

Review Article

A Scoping Review of Research on Older People and Intergenerational Relations in the Context of Climate Change

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Received: June 28, 2021; Editorial Decision Date: February 3, 2022

Decision Editor: Patricia C. Heyn, PhD, FGSA, FACRM

Abstract

Background and Objectives: In view of the inherited temporal dimension of climate change, this study aims to highlight diverse intergenerational effects and coping strategies by examining the state of literature on older people and intergenerational relations in the context of climate change.

Research Design and Methods: A scoping review of peer-reviewed scientific literature was conducted. We searched the following bibliographical data sets: PubMed, Web of Science, and APA PsycNet in addition to a snowballing search based on Google Scholar. The primary search was conducted between September 22, 2021 and September 26, 2021, using variations of the search terms: older people AND intergenerational AND climate change. Two independent raters classified the articles using prespecified inclusion and exclusion criteria.

Results: In total, 20 articles were maintained for data extraction. Articles reflect 2 poles in relation to older people and intergenerational relations in the context of climate change. The first emphasizes intergenerational conflicts and differences, whereas the second stresses solidarity and transmission of knowledge and practices between the generations.

Discussion and Implications: Both older and younger people are affected by age-based discrimination in the context of climate change. Generational differences in energy consumption and attitudes toward climate change exist. Nonetheless, these can be overcome by stressing the solidarity between the generations and the ability of older people to contribute to the climate change movement as well as by the ability of both young and old to transmit knowledge and practices related to sustainability.

Keywords: Climate change, Environmental sustainability, Generations, Global warming, Older people

The Intergovernmental Panel on Climate Change (IPCC) has warned of accelerated rates and more profound impacts of climate change in all regions of the world (IPCC, 2021). According to the World Health Organization (WHO), these pose immense risks to global health for all ages and geographic locations (WHO, 2018). Older people are particularly affected by climate change, because they are more susceptible to the impact of extreme heat waves, severe

weather disruptions, and polluted air (Frumkin et al., 2012; Gamble et al., 2013; Yu et al., 2011).

According to the Office of the United Nations High Commissioner for Human Rights' report, climate change threatens older persons' "rights to life, health, food, water and sanitation, housing, freedom of movement, livelihoods, social protection, development, and culture." The report concludes that key international climate change instruments

have neglected older persons. Moreover, there is no legally binding international instrument specifically protecting the human rights of older persons (Office of the United Nations High Commissioner for Human Rights, 2021).

Another source of concern with regard to older people in the context of climate change is the sentiment that older people and especially the Baby Boomer generation (born between 1946 and 1964) are better off than younger generations (Ayalon, 2020; Ayalon et al., 2021; Ho & Hendi, 2018; Tavener et al., 2014). Older people have been viewed as “greedy geezers,” depleting the earth’s resources to their own advantage (Street & Cossman, 2006), while younger people are facing unprecedented socioeconomic challenges, such as rising housing prices and high rates of unemployment and social insecurity, in addition to concerns about an uncertain future largely brought about by climate change (Moody, 2007). Yet despite some evidence and much rhetoric about generational disparities, a comprehensive review has found limited differences between young and older people’s attitudes or knowledge concerning climate change (Corner et al., 2015).

Recent evidence shows that older generations are expected to make sacrifices for a future which they will not be a part of (Puaschunder, 2016), and most aspire to leave a valuable legacy for future generations (Frumkin et al., 2012). Examples come from public initiatives and volunteer movements by older people to raise public awareness of climate change. These include the Elders, a group convened by Nelson Mandela, the green AARP blog, and the MacArthur Foundation Research Network on an Aging Society (Frumkin et al., 2012). Clearly, research has shown that older people can actively participate in the climate change movement in ways that contribute to their own mental health and well-being while simultaneously lending solidarity to younger and future generations (Gagliardi et al., 2020; Pillemer et al., 2009).

The present review examines older people and intergenerational relations in the context of climate change. This review is taken given the strong temporal perspective inherent in climate change: Actions performed in the past and present have major implications for future generations (Gardiner, 2006; Méjean et al., 2020). In light of the increased susceptibility of older people to climate change (Willoughby et al., 2017; Yu et al., 2012) and the heated political discourse, which tends to blame older people for their inaction (Han & Ahn, 2020), we conducted a systematic scoping review to synthesize knowledge of older people and intergenerational relations in the context of climate change. Our goal in undertaking this review was to examine the extent, range, and nature of evidence, to summarize these findings, and to identify knowledge gaps in the existing literature. The present scoping review is particularly timely considering the recent report of the WHO on the Decade of Healthy Ageing and climate change. According to the report, for most people, worldwide, a

healthy planet is a necessary condition for healthy aging and healthy longevity (WHO, 2022).

Our review is guided by the overarching concept of “intergenerational ambivalence”—the coexistence of interpersonal solidarity and tension among people belonging to different age groups (Lüscher & Pillemer, 1998). Intergenerational ambivalence aims to bridge the gap between traditional theories of intergenerational relations, namely, solidarity and conflict, that highlight only positive or negative facets of relationships. These representations, although important in the understanding of intergenerational dynamics, do not adequately capture the coexistence and cooccurrence of solidary and conflict in varied situations, circumstances, and stages of life. For example, caregiving is considered a prime example of intergenerational solidarity, and while it may be a mutually rewarding experience in many ways, it is also known to engender feelings of stress and loneliness, leading to increased caregiving burden. The coexistence of such diametrically opposite feelings with respect to the same situation comprises “ambivalence” in intergenerational relationships. And while this concept may have been explored primarily within the context of family relationships, it is equally applicable for the study of broader macro-level issues, where intergenerational interests converge or collide. One example of a global issue that affects all age groups alike is climate change. Considering the recent climate protests and public comments, it may be construed that climate discourse in the public domain emanates underlying intergenerational tension and conflict. However, a deeper look into localized climate interventions and initiatives may reveal the prevalence of intergenerational solidarity and cooperation. This scoping review therefore uses the framework of intergenerational ambivalence to identify examples of both intergenerational solidarity and conflict for a holistic understanding of intergenerational relationships in the face of climate change.

Method

Scoping review methodology was used to examine the multilayered nature of the literature and to systematically map the research on older people and intergenerational relations in the context of climate change. This kind of review aims to better identify relevant key concepts, theories, types of research, or research gaps. Scoping reviews are particularly valuable to explore multidisciplinary research questions and bodies of literature. In contrast to other types of systematic reviews, scoping reviews do not typically assess the quality of included studies and they start with a broader research goal (Arksey & O’Malley, 2005). Scoping reviews are distinct from narrative reviews in that they require structured search approaches of identification, selection, and reporting processes as established in PRISMA guidelines for systematic reviews (Page et al., 2021). For this review, we

followed the five recommended steps as detailed in the following sections (Arksey & O'Malley, 2005).

