Psychoemotional strain and phenomenon of «men and women mortality ratio» in the age aspect

Abstract:
The analysis of the number of died men and women of different age per 100 000 persons of the corresponding sex from 1985 to 2002 in the city Kyiv was conducted. It is established that in the wide range of ages the phenomenon of the morbidity ratio of persons of different age is of a non-linear character. It is found the availability of the significant effect (19.6%; p<0.001) on the degree of this ratio. Four specific periods, associated with different possible mechanisms of the effect of the psychoemotional strain on the human body, have been specified in the dynamics of the sex ratio. It is established that the psychoemotional factor affects persons of different age groups specifically. In this, its effect on persons of able-to-work age, is the most threatening. A quantitative assessment of the population health of different age groups with due account of mortality ratio of persons of different sex has been proposed. The explanation of changes of sex ratio in populations, based on the theory of evolution in their development, is presented.

Streszczenie:
Przeprowadzono analizę liczby zgonów kobiet i mężczyzn w różnym wieku na 100 000 mieszkańców miasta Kijów obu płci, obejmującą lata 1985-2002. Założono, że w szerokim przedziale wiekowym zjawisko wskaźnika umieralności kobiet i mężczyzn w różnym wieku ma charakter nieliniowy. Stwierdzono istotny wpływ napięcia psychoemocjonalnego (19.6%, p<0.001) na wysokość ww. wskaźnika. Cztery poszczególne okresy, związane z różnymi możliwymi mechanizmami wpływu napięcia psychoemocjonalnego na organizm człowieka, zostały określone w dynamice wskaźnika płci. Ustalono, że czynnik psychoemocjonalny wpływa w różny sposób na osoby w różnych grupach wiekowych. W szczególności, jego wpływ na osoby w wieku produkcyjnym jest najbardziej groźny. Zaproponowano ocenę ilościową stanu zdrowia ludności w różnych grupach wiekowych w zależności od wskaźnika śmiertelności osób obu płci. Przedstawiono także wyjaśnienie zmian współczynnika płci w populacji, w oparciu o teorię ewolucji w ich rozwoju.

Keywords: sex ratio, age, emotional strain, population health, mortality

A modern man is standing on such stage of the social development, which is characterized by the increase of the quantity and quality of signals, coming from the environment and acceleration of the life tempo, causing the increase of the physiological cost of the vital activity, and, as a result, development of the psychoemotional stress, with further development of health disorders in the population. To the most important factors, influencing the state of health of the population in Ukraine (working population, in particular), emotional overloads in combination with economic and social reforming, occurring in Ukraine, should be mentioned.
population live under effect of the chronic psychoemotional stress [5]. And in this, a considerable decrease of the life quality, economic instability and social unprotected population are main causes of the stress, resulting in the increase of rates from cardiovascular pathologies [6]. In Ukraine (by the data of the demographic statistics in the city Kiev) diseases of the blood circulation system makes 62.4% of the population mortality. In the prevalence of diseases of the blood circulation system in 2003 the most spreading were: hypertension (44.8%) and ischemic heart disease (39.6%). Their indices within 1994-2003 showed a stable tendency to the increase [7], showing negative tendencies in the population health, associated with the effect of chronic psychoemotional stress, in particular.

The working population is particularly pressed by the society, as conditions of its occupational activity are very often reach extreme ones. The formation of new social changes in the sphere of labor are accompanied by the occurrence of negative emotions and sufferings in workers, causing worsening their functional state, work capacity, development of apathy, depression and uncontrolled aggression, psychoemotional stress and, as a result, psychosomatic diseases. The psychoemotional stress, as a mass phenomenon, causes the so-called risk-related socio-psychological situations in working collectives [8], developing as violations of official, legal, technological or moral norms, etc. The growth of antagonistic relations in professional collectives, where can occur contradictions between demands, workers’ desires and available possibilities in order to get them, prevent normal functioning of such collective, and may cause formation of the population stress.

