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Migration health crisis associated with climate change: A systematic review

Sadegh Ahmadi Mazhin^{1,2}, Hamidreza Khankeh^{1,3}, Mehrdad Farrokhi¹, Mohsen Aminizadeh^{1,4}, Mohsen Poursadeqiyani^{5,6}

Abstract:

BACKGROUND: The empirical assessment of the health outcomes associated with migration caused by climate change is still unclear. However, health outcomes in the early stages are expected to be similar to the health outcomes associated with refugees. The objective of the present study was a systematic review of the health effects of migration caused by climate change.

METHODOLOGY: A systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Online databases (PubMed, Scopus, Web of Science, and Google Scholar) were used to identify papers published that evaluated the health effects of migration caused by climate change. The search, article selection, and data extraction were carried out by two researchers independently. All English-language articles on the health effects of migration caused by climate change were included in this study.

RESULTS: An analysis of the complex ways in which climate change influences populations can be facilitated using a three-class classification: compulsory displacement, resettlement planning, and migration. Subsequent to climate changes, other changes, and environmental deficiencies, compulsory displacement may occur in case of inadequacy of compatibility responses. A part of migration-related health outcomes caused by climate change is from displacement from rural to urban areas, especially in developing countries. There is significant documentation on health and livelihood inequalities between migrant groups and host populations in developed countries.

CONCLUSION: If climate change continues in its current direction, it is likely that the number of refugees and crises will increase in the coming decades. Although the domain and the extent of health hazards caused by the displacement of the population associated with climate change cannot be clearly predicted, by reducing global greenhouse gas emissions, along with social and environmental adaptation strategies, migration caused by climate change, health risks and its relevant crises can be greatly reduced.

Keywords:

Climate change, health, human migration, population dynamics

Introduction

Today, the effects of climate change are well felt, and futures studies show that these changes have a catastrophic effect on human health. The consequences of these changes for the world's population can lead to undermining the achievements of the past half-century in terms of global development and global health. Existing global warming scenarios show an average of 2.6°C–4.8°C

by the end of the century. It is essential to prevent the increase of the average global temperature to <2°C to stop the potentially catastrophic effects of climate change by the end of the century. The direct effects of climate change include increased heat stress, displacement, drought, and increased hurricane severity and indirect effects, on the other hand, include threatening the population health through adverse changes in the air pollution, the spread of diseases, food insecurity and lack of nutrition, displacement, and mental health.^[1]

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¹Health in Emergency and Disaster Research Center, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran, ²Department of Nursing, Dezful University of Medical Sciences, Dezful, Iran, ³Department of Clinical Science and Education, Karolinska Institute, Stockholm, Sweden, ⁴Health in Emergency and Disaster Research Center, Kerman University of Medical Sciences, Kerman, Iran, ⁵Department of Occupational Health Engineering, Torbat Heydariyeh University of Medical Sciences, Torbat Heydariyeh, Iran, ⁶The Collaboration Center of Meta-Analysis Research, Torbat Heydariyeh University of Medical Sciences, Torbat Heydariyeh, Iran

Address for correspondence:

Dr. Mohsen Poursadeqiyani.
E-mail: mo.poursadeqiyani@uswr.ac.ir

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Human migration has a long history in response to climate change. Migratory flows have been shaped by climate impacts on environmental conditions, air temperature, access to water and food, social structures, and migration routes.^[2,3] In recent centuries, many climatic migrations have mainly been related to air cooling, drought, and food shortages. The dramatic increase in displacement and migration in Europe in the early seventeenth century after the ice age (with a sharp increase in food shortages, hunger, epidemic diseases, and war), the movement in Europe and the northeast of the United States during 1815–1818 and the climate and livelihood crises in Ireland in the 1840s are examples of such migrations.^[4-6]

Today, for the first time in history, human-made global climate change makes pressure on populations.^[7] Climate change is damaging communities and livelihoods through the impact on ecosystem products and services, loss of agricultural land, and increased severity and width of environmental pollution.^[8] These influences, as an adaptive strategy, may increasingly force people to migrate.^[9] Although climate change alone will not lead to population displacement, by creating environmental impacts and exacerbating vulnerabilities, people deal with life-threatening problems in the place they live.^[10] In the case of less developed countries, social, demographic, political, and economic stressors such as high population density, limited economic opportunity, unequal distribution of resources and services, urban planning, land planning, and armed conflict will be aligned with climate risks and affect decision-making for migration.^[11]