Step 1: Identifying the Research Questions

The main aim of this review was to examine the scientific knowledge of older people and intergenerational relations in the context of climate change. Following Arksey and O'Malley (2005), the review relied on a structured process that resulted in four thematic areas: intergenerational conflict, intergenerational differences, intergenerational solidarity, and intergenerational transmission. These areas were not preconceived but evolved after reading and rereading selected articles on older people and intergenerational relations in the context of climate change.

In this study, intergenerational conflict is defined as a conflict between generations for shared resources such as the planet that we inhabit. Conflicts may be of a personal nature, such as a clash of values between family/community members belonging to different age groups, they may be restricted to certain places or circumstances such as voting and decision-making powers resting disproportionately with particular age groups or may be a generic perception about a particular age group, such as older adults or young people, arising from a sense of prejudice toward that population.

Intergenerational differences are related to intergeneration conflict and are often a cause for the same; however, the key distinction lies in the fact that in this case, although there may be differences in world views, values, lifestyles, and societal powers/privileges, these do not introduce an element of conflict within interpersonal relationships.

Intergenerational solidarity comprises examples of different generations working in collaboration toward a common goal and a common interest. Intergenerational solidarity is built upon compassion, empathy, and commitment toward the welfare of all.

Intergenerational transmission is closely linked to intergenerational solidarity. It implies the transfer and sharing of knowledge and resources with other generations with the aim to benefit their lives and futures. Intergenerational transmission primarily flows from older to younger generations; however, the reverse may also hold true.

Step 2: Identifying Relevant Studies

The following criteria were used to guide the search for relevant articles.

Inclusion criteria

- Research that has a primary focus on older people (older than the age of 60) AND intergenerational relations AND climate change (including natural disaster and environmental activism)

- Qualitative, quantitative, mixed-methods research, including theoretical discussions
- Studies from anywhere in the world
- Studies with full text available in English
- Peer-reviewed publications only
- In cases where different records used the same data set and carried out the same analysis, the most complete record was included.

Exclusion criteria

- All languages other than English
- Studies that focus on (intergenerational relations) OR (climate change) as separate issues and do not link the concepts
- Studies that do not focus on older people, yet focus on intergenerational relations and climate change
- Full texts unavailable for review
- Non-peer-reviewed journals
- Book chapters, book reviews, commentaries, or editorials
- Duplicates.

Search Strategy

The search strategy was developed using PubMed. A variety of search terms were used from an extensive list of primary search terms for PubMed. The primary search terms focused on the following: Older people AND Intergeneration AND Climate Change (Supplementary Section 1).

The search strategy developed for PubMed was modified to comply with the other bibliographical databases included in this scoping review: APA PsycNet and Web of Science. We used Google Scholar's "cited by" and "related" functions to identify additional articles, relying on the relevant papers selected in this stage.

Step 3: Study Selection

Titles and abstracts were screened by two independent reviewers to determine eligibility based on the predefined inclusion and exclusion criteria. Any uncertainty with a title/abstract resulted in transferring the article to the second stage for further scrutiny. Next, shortlisted articles were reviewed (full-text screening). A PRISMA flow chart was followed and populated with relevant numbers of articles.

Step 4: Charting the Data

We developed a table to guide the extraction process. In addition to the characteristics of the study and methods (e.g., geographic location, sample size type of study design), we summarized the main themes and conclusions outlined by the authors. These are described in a narrative form in the

text. We piloted and revised the extraction table. This stage was also conducted independently by two raters.

Step 5: Collating, Summarizing, and Reporting the Results

We relied on a narrative synthesis to develop thematic findings and present them as a story at the nexus of studies on older people, intergenerational relations, and climate change.

Results

Our preliminary search strategy was conducted between September 22, 2021 and September 26, 2021, yielded 862 articles (28 PubMed, 122 APA PsychNet, 673 Web of Science, 39 snowballing). After removing 76 duplicates, 786 articles were maintained. Of these, 721 were excluded based on title and abstract. The remaining 65 were retained for full-text review. Figure 1 outlines the search flow, using the PRISMA guidelines.

Twenty articles were included in the final analysis. Of these, two were review articles, one was a consensus paper, two were repeated cross-sectional, and one was a cross-sectional study. The remaining studies were qualitative or mixed methods in nature. Most articles originated in and focused on the United States ($N = 8$). Studies that focused on either a single European country or on several European countries (one of which also included the United Kingdom and the United States) also were common ($N = 6$). The remaining studies focused on China, the United Kingdom, Russia, the Philippines, Tanzania, and Bolivia. The earliest article identified was written in 1999. There was a steady increase in the number of published articles over time (see Table 1 for study characteristics).

Thematic grouping took place after reading and coding the selected papers. We decided on four main categories addressing various aspects of intergenerational relations:

conflict ($N = 2$), differences ($N = 8$), solidarity ($N = 6$), and transmission ($N = 4$).

Intergenerational Conflict

The potential for conflict between the generations in the context of climate change was discussed by two studies. Both had an international focus, concerning Europe, North America, the United Kingdom, or Africa. The study by Kaya (2019) has argued that antiage discrimination laws can successfully address environmental vulnerabilities for all age groups (“older people,” “children,” “later birth cohorts,” and “earlier birth cohorts”) as opposed to prioritizing one age group over another. The author has presented age-related discriminatory environmental impacts to demonstrate how different age groups will experience diverse and unequal issues arising from the common challenge of climate change. Therefore, to effectively address the broad range of age-based environmental impacts, the scope of antiage discrimination laws must be broadened to benefit all generations equally rather than primarily older adults, the usual beneficiaries of antiage discrimination laws. The second study that addressed intergenerational conflict was undertaken by Murphy (2021) who examined intergenerational divide in the context of climate change. A critical analysis of social media contents along with surveys of voters’ attitudes revealed the prevalence of intergenerational conflict aimed toward both the young and the old. Younger generations tended to believe that older generations were unable to grasp the science behind climate change or the severity of the problem. However, when they tried to explain or protest, their voices were suppressed and excluded from policy decisions. Moreover, they were dealt in injustice by being belittled, discredited, accused of establishing “climate cults,” and being told to “go back to school” even though they were fighting a legitimate fight for their future. Both studies pointed to age-based discrimination that affects both young and old. They also highlighted the necessity to recognize the potential escalation of intergenerational conflict if a particular generation is prioritized in the formulation of climate policies/laws over others or if one generation is held responsible for the climate crisis to the detriment of others when all generations are affected by climate change and merit equal consideration.

