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SELECTED CHALLENGES OF THE ELDERLY IN THE CONTEXT OF CLIMATE CHANGE

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ABSTRACT: The purpose of the article is to diagnose challenges related to the needs of seniors having to do with climate change. Selected challenges are addressed in detail, i.e., seniors' greater exposure to the effects of climate change, and seniors' limited digital competence and financial resources, which are important barriers to minimising the negative effects of climate change. The practical goal is to develop recommendations for improving the situation of seniors in the face of climate change. The issue of ageing in the context of climate change can be considered original. There is a clear gap in the literature in this area, although it is indicated that this is one of the most important challenges of this century globally. Research is conducted in theoretical and empirical dimensions. The theoretical parts present an analysis of literature on the subject, legal acts and source materials of EU institutions. In the empirical part, the first step was to define the data necessary for the empirical analysis and to define the geographic area to which the data were to apply (the EU). The analysis was carried out using descriptive statistical methods. This part also includes a comparative analysis of issues related to the ageing of the population in individual EU member states, causes of death in older people broken down by the most common diseases (for the EU), digital competence of EU residents broken down by age group, and income of older people in the EU. The empirical part is based on an analysis of data from the Eurostat database. Some limitation in rearranging the data was their limited availability, i.e. not all the most up-to-date data applied to all countries. The article presents only those data for which values were obtained from all countries and then aggregated to EU values. Three hypotheses were put forward, which are addressed in the final part of the article. Our analysis shows that the elderly are already more severely affected by climate change, as they are overwhelmingly at risk of cardiovascular disease, respiratory disease, as well as pandemic illnesses and mental disorders. Added to this is a health and social care system that is inadequately prepared for these challenges Cognitive barriers quite prevalent in the elderly group, along with language and technological barriers, which can effectively limit the ability to minimise the negative effects of climate change. Our analysis shows that seniors are a marginal group of Internet users worldwide, which, among other things, may make it more difficult to access hazard warnings and information on how to respond and more vulnerable to mortality in the wake of extreme weather events. We assume that a lack of digital competence significantly impairs seniors' quality of life. Our analysis shows that the financial resources of the elderly are already limited, and many seniors are not coping financially. Certainly, this situation will make it much more difficult or even impossible to adapt, at least in terms of the housing conditions of seniors, to the needs of the changing climate. The end result of the article is a list of recommendations for public authorities to improve the situation of the elderly in the face of climate change, broken down into the following categories: greater vulnerability of the elderly to the effects of climate change; relatively low digital competence of the elderly in the face of climate change; limited financial resources of the elderly in the face of climate change.

KEYWORDS: ageing population, climate change, extreme weather events, digital competencies, financial resources

Introduction

Europe has a growing ageing population. According to forecasts, by 2070, nearly 30% of the European Union's population will be people over 65. Population ageing is an important challenge for the policies of European countries in a broad economic, social, political and environmental context. The issue is multi-faceted and concerns, on the one hand, the provision of a variety of leisure activities for active seniors, and on the other, the need to organise health care, including long-term care for dependents.

At the same time, the process of adverse climate change, resulting from air pollution, smog, unsustainable production and consumption, is proceeding rapidly. Over the past 150 years, the average temperature has increased by almost 0.8°C globally and about 1°C in Europe. It is estimated that by 2100, the global temperature could rise another 1.8-4.0°C. Compared to the pre-industrial era, this means a temperature increase of more than 2°C. Above this threshold, the risk of irreversible changes increases significantly (European Environment Agency, 2016).

The overlap of the above phenomena is related to the yet little realised challenge of climate change-related health security for the elderly. Our analysis shows that the elderly subjected to harsh environmental factors, including the effects of climate change, will become one of the most vulnerable social groups in terms of health (e.g., the strain on the body caused by heat waves in summer or smog in winter), social (e.g., alienation resulting from the inability to stay out of facilities in smog, heat waves, heavy rains) and economic (e.g., the cost of equipping and maintaining homes with air conditioners, air purifiers). In addition to seniors, these groups include children and people with complex health problems, including those with disabilities. However, given the intensifying nature of climate change and its growing number of consequences, the oldest generation will be particularly affected. This is because the result of these changes is a series of processes that will directly or indirectly affect the health and living conditions of the elderly. The most severe phenomena will certainly include extreme heat waves for weeks, unpredictable weather phenomena such as heavy rains, tornadoes or months-long droughts, as well as the spread of infectious diseases and the degradation of ecosystems. The elderly are more sensitive to changes in the environment and less resistant to the impact of harmful and infectious agents and toxins. Seniors also have a higher disease burden than people of younger ages. As a result, the elderly are less able or even incapable of adapting to changing external factors. Improper habits and lack of adequate response can lead to severe heatstroke and dehydration in the elderly, and this can exacerbate existing medical conditions. Equally dangerous are other extreme weather events, e.g. floods, hurricanes or fires, which carry the risk of impairing the health and even death of the elderly, due to impaired physical and mental fitness, in situations where a quick and efficient response is important. Many are unable to ensure their own safety, decide to evacuate, secure their homes against strong winds or floods, or escape from danger in time. In this situation, it is crucial not only to prevent further aggravation of climate change, but also to develop effective solutions for improving the health and living conditions of seniors, as well as preventive measures, better adaptation of the health care system, improving the system of information exchange and warning, and expanding the scope of cooperation between institutions at different levels (local, national and international).

The issue of the impact of climate change effects on the health and living conditions of seniors is therefore a broad issue, requiring consideration of many factors and areas of impact. Thus, both globally progressive climate change and population ageing around the world are seen as key challenges and problems for humanity as a whole, and in particular for countries where the elderly are the fastest-growing age group. Despite the importance of the problem, analysis in this area has so far been limited, although the number of studies has clearly increased in the past few years. It is therefore still an important research gap, which prompted the authors of the article to take up this topic

The purpose of the article is to diagnose the challenges associated with the needs of the elderly, having to do with climate change. The introduction to the assessment of the issue at hand is a synthetic analysis of the nature and dynamics of climate change and the ageing process. Based on the assumption that the poorest and most vulnerable communities are affected first by climate change, selected challenges related to the needs of seniors are addressed in detail, namely: the greater vulnerability of the elderly to the effects of climate change, and the limited digital competence and financial resources of the elderly, which are important barriers to minimising the negative effects of cli-

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mate change. Research is conducted in theoretical and empirical dimensions. The theoretical parts present an analysis of literature on the subject, legal acts and source materials of EU institutions. In the empirical part, the first step was to define the data necessary for the empirical analysis and to define the geographic area to which the data were to apply (EU). The analysis was carried out using descriptive statistical methods. This part also includes a comparative analysis of issues related to the ageing of the population in individual EU member states, causes of death in older people broken down by the most common diseases (for the EU), digital competence of EU residents broken down by age group, and income of older people in the EU. The empirical part is based on an analysis of data from the Eurostat database. Three hypotheses are put forward, which are addressed in the final part of the article. The conclusion develops recommendations for public authorities to improve the situation of older people in the face of climate change.

Issues analysed

Climate change

Carbon dioxide emissions from the burning of fossil fuels have increased dozens of times since the Industrial Revolution. In 1850, less than 1 billion tons of CO_2 were emitted, while today global emissions have reached 38 billion tons of CO_2 per year (WWF, 2020). This situation has led to an increase in the Earth's surface temperature. Over the past 150 years, the average temperature has increased by almost 0.8°C (European Environment Agency, 2016). Globally, 2024 was the warmest year in more than 100,000 years, with the global average temperature rising 1.28 degrees C above the 20th-century baseline (1951-1980) and 1.47 degrees C warmer than the mid-19th century average (1850-1900), surpassing even the record set in 2023 (Bardan, 2025) (Figure 1). Global average temperatures during the 12 months of 2024 reached record highs in every month (Younger, 2024). The Intergovernmental Panel on Climate Change (IPCC) estimates that global temperatures could increase another 1.8- 4.0 ºC by 2100 (European Environment Agency, 2016). Compared to the pre-industrial era, this represents a temperature increase of more than 2 ºC. Above this threshold, the risk of irreversible, catastrophic changes increases significantly. "Not every year is going to break records, but the long-term trend is clear. We're already seeing the impact in extreme rainfall, heat waves, and increased flood risk, which are going to keep getting worse as long as emissions continue." said Gavin Schmidt, director of NASA's Goddard Institute for Space Studies (GISS) in New York (Bardan, 2025).

