The mortality of the population due to acute myocardial infarction (AMI) is not an exception. It is one of the main causes of mortality of patients with diseases of the cardiovascular system [1, 12], which makes it relevant to study the different aspects of mortality from this pathology.

**Highlights of previously unsolved aspects of the general problem**

It should be noted that the AMI mortality among the population of Ukraine needs the identification and scientific substantiation of epidemiological and regional peculiarities. This will allow to optimize the existing problems as to prevention, organization of diagnostics and treatment, as well as rehabilitation processes in relation to AMI by implementing the modern highly effective medical technologies in clinical practice.

**Aim of the study**

The aim was to examine the peculiarities of dynamics and the regional aspect of mortality among the population of Ukraine due to AMI for the period of 2002-2013.
Results of study and discussion

It was established (graph 1) that the number of deaths due to AMI among the population of Ukraine for the period of 2002-2013, according to index of growth rate, had increased by +24.6% (n=2815) and in 2013 there were 11448 cases of deaths, while the index of accumulation of natural phenomenon in 2005 had increased by +1.11, in 2010 – by +1.05 and in 2013 – by +1.14. It should be mentioned that the number of residents of Ukraine for the analysed period, according to the absolute growth rate, has decreased by -2904055 persons (-6.4%) and in 2013 – by 45553047 persons [6].

By analysing the value of the integral index of mortality level among the population of Ukraine due to AMI we have determined its tendency to rapid growth in public health of population of the country. In 2005 it has increased by +13.4% as compared to the data of 2002; in 2010 it has increased by +7.9% as compared to the data of 2005; in 2013 it has increased by +15.1% as compared to the data of 2010. Therefore, in general, the mortality level in 2013, according to the index growth rate, has increased by +40.7% as compared to 2002 – 17.9 cases per 100 thousand persons. As for the gender structure of the index of mortality of Ukrainian population due to AMI, it was determined that during the analysed years the specific weight of men prevailed by 15.2±4.7% as compared to females. The index was 55.2±0.46% – 59.2±0.5%, whereas among the women who passed away because of the studied phenomenon the index was within 40.8±0.5% – 44.8±0.46%.

In the context of the above-mentioned it was determined that the level of mortality due to AMI among men in Ukraine in 2013, as compared to 2002, had increased by +33.8% and had reached 30.1 deceased per 100 thousand male persons (graph 2).

As to the coefficient of level of mortality among women due to the given pathology, it was established that the researched index in 2013 (21.0 cases of deaths per 100 thousand women) also had shown the tendency to increase by +50.0%, which confirmed the data of index rate growth as compared to the data of 2002 (14.0 cases of deceased per 100 thousand females).

Moreover, it was determined that the index of correlation between mortality of women and men due to AMI during the studied period had the following numerical expression, namely: in 2002 per 100 deceased women there were 139 deceased men; in 2005 – 100:145; in 2010 – 100:138 and in 2013 – 100:123. This confirmed the existing tendency to equalization of the number of cases of deaths due to AMI among men and women.

In the course of scientific inquiry it was proved that in the structure of mortality due to AMI (graph 3) according to the place of residence the specific weight of urban residents was 4.6 times higher (82.0±0.4%) than that among the rural residents, where the given index was 18.0±0.4%.

It was clarified that the coefficient of correlation among the dead rural and urban residents due to AMI in 2002 was 1:5.1; in 2005 – 1:4.8; in 2010 – 1:4.6, whereas in 2013 that index had the numeric expression of 1:4.0. This
confirmed the growth of the number of persons who passed away because of that pathology in rural areas by 38.1% \((n=870)\), in spite of the growth of the number of the deceased – +21.2% \((n=1945)\) urban residents.