Intergenerational Differences

Eight studies addressed differences between the generations. This line of research is focused mainly on intergenerational differences between people of different age groups or different cohorts with regard to energy consumption (Bardazzi & Pazienza, 2020; Isabelle, 2011), ecological knowledge (Galang & Vaughter, 2020; Kaijage, 2021), and attitudes toward climate change (Gray et al., 2019; Herman-Mercer et al., 2016; Kafková, 2019; Zhang, 2018). Most found evidence of age and generational differences

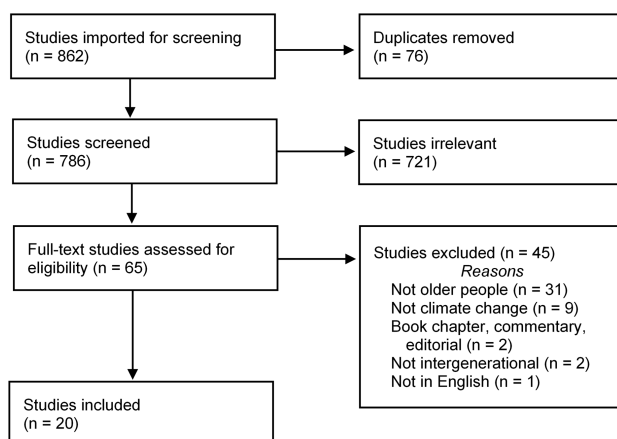


Figure 1. PRISMA flow of research articles.

Table 1. Study Characteristics

Study	Location	Design	Data collection	Population	Number of participants	Age	% Women	Intergenerational theme
Barber, 2014	United States	Qualitative research	Mail	Grandparents who participated with their grandchildren in an intergenerational Elderhostel and experienced a forest fire	13 grandparents	69.2	69.30%	Solidarity
Bardazzi & Paziienza, 2020	Italy	Repeated cross-sectional	Secondary data from the Italian Household Budget Survey	Italian Household Budget Survey	About 20,000 households each year to represent the Italian population	25–85	Not specified	Differences
Boyd, 2019	United Kingdom	Participant observation through notes and photographic evidence	Observation	The children consisted of two groups, 3- to 4-year-old children and 2- to 3-year olds. The same children attended the cafe over the 6 months. Older participants came from within the Liverpool 6 district of Everton	Not reported	Not reported for older people (children 2–4)	Not reported	Transmission
Chazan & Baldwin, 2019	United States	Group discussion, participant observation, media analysis	Group discussion, participant observation, media analysis	Nongrandmother activists from the ShellNo Action Coalition, with whom the grandmothers (grannies) had been nurturing relationships since before the 2015 actions, and grandmothers between ages 60–80	Eight panelists and 100 grandmothers from over 12 geographically diverse areas	60–80 for grandmothers; age of other eight people not given	100% for grannies; others not given	Solidarity
Crate, 2006	Russia	Mixed methods—qualitative and quantitative	In-person	Two 6-member focus groups in each of the four villages, one female and one male group with two youth, two middle-aged, and two older participants	Two focus groups of six members each; 15 interviews; 13 older people; 15 older people; and students	Middle age, older people; five age groups—undefined	50% of focus group members	Transmission
				Semistructured interviews with five individuals from each age group for a total of 15 inhabitants in each of the four villages				

Table 1. Continued

Study	Location	Design	Data collection	Population	Number of participants	Age	% Women	Intergenerational theme
D'abundo et al., 2011	United States	Mixed methods—qualitative and quantitative (pre-post design)	In-person	Students and older people	86 (43 students and 43 older people)	Students—not reported; adults >60	88.4% of the students; older people—not reported	Transmission
Ekstrom, 1999	United States	Text and opinion + case studies	Secondary data (case studies)	Older people engaged in environmental or sustainability issues	Not reported	Not reported	Not reported	Solidarity
Galang & Vaughter, 2020	Philippines	Mixed methods—qualitative and quantitative	In-person	Users of an agroforestry landscape; three representative villages	Three representative villages: 15–20 people in each focus group; survey: 36 youth, 36 middle-aged, 36 older people	Not reported: youth, middle-aged, older people	21%—youth; 30% middle-aged; 28% older people	Differences
Isabelle, 2011	France	Qualitative research	In-person	People of various ages who have lived through events that have influenced their energy-related behaviors	Not reported	Different age groups—the oldest event mentioned the second world war	Not reported	Differences
Gray et al., 2019	United States	Cross-sectional study	Internet	Age groups that make up the four current generations that are active voting members of the public	469	Four age groups: The Silent Generation: 1925–1945; Baby Boomers: 1946–1964; Generation X: 1965–1981; Millennials: 1982–1999	60%	Differences
Herman-Mercer et al., 2016	United States	Qualitative research	In-person	Participants from four villages: Cohort 1, ages 18–29, the millennial generation, young adults; Cohort 2, ages 30–49, generation X; Cohort 3, ages 50–64, baby boomers; and Cohort 4, ages 65 and older	51	Four age groups: 18–29, 30–49, 50–64, ≥65	Not reported	Differences

Table 1. Continued

Study	Location	Design	Data collection	Population	Number of participants	Age	% Women	Intergenerational theme
Kafková, 2019	Six European countries (Austria, Czech Republic, Germany, Netherlands, Slovak Republic, and Spain)	Repeated cross-sectional	Method of survey administration not reported	Representative of 18 and older populations in Austria, the Czech Republic, Germany, Netherlands, Slovak Republic, and Spain	Not reported	Not reported (age groups: 18–24, 25–34, 35–44, 45–54, 55–64, 65–74, 75+)	Not reported	Differences
Kaijage, 2021	Tanzania	Qualitative case study including focus group, photo narratives, documentary review, and field observations	In-person for focus group, in-depth interviews, photo narratives, documentary review, and field observation. Secondary data analysis of historical texts on people and communities of Mtwara, literature on environmental changes in Tanzania and reports of the Tanzania Meteorological Agency	Residents of two villages in Masasi district in Mtwara region	Focus group: 72 (two villages; six groups in each village; six participants in each focus group) In-depth interviews: 18	In-depth interviews (six older adults [64+], six middle-aged people [30–50], and six youth [below 30])	Not reported	Differences
Kaya, 2019	Several countries (European Union, United States, United Kingdom)	Review	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	Conflict
Kruger et al., 2014	Global (United States authors)	Review	Not relevant	Not relevant	Not relevant	Not relevant	Not relevant	Solidarity
Llamazares et al., 2015	Bolivia	Qualitative research	In-person	A group of hunter-gatherers of Bolivian Amazonia	300	Sample 1 (complete sample; 300 participants): 37.75 years; <i>SD</i> = 16.97 Sample 2 (sub-sample; 113 participants): 39.29 years; <i>SD</i> = 18.82 Sample 3 (sub-sample; 16 participants): 36.53 years; <i>SD</i> = 15.58	Sample 1: 52.67% Sample 2: 48.21% Sample 3: 43.75%	Transmission