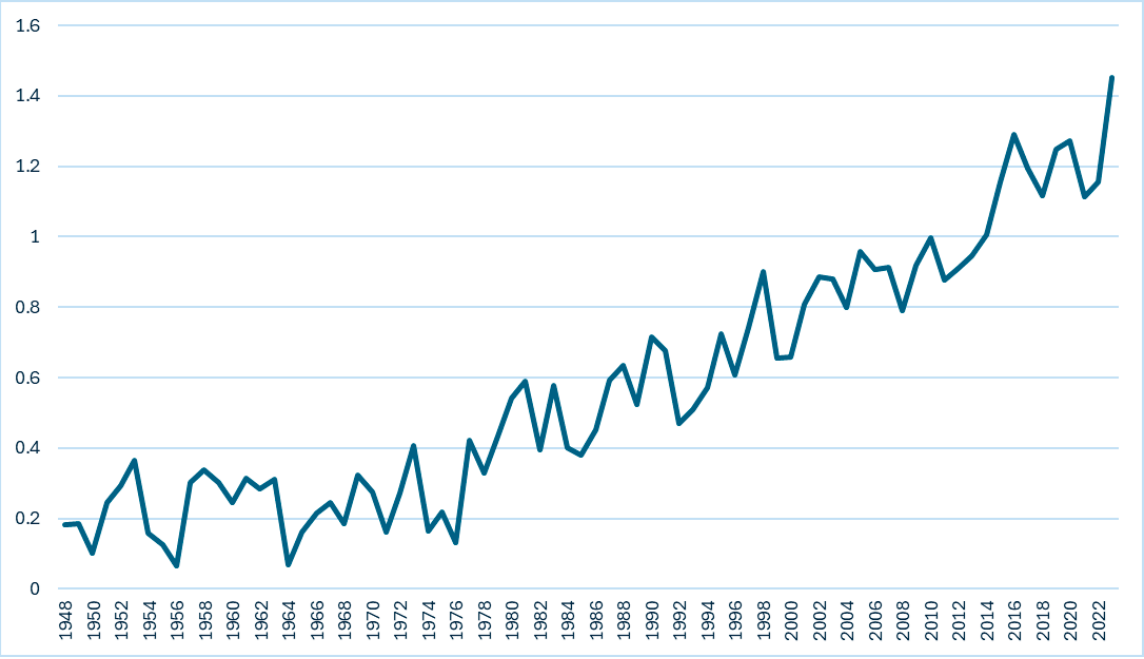

Figure 1. Increase in annual average global temperature relative to 1850-1900 baseline (in degrees C)

Source: authors' work based on Eurostat data.

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Europe is the fastest-warming continent. Since the 1980s, the continent's warming has been about twice as fast as the world's. In 2022, a record hot summer is estimated to have led to 60-70,000 premature deaths in Europe (European Environment Agency, 2024a). However, analysing data on the estimated additional deaths per year worldwide between 2030 and 2050 due to the negative effects of climate change (including extreme heat, natural disasters, or changing infection patterns) indicates a figure of 250,000 (WHO, 2018). The average annual temperature over European land areas in the last decade was 2.12 to 2.19°C higher than in the pre-industrial period (European Environment Agency, 2024b). 2023 was the second warmest year on record in Europe, while the warmest year on record for European measurements so far was 2020, with an anomaly range of 2.53 °C to 2.71 °C above pre-industrial levels. Particularly high warming was observed in Eastern Europe, Scandinavia and the eastern part of the Iberian Peninsula.

Temperatures in European land areas are projected to continue rising at a faster rate than the global average. Terrestrial temperatures in Europe are expected to rise by a further 1.2 to 3.4 °C or 4.1 to 8.5°C by 2071-2100, depending on the scenario, compared to 1981-2010 (European Environment Agency, 2024). The highest level of warming is forecast in northeastern Europe, northern Scandinavia and inland areas of Mediterranean countries. The lowest warming is expected in Western Europe, especially in the UK, Ireland, western France, Benelux and Denmark.

Ageing population

Europeans are living longer and healthier lives. Over the past fifty years, life expectancy at birth has increased by about 10 years for both men and women. In 2022, life expectancy at birth will be 80.6 years. In 2070, life expectancy is projected to be 86.1 years for men (78.2 in 2018), and 90.3 years for women (83.7 in 2018) (European Commission, 2020). At the same time, since at least the 1960s. (with the exception of the first decade of the 2000s) The birth rate has been declining. In 2018, the fertility rate was 1.55, and in 2022. – 1.46. Some EU countries have low or extremely low fertility rates (e.g. Malta – 1.08, Spain – 1.16, Italy – 1.24, Poland – 1.29) (Eurostat, 2024b). In 2022, 2 times fewer children will be born than 6 decades ago.

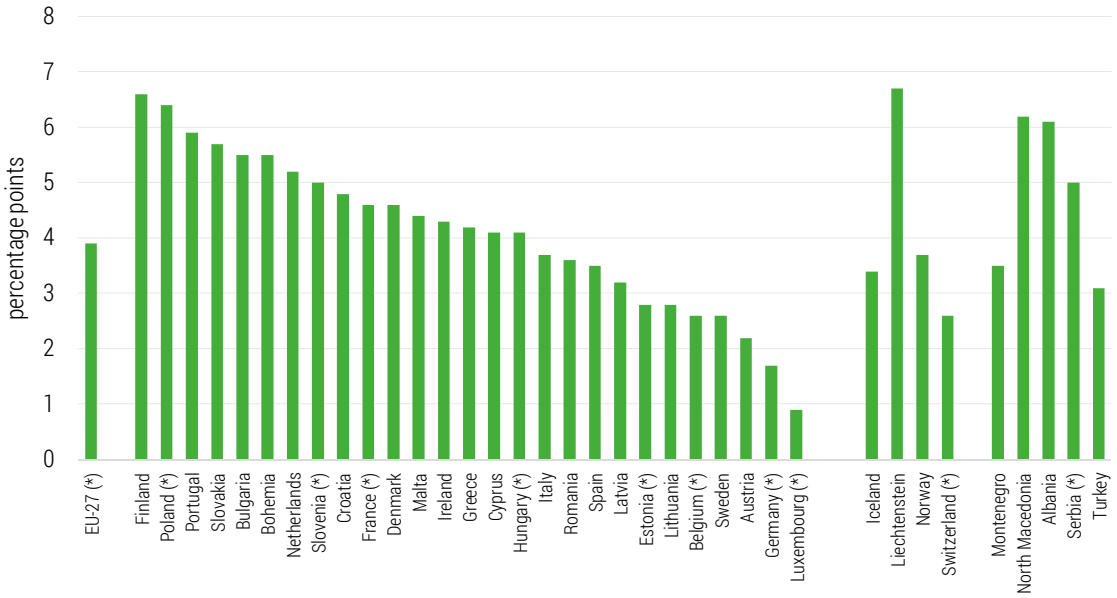

Figure 2. Increase in the share of the population aged 65 years or over, between 2009 and 2023

Source: authors' work based on Eurostat data.

