the imaging methods during hospitalization, all patients underwent ultrasound examination of the abdominal organs, which was also performed during the inpatient treatment of patients in dynamics. If necessary, an ultrasound examination of the chest cavity was performed. Computed tomography of the abdominal organs and retroperitoneal space, enhanced by intravenous contrast, was performed in all patients with severe pancreatitis, as well as in doubtful cases during diagnosis, when infection of fluid accumulations is suspected.

The main criteria for including patients in the group were:

1. The patient's age ≥ 18 years on the day of signing the informed consent;
2. Women of reproductive age, in whom pregnancy is excluded;
3. Patients must have a diagnosis of acute pancreatitis of one of the following etiologies: alcoholic, alimentary, biliary, postoperative (including ERCP-induced), post-traumatic, drugs-induced, of unknown etiology;
4. Patients must have at least two of the following three symptoms of pancreatic inflammation (according to the criteria for the diagnosis of acute pancreatitis, according to the Atlanta guidelines, 2012): abdominal pain corresponding to the disease, biochemical signs of pancreatitis (serum amylase and/or lipase more than three times the upper limit of normal), characteristic imaging data of the abdominal cavity [15].
5. Patients with postoperative pancreatitis should have an increase in the level of serum amylase in the first 0-2 days of the postoperative period, corresponding clinically significant signs of acute pancreatitis and radiological changes corresponding to acute inflammation of the pancreas or its remnant (according to the criteria of the International research group on pancreatic surgery (ISGPS), 2022) [16].
6. Written, voluntary, signed informed consent must be obtained from the subject or a legally authorized representative in accordance with local regulations for the processing of information and data obtained in the process of examination and treatment. The subject or legally authorized representative must be able to read and understand the informed consent form.

Exclusion criteria:

1. The age of patients at the time of hospitalization is less than 18 years;
2. Women who are pregnant;
3. The diagnosis of acute pancreatitis indicated in the medical record does not meet the criteria for diagnosis Atlanta, 2012;
4. A serious disorder of the immune system, for example: known absolute neutropenia (absolute number of neutrophils < 500 cells/μL), a known infection caused by the human immunodeficiency virus (HIV), chemotherapy or radiation in the past 3 months;
5. A positive test for COVID-19 at the time of hospitalization or during the hospital stay.

Patient data were entered into the prospectively supported database in Excel. Patients of the study cohort were divided into groups according to the following criteria: sex distribution (men and women), etiology of the disease (nutritional, alcohol, biliary factor, postoperative pancreatitis, post-traumatic, drug, stress factor or unknown etiology), severity of the disease according to the Atlanta 2012 classification (mild course, moderately severe, severe), morphological form of the disease (edematous, aseptic necrotic, infected necrotic), presence of complications (with and without complications), treatment outcomes (survived or died).

Statistical analysis of the results was performed using SPSS version 24.0 software. Data visualization was performed using the R software package version 4.3.3. The normality of the data distribution was assessed using the Shapiro-Wilk test (W-test). For normally distributed data (p-value from the W-test > 0,05), the mean (M) ± standard deviation (σ) was used. Such data includes patient age, length of stay, and other quantitative variables. A significant part of the data, including the prevalence of etiologic factors, complication rates, mortality rates, and some others, was presented as percentages for the convenience of comparing categorical variables and visualizing their distribution between patient groups.

If the data were normally distributed, a parametric t-test for independent samples was used. This test allowed us to assess the presence of statistically significant differences between the mean values in two independent groups (e.g., patient age). Categorical variables (e.g., etiologic factors, disease severity, presence or absence of complications) were analyzed using Pearson's χ^2 test to determine whether there were statistically significant differences in the distribution of variables between groups.

The analysis of dynamic series was conducted to assess changes in the incidence of acute pancreatitis

during the study period. To do this, the following indicators were calculated: absolute increase/decrease – to assess changes in the number of cases, increase/decrease rates – to assess the relative change in morbidity compared to the previous period, and the fixed-base index – to compare changes over years with a fixed base (2011) to determine morbidity trends in the region.

Results with a p-value of less than 0,05 were considered statistically significant.

RESULTS

Over the past 12 years, 18715 patients have received inpatient treatment for AP in the Vinnytsia region. Annually 1559±259 people require inpatient treatment due to this pathology with the average annual hospital stay 10850±856 days. The incidence rate of AP in 2022 consisted 134,4 cases/100000 population.

The dynamics of the population and the number of patients with acute pancreatitis at the regional level in the period from 2011 to 2022 are shown in graph. There is a significant increase in the incidence of acute pancreatitis during this period against the background of a decrease in the population (Fig. 1).

Changes in the absolute number of the population, cases of acute pancreatitis and growth/decrease rates during 2011-2022 are shown in Table 1. During the study period, there was a steady decline in the population. On average, the population decreased by 12-14 thousand people annually, with an acceleration of the decline in the following years. In the first years, such as 2012 and 2013, the population decline rate was the lowest – about -0,43% and -0,44%, respectively. The largest decline occurred in 2022, when the population decreased by 19,6 thousand people and the highest rate of population decline was observed – -1,28%. It is also worth noting that since 2017, the population decline has become more noticeable, from 11,8 thousand in 2017 to almost 20,0 thousand in 2022.

As for the change in the absolute number of cases of acute pancreatitis, the number of patients with acute pancreatitis increased from 1141 in 2011 to 2029 in 2022 (Table 1). During the entire study period, there were only three years when the number of cases of acute pancreatitis decreased, in particular in 2016 (-32 patients), 2017 (-14 patients), and the largest drop occurred in 2018, when the number of patients decreased by 199 people. In 2020-2022, the number of patients with acute pancreatitis increased sharply, with the largest increase (+254 patients) in 2021. Regarding the growth rate of the number of patients with AP, the highest growth rates were observed in 2014 (+16,21%) and 2021 (+16,30%), indicating a significant increase in the number of patients with AP in these years. The largest decrease in the number of patients with AP occurred in 2018 (-11,81%), indicating a sharp decrease in the number of patients (Table 1).