Table 1. Continued

Study	Location	Design	Data collection	Population	Number of participants	Age	% Women	Intergenerational theme
Mitrofanenko et al., 2018	Austria	Case study (mixed methods)	In-person	Youth and older women at the biggest biosphere reserve in Austria	75 (25 older women and 50 youth); and five middle-aged women	Older women ≥60, youth-20s; middle-aged 40–50	100% older people and middle-aged women; 50% youth	Solidarity
Murphy, 2021	Europe, North America, Australia, and Africa	Mixed methods—qualitative and quantitative	Social media and survey	Social media data, Afrobarometer, and Eurobarometer data	The Afrobarometer (2019): 25,823 interviews across 34 countries The Eurobarometer (2019): 27,607 interviews across 28 countries	Not reported	Not reported	Conflict
Pillemer et al., 2011	United States	A consensus on recommendations for a research agenda on aging and environmental sustainability	In-person	A consensus among social scientists, medical researchers, and community stakeholders	Phase 1: 23 researchers Phase 2: not specified but three working groups Phase 3: 23 original researchers and 14 national experts	Not reported	Not reported	Solidarity
Zhang, 2018	China	Mixed methods—qualitative and quantitative	Mixed methods—survey, interviews, intergenerational theater	Residents of Nanjing, Yangze River Delta, China	752 for survey Strand A: 90 for interviews (subsample of the survey) Strand B: 15 for in-depth qualitative research (three-generation family)	Survey: 16–90 (most interviewees were aged 21–70 years)	Roughly 50%	Differences

(Bardazzi & Paziienza, 2020; Galang & Vaughter, 2020; Herman-Mercer et al., 2016; Isabelle, 2011), although two only found minimal differences (Gray et al., 2019; Kafková, 2019). The studies were diverse in their geographic focus, including the United States (Gray et al., 2019; Herman-Mercer et al., 2016), Philippines (Galang & Vaughter, 2020), Tanzania (Kaijage, 2021), China (Zhang, 2018), and Europe (Bardazzi & Paziienza, 2020; Isabelle, 2011; Kafková, 2019).

The study by Bardazzi & Paziienza (2020) examined the roles of age and generation in energy consumption patterns in Italian households to assess how aging and future population structures might affect energy consumption. The authors found that consumption of both natural gas and electricity increased with age. By combining their findings with demographic projections up to 2050, they concluded that energy demand calculations must account for age and generation effects to avert a severe underestimation of energy demand in the future. The study by Isabelle (2011) examined how people in France relate to energy at different stages of life (“childhood,” “adolescence,” “young adulthood,” “adulthood,” “retirement”)—in the context of family relationships, historical events, energy policies, environmental issues, and energy-related technologies. The author concluded that at each stage of life individuals are propelled to interact with energy in different ways in a society/environment that has been built before and around them. Therefore, in order to influence energy-related behaviors toward sustainable choices, each age group must be provided with tools and technologies (e.g., messages of social justice through video games for adolescents or energy-efficient household appliances for adults) to match their life stage. Importantly, these tools must not only be personalized to each life stage but must also be deployed simultaneously to bring about effective and lasting change.

Two studies focused on intergenerational relations and ecological knowledge. The first, by Galang and Vaughter (2020), examined generational persistence and sources of local ecological knowledge among agroforesters in the Philippines. A survey of “youth,” “middle-aged,” and “older adult” users of agroforestry landscape revealed that although all age groups possessed high levels of local ecological knowledge, the sources from which they derived their knowledge differed. For the youth, institutional-based learning was instrumental to knowledge acquisition, whereas for older generations, experiential learning was more relevant. The authors concluded that future policies must focus on age-targeted interventions for effective management and conservation of agroforestry land. The second study on ecological knowledge and intergenerational relations was undertaken in Tanzania by Kaijage (2021). This study examined the role of current socioeconomic and environmental changes on the transfer of traditional ecological knowledge. The author found that modern means of communication such as the media, mobile phones, and training programs were eroding traditional platforms of sharing

local ecological knowledge and practices. Moreover, climate change was rendering traditional knowledge inaccurate in the prediction of weather events. This resulted in a lack of trust in traditional knowledge, poor levels of interaction between older and younger generations, and a gap in the continuity and flow of knowledge from older people to youth. Consequently, traditional knowledge was becoming “patchy” and unable to meet societal needs.

Intergenerational differences, sometimes minor, were also found in attitudes toward climate change. Gray et al. (2019) studied the polarizing portrayals of older and younger generations in their concerns about climate change in the United States. Although popular media and previous research had reported that older generations were less interested and invested in climate action compared to younger generations who were leading the climate movement, other research had also previously found that there were no differences in how younger and older generations viewed climate change. Gray et al. (2019) undertook an age and generational cohort-based analysis and found that younger generations did not experience environmental losses more acutely than older generations. In fact, environment value orientation and self-reported political orientation were more influential in how different generations viewed climate change and action rather than age and cohort. Similarly, Kafková (2019) conducted a study using age, period, cohort analysis to examine the influence of age on environmental values in six European countries and concluded that cohort effects have no influence on environmental values, and age is weakly related. Period effects, however, had a strong influence on environmental values and volunteering behaviors. Notably, the youngest age group (18–24 years) were slightly more willing than others to pay more for environmental protection. Herman-Mercer et al. (2016) undertook a study on cultural dimensions of climate change in four indigenous communities in subarctic Alaska and found that although members of all ages across the four communities had observed changes in their environment, older generations had observed more changes than younger generations and perceptions related to these changes varied by age. The biggest variation was found in how people of different generations (ages 18–29, 30–49, 50–64, and 65+) thought of “typical” weather that influenced how they perceived the extent and impact of climate change. The authors concluded that generational differences in observations and perceptions of climate change needed to be taken into account in climate change adaptation strategies. In the final study that addressed intergenerational differences, Zhang (2018) examined intergenerational justice and solidarity in sustainability in China and found that, with increasing age, people were more concerned about large-scale sustainability; that older adults were more concerned about the causes of climate change; and that views regarding responsibility for environmental problems changed with increasing age. On the other hand, there were little to

no differences in how different age groups perceived the preservation of the future. Overall, the author concluded that although there were considerable differences on the subject of intergenerational justice, there were also some instances of intergenerational solidarity.