(*)Break in the time series in various years between 2009 and 2023

Increasing life expectancy with low birth rates is causing the population structure by age to change, with a significant increase in the proportion of elderly people. Currently (2023), more than one-fifth of the EU population (21.3%) is made up of people 65+ (Eurostat, 2024c). In one decade alone (2003-2013), the share of people 65+ in some countries increased significantly – most signifi-

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cantly in Poland by 5.5 p.p., Slovakia by 4.8 p.p., Hungary by 4.6 p.p.. The dynamics of these changes are increasing – between 2009 and 2023, the share of people 65+ continues to increase – in Poland by 6.4 p.p. already, and in Slovakia by 5.7 p.p. (Figure 2). It is estimated that by 2070, the share of older people in the total EU population will rise to 30%. Thus, it is indicated that Europe is the continent with the most advanced ageing process.

At the same time, the share of senior citizens will increase significantly. It is expected that in 2019-2070, the proportion of people aged 80+ will more than double and reach 13%. At the same time, these changes will take place differently among men and women – especially the share of the oldest women will increase significantly. The share of women aged 85+ in 2100 will rise to 5.5% of the total population from 1.9% in 2019.

It should be noted that population ageing is a phenomenon that generates a number of social, economic and political agendas (Kubiciel-Lodzińska, 2022) and entails economic, budgetary, welfare, health, social, infrastructural and communication adjustments that societies will have to face in the coming years (Bogetic et al., 2015). The ageing of the population causes a decrease in income and a reduction in the availability of resources, due to, among other things, lower incomes (pensions), but also higher running costs (Kastor & Mohanty, 2018), such as for medicines or health and care services.

Research methods

Research on the challenges of the elderly in the context of climate change is conducted in theoretical and empirical dimensions, to a limited extent. Performing a preliminary analysis of the literature, it was recognised that this phenomenon has been gaining prominence over the past few years (an analysis of the Scopus database in September 2024 identified 1,130 papers in which keywords such as “climate change” and “older” (or “older adults” or “senior” or “ageing” or “aged”) appeared, half of which were published in the past three years. This paper is based on a literature review and data analysis.

The purpose of this article is to diagnose the challenges associated with the needs of the elderly related to climate change. The scope of the analysis conducted for the purpose of this article is shown in Figure 3.

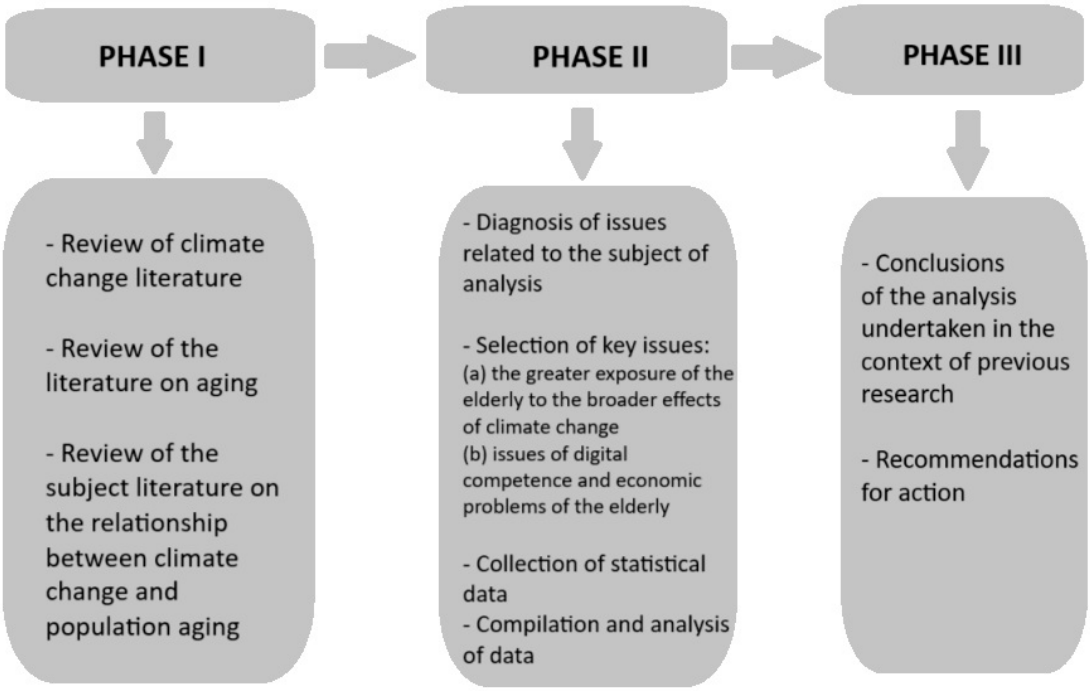

Figure 3. Phases of the research process

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The theoretical parts present an analysis of literature on the subject, legal acts and source materials of EU institutions. The literature review made it possible to define the research gaps in this area and, consequently, to define the research objective and research hypotheses. As indicated, the issues of interest were the identification of challenges related to the needs of the elderly, having to do with climate change, followed by a detailed analysis of selected among them. In the latter context, the issue of the nature of the elderly's vulnerability to the effects of climate change was recognised, as well as the extent of the digital competencies and financial resources of the elderly, which may be an important factor in influencing the effects of climate change, e.g., in terms of accessing information about the risk of extreme weather events, buying air conditioning or health or property insurance.

We put forward the following hypotheses:

- Q1 – of climate change on the situation of the elderly are multifaceted and complex in nature
- Q2 – Due to the nature of the currently most common causes of death in the elderly, the exposure of seniors to the negative effects of climate change is high,
- Q3 – limited digital competency and financial resources of seniors can be a significant barrier to minimising the negative effects of climate change.

The next step was to define the data necessary for the empirical analysis and to define the geographic area to which the data were to apply. It was felt that the issue would be analysed in the context of the EU as a whole, since both population ageing (Europe is the most ageing continent) and climate change (Europe is the fastest warming continent) are uniquely felt here.

The article is cross-sectional in nature, based on a review of the literature on the subject and analysis of statistical data from the Eurostat and Statista databases. Some limitation in rearranging the data was their availability: access to some of the data of all EU countries oscillated in 2021, and some of the full data was available for 2024. Lack of access to data within individual EU countries posed a problem for their aggregation, which meant that the article presents only those data for which values were obtained from all countries (and then aggregated to EU values)

The analysis was carried out using descriptive statistics methods (tabular description, graphical presentation of results, and determination of distribution measures using the arithmetic mean). This part also includes a comparative analysis of issues related to population ageing in individual EU member states, causes of death in older people broken down by the most common diseases (for the EU), digital competence of EU residents broken down by age group, and income of older people in the EU. The detailed scope of the analysis is as follows:

1. Trends in heat-related mortality (2000-2020):

   Data on the annual number of heat-related deaths per million people per decade in Europe for the general population from 2000 to 2020 were obtained from the Eurostat database. Changes in the number of heat-related deaths in different EU countries were analysed, taking into account changes over time. A map chart was used to visualise these trends, allowing the spatial distribution of deaths in Europe to be shown in the context of rising temperatures and heat waves.
2. Causes of death among people 65+ in the EU (2011-2021):

   Data on causes of death among people aged 65 and older in EU countries from 2011 to 2021 were taken from Eurostat. The analysis included the main causes of death, such as cardiovascular diseases, cancer, respiratory diseases and other causes. A bar chart was used, which shows the average number of deaths in each cause category for EU countries, allowing comparison of the distribution of causes of death over the analysed period.
3. Distribution of Internet users worldwide by age group (2024):

   Data on the distribution of Internet users worldwide by age group in February 2024 was downloaded from Statista. The percentage of Internet users in different age ranges around the world was analysed. A pie chart was used, which illustrates the proportion of Internet users by age group, allowing visualisation of the global distribution of users.
4. Internet use in the European Union (2009-2024):

   Data on Internet use in the European Union from 2009 to 2024, broken down by age group, were downloaded from Eurostat. Time trend analysis was applied, examining changes in the number of Internet users by age group over the analysed period. The results are presented in a column chart, which shows the changes in Internet availability in the European Union by different age groups.

