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SCOPING REVIEW

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Climate change effects in older people's health: A scoping review

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Abstract

Background: Climate change has serious consequences for the morbidity and mortality of older adults.

Objective: To identify the effects of climate change on older people's health.

Methods: A scoping review was conducted following the Joanna Briggs Institute guidelines and the PRISMA-ScR checklist. Quantitative research and reports from organizations describing the effects of climate change on older people were selected.

Results: Sixty-three full-text documents were selected. Heat and air pollution were the two factors that had the most negative effects on cardiovascular and respiratory morbidity and mortality in older people. Mental health and cognitive function were also affected.

Conclusions: Climate change affects several health problems in older individuals, especially high temperatures and air pollution. Nursing professionals must have the necessary skills to respond to the climate risks in older adults. More instruments are required to determine nursing competencies on climate change and the health of this population group.

Patient of Public Contribution: No patient or public contribution.

KEYWORDS
climate change, health, nursing, older adults, older people, scoping review

1 | INTRODUCTION

Climate change caused by human activity is associated with increasingly extreme temperatures: increases in the intensity, duration and frequency of weather events (hurricanes, floods, droughts, etc.), air pollution and vector-borne diseases (IPCC et al., 2022; Kappelle et al., 2022), These effects are linked to a negative impact on human health, generating cardiovascular (De Blois et al., 2015; Moghadamnia et al., 2017), respiratory problems, dementia, cognitive impairment (Rocque et al., 2021), post-traumatic stress disease (PTSD), depression and anxiety (Hrabok et al., 2020). Moreover, there will be a significant increase in health risks related to climate-sensitive diseases and conditions. The size of the impact will depend on emissions, as well as the adaptation pathways achieved in the near future. Even if current levels of warming were maintained, a considerable increase in global deaths generated by these causes is projected (Cissé et al., 2022).

Although climate change is a problem that affects all of humanity, the population over 65 years of age is especially vulnerable to suffering adverse effects on their health, mainly due to two factors:

- It is a growing population group that will double in number in just 50 years. In 2020, those over 60 outnumbered children under 5 for the first time in proportion (United Nations Department of Economic and Social Affairs PD, 2022).
- Older adults tend to have less adaptability to face these adverse effects due to the physiological changes related to ageing (Filiberto et al., 2009), the cumulative effect of repeated exposure (Stein et al., 2008), social determinants such as low economic or educational level, and insufficient family and social networks (Geller & Zenick, 2005).

Therefore, two important problems come together: Climate change and a rapidly ageing demographic, which will cause a greater demand for health in this age group exposed to adverse climatic effects (Sánchez González & Chávez, 2019). Health professionals must be aware of the negative repercussions of climate change on the health of older adults and have the necessary competencies in order to care, implement strategies to mitigate its effects and include adaptations aimed at this population (Anderko et al., 2016; Organización Panamericana de, la Salud, 2020).

Today, a growing concern exists to understand how global warming will affect the ageing population (Sánchez González & Chávez, 2019). Therefore, this review aimed to know the main effects of climate change on the health of older individuals. The authors chose to carry out a scoping review since the review design best suits the extensive information on the topic. In addition, it allows the incorporation of research results carried out by institutions specialized in the issue (Peters et al., 2015, 2020). Although there is an integrative review to delve into the resilience of this population group to climate change (Leyva et al., 2017), no scoping review on the effects of climate change on the health of older people has been found. This scoping review will provide an updated and in-depth analysis of the influence of environmental factors related to climate change on the health of older people, adding to the available research with the latest reports from agencies and institutions specializing in climate change and health. A recent scoping review of climate change effects focusing on children (Helldén et al., 2021) highlights the need for such a review also on the effects of climate change on older adults, as another group vulnerable to such effects.

The research questions that guide the review are:

- What effects does climate change have on older people's health?
- What are the climate change factors that most affect older adults?

2 | METHODS

2.1 | Protocol

For preparing this scoping review, the recommendations of the JBI manual for synthesis of evidence were followed (Peters et al., 2020). Therefore, before said review, a protocol was prepared and published describing the inclusion criteria, search strategy, analysis, and method of extraction and presentation of the data (Montoro-Ramírez et al., 2022). In addition, for greater rigour, the review has been submitted to the PRISMA-ScR checklist, ensuring compliance with information standards (Appendix A; Tricco et al., 2018).

2.2 | Eligibility criteria and search strategy

As recommended by the scientific evidence (Peters et al., 2015; Pollock et al., 2021), the search strategy has been developed in three steps: an initial search of keywords in PubMed and Cumulative Index of Nursing and Allied Literature Complete (CINAHL), a search in different databases using the previously identified terms to form the search strings (Appendix B) and, finally, a search in the references of the articles included in the review. A senior lecturer specializing in systematic reviews was involved in designing and validating the search strategy.