Intergenerational Solidarity

Six studies addressed solidarity between the generations. Four of these studies originated in and focused on the United States (Barber, 2014; Chazan & Baldwin, 2019; Ekstrom, 1999; Pillemer et al., 2011). One had a global focus, but originated in the United States (Kruger et al., 2014) and one originated and focused on Austria (Mitrofanenko et al., 2018). One study was a review paper (Kruger et al., 2014), another was a consensus paper (Pillemer et al., 2011), and the remaining studies were either qualitative (Barber, 2014; Chazan & Baldwin, 2019; Ekstrom, 1999) or mixed methods, using qualitative and quantitative data (Mitrofanenko et al., 2018). These studies suggest that the involvement of older people in the climate change movement and their shared experiences with the younger generations foster positive intergenerational relations, improve the status of older people, and help the climate movement.

Barber (2014) conducted a study with 18 grandparents and 14 grandchildren who were affected by a forest fire as they participated in an intergenerational Elderhostel program. In the aftermath of the incident, grandparents reported stronger bonds and emotional closeness with their grandchildren in addition to increased quality, frequency, and intensity of conversation. Moreover, grandparents were able to provide comfort in a time of crisis and help their grandchildren process the event and reframe it in a positive way, such as expressing gratitude for being alive when they had lost all their belongings in the fire. The author concluded that in times of crisis and extreme stress, grandparents could play an instrumental role in the well-being of younger generations. Chazan & Baldwin (2019) conducted a study to highlight the prevalence of intergenerational solidarity at a time when the climate fight is portrayed as the lone effort of younger generations. The authors analyzed the role of the Seattle group of the Raging Grannies, a network of older activists, who mobilized their age, gender, and whiteness to support young activists engaged in Seattle's ShellNo Action Coalition and blocked Shell Oil's rigs from traveling from Seattle to the Arctic. The study served as an example of strong intergenerational and intersectional solidarity, whereby older adults lent support, mentorship, and resources aimed at fostering climate justice. The article by Ekstrom (1999) documented the roles of older adults in applied environmental concerns. The author used case studies on senior involvement and engagement in intergenerational exchanges to not only demonstrate the extent to which older adults can contribute toward the building of sustainable communities but to also challenge negative stereotypes associated with older

adults. Mitrofanenko et al. (2018) conducted a study on the management of a biosphere reserve in Austria and found that two key population groups, older women and youth, were underrepresented even though stakeholder participation was integral to sustainable development. The authors concluded that there was much scope for intergenerational collaboration and knowledge exchange between younger and older generations and recommended intergenerational practice as a management tool for the reserve. Pillemer et al. (2009) published a multidisciplinary conference consensus paper to address the topic of aging, environmental sustainability, and conservation. The article highlighted the extreme susceptibility of older adults to environmental threats, acknowledged the fact that as people age their contribution to environmental problems will likely increase, and proposed intergenerational strategies such as environmental volunteerism to harness the skills and knowledge of older adults in environmental sustainability and conservation. Finally, Kruger et al. (2014) published a review paper based on the central premise that environmental change and older adults affect one another and therefore environmental sustainability is by necessity an intergenerational phenomenon. The article highlights the need for both environmental and social equity in order to benefit older, as well as younger and future generations, and recognizes the potential of older adults to share sustainable behaviors with younger generations. Like the other papers included in this section on intergenerational solidarity, this article also emphasized the need and potential of intergenerational programs to promote sustainability.

Intergenerational Transmission

Transmission of knowledge, practices, and attitudes between the generations was examined in four studies (Boyd, 2019; Crate, 2006; D'abundo et al., 2011; Fernández-Llamazares et al., 2015). With one exception (D'abundo et al., 2011), transmission was examined as occurring from the older to younger generations. Studies originated in Bolivia, the United States, Russia, and the United Kingdom. Two of the studies were qualitative (Boyd, 2019; Fernández-Llamazares et al., 2015) and two employed mixed methods (Crate, 2006; D'abundo et al., 2011).

Boyd (2019) wrote about a Legacy Intergenerational sustainability skill café in England where children and families interacted with older adults within the community to learn about dying cultural traditions that promote sustainability. The program not only provided a sense of purpose to older adults but also helped them to share life skills. Additionally, the program challenged gender stereotypes as children watched their fathers cooking, knitting, and sewing and their mothers mending scooters and punctures. The article promoted intergenerational activities for their potential to reduce social isolation, improve mental health, and facilitate intergenerational cooperation. Crate (2006) undertook a study in Post-Soviet Russia to examine how traditional

occupations such as fishing, hunting, and herding that had sustained northern rural communities even after the fall of the Soviet Union in 1991 were now being challenged by globalization, mass media, and modernization as these were interrupting the flow of traditional knowledge from older to younger generations. An intergenerational elder knowledge project “Take Advice from the Elders” was therefore undertaken to document traditional knowledge to enhance sustainability while simultaneously identifying new ways to promote conversation between older and younger generations. The project was successful as elder knowledge was recognized as an integral part of the community’s common vision of sustainability. Fernández-Llamazares et al. (2015) conducted a study in Bolivia to assess the capacity of local environmental knowledge to keep up with rapid changes in the ecosystem. For this, they used the concept of baseline shifting syndrome—a sociopsychological phenomenon that examines “generational amnesia” (when traditional knowledge is not passed down to future generations, affecting how the latter perceive ecological change) and “personal amnesia” (when people update their own perception of normality over the life course); in both instances, the loss of knowledge remains unperceived. The authors found that age-related differences in perceptions of environmental change coupled with decreased intergenerational transmission of local knowledge had affected the natural baseline against which people measured changes in their environment. Consequently, the adaptive capacity and success of the entire ecosystem may be endangered. D’abundo et al. (2011) provided an example of intergenerational transmission from younger to older generations through the “Recycling Mentors” service-learning program aimed at promoting recycling and environmental awareness among younger and older generations. The program included personal interactions between students and older members of the community and information materials like brochures. At the end of the program, students reported increased awareness about environmental issues, a change in how they viewed older adults, and an interest in adapting different communication methods to address diverse age groups in the future.