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5. Mean equivalized net income in the EU by two age groups from 2007 to 2023: Data was taken from Eurostat. Differences in net income between the two age groups over the years were examined. A column chart was used for the analysis, which illustrates changes in net income over different periods, allowing comparison of income levels across the age groups analysed.

The use of appropriate visualisation tools made it possible to interpret the results and compare trends in different research areas.

Results of the research

Since the effects of climate change are indeed affecting society as a whole, but especially people from disadvantaged groups, it would seem that awareness of the need to take environmental action and minimise the negative effects of climate change should be significant in these groups. Meanwhile, there is little research on attempts to explain the lack of pro-environmental behaviour among the elderly. Mainly, the belief that "a single person cannot make a difference" persists, compounded by a lack of knowledge and disbelief in the negative predictions associated with a changing climate (Moody, 2014; Moody, 2017). It also appears that older people are less likely to believe that climate change is real and that it is the result of human action (Milfont et al., 2021).

In the literature, the most commonly cited climate challenges faced by the elderly are (Prina et al., 2024):

- temperature extremes (Schneider et al. 2017; Page et al., 2012; Åström et al., 2011; Hajat & Kosatky, 2010);
- fires (Xu et al., 2020; Liu et al., 2017);
- droughts (Hayes et al., 2018);
- Floods, storms, sea level rise (Gotanda et al. 2015; Mimura, 2013; Alderman, 2012);
- air quality (Di et al., 2017; Zanobetti & Schwartz, 2008; Bell, 2008);
- climate-sensitive infectious diseases (McMichael, 2013; McMichael et al., 2006; Gavazzi & Krause, 2002);
- food and water insecurity (HelpAge International, 2014; Bates et al., 2008);
- health and welfare system (Ebi & Semenza, 2008);
- Displacement, migration, relocation (Rigaud et al., 2018; McLeman & Smit, 2006);
- vulnerability and resilience of the elderly to existing risks (Bayraktar & Yilmaz, 2018; Andrews & Phillips, 2004);
- low digital competence (Iyengar & Kazimzade, 2025; Focacci, 2024)
- economic issues (Vincent & Velkoff, 2010;).

The remainder of the article focuses on two general issues: the greater exposure of the elderly to the broader effects of climate change, and the digital competence and economic resources of the elderly.

Greater vulnerability of the elderly to the effects of climate change

The elderly are among the social groups most vulnerable to the negative effects of climate change, as a result of a number of factors, but the main ones include: physiological vulnerability to extreme weather events, limited mobility and responsiveness, and economic issues.

When analysing physiological vulnerability to extreme weather events, it is worth highlighting the fact that the elderly are more susceptible to the negative effects of heat waves, which include dehydration, heatstroke, increased blood viscosity, deterioration of health due to pre-existing chronic diseases, mainly cardiovascular, and extremely high temperatures can even lead to kidney failure (U.S. Global Change Research Program, 2016). Literature studies show that during heat waves, it is in this age group that mortality significantly increases (Gabriel & Endlicher, 2011). Additionally, the presence of comorbidities and the use of multiple medications by the elderly negatively affect the body's ability to thermoregulate (Díaz, 2022).

In recent decades, extreme heat has been by far the leading cause of reported deaths from extreme weather and climate events in Europe. Between 2000 and 2020, heat-related deaths increased in 94% of monitored European regions (Figure 4). An estimated 55,000 to 72,000 people died each

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summer of 2003, 2010 and 2022 due to heat waves (Copernicus Climate Change Service, 2023). The most affected regions were in the central and southern parts of the Iberian Peninsula, where the number of additional deaths increases by 40-50 for every one million people per year. In 2003 and 2010, prolonged heat waves arose, which were dubbed "mega heat waves" due to the deaths of tens of thousands of people (Barriopedro et al., 2011; Korzeniecki, 2015). The most vulnerable groups, i.e. the elderly, chronically ill and children, were found to be particularly vulnerable to the heat waves (Krzyzewska, 2014).

The impact of heat on human health is particularly pronounced in cities as a result of the urban heat island effect (Singh & Kalota, 2019; Michalak et al., 2022). In this case, urban environments are much warmer than the surrounding rural areas, especially during periods of hot weather, due to the abundance of paved surfaces, buildings, vehicles and heat sources (Diamantini & Vettorato, 2011; Gartland, 2008). Additionally, it is common for seniors, for economic reasons and hindered mobility, not to leave the city during hot weather, often staying in non-ergonomically designed neighbourhoods with little greenery to protect against high temperatures (Michalak et al., 2022).

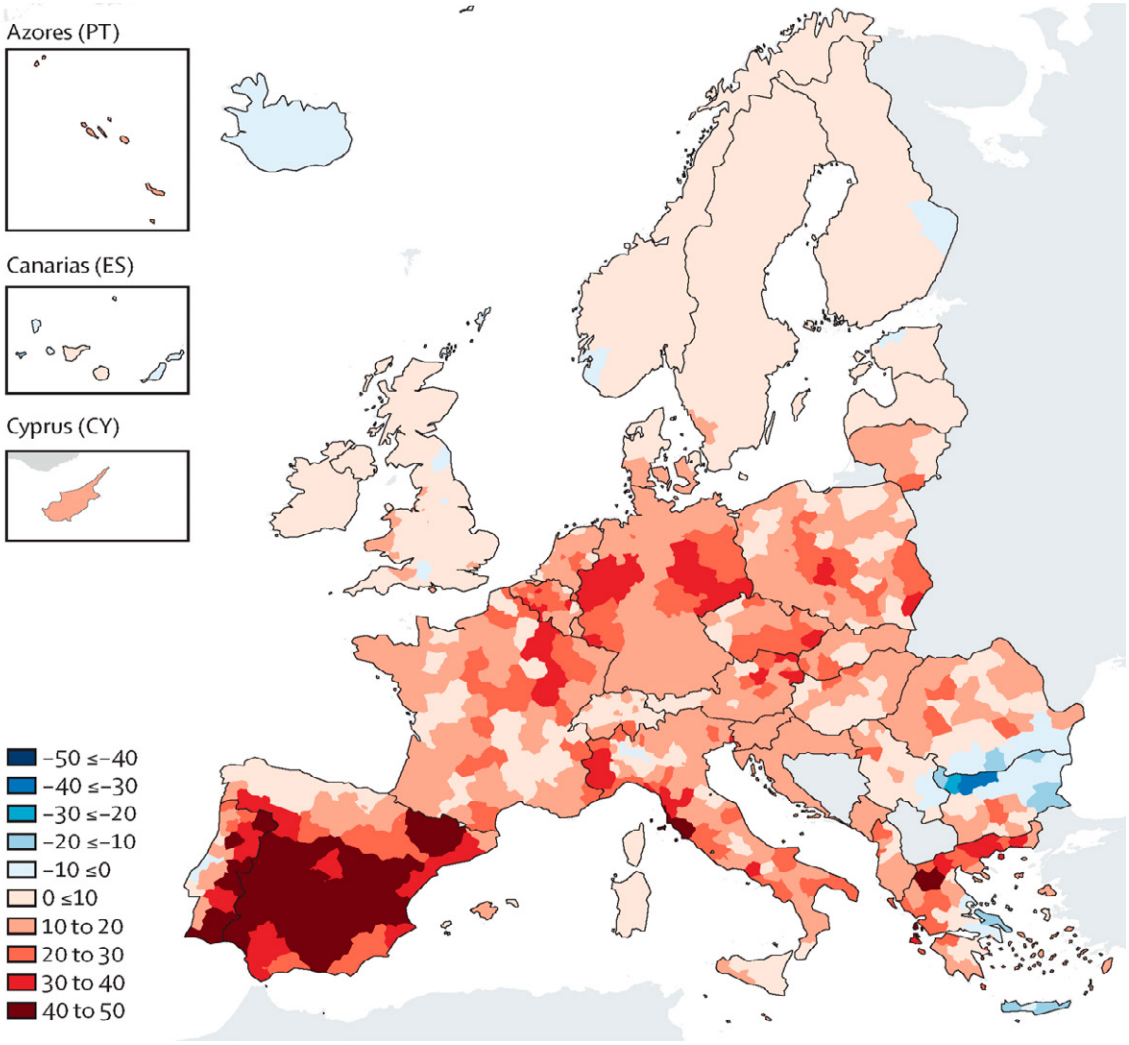

Figure 4. Trends in heat-related mortality (annual number of deaths per million per decade) in Europe for the general population (2000-2020)