Several authors [8] have managed to specify a relatively full list of socio-psychological phenomena, which can be the cause of development of risk socio-psychological situations and promote their further aggravation. The most important among them are: re-organization of usual norms of interrelations and behavior of different social groups; occurrence of new common interests and purposes in the groups; competitive mutual relations; decrease in the level of the state guardianship, followed by the necessity to relay upon own abilities and initiatives; decrease of the level of social protection; lack of confidence in the tomorrow; increase in the break in incomes between different population layers; polarization of views and life style of different population layers; lack of the scientifically supported management; stable conservative psychological motivations in the significant part of the population concerning understanding of the social equity; unhealthy style of life of the part of the population due to poor nutrition, bad work, life and economic conditions, alcoholism, smoking, etc. All these factors cause decrease of the stability to oppose stress factors. For example, the work of Kagan A.R., Levi is an illustration of the rightness of such conclusions [9], where they demonstrate, that specialists exposed to constant psychoemotional stress suffer most often from arterial hypertension (aviadispatchers, drivers of the public transport, telephone operators, etc).

At present a model of work stress development, proposed by R. Karasek [10] is rather popular and studied. It is supposed in this model, that two prerequisites are really existing, which promote stress formation when making high demands to the executed work, accompanied by low level of payment as well as high demands to work with the limited possibility in taking a decision.

The action of such factors increases the risk of diseases development. It is interesting, that both types of the psychoemotional stress development, described in the model, are independent chains, contributing to the pathological process development [11,12]. In particular, it has been established that in individuals with low income level, a significantly higher systolic arterial pressure rise, heart rate and cortisol in the morning working hours [13]. In the same population categories the increase level of plasma fibrinogen is observed [14]. The laid data is likely to prove the availability of several mechanisms, binding a low socio-economic status and high risk of the development of the cardio-vascular pathology.

K.V. Sudakov has explained the role of negative emotions in damaging the human health from the point of view of the theory of the functioning systems by P.K. Anokhin [15]. In his opinion, changing the structure of demands, occurring in socio-economic difficulties, is accompanied by the growth of negative emotions. Such emotions actively stimulate subjects to search for means in order to satisfy the initial needs. After manifold satisfaction of a one-type need, positive emotions are forming as an award for successful achievement of any result, useful for a man. In this case the apparatus acceptor can prognosticate definite results just in the period of the occurrence of the corresponding need. It should be added that in the case of not satisfaction or partial satisfaction of the need an individual should actively look for an exit from the situation occurred. The difference in the result of the action and its prognosis, received with the help of the mentioned acceptor, cause the deepening in the level of negative emotions. A specific “circulus virtuosus”, occurs, strengthening the effect of negative emotions on humans, and so, on their health.

As it is seen from the laid evidence, the effect of chronic psychoemotional strain, recorded in modern Ukraine, can lead to worsening of the population health. So, at present, the problem of the assessment of the effect of the psychoemotional strain on the population health is rather actual and, in this, for its solution it is important the search
and use of adequate indicators, which, in the integrated form, can contain information about the population health.

The Purpose of the work was to distinguish peculiarities in the dynamic of the population health in Ukraine under the effect of the psychoemotional stress, using a phenomenon “mortality ratio between men and women” in the age aspect.

Materials and methods

Statistical materials have been analyzed, proposed by Kiev administration on medical statistics, concerning the number of died man and women of various age per 100 000 individuals of the corresponding sex from 1985 to 2002 in Kiev. Such period of time was taken not randomly. It is characterized by three conditionally distinguished periods, strictly differed by the level of the effect of the psychoemotional factor on the population of Ukraine: 1985-1991 (I – period of sufficiently stable life of the population in the USSR); 1992-1998 (II – period of disintegration of the USSR and development of the severe world economic crises); 1999-2002 (III – period of certain stabilization of social and economic situation in the country). Coefficient of the sex ratio of died persons (M/W, where M and W are the number of died men and women, respectively, per 100 000 men or women) was taken for groups of different age ranges (before 1 year old, 1,2,3,4 years old, 5-9 years old, 10-14 years old, 15-19 years old, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80-84 years old, more than 85 years old). Studying peculiarities of the dynamic of the population health in Ukraine was conducted using one-factor disperse analysis.

Results and discussion

There is a great deal of health indices, showing the effect of the psychoemotional stress on the population. It is known that indices of the morbidity of blood circulation system are often used as an indicator of the population stress, having a significant specific weight in causes of the mortality. To some extent, the number of attendances to ambulatories or polyclinics describes the picture [16]. Here, a significant change of the number of physician’s attendances over the period after USSR disintegration, after the economic crises of 1997-1998 as well as at present is observed. However, it is an indirect index and it shows not only changes of the state of health of the population, but qualitative and quantitative characteristics of medical care.