The analysis of the table 2 with dynamic indices (2011 = 100%) shows a steady decline in the population every year. In 2022, the population amounted to 91,98% of the 2011 level, which indicates a significant reduction in its size. Throughout the entire observation period, there was a stable downward trend in population size.

In contrast to the population, the number of patients with acute pancreatitis has increased significantly over the entire observation period (Table 2). The dynamics index shows that in 2022 the number of patients reached 177,83% of the 2011 level. Moreover, until 2018, the number of patients had slight fluctuations, with some declines. However, since 2020, there has been a sharp increase, especially in 2021 and 2022.

Regarding the dynamics of the number of surgical interventions for acute pancreatitis in patients at the regional level, the overall trend is unstable, with fluctuations in the proportion of operated patients during this period. In particular, in 2011-2013, there was an increase in the proportion of operated patients to about 4% of all patients with AP. From 2014 to 2015, there was a significant decrease in the proportion of operated patients with AP to about 2%, after which this figure gradually increased again in 2016-2019. In 2020, there was a significant peak when the proportion of operated patients reached about 5%. Since 2021, the proportion of operated patients with AP has been decreasing, and in 2022 the lowest point of the graph is observed, which is less than 3% (Fig. 2).

Analysis of the database of 677 patients who were treated for acute pancreatitis in two hospitals during 2017-2022 found that among the study cohort of patients there were 411 (60,7%) men and 266 (39,3%) women. The average age of the patients was 49,99±13,38 years. Men with acute pancreatitis were significantly younger than women: the average age of men was 47,34±14,32 years, women – 54,15±16,31 years ($p<0,05$). Only 9,9% (67) of patients were hospitalized early from the onset of the disease – up to 6 hours. The vast majority of patients – 90,1% (610) were hospitalized 6 hours after the onset of the disease (Table 3).

The length of the hospital stay depended on the severity of the disease, the presence of complications, concomitant pathology and varied from several days to several months, which can explain the wide confidence interval of this indicator – 10,77 ± 6,65 days.

The classification of acute pancreatitis into mild, moderate and severe forms of the course by severity

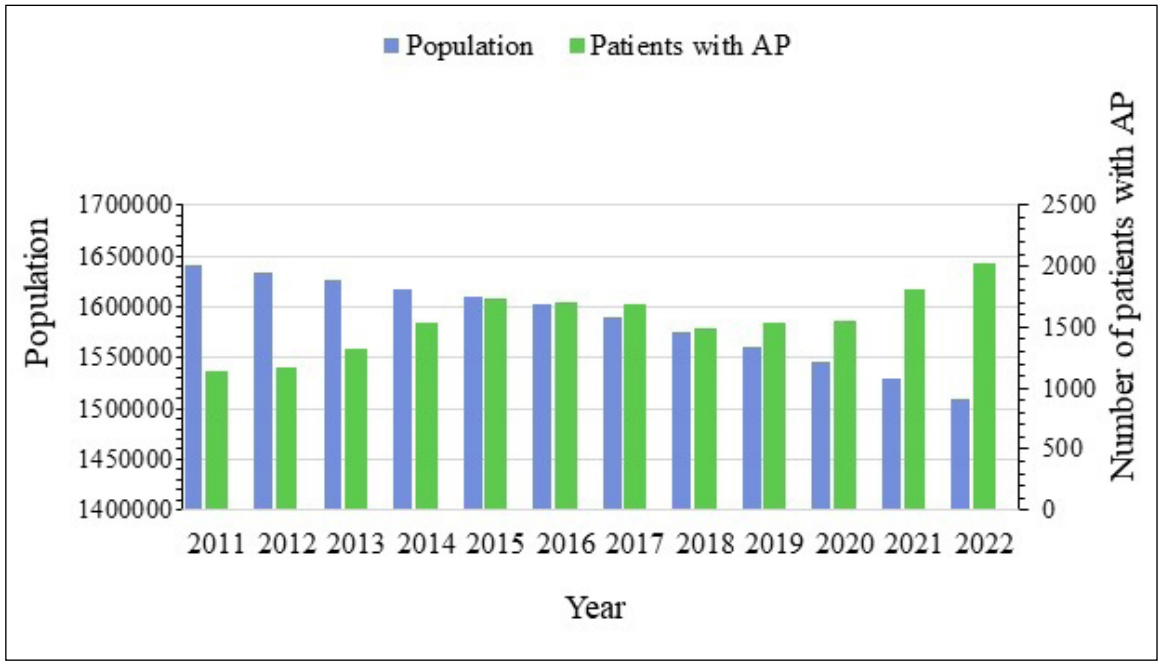

Fig. 1. Dynamics of the population and number of patients with acute pancreatitis at the regional level in 2011-2022.