The original articles were located in the PubMed, CINAHL, Scopus, Cochrane, PsycINFO and Cuiden Plus databases from October to December 2021. Additionally, reports were located on the web pages of organizations specialized in climate change, health and/or older people.

For the selection of studies, the following inclusion criteria were considered:

- Population: people aged 65 and over.
- Concept: effects of climate change and its impact on older adults' physical and mental health.
- Context: any geographic area and level of care.
- Source: original quantitative studies. As grey literature, publications and reports made by organizations specialized in climate change, health and/or ageing.

Sources of evidence published in English and Spanish from 1 January 2008 to 31 December 2021 were considered. Contacting any author was unnecessary as all the articles and complementary data were available.

2.3 | Screening and data extraction

After removing duplicate studies, a first selection was made in pairs of articles by title and abstract. Any disagreement regarding accepting a study for full-text review was resolved between the two reviewers by discussion, without the need to resort to a third reviewer who would discriminate for this purpose. Subsequently, the studies selected in the previous phase were analysed in full text, discarding those not meeting one or more inclusion criteria.

The data of interest from each source included in the review were collected in a table tested by two of the authors. To facilitate its consultation, a slight modification was made with respect to the format proposed in the protocol published a priori (Montoro-Ramírez et al., 2022), finally including the following data:

- Study identification data.
- Study population.
- Aim.
- Design.
- Main results.

2.4 | Analysis and presentation of results

To support the review, the extensive information was presented in several ways:

Characteristics of the included literature:

- Diagram of the distribution of sources of evidence by year of publication.
- Presentation in table format of the number of original investigations developed in each country, broken down by the effect of the climate change they study.

Effects of climate change on older adult's health:

- Table, where the most relevant information of each investigation included in the review, was collected.
- Narrative description of the results, classifying them into different conceptual categories according to the effects of climate change that cause negative impacts on the health of older adults.
- Table in which the effects of climate change are related to the health problems they directly affect.

3 | RESULTS

3.1 | Search outcomes

The number of references returned by the initial search in the different databases is detailed in Appendix B. An initial elimination was performed using the filters provided by the automation tools. Then, 58 duplicates were removed, leaving 1240 references to be examined. In the peer review of the title and abstract, 1110 articles that did not meet the inclusion criteria were discarded, leaving 130 articles for full-text review. After removing 100 studies, 30 original articles were recovered. On the contrary, 24 original studies obtained through reverse citation search and nine reports from official bodies (Stockholm Environment Institute; EEA, European Environment Agency; The Lancet; HelpAge International; EPA, United States Environmental Protection Agency; USGCRP, US Global Change Research Program; WHO and the Ministry of Health, Social Services and Equality of the Government from Spain). Finally, 63 documents (54 original articles and nine reports from specialized institutions) were included in this scoping review, as shown in the PRISMA flowchart (Page et al., 2021; Figure 1). The most relevant characteristics of these publications are included in the table in Appendix C. Likewise, in Appendix D, the original articles excluded from the selection process are shown along with the criteria for which they have not been selected.

3.2 | Study characteristics

In general, most of the publications were published between 2011 and 2019 (Figure 2) and focus on the study of extreme temperatures and air pollution (Table 1).

Most of the original investigations were carried out in North America, with extreme temperatures and hurricanes being the most studied climate change factors in this geographic location. Asia follows in the number of publications, mainly with studies on extreme temperatures and air pollution. Next is Europe, with all its studies focused on temperatures and air pollution. Finally, Oceania and South America with articles on high temperatures (Table 1).

Regarding the design, observational studies prevail (Cohorts $n=19$, Cases and controls $n=4$, and descriptive cross-sectional $n=18$). We also found studies of mortality projections ($n=4$) and other types of designs ($n=9$), such as time series.

3.3 | Climate change effects on older people's health

After the study and analysis of the information obtained in the review, the main results were categorized by climate change effects, detailing how they negatively affect older adults' physical and mental health.

3.4 | Extreme temperatures: Heat

Intense heat decreases kidney function in older patients taking antihypertensive medication ($p<.001$) (Sagy et al., 2016). There is an increased risk of hospitalization due to renal, respiratory, heat-related causes (Gronlund et al., 2016) and hyperthermia ($p<.001$) (Noe et al., 2012) in people over 85 years of age (Gronlund et al., 2016; Noe et al., 2012), with low socioeconomic status, who live in old houses and in cities with a low prevalence of air conditioning ($p<.001$) (Gronlund et al., 2016). There is an increase in the risk of hospitalization for cardiovascular disease (CVD), although it is not statistically significant (Giang et al., 2014).