Legend: *red shades – increasing trend, blue shades – decreasing trend.*

Source: https://climate.copernicus.eu/esotc/2023/extreme-weather-and-human-health

Climate change-related heat waves, but also forest fires, storms and floods, virus-borne diseases and mental health disorders such as anxiety, depression and post-traumatic stress disorder, can exacerbate existing problems, including existing illnesses and deaths. In the case of floods, they can be a source of health problems for the elderly due to exposure to moisture or mould, or due to contact

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with contaminated water (Intergovernmental Panel on Climate Change, 2022). The situation of the elderly is particularly unfavourable in this context, as among the leading causes of death among seniors today are diseases that are influenced by climate change (Figure 5).

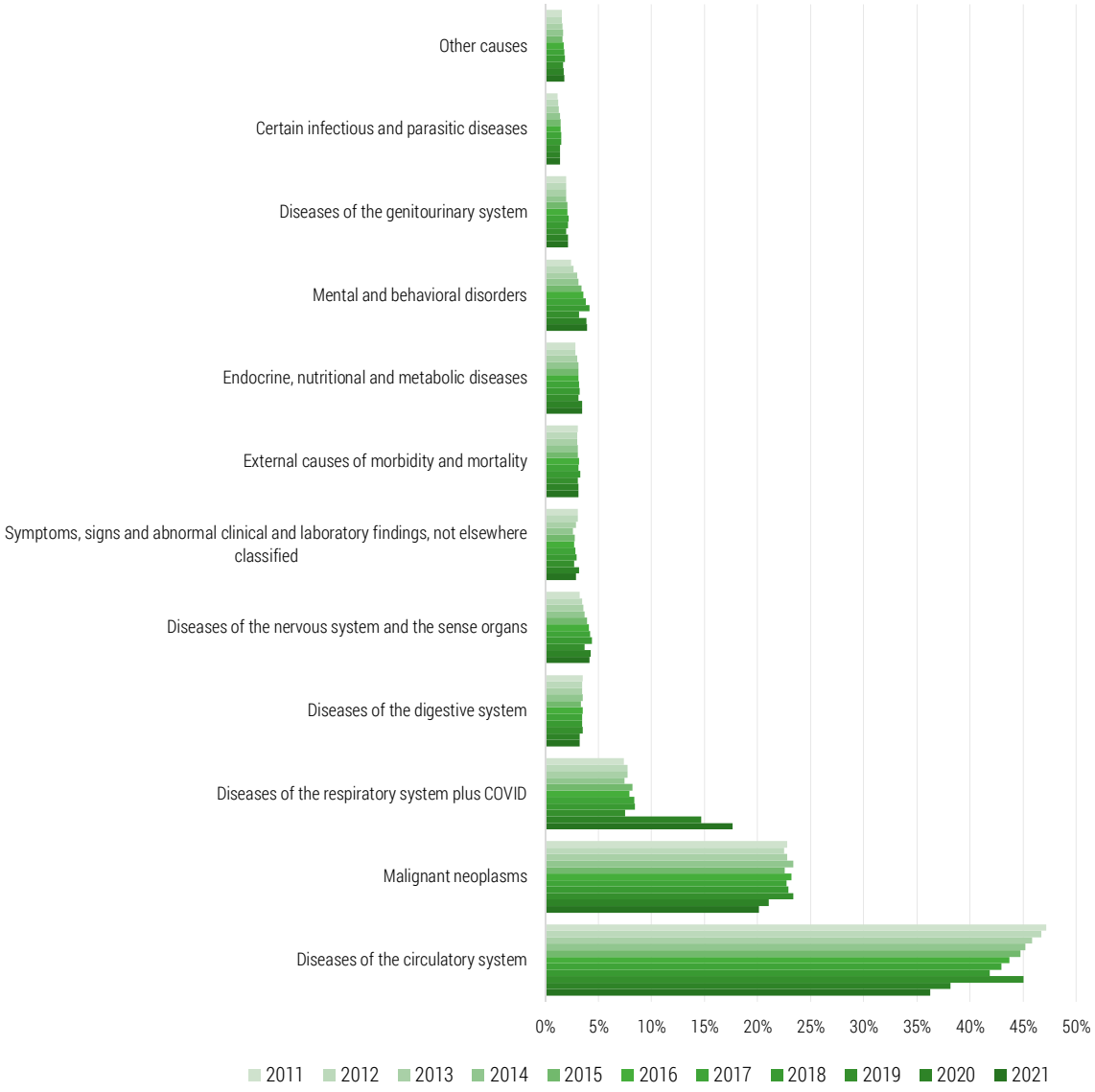

Figure 5. Causes of death – deaths for the age group 65 and over – average for EU countries (2011-2021)
Source: authors' work based on Eurostat data.

In 2021, there were 5.3 million deaths of residents in the European Union. Of these, 84.4% of the total involved people were aged 65 and older. More than a third (35.7%) of all deaths in the elderly population were due to cardiovascular disease. The second most common cause of death among the elderly was malignant neoplasm, accounting for one-fifth (20.1%) of all deaths. The third most common cause of death among seniors was respiratory diseases (17.5%), including mortality from COVID-19 (11.1%). Among those under 65, the two leading causes of mortality were reversed: malignant neoplasm was the most common cause of death, accounting for 30.6% of deaths in this age group, while cardiovascular disease was the second most common cause of death (19.6%). The COVID-19 mortality rate among the elderly was 504 deaths per 100,000 elderly residents, while the rate among those under 65 was 21 deaths per 100,000 residents (Eurostat, 2024a). Also prominent among the causes of death among the elderly are nervous system diseases and mental and behavioural disorders, which together account for 8.1% of deaths.

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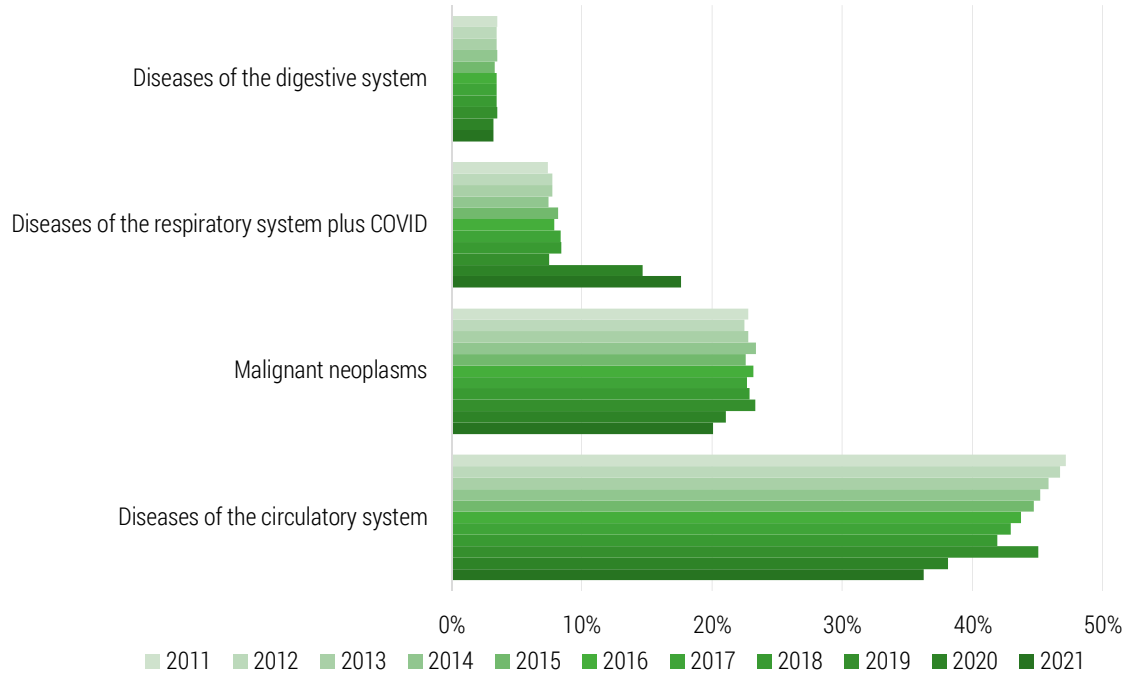

Figure 6. Most common causes of death in the age group of 65 and over – average for EU countries (2011-2021)
Source: authors' work based on Eurostat data.