Table 1. Dynamics of the number of population and patients with acute pancreatitis in 2011-2022 in absolute terms and their growth/decrease rates at the regional level

Years	Population (thsd)	Absolute increase / decrease (thsd)	Growth rate (%)	Patients with acute pancreatitis (persons)	Absolute increase / decrease (persons)	Growth rate (%)
2011	1641,2	-	-	1141	-	-
2012	1634,2	-7,0	-0,43%	1168	+27	+2,37%
2013	1627,0	-7,2	-0,44%	1326	+158	+13,53%
2014	1618,0	-9,0	-0,55%	1541	+215	+16,21%
2015	1610,6	-7,4	-0,46%	1732	+191	+12,40%
2016	1602,2	-8,4	-0,52%	1700	-32	-1,85%
2017	1590,4	-11,8	-0,74%	1686	-14	-0,82%
2018	1575,8	-14,6	-0,92%	1487	-199	-11,81%
2019	1560,4	-15,4	-0,98%	1535	+48	+3,23%
2020	1545,4	-15,0	-0,96%	1558	+23	+1,50%
2021	1529,1	-16,3	-1,05%	1812	+254	+16,30%
2022	1509,5	-19,6	-1,28%	2029	+217	+11,98%

was performed according to the criteria of the Atlanta 2012 classification. More than half of all patients had a mild form of acute pancreatitis – 52,6% (356) of cases, which included only the edematous morphological type of the disease. In 28,4% (192) of patients, acute pancreatitis had a moderate severity of the course and was represented in the vast majority by an edematous morphological form – 69,8% (134) of cases, in 29,2% (56) of cases – by an aseptic necrotic form, and in 1,0%(2) – infected necrotic form. A severe form of acute pancreatitis developed in 129 (19,0%) patients and was represented by an edematous form of the disease in 9,3% (12) cases, an aseptic necrotic form in 57,4% (74) cases, and an infected necrotic form in 33,3% (43) of cases.

According to the development of different morphological forms in different age ranges, the distribution is as follows: the edematous form of acute pancreatitis affected all age categories of patients from 18 to 88 years. The more severe the course of acute pancreatitis, the in later age it developed in patients. In particular, with the aseptic necrotic form, the age of the patients varied from over 20 years old to 88 years old. For the infected necrotic form, the age range of patients started after 30 years and up to 84 years (Fig. 3).

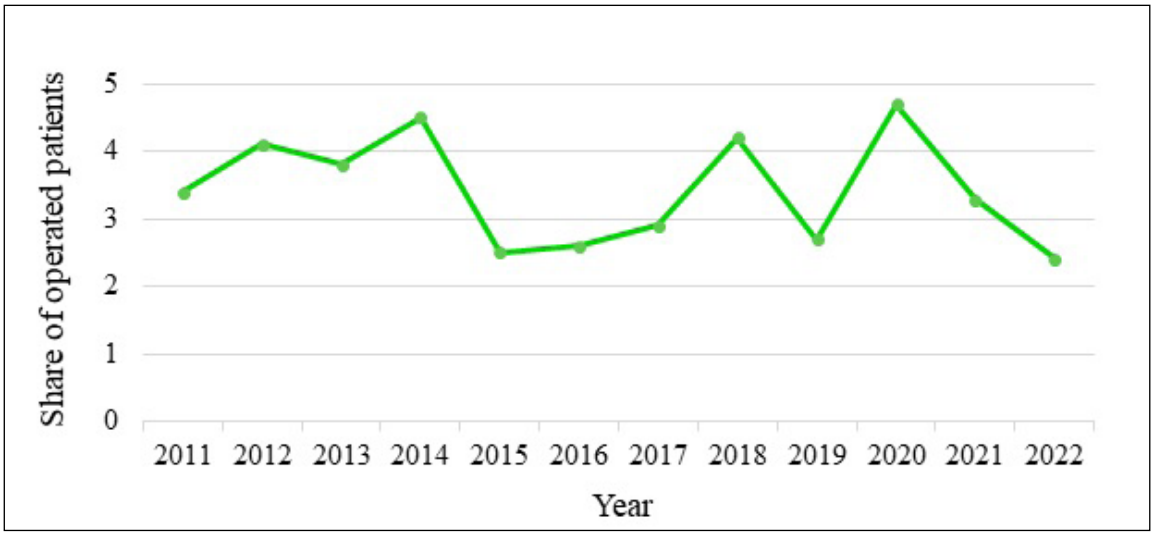

Fig. 2. Dynamics of the share of operated patients with acute pancreatitis at the regional level in 2011-2022

Table 2. Dynamics of the number of population and patients with acute pancreatitis with a fixed base (2011) at the regional level

Years	Population (thsd)	Dynamic index with fixed base (2011 = 100%)	Patients with acute pancreatitis (persons)	Dynamic index with fixed base (2011 = 100%)
2011	1641,2	100,00%	1141	100,00%
2012	1634,2	99,57%	1168	102,37%
2013	1627,0	99,13%	1326	116,21%
2014	1618,0	98,59%	1541	135,06%
2015	1610,6	98,14%	1732	151,80%
2016	1602,2	97,62%	1700	148,99%
2017	1590,4	96,90%	1686	147,77%
2018	1575,8	96,02%	1487	130,32%
2019	1560,4	95,08%	1535	134,53%
2020	1545,4	94,16%	1558	136,55%
2021	1529,1	93,17%	1812	158,81%
2022	1509,5	91,98%	2029	177,83%

The genesis of acute pancreatitis differed significantly in the groups by gender and severity of the course. Thus, in women, the dominant factors of acute pancreatitis, regardless of the severity group, were alimentary and biliary, which together accounted for 61,3% (163). In the group of women with a mild course of acute pancreatitis, ERCP-induced pancreatitis occurred more often than in men – 13 cases and 4 cases, respectively ($p<0,05$). In men, the biliary factor was represented to a lesser extent than in women in all three severity groups. On the other hand, the dominant factors of acute pancreatitis in men in all three severity groups were food and alcohol – 61,8% (254) (Fig. 4).