Increases in the diurnal temperature range are statistically associated with increased cardiovascular (Wang et al., 2013; Zheng et al., 2016), digestives, genitourinary and respiratory emergencies (Anderson et al., 2013; Wang et al., 2013). This acute effect may be aggravated by age (≥75 years old), sex (women) (Wang et al., 2013; Zheng et al., 2016), and time of year (cold season) (Zheng et al., 2016). It also causes increases in heart rate (HR) ($p<.05$) and blood pressure (BP), although in the latter case it was not significant (Lim et al., 2013).

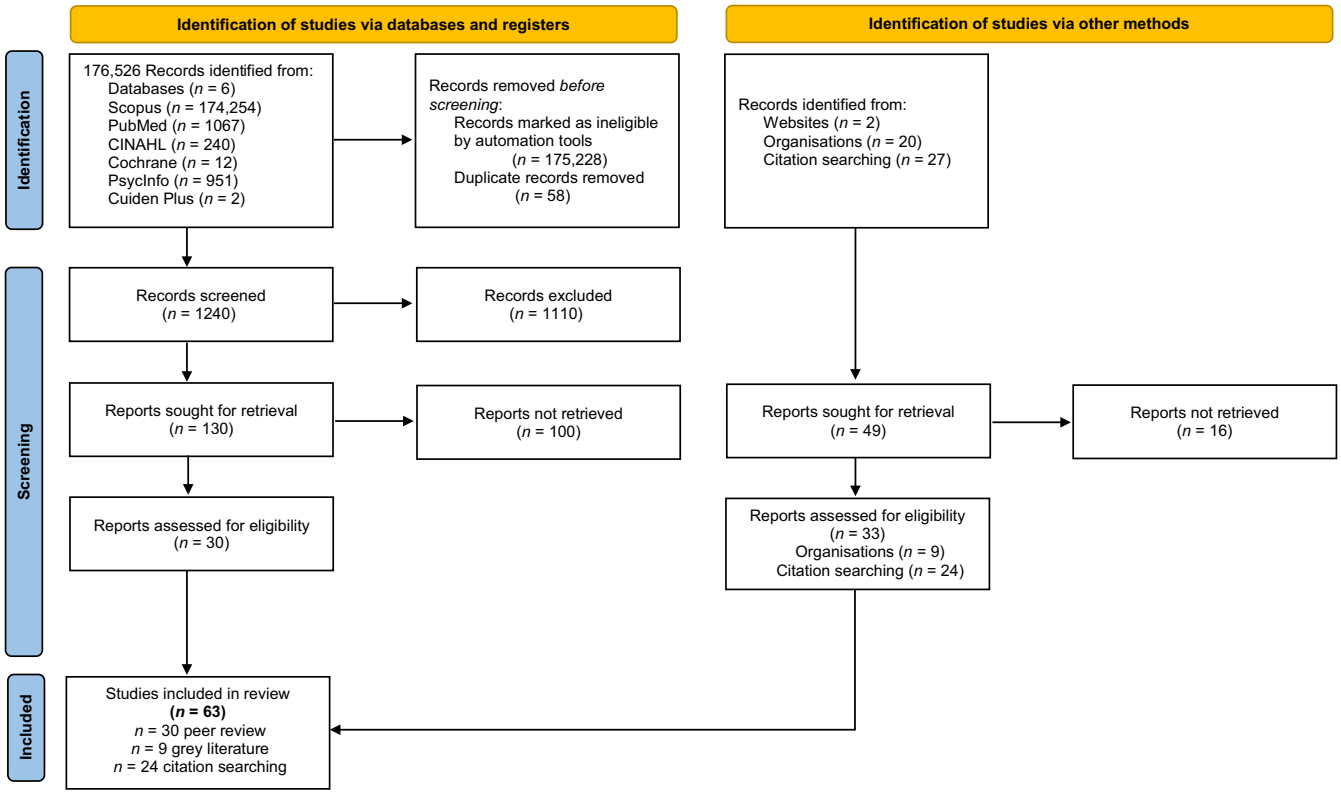

FIGURE 1 PRISMA 2020 flow diagram for new systematic reviews which included searches of databases, registers and other sources. *Source*: Page et al. (2021), http://www.prisma-statement.org/.