Accordingly, the accumulation index of persons who died because of the AMI among the rural residents in 2005, as compared to 2002, was +1,13; in 2010 – +1,13, and in 2013 – +1,24; whereas among the persons who died because of that pathology in the cities the analysed index had the following expression: in 2005 – +1,1; in 2010 – +1,1 and in 2013– +1,1. This data again proved the direction to more rapid growth of the number of deaths among the rural residents, as compared to mortality among the urban residents, which confirmed the steady upward trend of the researched phenomenon.

Besides, it was determined that prevalence index of AMI mortality for that period among the urban residents, according to the index of growth rate, also had the steady upward trend - by +31.7% in 2013 (29.5 deaths per 100 thousand urban residents), as compared to the data of 2002 (22.4/100 thousand); in 2005 it gradually increased by +11.6%; in 2010 – by +4.8%, in 2013 – by +12.6%.

Despite the lower level of the average value of coefficient of mortality level due to AMI among the population of rural areas \((M=12,03/100\) thousand) - 53.34±0.33% less than the same index among the urban residents \((M=25,78/100\) thousand), the first index was characterized by the gradual numerical growth: in 2005 – +20.4%; in 2010 – +19.8%, in 2013 – +26%. In 2013 its growth for the whole studied period according to the index growth rate was +81.8%, which was 16 dead persons per 100 thousand rural residents.

The results of analysis of the age structure of the deceased because of the AMI (graph 4) showed the undulatory character of mortality with the beginning of that natural process among the population of Ukraine at the age of 17-19 \((0,06±0,04%)\) and completion at the age of 100 or more \((0,01±0,01%)\). 70-79 years old \((34,81±0,54%)\) is the age, when the main peak of deaths caused by that pathology among the Ukrainian population was observed.

Graph 4. Age structure (%) of mortality among population of Ukraine due to AMI in 2002-2013

It was established that in the age structure in average for the studied period the prevalence of mortality due to AMI was +3.6 times (78,1±0,4%, \(n=7748\)) urban residents, as compared to the data of 2002, was +1,15; in 2005 – +1,1; in 2010 – +1,13, and in 2013 – +1,24; as compared to 2002, was +1,15; in 2005 – +1,1; in 2010 – +1,13, and in 2013 – +1,24; as compared to 2002 (94.8/100 thousand) and in 2013 – +23.8% (134.6/100 thousand) as compared to the previous analysed years.

The study of index of mortality due to AMI among the population of the working age showed the undulating character with the highest rise in 2005, according to the growth rate coefficient – +36,4% \((7.5/100\) thousand) with the decline in 2010 – -6,7% \((7.0/100\) thousand) and in 2013 – -2,8% \((6.8/100\) thousand).

Figure 5. Data on mortality due to AMI among persons of working age and people older than working age during 2002-2013 in Ukraine (abs. data: per100 thousand persons of working age and people older than working age)
In the context of analysis of mortality of the population of Ukraine due to AMI the investigated data and mortality of patients in the in-patient departments of medical institutions should be regarded as indicators of effectiveness of timely appeal for medical aid, term and completeness of hospitalization, beginning of treatment, effectiveness of methods, technologies of treatment and rehabilitation measures [13], quality of care for patients and organisation of work of structural specialized subdivisions of medical institutions, and medical and preventive treatment is institutions in general.

It was confirmed (graph 6) that in the specialized in-patient departments of medical institutions of Ukraine in 2002 69.5±0.89% (n=5998) patients of the total number of deceased (n=8633) died due to AMI; in 2005 – 63.5±0.82% (accordingly=6068 to n=9559); in 2010 – 65.3±0.81% (accordingly n=6549 to n=10031), whereas in 2013 the specific weight of persons who passed away because of the AMI in specialized inpatient departments was 65.5±0.76% (accordingly=7496 to n=11448), demonstrating the increasing number of deaths in cardiology in-patient departments of medical institutions of Ukraine for the analysed period by +25% or n=1498 cases.