Among all 677 patients with acute pancreatitis, there were 59 (8,7%) deaths, of which 31 (52,5%) were men, 28(47,5%) were women. The age distribution of fatal cases is characterized by a wide range – fatal cases from acute pancreatitis occurred in patients of both sexes from 20 to 80 years of age. The vast majority of fatal cases occurred in patients with alimentary and alcoholic genesis of the disease – 62,7%(37). The alcoholic acute pancreatitis occurred most frequently in patients from 30 to 60 year age groups in both lethal and survival cohorts. The age range of surviving patients in most cases was also between 30 and 60 years old, that is, working age, which emphasizes the socio-economic burden that this disease has on society (Fig. 5).

The reason of acute pancreatitis, such as post-traumatic, postoperative and ERCP-pancreatitis deserves special attention. There was gender variability too: in men, post-traumatic pancreatitis significantly prevailed, while in women, postoperative genesis and ERCP-induced factor prevailed. In particular, men have post-traumatic pancreatitis in 0,9%(4), postoperative

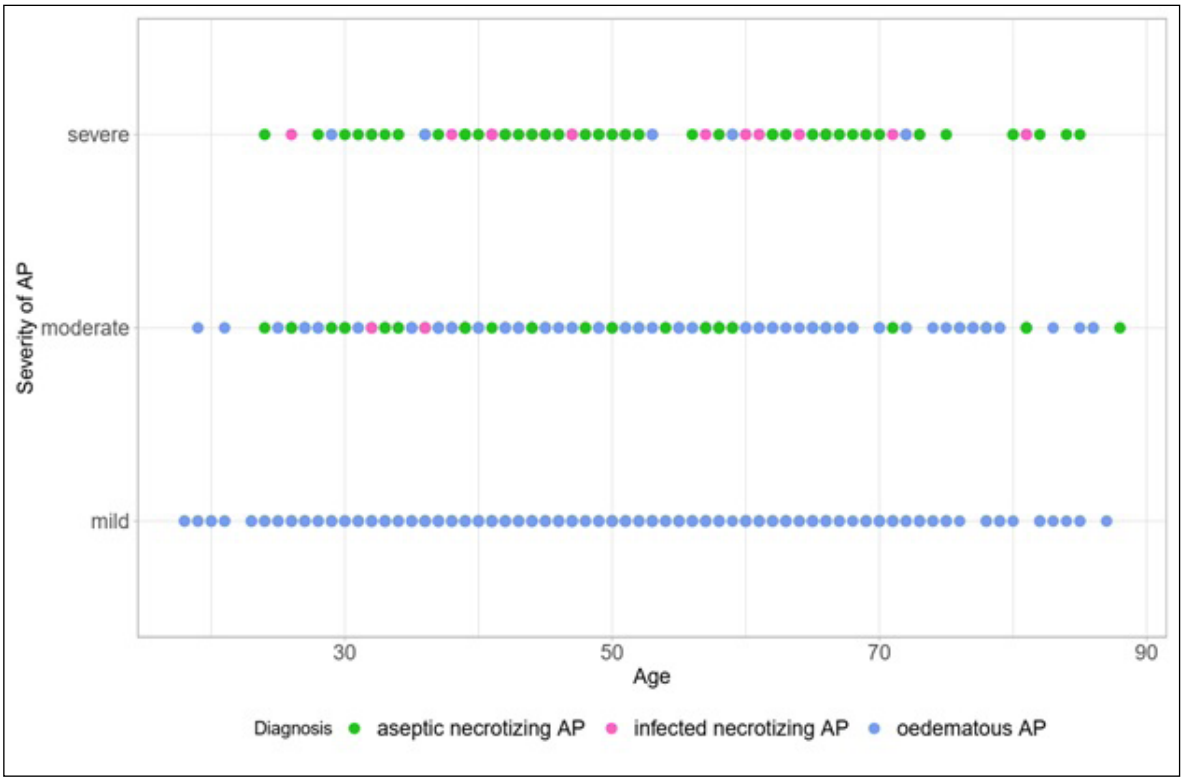

Fig.3. Distribution of patients of the study cohort with acute pancreatitis depending on age, severity of acute pancreatitis and morphological form of the disease.

pancreatitis – in 3,9%(16), ERCP – in 1,7%(7). There was no post-traumatic pancreatitis in women, instead, postoperative pancreatitis developed in 4,3%(11) of cases, and ERCP-induced pancreatitis – in 4,3%(11).

By gender and age, the distribution among patients of study cohort with acute pancreatitis in the general group was as follows: in the group of surviving patients, men dominated – 380 (61,5%), whose average age was 47,02±14,45 years. There were less women than men – 238 (38,5%), but their average age was higher than men and amounted to 53,02±16,55 years ($p<0,05$). In the group of patients who died, more than half of the cases were also men – 31 (52,5%), their average age was lower than the average age of women who died – 49,76±13,24 years and 61,46±12,6 years, respectively ($p<0,05$). So, in the group of men over the age of 50, a decrease in both morbidity and mortality from acute pancreatitis was noted, whereas in women over 50, an increase in both indicators was noted (Fig. 6).

The vast majority of fatal cases occurred in patients with the necrotic form of the disease – 56(94,9%), but there were also 3(5,1%) fatal cases in patients with the edematous form of the disease. The cause of death in the early stage was the development of enzyme endotoxemia and multiple organ failure. Aseptic necrotic form was the cause of death in more than half of all deceased patients with acute pancreatitis – 38 (64,4%) cases, infected necrotic form was the cause of death due to septic complications in 18(30,5%) cases (Fig. 7).