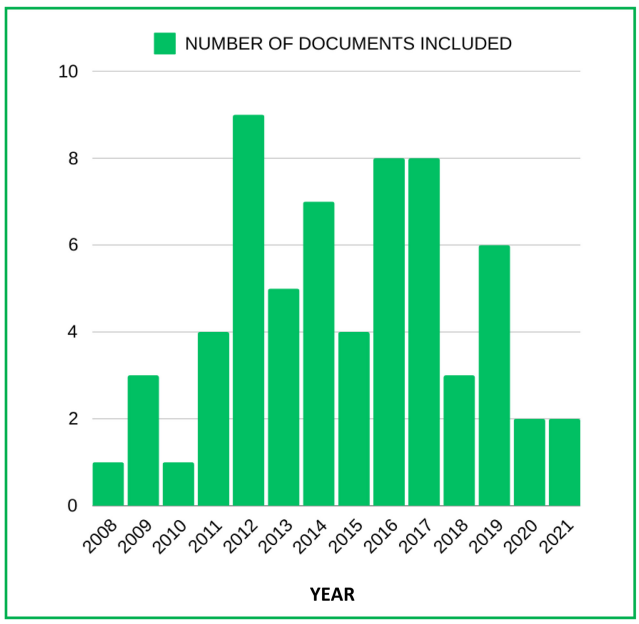

FIGURE 2 Number of original articles published between 2008 and 2021.

High temperatures are a risk factor for death in the older adults (Lim et al., 2016; Rocklöv & Forsberg, 2010; Vutcovici et al., 2014) from cardiovascular causes (Tam et al., 2009), especially in those with chronic diseases (Zanobetti et al., 2012), especially in those with chronic underlying pathologies such as chronic obstructive pulmonary disease (COPD), diabetes, chronic congestive failure or who have suffered an acute myocardial infarction. In general, it can be established that the greater the percentage of the population over 65 years of age in a region, the lower the summer threshold temperature at which excess mortality begins to occur (Zanobetti et al., 2012). Increasingly higher temperatures will cause a significant increase in mortality in summer and a slight decrease in deaths related to temperature in winter (Bennett et al., 2014; Shi et al., 2016).

Heat stress causes a decrease in cognitive ability in those over 65 years of age ($p < .05$), producing a decrease in their verbal ability and mathematical reasoning (Yi et al., 2021). Increases the risk of dementia admissions when there is prolonged exposure to high temperatures and large temperature variations (Wei et al., 2019).

3.5 | Extreme temperatures: Heatwave

Older people are especially susceptible to the health risks caused by heat waves (European & Kaźmierczak, 2019; Romanello et al., 2021). The most frequent reasons for admission are the following, ordered from highest to lowest risk: (Bobb et al., 2014; Hopp et al., 2018)

TABLE 1 Number of original articles published by country and climate change effect.

Country	Extreme temperatures	Air pollution	Temperature air pollution	Extreme whether events	Subtotal	(%)
US[a]	9	6	1	9	25	45.5
China[b]	5	1	3	0	9	16.4
South Korea[b]	1	2	0	0	3	5.5
Italy[c]	2	1	0	0	3	5.5
Sweden[c]	2	0	0	0	2	3.6
Canada[a]	1	0	1	0	2	3.6
Japan[b]	2	0	0	0	2	3.6
Israel[b]	1	0	0	0	1	1.8
Australia[d]	1	0	0	0	1	1.8
Vietnam[b]	1	0	0	0	1	1.8
France[c]	1	0	0	0	1	1.8
Brazil[e]	1	0	0	0	1	1.8
Denmark[c]	0	1	0	0	1	1.8
Germany[c]	0	1	0	0	1	1.8
Slovenia[c]	0	0	1	0	1	1.8
Thailand[b]	0	0	0	1	1	1.8
Subtotal	27	12	6	10	55	
(%)	49.1	21.8	11	18.1		100

Note: The percentage data in Table 1 are made taking into account 55 origins since a study is carried out by two countries.

[a]North America.

[b]Asia.

[c]Europe.

[d]Oceania.

[e]South America.

- heat stroke and sunstroke;
- anhidrotic heat exhaustion;
- heat exhaustion;
- acute and unspecified renal failure;
- dehydration;
- fluid and electrolyte disorders;
- kidney failure; and
- urinary tract infections.

There is an increased risk of fluid disorder and heat exhaustion in the older age group (≥85 years old) (Hopp et al., 2018). There are a greater number of hospitalizations when the heatwave is more intense (Hopp et al., 2018) and on the same day as the hottest event (Bobb et al., 2014). Renal and respiratory hospital admissions are also increased (Gronlund et al., 2014). Older adults are more at risk of suffering heat stroke when indoors if the room temperature is high and they do not have cooling appliances (Kondo et al., 2013). In contrast, the risk of being admitted for non-hypertensive congestive heart failure is not statistically significant (Hopp et al., 2018), and the hospitalization rate is even reduced compared with days without a heat wave (Bobb et al., 2014), generally producing a decrease in admissions by CVD (Gronlund et al., 2014).

Mortality related to cardiovascular, cerebrovascular and respiratory causes increases (Diniz et al., 2020; European & Kaźmierczak, 2019; Oudin Åström et al., 2015; Romanello et al., 2021; Schifano et al., 2009), worsening the risk of death from respiratory causes in older age groups (+75 years old) and in women (Schifano et al., 2009). The urban Heat Island effect increases the risk of death in older people living in urban areas by 2.24 times ($p < .05$) (Laaidi et al., 2012).