It was established that the index of hospital lethality in average for the analysed years was 13.19±0.19%. The above-mentioned index insignificantly declined (-1%) in 2005 (12.87%) as compared to data of 2002 (12.99%), while in 2010 it increased by +1.1% as compared to 2005 – 13.0%. However, in 2013 the index of hospital lethality due to AMI was characterized by the rapid growth +6.8%. Deaths in cardiology in-patient departments due to AMI amounted up to 13.88% of the total number of those discharged and deceased.

During the research we have analysed the places of death of patients with AMI. As a result it was determined that from the total number of persons who died because of the AMI 65.9±0.4% died in the in-patient departments of medical institutions, whereas 3.5±0.4% of persons died in the process of providing pre-hospital medical care and transportation by teams of emergency medical services.

The paradoxical fact is that 30.6±0.4% of patients (n=3390) died out of institutions of the health care system. It was proved that the correlation index among those deceased in the in-patient departments and out of them was the highest in 2002 – 228:100; it was the lowest in 2005 – 174:100. In the following years there was the upgoing trend of hospital mortality: 2010 – 188:100, 2013 – 190:100. It confirms in most cases the late appeal of patients for medical care at occurrence of cardiac pain [11].

During the research we have examined such component of mortality as pathoanatomical autopsies of the deceased due to AMI, conducted to determine the causes and mechanisms of death of patients [7]. It was the objective criteria for assessing the final results of activity of attending physicians / structural subdivisions and medical and preventive treatment institutions in general [5].

It was proved (graph 7) that the specific weight of pathoanatomical investigations during the studied years
was characterized by the decline in 2005 – -2.5% (83.8%) as compared to 2002 (85.4%), by growth (+2.4%) in 2010 (85.3%) as compared to 2005, and by rapid growth in 2013: +3.6% (88.4%) as compared to pathoanatomical autopsies of dead bodies (due to AMI) in 2010.

Thus, despite the high indexes of diagnoses of AMI confirmed by the pathoanatomical studies, still there were a significant number of deceased whose diagnoses of AMI were not confirmed posthumously [4]: in 1286 dead persons in 2002 or in 14.6% of all cases of deaths for that reason; in 1592 deceased (16.7%) in 2005; in 1471 dead persons (14.7%) in 2010 and in 1322 deceased in 2013 (11.6%).

The analysed state of mortality among the population of Ukraine due to AMI in the context of the existing administrative territorial units [2] clearly showed (table 1) that the population of the Eastern region was in the first rating place in the regional peculiarities of the natural process of the given pathology with the index at 31.1 cases per 100 thousand population.