Figure 6 shows four main causes of death among people 65 and older in the EU from 2011 to 2021. Deaths from malignant neoplasms characterise stable growth, a high level (but quite varied over the years) of deaths from cardiovascular diseases, and a large increase in deaths from respiratory diseases, including COVID, which is not surprising, since 2021 was the peak of the COVID-19 pandemic (Klemens, 2024).

Extremely important in the situation of elderly people exposed to the negative effects of extreme weather events is their limited mobility and responsiveness, which significantly hinders their ability to evacuate during natural disasters (Haq et al., 2010). Their reaction times tend to be longer than those of younger people, which can be compounded by diseases of the musculoskeletal system or paralysis associated with heightened levels of anxiety. Dependence on outside help, such as family, neighbours or emergency services, further increases their vulnerability.

Digital competence and financial resources of older people

Some older people have low digital competencies and rarely or not at all use modern devices and media: smartphones, the Internet, social media (Michalak et al., 2022). Internet users around the world are mainly young people. One in three of them is between 25 and 34 years old, and one in five is between 18 and 24 years old. The share of those aged 65 and over is marginal (about 4.2%) (Figure 7).

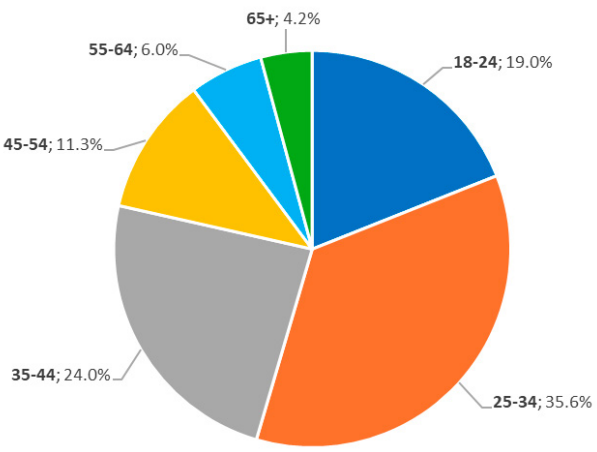

Figure 7. Distribution of internet users worldwide as of February 2024, by age

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The percentage of people using the Internet in the EU is consistently very high, especially in the 16-24 age group, and high with an increasing trend in the 25-64 age group. In the case of older people (age group 65 to 74), the largest upward trend in the analysed years is visible (from about 20% to almost 80%) (Figure 8). The data presented do not specify the forms of Internet use, but show the baseline digital competence in this aspect.

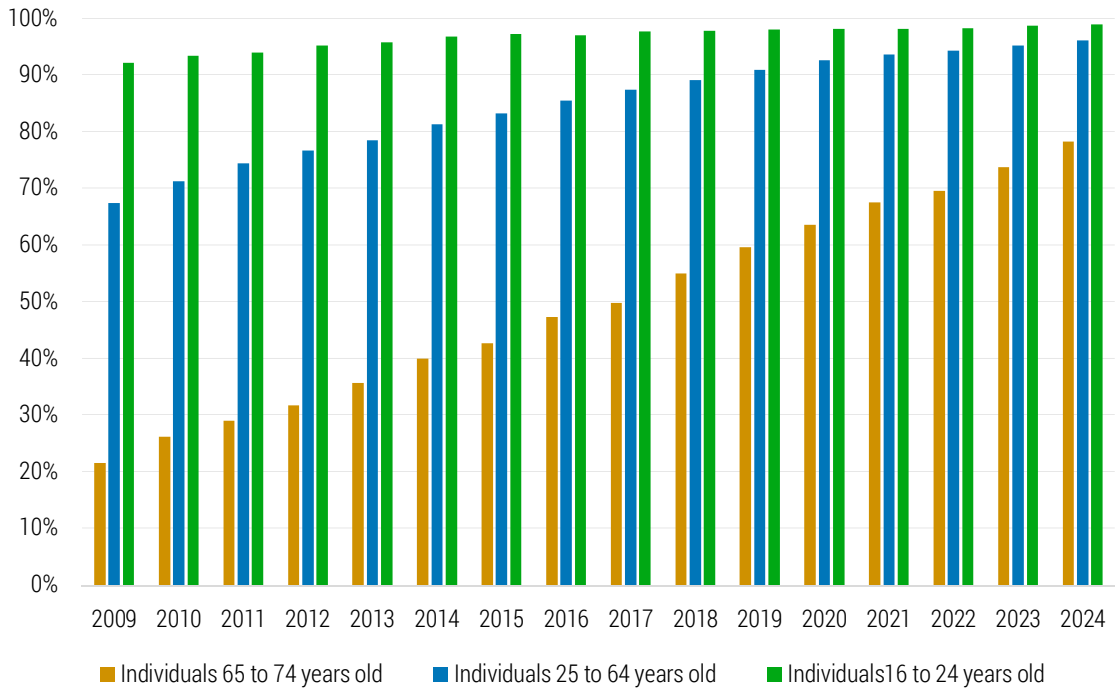

Figure 8. Internet use in the European Union from 2009 to 2024 (by age group)

Source: authors' work based on Eurostat data.

Although seniors in the EU are more likely to use modern technologies, they still use them to a lesser extent compared to other age groups (Figure 8). In the context of climate change, this situation can be a significant barrier for seniors in terms of accessing information (Hunsaker & Hargittai, 2018) about extreme weather risk messages or in terms of limiting the ability of seniors to receive medical assistance, both during and after an ongoing extreme event (see also: Michalak et al., 2022).

The elderly also often have limited (free) financial resources, which can contribute to limited access to adequate resources, such as air conditioning, adequate medications, or health and property insurance to protect against the effects of natural disasters (Haq & Gutman, 2020; Organisation for Economic Co-operation and Development, 2022).

The differences between the average net income of the two age groups in the EU from 2007 to 2023 are presented in Figure 9. During the analysed time period, the disposable income of people in the 65+ age group has consistently been at a negative level. In addition, it is characterised by significant negative deviations (up to -12.7%), despite the fact that the trend is downward (which may be due, among other things, to the larger share of people 65+ in the total population). At the same time, the disposable income of people aged 18-64 was consistently positive, although the values were not significant (up to 4.0% macro). The above data show that the material situation of the elderly, despite improvements in recent years, is still unfavourable. In no year of the analysed period did income have positive values, which means that a significant proportion of seniors may have problems financing basic expenses, such as food, rent and medicine. The material position of the elderly may be important in the context of ongoing climate change, and for two reasons. On the one hand, climate change will be responsible for reducing the quality of life of the elderly, and on the other hand, the cost of equipping and maintaining housing with air conditioners and air purifiers, among other things, will be quite a challenge for seniors.