A risk profile of experiencing greater adverse effects during a heat wave event has been established: women, over 75 years of age, living alone or in a residence, with chronic illnesses or severe mental illnesses (Haq, 2017; Ministerio de Sanidad, Servicios Sociales e Igualdad, 2014).

3.6 | Extreme temperatures: Cold

Older adults are also more susceptible than other age groups to cold waves (European & Kaźmierczak, 2019). Low temperatures are associated with a higher risk of CVD hospitalizations ($p < .001$); higher values are obtained a week or even 14 days after exposure (Giang et al., 2014). The highest risk diagnosis is hypothermia ($p < .001$), and

the most vulnerable population is those over 85 years of age (Noe et al., 2012).

Low temperatures generally lead to more cold-related deaths in countries with milder winters than in those with harsher winters (Ministerio de Sanidad, Servicios Sociales e Igualdad, 2014). Intense cold generates excess mortality, especially in women, those older than 75 years and those with respiratory diseases (Haq, 2008; Ministerio de Sanidad, Servicios Sociales e Igualdad, 2014).

When exposure to extreme temperatures is short-term, deaths are due to circulatory causes (Lin et al., 2011; Ministerio de Sanidad, Servicios Sociales e Igualdad, 2014); however, if prolonged, intense heat has a greater effect on mortality than cold (Lin et al., 2011). There is a higher risk of hospitalization or death due to congestive failure in the winter period compared with the summer period in patients previously diagnosed with this disease, regardless of environmental contamination ($p < .0001$). This risk is further increased if the patient is taking medication for the cardiovascular, renal or central nervous system ($p < .0001$) (Vanasse et al., 2017).

3.7 | Air pollution

Air pollution affects the mental and physical health of older adults to a greater extent than the general population, especially in those with chronic diseases (European & Kaźmierczak, 2019; Ministerio de Sanidad, Servicios Sociales e Igualdad, 2014). It aggravates most respiratory problems (such as COPD, asthma (Andersen et al., 2012) and pneumonia (Haq, 2017)), increasing the number of hospitalizations for these causes (Liu, Wilson, Mickley, Dominici, et al., 2017; World Health Organization. Regional Office for Europe, 2013). Women and Black race people are more vulnerable to respiratory diseases ($p < .05$) (Liu, Wilson, Mickley, Ebisu, et al., 2017). In addition, it causes an increase in hospital admissions for cardiovascular reasons (Haq, 2008; World Health Organization. Regional Office for Europe, 2013), mainly in obese patients and patients with diabetes (United States Environmental Protection Agency, 2016a, 2016b). Other risk factors for suffering a coronary event due to air pollution are gender (female) ($p = .02$) and age (group from 75 to 84 years) ($p = .001$) (Colais et al., 2012).

Environmental pollutants are significantly associated with excess mortality in those over 65 years of age from cardiovascular (as the temperature gets warmer) and respiratory causes (on very cold days) (Kim et al., 2020; Ministerio de Sanidad, Servicios Sociales e Igualdad, 2014).

There is a statistically significant positive relationship between exposure to air pollution and the occurrence of depressive symptoms in those over 65 years of age (Lim et al., 2012); however, other research found no such evidence (Wang et al., 2014). There is also an exposure between prolonged exposure to environmental pollutants and high anxiety and stress levels in older adults (European & Kaźmierczak, 2019). Chronic exposure to air polluted by traffic smoke accelerates cognitive impairment by about 2 years ($p = .001$) (Power et al., 2011; Weuve et al., 2012) and is a risk factor for the development of mild cognitive impairment ($p < .01$) (Ranft et al., 2009). Along the same lines, high levels of pollutants have been associated with the risk of developing vascular dementia and Alzheimer's disease ($p < .05$) (Wu et al., 2015). Living on a street with heavy traffic (more than 10,000 cars/day) is a significant risk factor ($p < .01$) for the appearance of mild cognitive impairment (Ranft et al., 2009).

3.8 | Temperatures and air pollution

The decrease in average temperature is related to the risk of a congestive failure event in previously diagnosed patients. This risk increased even more if patients took medication to treat problems related to the cardiovascular and renal system ($p < .0001$) or the Central Nervous System ($p < .0001$) (Vanasse et al., 2017).

The joint action of high concentrations of environmental pollutants and high temperatures induces a decrease in HR in the hot season ($p < .05$), which can precipitate cardiovascular events (Ren et al., 2011).

During a heat wave, the older people who live in residences and are subjected to high temperatures and low indoor air quality, suffer an intense and significant increase in HR and a decrease in BP ($p = .0001$). This can influence cardiocirculatory diseases (Fink et al., 2015).