### The regional peculiarities of AMI morbidity among the population of Ukraine in 2013

| Name of regions of Ukraine | Names of regions and cities under central authority | Level of morbidity due to AMI (1.21) |
|---------------------------|--------------------------------------------------|-------------------------------------|
|                           | All population (cases per 100 thousand population) | including, among                     |
|                           | (per 100 thousand urban residents) | (per 100 thousand rural residents) |
| Western region            | Lviv region 26,6 | 32,8 | 17,1 |
|                           | Ivano-Frankivsk reg. 12,5 | 13,1 | 12,1 |
|                           | Ternopil region 21,5 | 28,7 | 15,9 |
|                           | Volyn region 13,2 | 17,0 | 9,2 |
|                           | Rivne region 12,1 | 14,1 | 10,4 |
|                           | Chernivtsi region 18,3 | 29,2 | 10,3 |
|                           | Zakarpattia region 20,9 | 28,0 | 16,8 |
|                           | **Level of the Western region** | **Scope = 12.1 - 26.6** | **13.1-32.8** | **9.2-17.1** |
|                           | Total 17,9 | 23,3 | 13,1 |
| Eastern region            | Kharkiv region 36,0 | 39,9 | 20,6 |
|                           | Donetsk region 31,8 | 32,8 | 22,0 |
|                           | Luhansk region 25,4 | 26,2 | 20,4 |
|                           | **Level of the Eastern region** | **Scope = 25.4-36.0** | **26.2-39.9** | **20.4-22.0** |
|                           | Total 31,1 | 33,0 | 21,0 |
| Southern region           | Zaporizhia region 37,0 | 41,8 | 21,3 |
|                           | Kherson region 18,2 | 21,2 | 13,6 |
|                           | Odessa region 24,2 | 28,9 | 14,9 |
|                           | Mykolaiv region 22,3 | 27,6 | 11,1 |
|                           | AR of Crimea 25,2 | 29,0 | 19,0 |
|                           | Sevastopol 32,2 | 33,3 | 16,8 |
|                           | **Level of the Southern region** | **Scope = 18.2-37.0** | **21.2-41.8** | **11.1-21.3** |
|                           | Total 26,5 | 30,3 | 16,1 |
| Northern region           | Zhytomyr region 16,2 | 19,0 | 12,4 |
|                           | Kyiv region 28,6 | 30,2 | 26,0 |
|                           | Chernihiv region 21,7 | 25,1 | 16,0 |
|                           | Sumy region 20,2 | 23,2 | 14,1 |
|                           | Kyiv 35,7 | 35,7 | - |
|                           | **Level of the Northern region** | **Scope = 16.2-35.7** | **19.0-35.7** | **12.4-26.0** |
|                           | Total 24,5 | 26,6 | 17,1 |
| Central region            | Vinnitsya region 16,4 | 20,1 | 12,8 |
|                           | Dnipropetrovsk reg. 28,3 | 30,0 | 20,1 |
|                           | Kirovohrad region 16,9 | 19,0 | 13,4 |
|                           | Poltava region 28,1 | 32,4 | 21,4 |
|                           | Cherkasy region 16,9 | 20,0 | 13,0 |
|                           | Khmelnytsky region 20,1 | 22,9 | 16,7 |
|                           | **Level of the Central region** | **Scope = 16,4-28.3** | **19.0-32.4** | **12,8-21,4** |
|                           | Total 21,1 | 24,1 | 16,2 |
|                           | **Rating place** | IV | IV | IV |
100 thousand persons (including: the urban population – 33.0/100 thousand and the rural residents – 21.0/100 thousand). The situation with the AMI mortality in the Eastern region of the country was 1.74 times higher than that of the Western region, where the index of mortality was 17.9 cases per 100 thousand persons. Western region took the last fifth place in the rating across the entire population: urban (23.3/100 thousand) and rural (13.1/100 thousand) residents.

The Southern region of the country was in the second place in the ranking. Here the index of prevalence of AMI mortality was 26.5 cases per 100 thousand persons. However, among the residents of cities the analysed coefficient was 30.3/100 thousand, while among the village residents –16.1/100 thousand.

The Northern region (24.5/100 thousand in the region; 26.6/100 thousand – the urban residents and 17.1/100 thousand – the rural residents) was in the third place in the rating by value of index of mortality level due to AMI among the population. The Central Region was in the fourth place in the ranking (21.1/100 thousand for the entire population; 24/100 thousand – in cities and 16.2/100 thousand – in rural areas).

It was discovered that the coefficient of correlation among the residents of villages and cities, who died due to AMI in the aspect of regions of the country, was the highest in the Southern and the Western regions: 188 rural residents and 178 urban residents – per 100 deaths from that pathology. Whereas in other regions (Eastern, Northern and Central) those indexes were much lower: 100:157, 100:155, 100:149 respectively.

The analysis of AMI mortality level in 2013 in certain areas (graph 8) revealed the highest value of the analysed index in Zaporizhia region (3.0 dead per 100 thousand persons), and the lowest value in Rivne region (12.1/100 thousand). The existing difference between the maximum and minimum value of the index (3.1 times) confirms its significant regional differences.

