

Aging and Life Expectancy during the COVID-19 Pandemic

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Abstract

The increasing number of elderly population represents a current demographic phenomenon due to enhancing morbidity and the reduction of mortality in older ages, demographic decline through decreasing birth rates, increasing mortality in younger ages, migration of young population, progress in the medical field and social care, improving the standard of living.

The increase in life expectancy over the last decades is associated with the increasing number of elderly population. In turn, life expectancy is determined by the public health system and the medical services provided to the population, the individual lifestyle, the economic, social, cultural and political context, as well as the environment.

The COVID-19 pandemic has a negative effect on life expectancy through direct or indirect increase of the mortality of the population, as well as a negative impact on the birth rate and the increased vulnerability of geriatric population.

Keywords: aging, health, life expectancy, mortality, morbidity, COVID-19.

The demographic process of aging

During the last decades, a demographic phenomenon common rather of developed countries has been observed in contemporary life, namely the increasing number of elderly population, i.e. the aging of population.

In the year 2000, the percentage of people over 60 years of age was of 17. The increase of the population over 65 years of age is estimated at 2.4% per year. Based on modern Bayesian statistic studies it was established that the world age record of 122 years recorded in France by Jeanne Calmet (deceased in 1997) might be outrun, as stated in a recent study published by Demographic Research, a study platform created by the Max Planck Institute for Demographic Research (Rostock, Germania, 2021) showed (Pearce & Rafery, 2021).

The maximum age at death during the period 2020-2100, estimated with a probability of 100% might exceed 122 years; with a probability of 99% a person might live up to 124 years, with a probability of 68% a person might live up to 127 years, and with a probability of 13% a person might reach the age of 130 years.

At present supercentenarians are rather the exception. The number of people living beyond the age of 100 years

increased during the last decades, the current estimation being at half a million people. The continuous increase in the world population also renders extreme longevity possible. Nonetheless, some researchers argue that diseases, as well as structural, functional and mental deteriorations in humans lead to a natural boundary of life expectancy.

In 1988, the World Health Organization (WHO) placed the problem of aging among the first five health problems of the world.

A series of factors contribute to the increasing number of elderly population, through the amelioration of morbidity and the reduction of mortality at advanced ages. These factors are the demographic decline through the decrease of birth rates and of fertility, the increase of mortality in younger ages, the migration of young population, the progress in medicine, the progress in social care and the improvement of the standard of living.

For the range of population who passed the middle of a lifespan, the WHO introduced the term “people of third age”, while this “third age” is considered by many the “golden years” of adulthood, and which would range within the interval 65 to 80+ years (Barnes, 2011). Today, the threshold for old age is considered 60-65 years. For elderly people, the

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following descriptions are used: elderly (between 60/65 – 70 years), old age (between 70 – 85/90 years) and longevity (above 85/90 years) (Newman & Murabito, 2013; Revelas et al., 2018; Tache & Bocu, 2001).

According to the report of the European Commission, regarding the state of health in 2020 there is a gap of almost 8 years between the life expectancy of the two genders, women living on average 78.4 years as compared to only 70.5 years in men. The highest life expectancy is recorded in Northern countries like Norway (83.3 years) or Iceland (83.1 years) (Şerb, 2021; Zaim, 2021; Neagu, 2021).

The demographic aging process is characterized by:

- increased percentage of the female population – feminization of the population in industrialized countries, with an age difference of 5-7 years as compared to the male population at all ages;
- differences between urban and rural environment, determined by the increase in life quality in the urban and rural environment and the migration of population from cities to the countryside, in its turn determined by the beneficial effect of life in the countryside;
- the impact of certain criteria on the increase of lifespan – education, personal income, marital status, living conditions, hereditary factor in families with longevity, health state (Mavritsakis, 2014).

Risk factors influencing aging

There is a series of factors with negative impact on the lifespan and the quality of life, factors with individual, geographic, racial particularities, as well as particularities referring to gender, social status, occupation, physical and mental state of health. These factors can influence the life expectancy and the lifespan, as well as potential diseases (Olinescu et al., 2004).

Factors with maximum degree of risk are:

- genetic background and family history, the consequences of which are cardiovascular diseases, cancer, diabetes;
- smoking, the consequences of which are cardiovascular and respiratory diseases, cancer;
- alcoholism, the consequences of which are cirrhosis, atherosclerosis and cancer;
- obesity, the consequences of which are cardiovascular diseases, diabetes, retinitis.

A medium risk with diverse consequences is represented by the financial status, the medical insurance and disease treatment.