Several studies of mortality projections in scenarios of increased temperatures and high greenhouse gas emissions have estimated an enormous increase in future mortality of the older population, mainly due to CVD (Huang et al., 2018, 2019; Li et al., 2016), even if processes of adaptation of the population to these conditions occur (Huang et al., 2018; Li et al., 2016). In general, the effects of heat are stronger and more immediate, with the maximum number of cases being recorded on the same day of exposure and declining rapidly the next day. On the contrary, the effects of cold appear with a delay of between 2 and 7 days and are longer lasting (up to the next 20 days) (Huang et al., 2018, 2019; Li et al., 2016).

3.9 | Extreme weather events

Extreme weather events such as hurricanes or floods cause significant physical and mental trauma before, during and after the event (United States Environmental Protection Agency, 2016a), and older people with disabilities, chronic illnesses, low economic status and institutionalized are more vulnerable (United States Environmental Protection Agency, 2016a, 2016b).

After a *hurricane*, hospital and emergency departments experience an increase in the volume of consultation cases (Becquart et al., 2019; Lawrence et al., 2019; McQuade et al., 2018). CVD-related hospitalizations increase ($p < .001$) (Becquart et al., 2019), intracranial haemorrhages ($p < .0001$) and respiratory reasons ($p < .0001$) (McQuade et al., 2018). The number of cases in the

emergency department due to injuries and mental disorders also increased ($p < .0001$). These effects occur both imminently and in the long term, with women at approximately twice the risk as men (Lawrence et al., 2019). Cardiovascular, respiratory and injury mortality increase, even increasing 3 months after the hurricane (Kim et al., 2017). Most of these deaths occur among the oldest (>75 years old) (Haq, 2008, 2017; Huang et al., 2019; International HelpAge, 2015; United States environmental Protection Agency, 2016b).

As a consequence of *extreme precipitations*, the risk of being hospitalized due to gastrointestinal infections (Bush et al., 2014; Haq, 2017) and dehydration caused by water and food contaminated by pathogens that proliferate in floodwater increases (Haq, 2017; International HelpAge, 2015). Older adults have higher

TABLE 2 Relationship between climate change effects and different health problems.

Health problems	Effects of climate change				
	Intense cold	Extreme heat	Heat wave	Air pollution	Extreme weather events
Cardiovascular system					
CVD	■	■		■	
Heart failure	■				
Ischemic heart disease		■		■	
Arterial hypertension		■			■
Myocardial infarction		■		■	
Congestive heart failure		■	■	■	
Acute coronary syndrome				■	
Arrhythmia				■	
Circulatory system	■	■		■	
Cerebrovascular disease			■		
Respiratory system					
COPD	■	■	■	■	
Respiratory tract infection	■	■			
Asthma	■		■	■	
Community-acquired pneumonia	■		■		
Renal and genitourinary system					
Acute kidney infection		■			
Kidney disease			■		
Digestive system		■			■
Diabetes		■	■	■	
Injuries and traumas					■
Infectious diseases		■			■
Dehydration			■		■
Mental health					
Anxiety					■
Depression				■	■
PTSD					■
Psychiatric disorders			■		■
Cognitive function					
Decreased cognitive function		■		■	
Dementia		■		■	
Vascular dementia				■	
Alzheimer's disease				■	

Shaded values Indicates the health problems influenced by climate change.

mortality rates; high due to direct causes, such as drowning, or secondary problems, such as injury, hypothermia, infectious disease, heart disease or mental illness (Haq, 2008; International HelpAge, 2015).

Droughts can increase the risk of infectious diseases, dehydration and mental problems such as anxiety. This is associated with higher mortality rates and different morbidities such as acute confusion, cognitive impairment, falls or constipation (Berman et al., 2017; Haq, 2008; International HelpAge, 2015).

Wildfires, in addition to contributing to increasing air pollution, generate direct deaths, especially among those over 70 years who suffer from chronic disability (Haq, 2017).

Extreme weather events cause the appearance of PTSD, with a high number of cases persisting several years after the event and doubling the risk of suffering cardiovascular events ($p = .006$) (Lenane et al., 2017), especially among hypertensive patients (Lenane et al., 2019). In women, this risk is double that of men ($p < .05$) (Lenane et al., 2019). In addition, they generate depression ($p = .02$) (Somporn et al., 2012) statistically related to a series of stressful factors derived from the event, such as suffering injuries, being a victim of a post-hurricane crime, or losing access to medical care (Sirey et al., 2017). Other disasters, such as floods, also generate depression among older adults related to a series of predominant factors: insomnia ($p = .002$), loneliness ($p < .001$), inadequate levels of vitamin D ($p = .014$), and poor social activity ($p < .001$) and physics ($p = .021$) (Somporn et al., 2012).