249 (36,8%) of all patients with acute pancreatitis developed complications, both early and late. In 72,3%(180/249) of them it was a combination of several complications simultaneously. According to the number of complications, pleurisy was the most common – 80 cases, fluid accumulation – 59 cases, peritonitis – 37 cases. Among purulent complications of acute pancreatitis, phlegmon of the retroperitoneal space developed in 25 cases, parapancreatic abscess – in 14 cases. Pancreatic pseudocyst developed in 31 cases. The development of pancreatogenic diabetes mellitus, as a result of the destruction of pancreatocytes and the impossibility of their endocrine function, occurred in 14 patients. Due to a severe general condition, 89(13,1%) patients with acute pancreatitis required hospitalization in the intensive care unit and resuscitation (Table 3).

DISCUSSION

CHANGES IN THE POPULATION AND THE INCIDENCE OF ACUTE PANCREATITIS AT THE REGIONAL LEVEL IN 2011-2022

This study analyzed the population and its incidence of acute pancreatitis at the regional level during 2011-2022. According to our estimates, a 12-year temporal

Table 3. Baseline characteristics upon admission of patients of the study cohort with acute pancreatitis (n=677)

Output data	
Age, years, M ± SD	49,99 ± 13,38
Gender, male/female	411\266
Duration of inpatient treatment, days, M ± SD	10,77 ± 6,65
Time from the moment of the first symptoms to the hospitalization of the patient	
• Until 6 Hours	67(9,9%)
• 6-24 hours	212(31,3%)
• 24-48 hours	184(27,2%)
• > 48 hours	214(31,6%)
Etiology	
• Alimentary	254(37,5%)
• Alcoholic	71(10,5%)
• Alcoholic-alimentary	24(3,5%)
• Biliary	126(18,6%)
• Drugs-induced	9(1,3%)
• Postoperative	27(3,9%)
• Posttraumatic	4(0,6%)
• ERCP-induced	25(3,7%)
• Provoked by psycho-emotional stress	3(0,4%)
• Of unknown etiology	134(19,8%)
The result of treatment	
Patients who survived	618(91,3%)
Patients who died	59(8,7%)
Morphological type of acute pancreatitis (Revised Atlanta classification, 2012)	
Oedematous interstitial acute pancreatitis	502(74,2%)
Necrotizing acute pancreatitis	175(25,8%)
• Aseptic necrotic	130 (0,74)
• Infected necrotic	45 (0,26)
Severity (Revised Atlanta classification, 2012)	
Mild	356(52,6%)
Moderate	192(28,4%)
Sever	129(19,0%)
The presence of concomitant pathology, the number of patients	586(86,6%)
Complication of acute pancreatitis	
There are no complications	428(63,2%)
Complication	249(36,8%)
• Fluid accumulations	59
• Pleurisy	80
• Peritonitis	37
• Postoperative pancreatic fistula	2
• Phlegmon of the retroperitoneal space	25
• Pancreatic pseudocyst	31
• Parapancreatic abscess	14
• Pancreatogenic diabetes mellitus	14
• Other complications	154
Hospitalization to the department	
Surgery	582(86,0%)
Intensive care and resuscitation	89(13,1%)
Another department	6(0,9%)

M±SD, where M is the mean, SD is the standard deviation.

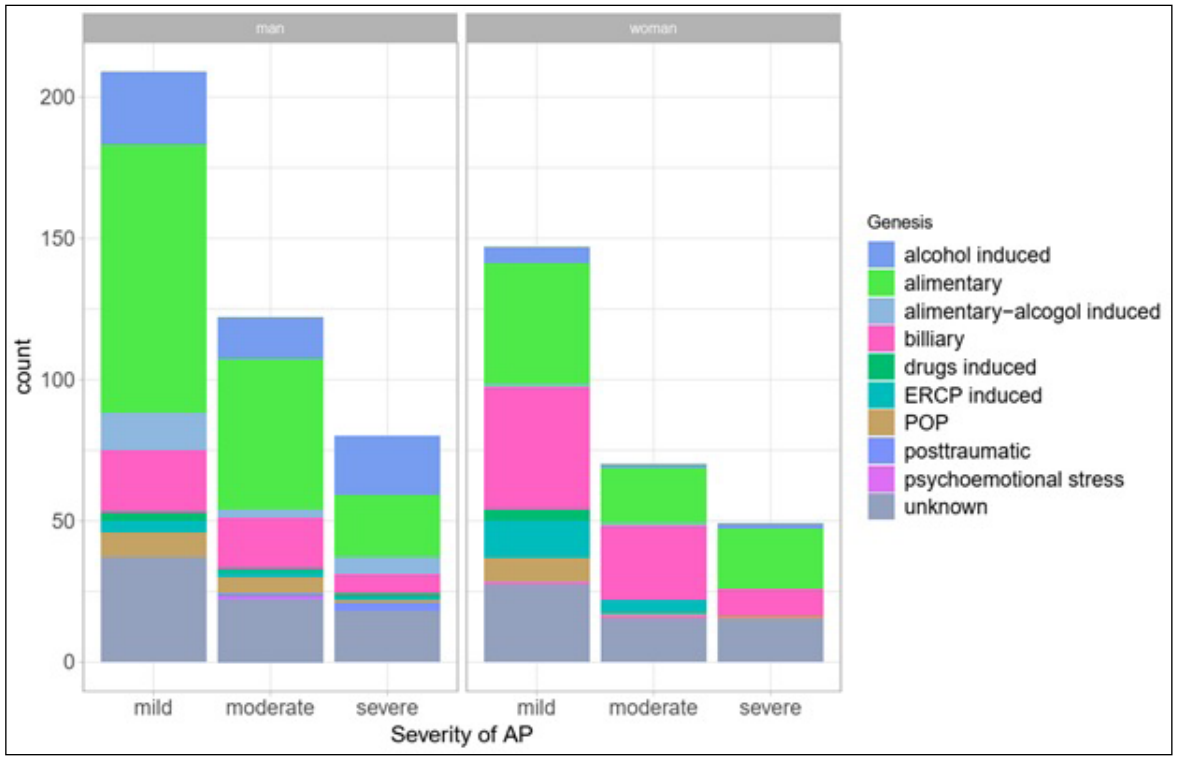

Fig. 4. Distribution of patients of the study cohort with acute pancreatitis by gender, genesis and severity of acute pancreatitis.