Environmental problems have always caused different forms of displacement across the globe, but recent studies have emphasized that displacements are more likely to occur due to climate change in the future.^[12] The empirical assessment of the health implications of migration is still not fully understood.^[13] There has been little research on the impacts of climate change-related migration on health, humanitarian, and equity aspect. Yet, the health risks posed by climate-related population movements are likely to become a major source of human suffering, disability, and loss of life. On the other hand, health outcomes in the early stages are expected to be similar to the health outcomes associated with refugees. Similar to refugees, migrants from climate change find themselves in places where they have low levels of public health.^[14] Compulsory displacements typically increase the risks of health outcomes, especially for vulnerable groups such as children, women, the elderly and those who have already been ill.^[15] Therefore, the present study systematically reviewing existing study in this field aims to identify the health effects of migration caused by climate change, and the results of this study can play a significant role as a guide in adaptive strategies

are also required to protect against increasing risks to human health and the adverse effects of climate-related migration and displacement and also the results of this study will extract the challenges associated with climate change migration and examine existing experiences.

Methodology

This study is a systematic review of the health effects of migration caused by climate change. The results of this study are based on articles published in English-language journals. In this study, all articles published by the end of 2018 were selected based on a search process done in Scopus, Web of Science, PubMed, Cochrane Library, Science Direct, and Google Scholar databases. Searching for the articles was done using keywords such as climate change, human population, population change, displacement people, health, health effect, drought, dust, sandstorm, flood, heatwave, migration in isolation, and combination using AND/OR conjunctions.

Accordingly, all articles in the field of health effects of migration caused by climate change were collected first, and after the completion of the search, a list of the abstracts was prepared. After concealing the profile of the articles, such as the name of the author and the name of the journal, the full text of the articles was passed on to two trained and skilled researchers. Each article was evaluated by two reviewers independently. If the articles were rejected by both reviewers, the reason was mentioned, and in case of disagreement between the reviewers, the article was judged by a third person. In order to evaluate the quality of the articles, the Strengthening the Reporting of Observational Studies in Epidemiology checklist was used, which has 22 parts. The scoring is based on the importance of each part according to the present study. The final score of the checklist was 30, with a minimum score of 15.^[16] Data extraction was performed using a preprepared checklist including the author's name, title of the article, time of the study, community under study, place of study, outcome of the research, study tool, study design, and type of changes.

All articles written in English on the health effects of migration caused by climate change were included in this research. It should be highlighted that studies that considered other aspects of migration were excluded from the study.

A total of 246 articles were found relevant to population changes caused by climate change. Twenty-nine and 92 articles were excluded due to repetitiveness and irrelevance to the study. Of these, 125 articles were concerned with the migration out of which 45 articles were devoted to the health effects of migration. After

reviewing the abstract of the articles, 25 papers that did not have the required information were excluded from further assessment. Ultimately, 20 articles had the inclusion criteria and were included in the study [Figure 1].

Results

As shown in Table 1, the extracted articles have been classified according to the year of publication, the target population, the intended outcome, the tool and design of the study, and finally, the type(s) of climate change [Table 1].

An analysis of the complex ways in which climate change affects populations can be facilitated using a three-class classification: compulsory displacement, resettlement planning, and migration.

Subsequent to climate change and other environmental changes and deficiencies, including food issues, access to water, climate change, land access, and other issues affecting the health of populations, compulsory displacement may occur if compromise responses are inadequate (compulsory displacement has a bilateral interaction with demographic slopes). This is because environmental changes and extreme weather events lead to a reduction in people's ability to live in their homes.

This displacement typically occurs at short intervals and may involve a wide range of people within the country. Resettlement may be considered for large populations to reduce their exposure to climate impacts. This probably encompasses the communities that have been deployed inside the country. Migration may also occur in response to, or in anticipation of, climate-related impacts or providing aid for urbanization within the country. Part of the health outcomes related to migration from climate change includes the dislocation from rural to urban areas, especially in developing countries.^[15,28]

Availability and quality of health care, health education, and preventive measures; the establishment of disease surveillance systems; control of pathogens; targeting the hidden population; monitoring and evaluating health interventions such as vaccination coverage; participation of the affected population in health care planning; coordination between services and administrative agencies and the target population and also paying attention to the health needs of the host population seem to be very important.^[15,20,34] As far as public health responses concerning population displacement associated with climate change, especially in sudden accidents, are taken into account, the above challenges are present. Other challenges in population displacement can be mentioned increased negative health outcomes in vulnerable groups, including reduced access to health care, incidence of water and foodborne diseases, food shortages, prevalence of sexually transmitted diseases, social instability, increased risks of maternal mortality, mental health problems, and increased violence.^[15,20,25]