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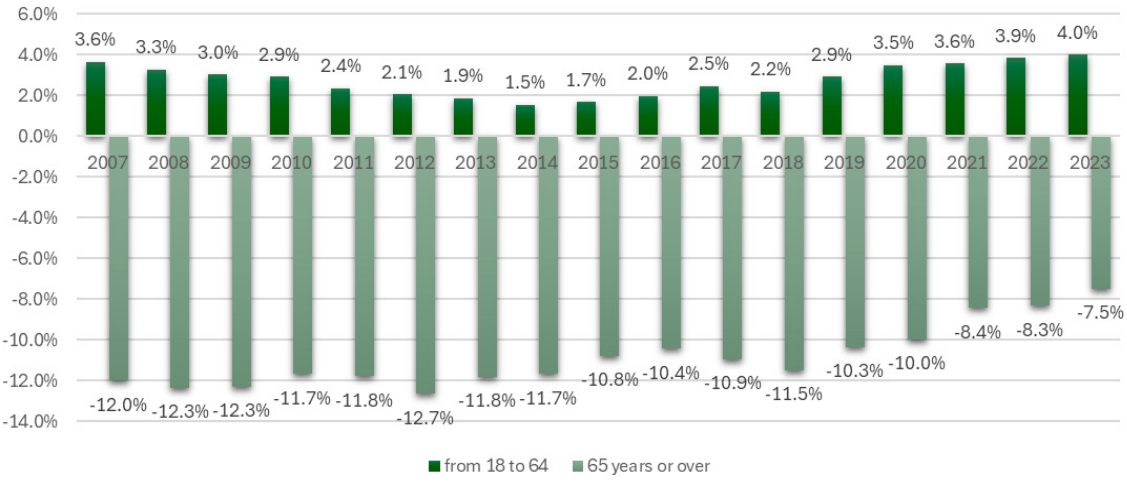

Figure 9. Mean equivalised net income in the EU by two age groups from 2007 to 2023

Source: authors' work based on Eurostat data.

Although adequate infrastructure and housing conditions can help minimise the negative effects of climate change, and the realisation that housing should be designed or retrofitted to provide adequate protection from extreme temperatures, floods or storms (United Nations Human Settlements Programme, 2021), additionally equipped with investments in energy-efficient technologies (e.g. thermal insulation, photovoltaic installations, adequately sealed glazing, properly sized radiators), which can simultaneously reduce greenhouse gas emissions and improve living comfort (International Energy Agency, 2021) – for seniors, such housing conditions are rare, mainly for economic reasons.

Discussion and conclusions

Studies related to population ageing and the impact of climate change on the economy and society have so far mostly been addressed separately, although it should be emphasised that they are among the key challenges of the 21st century. In the area of population ageing, analyses are mainly concerned with the scale and nature of the phenomenon, demographic projections, and challenges for government policy related to population ageing (Heffner et al., 2019). Climate change, in turn, is shown in the broad context of the causes of these changes (World Health Organisation, 2018), the dynamics of climate phenomena and their impact on rising global temperatures, melting glaciers, rising sea levels, but also on economic development and social cohesion. Among them, they point not only to specific changes in the physical environment, such as heat waves, forest fires, floods and deteriorating air quality, but also to health problems, food security and increased migration. In addition, economic losses due to climate change are estimated, as well as challenges and actions to counteract these changes (Romanello et al., 2022; Piguet et al., 2011).

On the other hand, there are relatively few studies showing the relationship between these processes, which means that the issue of ageing in the context of climate change is a clear gap in the literature, although there are voices indicating that this is an example of the most important issues of this century on a global scale (Prina et al., 2024). Research on the relationship between these processes has been conducted mainly in the US, Australia, the UK, and Canada. The interdependence of these phenomena manifests itself in terms of socio-economic effects and public policy challenges

Previous research in this area indicates that climate change will be felt most by the most vulnerable and disadvantaged groups in society. The elderly are mentioned in these studies alongside children, people with disabilities and people with immunocompromised or other comorbidities. Of the groups listed, seniors are the most numerous (Schwela, 2021). A review of the literature shows that this population is characterised by poor adaptive capacity to changing weather conditions, and thus may be directly and indirectly affected by the effects of climate change (Davies & Harwood, 2023). Of particular importance for the health of the elderly are heat waves, including the so-called urban heat island effect, the occurrence of extreme weather events, water, soil and air pollution (Balmain et al.,

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2018; Carnes et al., 2014). Seniors are not only exposed to extreme temperatures and a range of increasingly violent weather changes (such as droughts, floods, storms, sea level rise and wildfires), but also to deteriorating air quality and the spread of climate-sensitive infectious diseases. Experts show the multifaceted effects of climate change on the health of seniors, i.e. vasodilation and edema, perspiration, increased blood pressure and circulatory failure, bursting of blood vessels, reduced respiratory capacity, muscular weakness, appetite and thirst disorders, hyperthermia (Michalak et al., 2022). The health effects of climate change do not exhaust the complexity of the issue. Added to this is an inadequately prepared health and social care system for these challenges. In addition to the lower vulnerability and health resilience of the elderly to climate change, certain economic and social factors are also taken into account, such as seniors' low digital competence and worsening income situation. A review of the literature carried out for the purpose of determining the veracity of hypothesis Q1 thus allows us to conclude that the effects of climate change on the situation of the elderly are multifaceted and complex.

Our analysis shows that the elderly are already more affected by climate change, as they are predominantly exposed to cardiovascular diseases, respiratory diseases, as well as diseases caused by pandemics and mental disorders. Eurostat data shows that more than a third of all deaths in the elderly population in the EU today are due to cardiovascular diseases. They are a key cause of mortality among seniors. In addition, almost one in five seniors dies from respiratory diseases, and specifically from COVID-19 infectious diseases. Mental and behavioural disorders are the cause of death for almost one in ten seniors. This situation is due to the increased vulnerability of the elderly due to physiological and social factors. This is confirmed by various national analyses, e.g., in the UK, 95% of heat-related deaths were in people over 65 and 60% in people over 85 *(*UK Health Security Agency, 2022). In people with dementia living in nursing homes, agitation and destructiveness increase during heat episodes (Thompson et al., 2018). A study in Scotland found that people over 85 are most affected by extreme cold and heat exposure, particularly in cardiovascular mortality (Wan et al., 2022). In contrast, studies from Australia show that cardiovascular mortality rates increased on days when forest fires occurred (Finlay et al., 2012). Due to degenerative diseases, the elderly may also require more time or special support in case of evacuation. The significant mortality from COVID-19 shows that the elderly will be more vulnerable to future pandemics, which are more likely due to the increased spread of infectious diseases previously confined to tropical and subtropical areas (Romanello et al., 2022). The Eurostat data, supplemented by a review of the literature, lead us to believe that the Q2 hypothesis, which assumes that due to the nature of the currently most common causes of death in the elderly, seniors' exposure to the negative effects of climate change is high, is also true.

Cognitive barriers are quite common in the elderly group; together with language and technological barriers, they can effectively limit the ability to minimise the negative effects of climate change. Our analysis shows that seniors are a marginal group of Internet users worldwide. Although the EU are increasingly using modern technologies, especially Internet access, they are still at a lower rate compared to younger people. Barriers of this type can, for example, hinder access to hazard warnings and information on how to respond (Cutter et al., 2003). All of this makes older people more vulnerable to mortality following extreme weather events and evacuations (Åström et al., 2011; World Health Organisation, 2018; Aida et al., 2017; Willoughby et al., 2017; McDermott-Levy et al., 2019; Ayalon et al., 2021). We assume that a lack of digital competence significantly impairs the quality of life of *seniors.* Lack of orientation to the possibilities of using new technologies or the Internet in daily life may also result in a lack of development of the need to use them, and thus a lack of awareness of how the use of technology can help solve climate change problems.