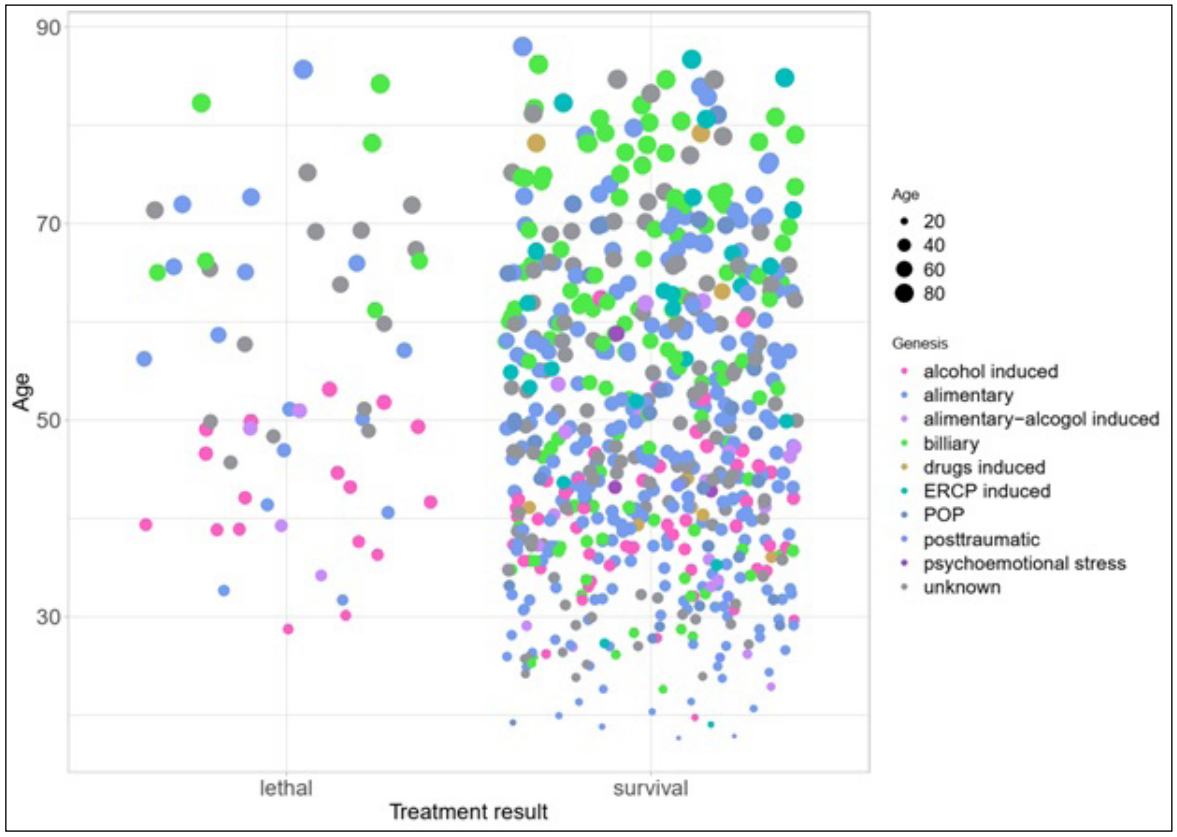

Fig. 5. Distribution of the patients of the study cohort with acute pancreatitis according to treatment results, genesis of acute pancreatitis and age.

analysis of the population dynamics and the number of patients with acute pancreatitis at the regional level revealed a statistically significant increase in the number of cases of acute pancreatitis against the background of a declining population. In particular, during the study period, the population of the region decreased by 8,02%. It should be noted that every year the population decline became more and more significant, reflecting

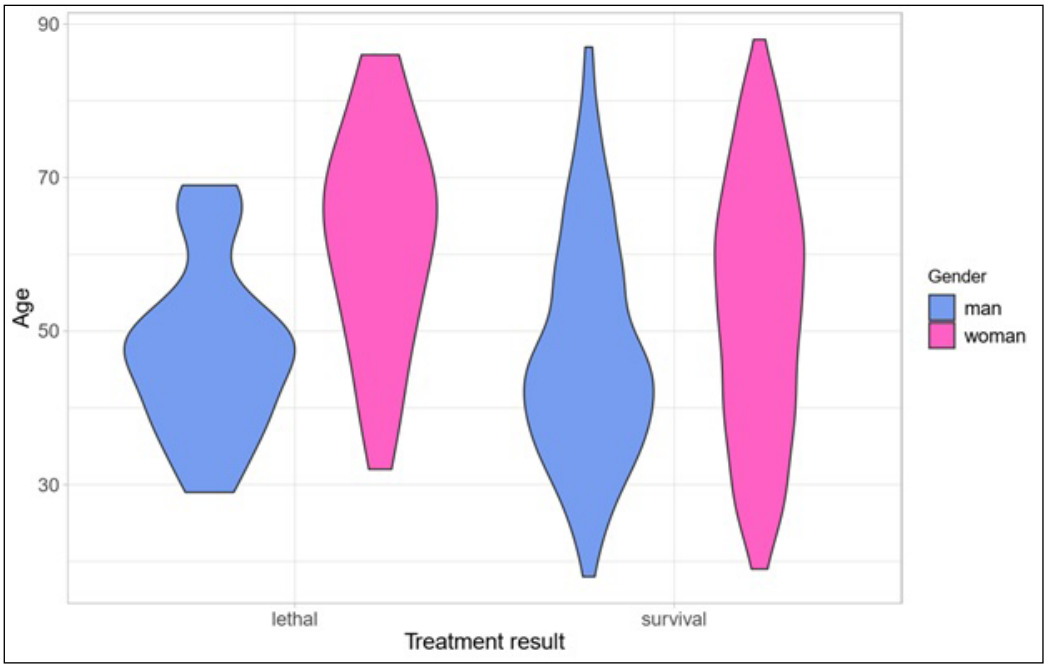

Fig. 6. Distribution of patients of the study cohort with acute pancreatitis depending on age, gender and results of treatment.