There are a number of events that might also influence the quality of life and the life expectancy:

- the death of the partner, of a family member and of friends;
- divorce, loneliness;
- illnesses, accidents;
- detention;
- retirement, changes in the family;
- financial losses;
- professional and legal problems (Olinescu et al., 2004).

Consequences of the aging process

The aging of the population also has undesired psychiatric, social and economic effects, as well as effects

on the family:

- losing the feeling of being socially needed, losing the responsibility, role and status within the family after retiring – socio-professional death;
- increasing of the index of economic dependence, assessed as the ration between inactive/active population;
- increased morbidity risk – old age people between 80-90 years, couples of old aged people who are sick, old age women, and old aged with comorbidities or severe disabilities;
- social consequences and consequences within the family – increasing number of families with few or no children, followed by the increasing number of old aged people without children, who live alone;
- institutionalization of old aged people, living in retirement homes or nursing homes, determined by the chronic pathology over 65 years of age; 50% of old aged people need medical care, which implies geriatric knowledge referring to the medical care of old aged persons for the doctor and the medical staff (Mavritsakis, 2014).

The increase in lifespan and the decline of the birth rate can contribute to the increase of old aged population (Ilmarinen, 2006). The increased level of psychological and social integration is associated to the longer lifespan of women and the increased longevity in women (Trudel-Fitzgerald et al., 2020).

Life expectancy

Life expectancy (LE) represents the number of years an individual of a certain age hopes to live on, if aspects of morbidity persist at a certain point. Although the term LE comes from demographics, it is considered a direct overview measure of mortality, coming with an implicit age standardization and it is used in epidemiology and public health as well.

Life expectancy is calculated exclusively based on the death rates specific for each age group and can thus be regarded as a summary, which is independent of the age structure of the underlying population and consequently standardized according to age.

Calculations begin with the estimation of the survival function $l(x)$, representing the probability of surviving from birth up to an age x :

$$l(x) = e^{-\int_0^x \mu(a) da}$$

where $\mu(x)$ is the death risk at age x .

The survival function is then used to calculate the mean duration of life, LE, as follows:

$$LE = \int_0^{\infty} l(x) dx$$

Life expectancy considerably increased during the last decades, the consequence being an increase in the longevity of the population at a global level, the number of population above 60 years of age is estimated to rise from 900 million in 2015, to 2 billion in 2050 (***, 2017).

Life expectancy is conditioned by the standard of living and by the following determining factors: medical care, public health system, individual lifestyle, cultural level, environmental quality, evolution of the economic, social and political sector.

The increase of life expectancy at the individual level is determined by a healthy lifestyle, meaning a healthy diet and the way leisure time is spent – daily physical exercise (Hernández-Lepe et al., 2021), sleep duration (Tanaka et al., 2020), as well as risk and comorbidity factors like smoking, alcohol and drug consumption (Chudasama et al., 2020; Junna et al., 2021).

The evolution of these factors over time, the prolongation of older anachronistic practices, interest groups, transition from the old system in Romania after 1990, politicization and corruption also contributed to the demographic disaster. An economic phenomenon increasingly accentuated and very much present is represented by the Romanian emigration towards more developed Western European countries, taking place simultaneously with the immigration of population from Southeastern Asia.

Health education for the young population – for improving the state of health and increasing life expectancy

If education in itself is beneficial for society, having important effects on the way the economy develops (***, 2020), then health education in particular is the concept underlying health promotion with the purpose of informing and educating the population regarding the medical field, while people are actively engaged to maintain their health, as well as to acquire skills and habits favorable for their health (Dincă, 2006).

The primary segment of the education system is represented by the resident population under 23 years of age, whose tendency to decrease is consistent with the tendency to decrease of the regular resident population, whereas the causes lie within the negative natural growth during the last decades and the international migration (***, 2020).

Physical education starts during preschool; the school environment can offer interesting and healthy PE classes, in order to boost the interest of children and youngsters in physical activities. PE is efficient in increasing the level of physical activity also through improving the physical condition (***, 2008). It has been shown that for children and youngsters in order to achieve major changes with respect to their health, it is necessary that the physical activity lasts at least 60 minutes/day, regardless of whether it is organized as playing in the school yard or PE lessons (Pop, 2019; ***, 2008). Physical activity can also be integrated in the activities taking place after the school program (after-school), given the fact that it was shown that physical education/sport performed only 2-3 times a week did not bring about major improvements in the state of health (***, 2008).

Measures of improving longevity and life expectancy

Controlling the process of aging with the purpose of increasing longevity and life expectancy means: rational

nutrition, physical activity, appropriate treatment of morbidities and antioxidant therapy.