In our opinion, in order to find reliable indicators for the population health, illustrating the information impact of socio-economic processes, it is reasonable to take into account fundamental relationships of the most important components of the population, i.e. sex ratio. Ch. Darwin was the first, who began to study this problem. In his well-known book «Origin of man and sex selection» he wrote: «As far as life habits, and so, a risk to be exposed to various dangers are different in males and females in many animals, we can assume that in many cases one sex in ordinary life conditions will die in more amounts than the other» [17, p. 367].

At present, sex ratio at the moment of conception is widely used in medical demography, names as a primary ratio, at birth – secondary and at maturity – tertiary. In many countries there is a distinct tendency to the growth of the primary coefficient of the sex ratio over the last decade. Such effect is likely associated with the increase of the level of the effect of the psychoemotional stress on the population of many countries of the world. Even in China, where the population resides mostly in rural areas, the secondary coefficient of the sex ratio before 1980 was stable and made 1,06. In 1981 it reached 1,085, in 1987 – 1,11, in 1989 – 1,138 [18]. By the data of these authors coefficients of sex ratios in the age of 0-4 year old increased from 1,07 in 1953 to 1,071 in 1982 and up to 1,102 in 1990.

The most popular the sex ratio was used when studying the effect of the psychoemotional stress, caused by military actions. Some authors consider that, though we cannot speak about the increasing effect of such coefficient due to the war as about a general phenomenon, is has a statistical proof in some countries [19]. In particular, when analyzing the psychic strain, manifested in the population of Slovenia before and in the short period of the war in June-July 1991, a significant change in the secondary coefficient of the sex ratio from 1,075 in 1991 to 1,016 in 1992 (р<0,03) [20] was one-factor disperse analysis. In Lublyana the change of the coefficient of the sex ratio was even more marked - from 1,16 in 1991 to 0,93 in 1992 (р<0,0001) and to 1,07 in 1993 (р<0,005). These data point to the efficient reaction of the coefficient of the sex ratio on the level of the psychological strain within 1-2 years old.

The data available prove that the level of the sex ratio affected by changes under the effect of not only the psychoemotional stress, by the stress caused by the exposure to different chemicals as well. For example, the exposure to high dioxin concentrations, observed in 1976 after Seveso accident, showed a significant decrease in the birth of men (decrease of the coefficient of the sex ratio) within 8 years (1977-1984) [21]. The analysis of the decrease of the sex ratio (from 1,066 in January 1993 to 1,004 in October 1994), in 9 months after the experienced acute strain, caused by earthquake in Kobe (January 1995), made by investigators, resulted in a conclusion, that such phenomenon was associated with chronic effect of a toxic agent, occurred in the environment as a result of the natural disaster [22]. The authors underline, that changes in
the coefficient of the sex ratio after the earthquake in Kobe were accompanied by the same decrease as the changes caused by London smog.

Thus, different stressogenic factors affect the sex ratio in different way. In particular, factors of emotional and chemical origin influence the decrease of the birth-rate in males. However, in the case of the sufficient constancy of ecologic state of the environment we can certainly consider, that the coefficient of the sex ratio depends, to much extent, on the level of the psychoemotional stress and on problems of socio-economic origin, greatly affecting its development. Just the same situation we have now in Ukraine.

Along with the discussed coefficients of the sex ratio modern medical statistics covers not only the ratio of sexes of alive, but died individuals as well. The analysis of namely such characteristics, in our opinion, has some advantages, because of the precise recording died persons. The above mentioned allows to get more precise qualitative information on the ratio of sexes, because mortality rates are recorded very accurately and give the possibility to study sex ratio of different age groups. The study of the sex ratio of died persons, representatives of various age groups, can give the possibility to receive interesting information on the level of the effect of the factor of emotional origin as well as on the level of the population health.

In order to prove the value of such supposition it is necessary, first of all, to establish the degree of the effect of the age on the K coefficient. The conducted analysis allowed to establish peculiarities in the changes of the K coefficient in different age groups (Fig. 1).

Here we should mark that K levels are significantly various: from <0.5 to >3.0. Such bell-shaped dependence of mortality sex ratio on the age in Ukraine is not unique. If, for instance, we take the taken index, calculated for the population of the Irkutsk region in Russia, where life conditions are more severe than in Ukraine, we can see the same structure of the mentioned relationship. However, the maximum K level (calculated by Leschenko’s data [23]) is recorded in the earlier age (25-29) and reaches the meaning 5,42. In this case, because of life conditions, the mentioned coefficient after 50 years old increases up to 8,83.