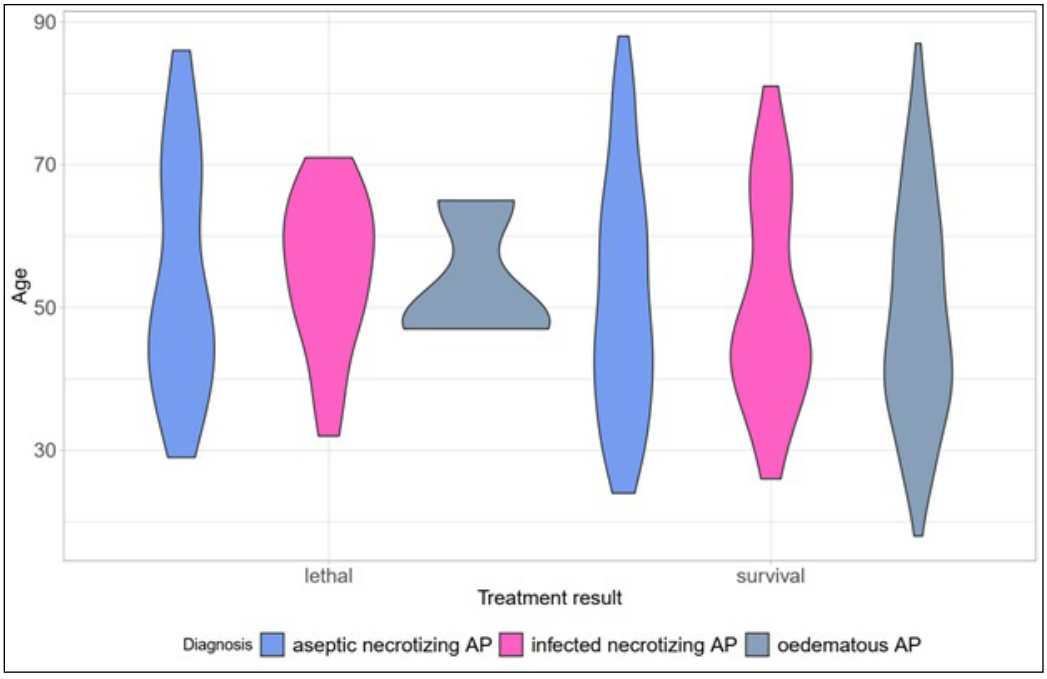

Fig.7. Distribution of patients of the study cohort with acute pancreatitis depending on age, treatment results and morphological form of acute pancreatitis.

the national trend of depopulation. For example, at the time of independence, Ukraine had 51,5 million inhabitants, and in 2019 – 37 million [17]. As for the population dynamics of European countries, according to the official website of the European Union, over the past two decades, from 2003 to 2023, the total population of the EU increased from 431,2 million to 448,8 million, i.e. by 4% [18].

It is worth noting that against the backdrop of population growth in the EU countries over the past decade, there has been a slowdown in natural population growth. Also, the picture in Western Europe, which had a relatively stable level of growth, mainly due to migrants, and Eastern Europe, which includes Ukraine, is different [18]. During the 20-year period from January 1, 2003 to January 1, 2023, the total population of the EU increased from 431,2 million to 448,8 million, a growth of 4%. Thus, in our opinion, the decline in the population of the region under study may be not only a consequence of demographic problems, such as aging, high mortality after the COVID-19 pandemic and low birth rates, but also a consequence of migration processes that have increased significantly since the outbreak of the war in Ukraine unleashed by Russia.

As for the dynamics of the incidence of acute pancreatitis, during the study period there was an increase in cases of acute pancreatitis. In particular, the index of dynamics shows that in 2022 the number of patients with acute pancreatitis reached 177,83% of the level of 2011, which amounted to 134,4 cases/100000 people. Thus, a clear contrast in the dynamics has been revealed – on the one hand, the population of the study region is decreasing, on the other hand, the number of cases of acute pancreatitis is increasing. The increase in the frequency of this pathology at the regional level was in line with global trends. The literature analyzed by us reports an increase in the incidence of acute pancreatitis in recent decades worldwide, regardless of continent [8,9,12,19]. For example, in Germany, according to a systematic analysis of 516618 hospitalized cases between 2008 and 2017, there was an increase in the annual incidence of AP from 48858 (2008) to 52611 (2017), mainly due to an increase in the incidence of biliary AP [20]. In England, according to the results of the population-based observational study of acute pancreatitis, the incidence of AP in 2000 was 20,5 cases/100000 population, and data from 2019 show that this rate has approximately doubled in this region [21]. We did not find clear data on the incidence of acute pancreatitis in Ukraine per 100 thousand people in the available literature. The incidence of AP in 17 other European countries ranges from 4,6 to 100 per 100000 [22]. Thus, the incidence of AP in the region we studied, which in 2022 amounted to 134,4 cases/100000 people, is significantly higher than the incidence of AP in other European countries.