3.10 | Vector and foodborne diseases

Older people with compromised immune systems may be more affected by vector-borne diseases such as St. Louise encephalitis, West Nile fever (United States Environmental Protection Agency, 2016a, 2016b) or Lyme disease (United States environmental Protection Agency, 2016b).

Due to global warming, the increase of 1°C will translate into a 4.5% increase in food poisoning among older adults due to the growth of bacteria such as Salmonella (Haq, 2008).

As an overview, as seen in Table 2, older people are especially vulnerable to extreme heat and air pollution since they are statistically associated with the majority of climate change-related morbidity and mortality. Extremely low temperatures aggravate health problems related to the cardiovascular, circulatory and respiratory systems fundamentally. In addition to the above, extreme heat has a substantial impact on the kidney and digestive systems, cognitive function and mental health of older adults. Atmospheric pollution acts synergistically with high temperatures, causing serious effects on the systems mentioned above. It is also an important risk factor for developing or accelerating cognitive deterioration in this population group. Extreme weather events are more related to cardiovascular and digestive problems, injuries and trauma, infectious diseases and the development of mental health problems.

4 | DISCUSSION

This review aimed to identify the main effects of climate change on the health of older adults and included 54 original articles and nine reports from specialized institutions. Once the extensive information collected had been analysed, it became clear that climate change disproportionately affects the health of this especially vulnerable population, which is supported by numerous investigations (Carnes et al., 2014; Filiberto et al., 2009; Harper, 2019; Kriebel-Gasparro, 2022; Leyva et al., 2017). A decrease in publications was detected in 2020 and 2021, which could be due to the increase in publications on COVID-19 in those years. In addition, the increased specificity on the various effects of climate change and its more detailed study may require more precise search terms in the future.

Extreme temperatures fundamentally affect mental, neurological, respiratory, renal and cardiovascular health (Bunker et al., 2016), especially extreme heat during heat waves in the latter case (Åström et al., 2011; Kenney et al., 2014). Interestingly, hospitalizations for cardiac reasons decrease with high temperatures, giving a false impression that heat acts as a protective factor against cardiac events (Bunker et al., 2016). This is because the effect of high heat is very acute, significantly increasing out-of-hospital cardiac deaths (Bunker et al., 2016). In the case of cold, most deaths are related to respiratory and cardiovascular problems (Bunker et al., 2016). Several studies support a slight decrease in winter deaths due to the increase in temperatures due to global warming (Barnett, 2007; Bunker et al., 2016). However, research using an analysis with a more recent statistical approach showed that of the mortality burden related to extreme temperatures, the majority occurred on days colder than the optimal temperature, compared with warmer days (Burkart et al., 2021; Gasparrini et al., 2015). Women are more affected by extreme temperatures (Bogdanović et al., 2013; van Steen et al., 2019), >75 years old (Bogdanović et al., 2013) (and especially those >85) (Stafoggia et al., 2006), patients with severe chronic or mental illnesses (Kenny et al., 2010; Schwartz, 2005), low socioeconomic level (Kaltsatou et al., 2018; Yang et al., 2013), Black race (Madrigano et al., 2015; Schwartz, 2005), polymedicated (Kriebel-Gasparro, 2022), who live in old houses with little thermal insulation (Gronlund et al., 2015; Vandentorren et al., 2006) and in urban areas (due to the Urban Heat Island Effect) (Kaltsatou et al., 2018; Vandentorren et al., 2006). Research suggests that the special vulnerability of the older population to high temperatures is due, among other factors, to decreased thermoregulatory capacity (Holowatz & Kenney, 2010; Kenney & Hodgson, 1987; van Hoof et al., 2017) and less sensation of thirst (Holowatz & Kenney, 2010; Meade et al., 2020). The second effect of climate change that mostly affects older people is environmental pollution, which aggravates respiratory (Leyva et al., 2017; Simoni et al., 2015) and cardiovascular problems (Leyva et al., 2017), increasing both morbidity and mortality related to these causes (Simoni et al., 2015). Several authors affirm that there is a synergistic effect between heat and air pollution that causes an even greater increase in cardiovascular problems and mortality (Analitis et al., 2018; Ji