The material situation of the elderly will also be a limiting factor in minimising the negative effects of climate change. Our analysis of Eurostat data shows that the income situation of seniors in the EU, as measured by the amount of disposable income over the period analysed, was characterised by consistently negative levels and significant deviations. This means that already the financial resources of the elderly are limited, and many seniors are not coping financially. In addition, European data show that even today, a significant proportion of seniors are at risk of poverty (Official Journal of the European Union, 2023). Certainly, this situation will make it much more difficult or even impossible to adapt at least the housing conditions of seniors to the needs of the changing climate. In the opinion of the authors, the above data proves the veracity of the Q3 hypothesis, which

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assumes that the limited digital competence and financial resources of seniors may be a barrier to minimising the negative effects of climate change. Although it should be noted that this aspect of challenges to climate change requires further research and analysis. In the context of Q2 and Q3, for example, it will be valuable to show whether there is a link between EU countries where seniors have low income and digital competencies and where they are more likely to suffer from climate-sensitive infectious diseases or be more vulnerable to existing risks

Today, as never before in history, there is a competition for financial resources between two phenomena: on the one hand, climate policies, such as modernising energy infrastructure, developing green technologies or building climate-resilient infrastructure, require significant public investment (Intergovernmental Panel on Climate Change, 2022), and on the other hand, growing spending on health care, pensions and social services for seniors is placing an increasing burden on state budgets (United Nations Department of Economic and Social Affairs, 2019). It is worth realising that taking measures that address the needs of both pressing issues simultaneously can be mutually beneficial, and a good example is energy-efficient housing for seniors (Organisation for Economic Co-operation and Development, 2015).

The increasing severity of extreme weather events, along with the growing number of senior citizens, is one of the biggest challenges for public policies. The needs of the elderly must be at the centre of both long-term and short-term strategies for dealing with these situations. Recommendations for public authorities to improve the situation of the elderly in the face of climate change could include the following:

- Greater exposure of the elderly to the effects of climate change:
  - Developing early warning systems tailored to the needs and capabilities of seniors, especially those who have difficulty accessing information quickly, e.g. SMS messages, phone calls, traditional media announcements;
  - Adapting public infrastructure that minimises the negative effects of climate change, such as organising facilities that serve as climate shelters in the form of cooled rooms available to seniors during heat waves; reducing heat islands by planting trees and shrubs (Klemens, 2022); and making extensive use of air-conditioned public transportation for the elderly and those with limited mobility.
  - Encouraging seniors to be active outdoors, e.g., by properly adjusting sidewalks, lighting and benches in public places (Akinci et al., 2022); being accompanied by caregivers for walks and exercise,
  - Creating awareness of climate prevention, e.g., developing health programs aimed at mitigating or preventing the occurrence of diseases spread by climate change, among other infectious diseases;
  - Organising community support networks, e.g., neighbourhood networks, local church organisations, non-profit organisations providing assistance to seniors in crisis situations;
- The relatively low digital competence of the elderly in the face of climate change:
  - Digital education to improve digital competencies of seniors, e.g., education skills to obtain information on extreme weather warnings, skills to use weather apps, skills to use public digital services such as vaccination registration.
  - Facilitating access to technology, e.g., access to low-cost Internet and mobile devices for low-income people; digital accessibility with assistive technologies (e.g., screen reader, speech synthesiser);
- Limited financial resources of the elderly in the face of climate change:
  - Subsidies and financial concessions for seniors, such as for heating costs, water consumption and electricity;
  - Subsidise or finance the cost of adapting housing to changing climatic conditions, such as the purchase of air conditioners, air purifiers, ecological heating sources, thermal modernisation of the building.
  - Increasing the availability, scope and quality of social and health services to reduce the economic burden on the elderly due to rising health care costs.

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The contribution of the authors

Conceptualisation, B.K., and B.S. ; literature review, B.K., and B.S.; methodology, B.K., P.M. and B.S.; formal analysis, B.K., P.M. and B.S.; writing, B.K., and B.S.; conclusions and discussion, B.K., and B.S.

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WYBRANE WYZWANIA OSÓB STARSZYCH W KONTEKŚCIE ZMIAN KLIMATU

STRESZCZENIE: Celem artykułu jest diagnoza wyzwań związanych z potrzebami seniorów w kontekście zmian klimatu. Szczegółowo omówiono wybrane wyzwania, tj. większe narażenie seniorów na skutki zmian klimatu oraz ograniczone kompetencje cyfrowe i zasoby finansowe seniorów, które stanowią istotne bariery w minimalizowaniu negatywnych skutków zmian klimatu. Celem praktycznym jest opracowanie rekomendacji dotyczących poprawy sytuacji seniorów w obliczu zmian klimatu. Zagadnienie starzenia się w kontekście zmian klimatu można uznać za oryginalne. W literaturze przedmiotu istnieje wyraźna luka w tym zakresie, choć wskazuje się, że jest to jedno z najważniejszych wyzwań tego stulecia w skali globalnej. Badania prowadzone są w wymiarze teoretycznym i empirycznym. W części teoretycznej przedstawiono analizę literatury przedmiotu, aktów prawnych oraz materiałów źródłowych instytucji UE. W części empirycznej pierwszym krokiem było zdefiniowanie danych niezbędnych do analizy empirycznej oraz określenie obszaru geograficznego, do którego dane miały się odnosić (UE). Analiza została przeprowadzona przy użyciu metod statystyki opisowej. Część ta obejmuje również analizę porównawczą kwestii związanych ze starzeniem się społeczeństwa w poszczególnych państwach członkowskich UE, przyczyn zgonów osób starszych w podziale na najczęstsze choroby (dla UE), kompetencji cyfrowych mieszkańców UE w podziale na grupy wiekowe oraz dochodów osób starszych w UE. Część empiryczna opiera się na analizie danych z bazy danych Eurostatu. Pewnym ograniczeniem w uporządkowaniu danych była ich ograniczona dostępność, tj. nie wszystkie najbardziej aktualne dane dotyczyły wszystkich krajów. W artykule przedstawiono tylko te dane, dla których uzyskano wartości ze wszystkich krajów, a następnie zagregowano je do wartości UE. Postawiono trzy hipotezy, do których odniesiono się w końcowej części artykułu. Nasza analiza pokazuje, że osoby starsze są już bardziej dotknięte zmianami klimatu, ponieważ są one w przeważającej mierze narażone na choroby układu krążenia, choroby układu oddechowego, a także choroby pandemiczne i zaburzenia psychiczne. Do tego dochodzi system opieki zdrowotnej i społecznej, który nie jest odpowiednio przygotowany na te wyzwania. Bariery poznawcze dość powszechne wśród seniorów, wraz z barierami językowymi i technologicznymi, mogą skutecznie ograniczać minimalizowanie negatywnych skutków zmian klimatu. Nasza analiza pokazuje, że seniorzy są marginalną grupą użytkowników Internetu na całym świecie, co między innymi może utrudniać dostęp do ostrzeżeń o zagrożeniach i informacji o tym, jak reagować, a także bardziej narażać na śmiertelność w wyniku ekstremalnych zjawisk pogodowych. Zakładamy, że brak kompetencji cyfrowych znacząco pogarsza jakość życia seniorów. Nasza analiza pokazuje, że zasoby finansowe osób starszych są już ograniczone i wielu seniorów nie radzi sobie finansowo. Z pewnością sytuacja ta znacznie utrudni lub wręcz uniemożliwi dostosowanie chociażby warunków mieszkaniowych seniorów do potrzeb zmieniającego się klimatu. Efektem końcowym artykułu jest lista rekomendacji dla władz publicznych mających na celu poprawę sytuacji osób starszych w obliczu zmian klimatu, w podziale na następujące kategorie: większa podatność osób starszych na skutki zmian klimatu; stosunkowo niskie kompetencje cyfrowe osób starszych w obliczu zmian klimatu; ograniczone zasoby finansowe osób starszych w obliczu zmian klimatu.

SŁOWA KLUCZOWE: starzenie się społeczeństwa, zmiany klimatu, ekstremalne zjawiska pogodowe, kompetencje cyfrowe, zasoby finansowe

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