In addition to morbidity, there has also been an increase in overall mortality from 1,7% to 2,2% over the past 12 years due to this pathology among the population we studied at the regional level. At the same time, in other European countries, there is a decrease in the overall mortality rate from AP. For example, in Germany, according to a systematic analysis of standardized data of patients with AP during the study period from 2008 to 2017, the average hospital mortality was 2,85% and has improved significantly over time, which, according to the authors, is due to the improvement of interdisciplinary treatment concepts [20]. An observational study conducted between 2008 and 2015 based on data from one of the largest hospital databases available in the United States also found a decrease in overall mortality rates from 2,9% to 2,0% during study period [23].

In our opinion, this fact can be explained only by multifactorial factors. In recent years, in Ukraine, there has been a change in the eating habits of the population and the abandonment of home cooking in favor of fast food. The emergence of clear unified criteria for the diagnosis of acute pancreatitis in accordance with the Atlanta 2012 recommendations reduced the number of overdiagnosis and misdiagnosis of acute pancreatitis in upper abdominal pain of other etiology and made it possible to accurately collect statistically reliable data. The rapid development of laboratory diagnostic and imaging methods, the possibility of 24-hour x-ray examinations at the emergency department level in emergency clinics, the high availability of these methods for patients contributed to high and accurate diagnosis of acute pancreatitis in the last decade [24]. The increase in the level of stress among the population, associated with a full-scale war in Ukraine, is a factor in the increase in morbidity, including acute pancreatitis.

GENDER, AGE, ETIOLOGICAL AND SOME CLINICAL CHARACTERISTICS OF PATIENTS WITH AP OF THE STUDIED COHORT

The gender distribution of patients with acute pancreatitis in our study cohort showed that the number of men exceeded the number of women with acute pancreatitis by 1,5 times. Our data are in line with the global data, which also indicate the prevalence of men over women among patients with AP – 68,9% vs. 31,1% [19]. Regarding age characteristics, in our study cohort of patients with AP, the average age of men was lower than the average age of women – 47,34±14,32 vs. 54,15±16,31 years, respectively ($p<0,05$). This may indicate a difference in the influence of risk factors between the sexes or that acute pancreatitis in men often manifests itself at a younger age. Further research may help to better understand these gender and age differences in the development of AP.

In the top three most common causes of the development of this pathology in the study cohort of patients, without taking into account the gender distribution, the nutritional factor was in the first place – 37,5% (254), in the second place was biliary factor – 18,6% (126), in the third place was alcohol factor – 10,5% (71). There were differences in the dominant causes of AP in men and women. In particular, in men, the dominant causes of AP were nutritional and alcohol factors, which together accounted for 61,8% (254), in contrast to women, in whom the dominant causative factors were nutritional and biliary factors, which together accounted for 61,3% (163). The predominance of the alcohol factor in men coincides with the general global trend, according to which in 45,7% of men the cause of death was an alcohol factor [19]. It logically follows that health care

measures aimed at reducing alcohol consumption among the population can effectively reduce the incidence and mortality of acute pancreatitis, especially among male patients.

The severity of acute pancreatitis has a wide variability from mild forms, which need conservative treatment to sever forms with life-threatening complications and mortality. Studies by other authors demonstrated a wide variability in the overall mortality of AP from 2,22% in the mild form to 45,63% in the severe form [24]. In our study in the vast majority of patients, acute pancreatitis had a mild course – 52,6%(356) of cases, the morphological type of acute pancreatitis in the vast majority was edematous interstitial – 74,2%(502). The overall mortality rate for acute pancreatitis in the studied group was 8,7%(59), had a wide range of variability with different severity, and corresponded to similar indicators in other studies that demonstrated overall mortality rate from 5,5% till 7,14% [19,26]. Thus, our results confirm the general global trends in the incidence of complications and mortality in various forms of acute pancreatitis.

During 2011-2022, there was an unstable dynamics of the proportion of patients with acute pancreatitis undergoing surgery. Periodic fluctuations in the number of surgical interventions may be due to various factors, such as changes in approaches to the treatment of acute pancreatitis, availability of new therapies or improved diagnostics that allow avoiding surgery. The high peak in 2020 may be due to certain circumstances, such as the COVID-19 pandemic, which may have affected medical practices or forced more aggressive treatments due to late hospitalization of patients. However, the overall trend indicates a decrease in the number of surgeries by the end of the survey period, which is fully consistent with current trends of refraining from open surgical interventions in favor of wait-and-see tactics in acute pancreatitis [27].

CONCLUSIONS

This study revealed a significant increase in the incidence of acute pancreatitis in Vinnytsia region during 2011-2022, reaching 134,4 cases/100 thousand people in 2022, which is 177,83% of the 2011 level and is in line with global trends towards an increase in the number of cases of acute pancreatitis. At the same time, the population of the region decreased by 8,02% between 2011 and 2022, which is part of the all-Ukrainian demographic crisis caused by both natural decline and active migration, in particular as a result of the COVID-19 pandemic and the full-scale war. The main etiologic factors for the development of the disease were nutritional (37,5%), biliary (18,6%) and alcohol (10,5%) factors. Men suffered from acute pancreatitis more often than women, and the average age of men was lower (47,34 ± 14,32 years) compared to the average age of women (54,15 ± 16,31 years). The mortality rate from acute pancreatitis in Vinnytsia region increased from 1,7% to 2,2% in 2011-2022, while the global trend is downward. This indicates a discrepancy in local and global trends in mortality from acute pancreatitis. In terms of treatment tactics, the general trend shows a decrease in the number of operations for AP by the end of the observation period, which is in line with the latest global recommendations. The results emphasize the importance of further research and development of preventive programs to reduce morbidity and mortality from acute pancreatitis in Ukraine.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

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