et al., 2020; Kim et al., 2015; Simoni et al., 2015). Women older than 75 years, Black people, low socioeconomic status, obese, with pre-existing conditions are more sensitive to exposure to environmental contaminants (Kan et al., 2008; Medina-Ramon & Schwartz, 2008; Simoni et al., 2015). In addition, air pollution is related to the appearance of depression, anxiety and stress, although some research has not found statistical significance (Wang et al., 2014). According to our results, prolonged exposure to polluted air is a risk factor for the appearance of different types of dementia, such as Alzheimer's disease (Tsai et al., 2019), while pollution caused by traffic accelerates cognitive decline (Power et al., 2016). According to different studies, reduced respiratory and expectoration capacity, the cumulative effect of prolonged exposure and decreased immune system response are factors related to ageing that make this population especially susceptible to air pollution (Carnes et al., 2014; Kriebel-Gasparro, 2022). We have also found that extreme weather events increase hospitalizations for cardiovascular, respiratory, injury, gastrointestinal infections (Carnes et al., 2014), mental disorders, PTSD and depression, with a consequent increase in deaths among those over 65 from these causes (Benevolenza & DeRigne, 2019; Kriebel-Gasparro, 2022), especially in women, >75, with some disability, chronic illness, low socioeconomic status and institutionalized (Fernandez et al., 2002; McCann, 2011). Climate change has increased the geographical areas of infectious diseases due to the increased probability of situations involving contaminated water and food and due to the increase in the spatial distribution of the vectors responsible for transmitting some of these diseases, increasing this type of disease in areas traditionally not affected by them and among older adults with a decreased immune system due to ageing (Kriebel-Gasparro, 2022).

4.1 | Implications for nursing

Nursing will witness climate change and its consequences on the health of people over 65 years of age. Therefore, nurses must be prepared to understand the relationship between the effects of climate change and the health of older adults. This will empower nurses to prevent and act on the effects of climate change on the health of older adults. The results of this review provide healthcare professionals with up-to-date information and enable them to assess and detect the effects of climate change on the health of older adults at an early stage. Simultaneously, they will be able to use this information to develop promotional and educational activities in environmental health, as well as care plans adapted to the climate risk to which this population is exposed.

4.2 | Limitations

Some perceived limitations of this study could be related to several characteristics of the documents. Most of the investigations included those older than 65 years as a subpopulation of analysis. This highlights the need for studies specifically targeting this population group to have a more nuanced understanding of how climate change affects their health. Another limitation is that the use of the keyword *climate change* and its synonyms may not capture some specific indicators such as extreme heat, floods, extreme precipitation, typhoons, hurricanes and air pollution due to pollutants such as particulate matter, nitrogen oxide, black carbon, sulphur dioxide or ozone on human health. Furthermore, the absence of a standard and clear definition of a heatwave, the use of different air pollution thresholds, and the use of different instruments to measure mental and neurological health make an extrapolated comparison of the results difficult. On the contrary, most of the studies were observational or cross-sectional. They were carried out in developed countries, so there is a lack of research in low-middle-income countries to understand the impact of climate change on health in these contexts that allow causal relationships to be established.

Potential areas for future studies lie in the identified research gaps, such as the need to conduct more longitudinal research with older adults as a specific study population, segregated by sex and age, and taking into account the physiological characteristics of ageing in this heterogeneous group. Thus, results would be obtained that would allow health professionals to understand the complexity of the problem. There is not much evidence related to other climate factors, such as drought or vector-borne diseases, so further research into these topics would provide a more complete understanding. It is also necessary to create instruments that allow nursing competencies to be measured in relation to climate change and the health of older people. This would help them reinforce their knowledge, skills or attitudes to correctly analyse the environment of older adults and identify the climatic risks to which they are exposed, improving the health care provided to this group.

5 | CONCLUSION

Climate change causes serious consequences for the health of older people, who suffer disproportionately from the negative impacts of high temperatures and air pollution. Nursing is witness to this, and as health professionals, we are obliged to develop mitigation (sustainable health practice) and adaptation strategies (education on climate risks, promotion of environmental health, and care for older adults who suffer negative effects). In short, it is in the hands of nurses to make significant changes in order to improve society's response to climate change and promote the transformation necessary to achieve healthy ageing. For this, more research is required to provide nursing professionals with tools that allow them to assess their competencies in climate change and the health of older people.

AUTHOR CONTRIBUTIONS

All five authors have made important contributions to the present investigation. Eva Mª Montoro-Ramírez, Isabel Mª López-Medina and Laura Parra-Anguita have been involved in the pairwise

selection of sources by title and abstract and in the main writing of the manuscript. Carmen Álvarez-Nieto and Gema Parra have critically reviewed the content. The version to be published has been approved by Eva Mª Montoro-Ramírez, Isabel Mª López-Medina, Laura Parra-Anguita, Carmen Álvarez-Nieto and Gema Parra. All authors agreed to be responsible for the information presented in the work and have guaranteed that any problems of accuracy or completeness are properly resolved.

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CONFLICT OF INTEREST STATEMENT

None declared.

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DATA AVAILABILITY STATEMENT

The data that supports the findings of this study are available in the supplementary material of this article.

PATIENT AND PUBLIC INVOLVEMENT

No patients were involved.

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