For further studies it is reasonable to consider specific parts of the presented curve. Firstly, it is seen that in the younger age (before 15 years old) K has comparatively small meanings, ranging in the very narrow interval 1-1.5. Such ratio of male and female death, being very close to the balanced state, is likely to point to definite emotional and somatic welfare in the life of this population as well as to approximately equal effect of negative environmental factors on individuals of both sexes.
the mentioned processes is manifested: this process begins to act on men in much earlier age than on women. Later, «randomly selected» the healthy men survive more often than women, in whom the mechanism of elimination begins to act in much more later age. Probably such state of affairs depends on that the psychoemotional state in men, who undergo a great pressure from life circumstances, due to the need to maintain worthy economic provision of life conditions for the family. In the later period of life such tendency became naturally weaker.

So, it is established that the phenomenon of the balance in mortality of individuals of different age undergoes significant changes. One-factor disperse analysis revealed the availability of significant effect of the age on the K coefficient. This factor shows the balance in the mortality by 19.6% (p<0.001). Four characteristic periods have been distinguished in the age dynamics, which are connected with different possible mechanisms of the effect of the psychoemotional factor on the human body.

Further, we will discuss in detail the proposed hypotheses about the effect of the level of the psychoemotional strain on individuals – representatives of different age groups of the population examined. For this, it is necessary to analyze «behavior» of the K coefficient in different periods of the development of the Ukrainian society.

It is established that for individuals of the younger age (before 15 years old) a significant effect of the psychoemotional state on the population was, in general, not expressed. The one-factor disperse analysis showed a significant effect of the factor of the psychoemotional stress on the group of individuals aged 15-19 (p<0.05). In this, the effect of this factor on the dispersion of the K coefficient was estimated at the level of 0.93%. The effect of this factor is rather interesting (Fig. 2a).

Almost unchangeable level of the K coefficient in periods I and II is followed by the certain decrease of this index in the period III. Such change of the K coefficient in 15-19 years old persons show a certain positive effect of the psychoemotional strain on individuals of such age and can be associated with certain positive life perspectives.

The situation is quite another for individuals of the following age group (20-24 years old) (Fig. 2b). After the disintegration of the USSR and the resulted psychoemotional problems, the K coefficient significantly increased almost by 1.5 times (p<0.05) and remained unchangeable in the period III for persons of that age group. The effect of the factor of the psychoemotional stress in this case, showed the meaning range of the K coefficient by 2.8%. It is interesting that such effect of the psychoemotional factor is recorded in the same way for other, more elder age groups (25-54 years old) at the significant level (from p<0.01 to p<0.001), although the degree of the effect of such factor changes to some extent for different age groups (from 0.48% to 1.27%). The recorded dynamics of the K coefficient demonstrates, that its maximum established level in the period II continues to act also in the period of the weakening of the effect of the psychoemotional factor on individuals of more able-to-work age.

The regularity of changes of the K coefficient for individual of the pre-pension age (for men) is rather significant, when perspectives of the career for most of them can gradually are lost, causing the increase of the psychoemotional strain (Fig. 2c). Here, the factor, which is under discussion, has also a significant effect (p<0.001) on the level of health of the population, which is assessed by K coefficient As it is clear from the Figure, we can see a constant increase of the K coefficient from period I to III, demonstrating unfavorable processes, occurred after the USSR disintegration in combination with gradual lost of life perspectives. Although, the effect of the psychoemotional factor demonstrates the dispersion of the K coefficient only by 0.54% in this age group, constant increase of this index (approximately by 1.2 time) points to the need to strengthen a social support to individuals of the mentioned age. It is directly in this case, that it is possible to make some compensation of the harm, caused to the human body, and to provide for «milder» entering the pension age.

![Fig 2. Effect of psychoemotional strain in different periods of the country development on the population health, assessed by the sex ratio (K). I – period, characterized by a significantly stable life of the population in the USSR in 1985-1991; II – period of the disintegration of the USSR and the severe economic crises in 1992-1998; III – period, characterized by a certain stabilization of the socio-economic situation in the country in 1999-2002.](image-url)
elder than 60. The regularities, established for representatives of the earlier pension age – 60-64 years old (Fig. 2d), illustrate the mentioned phenomenon. The one-factor disperse analysis allowed to assess the part of the effect of the psychoemotional strain to the transformation of the sex ratio. It makes 0.28% (p<0.001). For more elder groups this part is greater, however always the effect of the mentioned factor is significant at the high level (from p<0.05 to p<0.001). On the presented Figure it is seen, that the effect of the period II is minimum, however here we can see some delayed negative cumulative effect, when the effect of the high psychoemotional strain is manifested already after weakening of this factor.