Discussion

We relied on a scoping review to identify current scientific literature on the topic of older people and intergenerational relations in the context of climate change. This review is important considering the temporal characteristics of climate change impact and mitigation efforts: Activities taken (or not) in the present are likely to have an impact only in the future (Bodansky et al., 2017). Moreover, if mitigation efforts are successful, their future impact will be unnoticeable given the goal of limiting global warming to below 1.5°C, for instance. Although our initial interest in the topic stemmed from the discourse on the responsibility of older people to the current climate catastrophe (Ayalon, 2020),

our review showed little exploration of the role of older people regarding the current climate change crisis. Rather, the scientific evidence illustrates two discourses that stress the negative versus positive aspects associated with older people and intergenerational relations in the context of climate change. The first focuses on intergenerational conflict and differences; the other on intergenerational solidarity and transmission of knowledge and attitudes. Common to each is an acknowledgment of both young and old as being affected by climate change as well solutions for the climate crisis resting (equally) with both generations.

Whereas only two studies explicitly addressed intergenerational conflict, eight studies explored intergenerational differences. This shows that researchers are aware of potential disparities between the generations, but do not explicitly portray these as conflictual. These studies were heavily drawn from Europe and North America, where there are vocal climate change activist youths (Han & Ahn, 2020). The absence of voices from the global south is an important gap.

Studies addressing intergenerational solidarity originated mainly from the United States, in contrast to intergenerational transmission studies, which had diverse origins. Both groups of studies are optimistic about a future in which generations work toward a common cause or learn from each other. Further research is warranted to better understand global patterns in these views of climate change. This is important considering the spatial nature of climate change impact and mitigation efforts. Although the developed world is responsible for the industrial revolution, which has advanced the pollution of our planet, it is the developing world, which suffers the most from the unwanted effects of anthropogenic climate change (Bodansky et al., 2017).

Conclusion and Implications

Drawing on these findings, we offer a model that points to both negative and positive aspects associated with older people and intergenerational relations in the context of climate change (Figure 2). Whereas one discourse is focused on explicit areas of conflict and differences between the generation, the other points to the potential of intergenerational solidarity and the transmission of knowledge.

The findings suggest that both older and younger people are affected by age-based discrimination in the context of climate change and that generational differences in energy consumption and attitudes exist. Nonetheless, these can be overcome by stressing the solidarity between the generations and the ability of older people to contribute to the climate change movement as well as by the ability of each generation, young and old, to contribute and teach the other generation about sustainability issues. A consistent message across these studies is that both generations are affected by conflict and that both generations can benefit from intergenerational solidarity and transmission

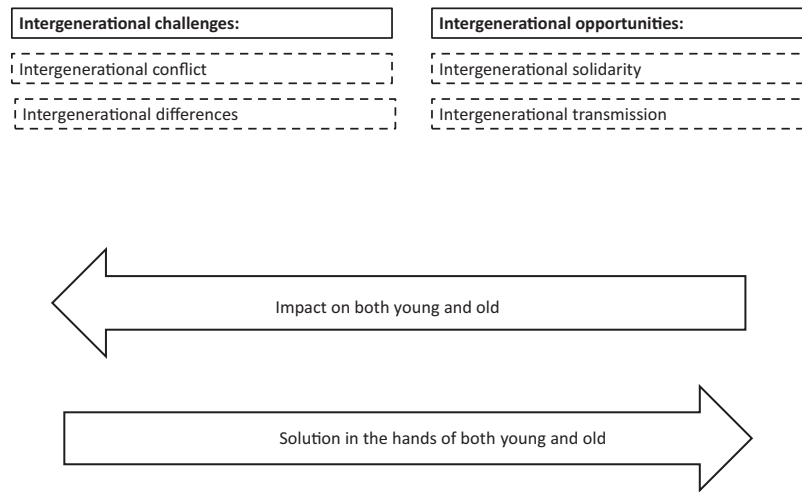


Figure 2. Intergenerational challenges and opportunities in the context of climate change.

of knowledge. Hence, consistent with the World Health Report on Ageism, which emphasized the impact of ageism across all ages (WHO, 2021), our findings also point to the importance of targeting all age groups as part of the climate change movement.

To further develop this model and ensure that it is of use for both researchers and policy stakeholders, several components should be strengthened. First, the topic of intergenerational tension or conflict between the generations was hardly addressed by the literature reviewed here. This possibly points to a lacuna in research, given the heated public debate that explicitly blames older people for the current climate change catastrophe (Roy & Ayalon, under review). Many of the studies not included in this review address the situation of younger people vis-à-vis older generations. These studies often explicitly blamed older generations for not acting or for being indifferent to the current or future impact of the crisis. However, these studies were not included here as they did not name older people explicitly, but rather used terms such as adults (Page, 1999; Weston, 2007). Hence, an important body of literature, which addresses intergenerational conflict, is quite limited in this scoping review. The role of policy and human rights violations in the context of older people and climate change also should be strengthened as only one study has highlighted this (Kaya, 2019). This is unfortunate given the recent Office of the United Nations High Commissioner for Human Rights' report (2021), which has highlighted the risks that climate change poses to older people's human rights.

Differences between the generations were addressed more extensively. However, there remains a question concerning the source of these differences. Whereas some of the studies reviewed specifically distinguished between chronological age and cohort effects, others did not. The need for longitudinal research is highlighted here, as this may provide important distinctions between the two possible sources of difference (e.g., cohort vs. age). The distinction

is important because it provides insights concerning the future need for preparedness. If the findings reflect cohort rather than age differences, it is possible that future generations will be more harmonized in their climate change opinions and practices. This in return may result in greater solidarity between the generations. In the field of intergenerational solidarity and transmission of knowledge, it is desired to employ experimental and quasi-experimental designs to better assess the impact of intergenerational interventions on the climate change movement. This has important practical implications given societal urgency to mitigate the negative impact of climate change and the possible benefits of generations working together to meet this goal. Such collaborative work is likely to result not only in better mitigation and adaptation efforts, but also in a world for all ages, in which chronological age is no longer a barrier or a hurdle. Finally, as climate change disproportionately affects the developing world (Wei et al., 2012), it is important to ensure adequate representation of research from the developing world. This will improve our understanding of intersectionality and power differences (e.g., spatial and temporal dimensions), by considering not only age, but also geographic location.