Harman (1995) recommends three ways of controlling the aging process through diet:

- reduction of caloric intake (moderated intake decreases the speed of the metabolism and the intensity of the mitochondrial oxidative processes);
- quantity and quality control of the dietary lipids (polyunsaturated fatty acids, saturated lipids, choline, high density lipoproteins);
- optimal intake of natural antioxidants.

The decline in effort capacity with aging is caused by the morphofunctional changes in the osteoarticular system, the muscle system, the respiratory system, the cardiovascular system, the nervous system and the endocrine system, which appear with increased age.

Aging, as well as physical effort, are physiological processes, which produce oxidative stress through disturbance of the redox homeostasis, the oxidants/antioxidants balance being in disfavor of the antioxidants (Tache, 2001).

Sport in the life of the elderly population

In order for it to render benefits, physical effort needs to be moderate, carried out correctly and continuously and if these three criteria are fulfilled, physical effort has, amongst other effects, a sanogenetic effect (preventive or curative/recovering) and a pro-longevity role, as well as for an active longevity (Pop, 2019).

In the past, there were certain wrong concepts, according to which old age was a disease and that resting would mean lack of motion and restraining from any physical or mental activity. Nothing more wrong: old age is a physiological state, by no means a disease, while physical effort of medium intensity and performed regularly is recommended for elderly people, especially in the fresh air, as well as working outside (Pop, 2019; Sbenge, 1999 cited by Bocu, 2007).

For people belonging to one of the categories elderly, old age or longevity, that is for people above 60-65 years of age, recreational, light physical activities (walking 1-2 hours daily, exercising 20-30 minutes daily), as well as other outdoor activities like hiking, gardening, swimming, cycling, fishing or hunting, are recommended, if allowed from a medical point of view (cardiovascular, locomotor) (Sbenge, 1999 cited by Bocu, 2007).

The benefits of physical activities in aged persons, whether it is aerobic training or anaerobic training, can be physical, by enhancement of the physical health state and increasing the lifespan, mental, by improving mental health and self-confidence and, last but not least, social by active social behavior and social independence. A medium intensity program performed daily on a regular basis has proven positive anti-stress, anti-wear and anti-ageing effects, leading towards a prolonged active life and quality of life (Rooney, 1993; Riga et al., 2004).

Another wrong concept is "I am too old and/or too weak to exercise". In reality, there are very few cases when it is truly recommended that any type of effort be avoided. There are cases when, regrettably, even family physicians do not encourage or even advise against physical activity

of aged people, as they do not have enough knowledge in the field. Surely, there are chronic diseases where effort is counter-indicated, but it is disputable to what extent chronic diseases represent a true insurmountable barrier for recommending physical exercise in aged people. Truly, chronic diseases are not curable but in most cases, they can be controlled through the appropriate therapy and through adjuvant means, such as certain types and intensities of physical activity. Even in the case of certain chronic diseases (certain cardiovascular diseases, diabetes mellitus), where in the past it was considered that physical exercise is completely counter-indicated, it was shown that, if effort is introduced and performed under control, before the onset age of the disease (usually in adults), but even afterwards, it can have beneficial effects (Dumitru, 2006; Polidori et al., 2000).

During the last years, in a number of European countries there were reports of interventions of communities for promoting physical activity amongst senior citizens (for example programs for improving balance and physical coordination of elderly adults, including prevention of muscle weakness and falling, as well as education and counselling for physical activities). Successful communication campaigns were also reported destined to raise awareness of the population regarding the benefits of physical activities and increasing the number of people who are physically active. Some campaigns addressed all citizens, while others aimed at vulnerable groups such as children and senior citizens (***, 2016).

The influence of the pandemic on the mortality of the population

The pandemic caused by the SARS-CoV-2 virus led to a direct or indirect increase in mortality rates in 2020, the causes being: the decline of life expectancy at birth and the rise in death probability according to age group.

Data published by the National Institute for Statistics in Romania (INS) show a decline of life expectancy in Romania in 2020 by 1.3 years as compared to 2019, a number of deaths with 37000 higher than in 2019 (19%), the number of 300000 respectively. According to gender, the decline in life expectancy was higher than 1 year and 6 months in men, as compared to only 10 months in women (***, 2018; ***, 2019).

Within the predominantly negative context of the pandemic and of the measures taken (restrictions regarding admittance to hospital, treatment, medical interventions) 46% of deaths occur in patients with other diseases, 13% in patients with non-COVID respiratory diseases and the remaining 41% are caused by the new Coronavirus (Ghețău, 2021).