Here, it is appropriate to refer, once again, to distinguished limits of changes in the socio-economic position of the country, involving the directed transformations in the psychoemotional state in the population. First of all, it is necessary to mark once again, that these limits are rather conditional. The disintegration of the USSR or the crisis of the 1998 should not be the cause the immediate increase of the mortality, did they? However, in these years the effect of the mentioned factors on the psychoemotional state of the population was maximal and it is very difficult to determine the degree of further weakening of their effect.

The distinguished stages are likely to be characteristic for many territories of the CIS countries. Thus, if we consider the changes of the K coefficient for the whole population of Russia over the period from 1980 to 2002 (by Leschenko’s data [23]), we can mark that by the year 1992 the coefficient was at the level of 1,25, from 1992 till 1998 it made 1,47, and after 1998 it remained at the same level (1,48).

It points to complicated socio-economic and demographic processes, occurring in the Russian Federation. If we calculate the coefficient of the sex ratio by the data of the expected life duration of newborns in Russia (by the data of T.K. Men’ and D.G. Zaridze [24]), we can see the following: this coefficient, obtained by the results of studies of 1990-2001, was the lowest in the period from 1993 to 1995 and made 0,14, 0,04 and 0,10, respectively, pointing once again to the conclusion about unfavorable changes in the population health, occurred after the disintegration of the USSR.

In the period of 1990-1991 the coefficient was equal to 0,37 (i.e. was almost 10 times more than in 1994).

So, it is found that the psychoemotional factor acts absolutely not similar on individuals of different age groups. And in this, its effect on individuals of able-to-work age is the most threatening. Fortunately, the degree of exposure to this factor is not so high. This is evidently associated with the presence of a large number of compensatory mechanisms in the society, decreasing the damage, caused by the psychoemotional stress. However, the high significance of the effect of the psychoemotional strain on the great number of individuals, of able-to-work age, in particular, cause a significant damage to the health of the population in Ukraine.

There is one more important question, related to the detection of the supposed mechanism, which regulates the dynamics of the obtained ratio of mortality of men and women of different age groups. In our opinion the most acceptable is V.A. Geodakayan’s hypothesis for explanation of this phenomenon [25], according to which each sex in the population plays its role and has its different information value in realization of its relations with the environment (variability) and previous generations (heredity). In the first case, this relation is realized mostly by males, providing adaptation of the population to changeable environmental conditions. So, in the action of this or that intensive factor of the environment (e.g. psychoemotional factor), male persons die first. In many cases women are conservative and are at most adapted to the past environmental conditions and realize the maintenance of the available genetic information and stabilization of its structure in the population. Such stabilization of the population components (men and women) is optimal and allows it to «test» different solutions of evolutionary tasks without great risk in adoption of unsuccessful decisions. According to this explanation, the ratio men/women in different age groups can give evidence on subtle information processes in the population in its interaction with the environment.

For individuals of especially able-to-work age the mechanism concerned acts to full extent. This is manifested in the increase of the mortality of the mentioned aged contingent, the reasons of which are conditioned by the effect of the so-called unnatural or external causes (accidents, traumas, murders, suicides). And, as it is mentioned above, when there are more severe environmental conditions (e.g. in Irkutsk region of Russia), the coefficient K is much higher than in Ukraine. If we consider the effect of the psychoemotional factor from the mentioned positions (after 1991), the mechanism of prevalence of the changeability in this case exert also a definite effect on the increase of mortality in men.

Thus, complicated processes, occurring in the population, especially in conditions of high psychoemotional strain, force mechanisms of the population development to function intensive, causing intended changes in the health of the population of Ukraine.

Conclusion

1. It is established, that the phenomenon of the mortality ratio of persons of different sexes is of a non-liner character in the wide range of ages. The presence of the significant effect (19.6%; p<0.001) of age on this ratio has been established. Four specific periods, related to different possible mechanisms of the effect of
the psychoemotional stress on the human body, has been distinguished.

2. It is established, that the psychoemotional factor has its specific effect on persons of different age groups. And in this, its effect on persons of able-to-work age is the most threatening.

3. A quantitative assessment of the population health of different age groups, based on the mortality ratio of persons of different sex has been proposed.

LITERATURE