Although the quality of the studies reviewed was not officially appraised, several methodological issues should be raised. Clearly, longitudinal, experimental, or quasi-experimental studies are missing. This suggests that the evidence provided by the reviewed studies is still limited. Research relying on representative samples and the reliance on reliable and valid measures across different cultures also is lacking. This precludes our ability to generalize the findings and to conduct cross-national comparisons. The few studies that were conducted in emerging economies were either qualitative or mix-methods in nature, largely relying on small sample sizes. Hence, our knowledge from these areas of the world is even more limited.

Finally, we limited our focus to peer-reviewed articles given the fact that these often represent higher-quality

contributions. Nevertheless, this has resulted in omitting policy, media and lay people discourse concerning the topic of older people, and intergenerational relations in the context of climate change. It also is important to note that as in any scoping review, it is possible that we have missed relevant articles, despite efforts to conduct a comprehensive search. Nonetheless, our findings stress both challenges and opportunities inherited in intergenerational relations in the context of climate change.

Supplementary Material

Supplementary data are available at *The Gerontologist* online.

Funding

This study was supported by a grant from the Israel Science Foundation (217/20) to L. Ayalon; N. Keating is an external collaborator on this grant.

Conflict of Interest

None declared.

References

- Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology*, 8(1), 19–32. doi:10.1080/1364557032000119616
- Ayalon, L. (2020). Life in a world for all ages: From a utopic idea to reality. *Journal of Elder Policy*, 1(1), 39–68. doi:10.18278/jep.1.1.3
- Ayalon, L., Keating, N., Pillemer, K., & Rabheru, K. (2021). Climate change and mental health of older persons: A human rights imperative. *The American Journal of Geriatric Psychiatry*, 29(10), 1038–1040. doi:10.1016/j.jagp.2021.06.015
- Barber, C. E. (2014). Forest fire as a shared intergenerational experience: Perceived short-term impacts on the grandparent–grandchild relationship. *Journal of Intergenerational Relationships*, 12(2), 128–140. doi:10.1080/15350770.2014.901114
- Bardazzi, R., & Paziienza, M. G. (2020). When I was your age: Generational effects on long-run residential energy consumption in Italy. *Energy Research & Social Science*, 70, 101611. doi:10.1016/j.erss.2020.101611
- Bodansky, D., Brunnée, J., & Rajamani, L. (2017). *International climate change law*. Oxford University Press.
- Boyd, D. (2019). The Legacy Café—A trial of intergenerational and sustainable learning in an early childhood centre in Liverpool. In *Social responsibility and sustainability* (pp. 373–388). Springer.
- Chazan, M., & Baldwin, M. (2019). Granny solidarity: Understanding age and generational dynamics in climate justice movements. *Studies in Social Justice*, 13(2), 244–261. doi:10.26522/ssj.v13i2.2235
- Corner, A., Roberts, O., Chiari, S., Völler, S., Mayrhuber, E. S., Mandl, S., & Monson, K. (2015). How do young people engage with climate change? The role of knowledge, values, message framing, and trusted communicators. *Wiley Interdisciplinary Reviews: Climate Change*, 6(5), 523–534. doi:10.1002/wcc.353
- Crate, S. A. (2006). Elder knowledge and sustainable livelihoods in post-Soviet Russia: Finding dialogue across the generations. *Arctic Anthropology*, 43(1), 40–51. doi:10.1353/arc.2011.0030
- D'abundo, M. L., Fugate-Whitlock, E. I., & Fiala, K. A. (2011). Recycling mentors: An intergenerational, service-learning program to promote recycling and environmental awareness. *Journal of Public Health Management and Practice*, 17(4), 373–375. doi:10.1097/PHH.0b013e3182159674
- Ekstrom, C. D., Ingman, S. R., & Benjamin, T. C. (1999). Gerontology/environmental links in aging education: Toward an intergenerational view of sustainability. *Educational Gerontology*, 25(6), 613–621. doi:10.1080/036012799267666
- Fernández-Llamazares, Á., Díaz-Reviriego, I., Luz, A. C., Cabeza, M., Pyhälä, A., & Reyes-García, V. (2015). Rapid ecosystem change challenges the adaptive capacity of Local Environmental Knowledge. *Global Environmental Change*, 31, 272–284. doi:10.1016/j.gloenvcha.2015.02.001
- Frumkin, H., Fried, L., & Moody, R. (2012). Aging, climate change, and legacy thinking. *American Journal of Public Health*, 102(8), 1434–1438. doi:10.2105/AJPH.2012.300663
- Gagliardi, C., Pillemer, K., Gambella, E., Piccinini, F., & Fabbietti, P. (2020). Benefits for older people engaged in environmental volunteering and socializing activities in city parks: Preliminary results of a program in Italy. *International Journal of Environmental Research and Public Health*, 17(11), 3772. doi:10.3390/ijerph17113772
- Galang, E. I. N. E., & Vaughter, P. (2020). Generational local ecological knowledge on the benefits of an agroforestry landscape in Mindanao, Philippines. *Asian Journal of Agriculture and Development*, 17, 90–108. doi:10.37801/ajad2020.17.1.6
- Gamble, J. L., Hurley, B. J., Schultz, P. A., Jaglom, W. S., Krishnan, N., & Harris, M. (2013). Climate change and older Americans: State of the science. *Environmental Health Perspectives*, 121(1), 15–22. doi:10.1289/ehp.1205223
- Gardiner, S. M. (2006). A perfect moral storm: Climate change, intergenerational ethics and the problem of moral corruption. *Environmental Values*, 15(3), 397–413. doi:10.3197/096327106778226310
- Gray, S. G., Raimi, K. T., Wilson, R., & Árvai, J. (2019). Will millennials save the world? The effect of age and generational differences on environmental concern. *Journal of Environmental Management*, 242, 394–402. doi:10.1016/j.jenvman.2019.04.071
- Han, H., & Ahn, S. W. (2020). Youth mobilization to stop global climate change: Narratives and impact. *Sustainability*, 12(10), 4127. <https://www.mdpi.com/2071-1050/12/10/4127>
- Herman-Mercer, N. M., Matkin, E., Laituri, M. J., Toohey, R. C., Massey, M., Elder, K., Schuster, P. F., & Mutter, E. A. (2016). Changing times, changing stories: Generational differences in climate change perspectives from four remote indigenous communities in Subarctic Alaska. *Ecology and Society*, 21(3), 28. doi:10.5751/ES-08463-210328
- Ho, J. Y., & Hendi, A. S. (2018). Recent trends in life expectancy across high income countries: Retrospective observational study. *BMJ (Clinical Research ed.)*, 362, k2562. doi:10.1136/bmj.k2562
- Intergovernmental Panel on Climate Change. (2021). *AR6 synthesis report: Climate change 2022*. <https://www.ipcc.ch/report/sixth-assessment-report-cycle/>