The highest prevalence of mortality was observed in Zaporizhia region (37/100 thousand), Kharkiv region (36.0/100 thousand), Donetsk region (31.8/100 thousand), in the city of Sevastopol (32.2/100 thousand) and in the city of Kyiv (35.7/100 thousand).

The most likely causes of that natural phenomenon in the above-mentioned administrative areas were: the process of social maladjustment of population of former industrial regions, characterized by the inability to effectively implement own professional role in certain micro-social conditions, and provoking economic and social dependence; psycho-emotional lifestyle, which negatively affected the human health due to increasing demonstrations of generally accepted norms of behaviour.

Moreover, it was proved that in the majority of regions of Ukraine (13) the mortality level due to AMI in 2013 ranged from 20.1 to 28.6 cases per 100 thousand persons.

Significantly lower indexes of prevalence of mortality due to AMI were in 9 regions, namely: in Rivne region (12.1/100 thousand), Ivano-Frankivsk region (12.5/100 thousand), Volyn region (13.2/100 thousand), Chernivtsi region (18.3/100 thousand), Vinnytsia region (16.4/100 thousand), Kirovohrad region (16.9/100 thousand), Cherkasy region (16.9/100 thousand), Zhytomyr region (16.2/100 thousand) and Kherson region (18.2/100 thousand).

No exception to that was the fact that the coefficients of mortality due to AMI, prevalence and health of population of the examined administrative areas are negatively affected by: the prolonged period of social and economic changes in the country, which caused the impoverishment of the population; population ageing process and chronic diseases; ignoring the basics of healthy lifestyles as the basis for the occurrence of risk factors; low efficiency of preventive, diagnostic and treatment activities of medical installations and the health care system in general, etc.

Conclusions

The study established that for the period of 2002-2013:

1. The mortality among the population of Ukraine due to AMI was characterized by the clear and consistent upgoing trend in the number of dead persons: by the absolute expression of that pathology – +40.8% (n=+2 815), which was 11448 deceased in 2013; by the coefficient of prevalence of the phenomenon - +40.7%, its value was 25.2 cases per 100 thousand persons as compared to the data of 2002;

2. The epidemiological peculiarities of mortality due to AMI were: mortality rate of men exceeded that of women by 15.2±4.7% (57.6±0.5% (n=5704) against 42.4±0.5% (n=4214) respectively); mortality rate of urban residents exceeded the mortality rate of rural residents by 4.6 times; mortality
rate of elderly persons exceeded the mortality rate of persons of the working age by +3.6 times (78.1±0.4% (n=7748) against 21.9±0.4% (n=2170) respectively); the majority of the deceased Ukrainian citizens were in the age group of 70-79 (34.8±0.54%), but this natural process began in the age group of 17-19 (0.06±0.04%) and ended in the age group of 100+ (0.01±0.01%); the number of deaths in cardiology inpatient departments increased by +25% (n=+1498) cases against the decrease of the average length of stay of patients by -24%, while 34.5% (n=3952) died out of health care institutions and in 11.6% (n=1322) cases the diagnosis of AMI was not confirmed posthumously, in the Eastern region (31.1/100 thousand) the mortality was 2 times higher than in the Western region (17.9/100 thousand), and as for the the administrative areas: Zaporizhia region (37/100 thousand), Kharkiv region (36/100 thousand), Donetsk region (31.8/100 thousand), the city of Sevastopol (32.2/100 thousand), and the city of Kyiv (35.7/100 thousand).

3. Areas of work to reduce the level of mortality due to AMI among residents of Ukraine: activation of prevention work at the national level and that performed by individual doctors of primary medical provision through informing the population regarding the bases of formation, preservation and promotion of healthy lifestyle; identification of patients with high risk of cardiovascular pathology; effective and high-quality implementation in clinical practice of the modern medical technologies - antithrombotic therapy, timely coronary artery bypass surgery, primary percutaneous coronary intervention / fibrinolysis and other types of invasive researches and methods of revascularization, which would positively affect the health of the nation.

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