The increase in number of deaths caused by non-COVID cardiovascular and respiratory diseases might be caused by negative effects of the increase of social isolation on coronary heart diseases and strokes in old age people living alone and classifying the deaths as due to respiratory diseases, caused by the SARS-CoV-2 virus.

Life expectancy in Romania and the impact of the pandemic on the birth rate

Although life expectancy at birth in Romania rose between the years 2000-2019 by 4 years (from 71.2 to

75.6 years), the COVID-19 pandemic reversed some of these gains, as life expectancy reached 74.2 years, while the decrease of 1.4 years is double as compared to the European mean of 0.7 years (Șerb, 2021; Coman, 2021; Neagu, 2021).

There is an internal demographic dynamics, the one between the status and the movement of population. The status, as number and structure according to ages, determines the dimensions of annual fluxes of demographic events, births and fatalities, while movement in its turn builds the status of the population through the size of the population according to ages derived from births (Ghețău, 2021). As in Romania, in the current rural, but even urban populations, which are impoverished of young population by internal and external migration and the low level of birth rate during the last 3 decades, an "explosion" of the number of births which exceeds the number of fatalities cannot take place, it is estimated that in 2050 the population of the country will reach approximately 15-16 million inhabitants. Romania will therefore become a country which is not sustainable from a demographic point of view, as a population which is in natural decline for a long period of time and which suffers an irretrievable deterioration of the age structure, cannot return to natural growth through internal resources Ghețău (2021).

For these estimations, the national and international sources take into consideration the following factors: the natural growth, calculated based on birth rate and mortality, demographic aging, the ratio between the working-age population, the young population and the old population, the work capacity (Ghețău, 2021; ***, 2021).

In Romania, the pandemic caused a decline in birth rates: the decrease of the number of newborns with 8900, in 77% of the cases the first child, the main cause of which is the delay of childbirth, giving up having a child, or maternal mortality.

Alongside other causes (for instance migration), the decrease of the birth rate causes the decrease in population (Ghețău, 2021; ***, 2021).

Causes of morbidity and mortality in Romania

In Romania, risky behavior regarding the health is responsible for high morbidity and for more than half of the total of fatalities: high alcohol consumption, excessive smoking, unhealthy diet and reduced physical activity.

Adult obesity is lower than in the EU, even if alcohol consumption and unhealthy diets are higher than the mean in the EU. Additionally, smoking in adults is now a little bit lower than the EU mean, whereas percentages of overweight, obesity and smoking in adolescents are high and have constantly risen during the last years.

According to the report of the European Commission on the state of health 2020, the pandemic revealed the importance of consolidation of primary medical assistance, of prevention services and public health, within a health system, which at present is highly dependent on caretaking in hospitals (Coman, 2021). Nonetheless, in Romania, the healthcare system is still chronically underfunded and expenditures on prevention services per capita are on the last but one rank in the EU, while there is an unprecedented medical exodus (Șerb, 2021; Coman, 2021).

Although Romania significantly increased the expenses on health, it remains the second country in the EU with the lowest expenses in the field, per capita, as well as per GDP share. The underfunding of primary medical assistance and of prevention represent weak spots, which can explain the high mortality rates in Romania, from causes which can be prevented, as well as from causes which can be treated.

The first three causes of death starting with the year 2000 in Romania were considered cardiac ischemic diseases, cerebrovascular accidents and cancer, especially pulmonary cancer. The COVID-19 pandemic brought an excess in mortality and it is considered that the true number of fatalities caused by this disease are probably higher than the reported number of deaths, which is explained twofold by the limited testing, as well as the presence of errors regarding the attribution of death causes (Șerb, 2021; Coman, 2021; Zaim, 2021; Neagu, 2021).

The impact of the pandemic on the geriatric population

The geriatric population is more vulnerable to the pandemic caused by the SARS-CoV-2 virus. Numerous studies showed data in this respect from elderly people with comorbidities relating to decrease of life expectancy and the mortality risk (Malik et al, 2021; Locatelli & Rousson, 2021; Upadhyay & Shukla, 2021; Ahmed et al., 2021; Promislow, 2020; Wang et al., 2020; Heuveline, 2020; Posch et al., 2020; Burton et al., 2021; Goldstein et al., 2021).

Conclusions

1. The increasing number of geriatric population is a current demographic phenomenon.
2. The increase of life expectancy during the last decades is associated to the increasing number of geriatric population.
3. The pandemic with the SARS-CoV-2 virus has a negative impact on the geriatric population and on life expectancy.
4. The increase in life expectancy implies rational nutrition, appropriate physical activity, antioxidant therapy and appropriate treatment of comorbidities.

Conflict of interests

The authors declare no conflict of interest.

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