- Isabelle, G.-M. (2011). Energy-related logics of action throughout the ages in France: Historical milestones, stages of life and intergenerational transmissions. *Energy Efficiency*, 4(4), 493–509. doi:10.1007/s12053-011-9124-8
- Kafková, M. (2019). Environmental attitudes in an intergenerational perspective. *Slovenský Národopis*, 67(2), 201–215. doi:10.2478/se-2019-0011
- Kaijage, J. M. (2021). Climate change and the nature of intergenerational transfer of knowledge in the contemporary world: The case of Masasi district in Tanzania. *Eastern Africa Social Science Research Review*, 37(2), 149–176. doi:10.1353/eas.2021.0012
- Kaya, R. (2019). Environmental vulnerability, age and the promises of anti-age discrimination law. *Review of European, Comparative & International Environmental Law*, 28(2), 162–174. doi:10.1111/reel.12279
- Kruger, T. M., Savage, C. E., & Newsham, P. (2014). Intergenerational efforts to develop a healthy environment for everyone: Sustainability as a human rights issue. *International Journal of Aging & Human Development*, 80(1), 27–40. doi:10.1177/00914150150591108
- Lüscher, K., & Pillemer, K. (1998). Intergenerational ambivalence: A new approach to the study of parent–child relations in later life. *Journal of Marriage and the Family*, 60(2), 413–425. doi:10.2307/353858
- Méjean, A., Pottier, A., Fleurbaey, M., & Zuber, S. (2020). Catastrophic climate change, population ethics and intergenerational equity. *Climatic Change*, 163(2), 873–890. doi:10.1007/s10584-020-02899-9
- Mitrofanenko, T., Snajdr, J., Muhar, A., Penker, M., & Schuppenlehner-Kloyber, E. (2018). Biosphere reserve for all: Potentials for involving underrepresented age groups in the development of a biosphere reserve through intergenerational practice. *Environmental Management*, 62(3), 429–445. doi:10.1007/s00267-018-1059-9
- Moody, H. R. (2007). Justice between generations: The recent history of an idea. In M. Bernard & T. Scharf (Eds.), *Critical perspectives on ageing societies* (pp. 125–137). Policy Press.
- Murphy, S. P. (2021). Climate change and political (in) action: An intergenerational epistemic divide? *Sustainable Environment*, 7(1), 1951509. doi:10.1080/27658511.2021.1951509
- Office of the United Nations High Commissioner for Human Rights. (2021). *Analytical study on the promotion and protection of the rights of older persons in the context of climate change*. <https://undocs.org/A/HRC/47/46>
- Page, E. (1999). Intergenerational justice and climate change. *Political Studies*, 47(1), 53–66. doi:10.1111/1467-9248.00187
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ (Clinical Research ed.)*, 372, n71. doi:10.1136/bmj.n71
- Pillemer, K., Wagenet, L., Goldman, D., Bushway, L., & Meador, R. (2009). Environmental volunteering in later life: Benefits and barriers. *Generations*, 33(4), 58–63. <https://www.jstor.org/stable/26555700>
- Pillemer, K., Wells, N. M., Wagenet, L. P., Meador, R. H., & Parise, J. T. (2011). Environmental sustainability in an aging society: A research agenda. *Journal of Aging and Health*, 23(3), 433–453. doi:10.1177/0898264310381278
- Puaschunder, J. M. (2016). Intergenerational climate change burden sharing: An economics of climate stability research agenda proposal. *Global Journal of Management and Business Research: Economics and Commerce*, 16(3), 31–38.
- Street, D., & Cossman, J. S. (2006). Greatest generation or greedy geezers? Social spending preferences and the elderly. *Social Problems*, 53(1), 75–96. doi:10.1525/sp.2006.53.1.75
- Tavener, M., Byles, J., & Loxton, D. (2014). Expert perceptions of the popular baby boomer image. *Australasian Journal on Ageing*, 33(4), E31–E35. doi:10.1111/ajag.12087
- Wei, T., Yang, S., Moore, J. C., Shi, P., Cui, X., Duan, Q., Xu, B., Dai, Y., Yuan, W., Wei, X., Yang, Z., Wen, T., Teng, F., Gao, Y., Chou, J., Yan, X., Wei, Z., Guo, Y., Jiang, Y., ... Dong, W. (2012). Developed and developing world responsibilities for historical climate change and CO₂ mitigation. *Proceedings of the National Academy of Sciences of the United States of America*, 109(32), 12911–12915. doi:10.1073/pnas.1203282109
- Weston, B. H. (2007). Climate change and intergenerational justice: Foundational reflections. *Vermont Journal of Environmental Law*, 9, 375. doi:10.2307/vermjenvilaw.9.3.375
- Willoughby, M., Kipsaina, C., Ferrah, N., Blau, S., Bugeja, L., Ranson, D., & Ibrahim, J. E. (2017). Mortality in nursing homes following emergency evacuation: A systematic review. *Journal of the American Medical Directors Association*, 18(8), 664–670. doi:10.1016/j.jamda.2017.02.005
- World Health Organization. (2018). *COP24 special report: Health and climate change*. <https://apps.who.int/iris/handle/10665/276405>
- World Health Organization. (2021). *Global report on ageism*. <https://www.who.int/teams/social-determinants-of-health/demographic-change-and-healthy-ageing/combating-ageism/global-report-on-ageism>
- World Health Organization. (2022). *The UN decade of healthy ageing 2021–2030 in a climate changing world*. <https://www.who.int/publications/m/item/decade-of-healthy-ageing-connection-series-no3>
- Yu, W., Mengersen, K., Hu, W., Guo, Y., Pan, X., & Tong, S. (2011). Assessing the relationship between global warming and mortality: Lag effects of temperature fluctuations by age and mortality categories. *Environmental Pollution (Barking, Essex: 1987)*, 159(7), 1789–1793. doi:10.1016/j.envpol.2011.03.039
- Yu, W., Mengersen, K., Wang, X., Ye, X., Guo, Y., Pan, X., & Tong, S. (2012). Daily average temperature and mortality among the elderly: A meta-analysis and systematic review of epidemiological evidence. *International Journal of Biometeorology*, 56(4), 569–581. doi:10.1007/s00484-011-0497-3
- Zhang, M. (2018). Intergenerational justice and solidarity on sustainability in China: A case study in Nanjing, Yangtze River Delta. *Sustainability*, 10(11), 4296. doi:10.3390/su10114296