Planned resettlement to reduce the vulnerability of climate change usually poses significant health and well-being risks. If necessary, social and health resettlement costs can be reduced by providing the right time to consult and planning the community, paying compensation equal to the standard of housing and material in the host society, ensuring that money and resources are spent to help communities to relocate, avoid paying mortgages to intermediaries, hiring displaced people wherever work is needed, and supporting housing, health services, mental health services, employment, and education.^[28,32,33] As far as possible, populations must be displaced and must be actively involved in all stages of the decision-making and resettlement process.^[15,27,35]

Among the negative health consequences identified in reviewing articles on planned resettlement can be mentioned poor mental health, food insecurity, unhealthy water and sewage system, lack of housing and increased infectious diseases in the displaced population, lack of land, unemployment, homelessness, marginalization, increased food insecurity, and loss of access to shared assets.^[15,20,34]

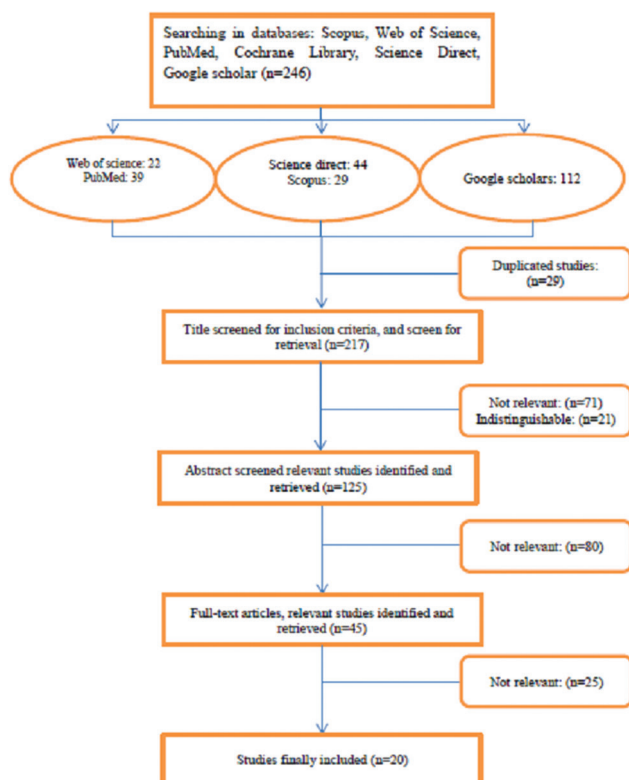


Figure 1: Results of Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow of the systematic literature search

Table 1: General characteristics of the articles that were eligible for the systematic review

Author	Title	Year	Society surveyed	Out come	Study tool	Study design	Type of climate change	Conclusion and suggestions
1	McGregor ^[17]	1994	Global	Food security	Articles and documentation	Review	All type	Recognizing that changing environments with forced migration Misleading the term “environmental refugee” and being conceptually, legally and institutionally unfounded
2	Afolayanm and Adelekan ^[18]	1999	Africa	Climatic change on migration and human health in Africa	Articles and documentation	Review	Drought	Describe the nature of climate change Proper prospects for governments and stakeholders to be aware of the consequences of climate change Strengthen and develop appropriate policies to reduce and reduce the impact on the general population of affected areas
3	Bates ^[19]	2002	Global	Classification scheme, Comparisons based on the characteristics of the causes of migration.	Articles and documentation	Review	All type	Significant environmental refugee control over immigration decision Impact of environmental change on natural disaster refugees Gradual destruction of “environmental migrants” and how they respond to environmental change
4	Barnett and Adger ^[20]	2007	Global	Climate change and human security	Articles and documentation	Review	All types	The direct and indirect effects of climate change on human security and violence Weakening human security with climate change by reducing access to and quality of natural resources important for livelihood
5	Reuveny ^[21]	2007	Global	Violent conflict	Articles and documentation	Review	All types	The relationship between climate change and sea level rise and melting glaciers Forecasting the impacts of climate change on migration by investigating

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Table 1: Contd...

Author	Title	Year	Society surveyed	Out come	Study tool	Study design	Type of climate change	Conclusion and suggestions
6	Keim ^[22]	2008	Global	Response	Review	Qualitative	Extreme weather events, including heat waves, drought, wildfire, cyclones, and heavy precipitation that could cause floods and landslides	the impacts of environmental problems on migration with emphasis on individuals from less developed countries The role of public health in reducing human vulnerability to climate change within the context of select examples for emergency preparedness and response Emergency preparedness, response and recovery activities resulting resilience
7	Obioha ^[23]	2008	Northeast region of Nigeria	Population drift and violent Conflict	Grounded theory Homer-Dixon model	Qualitative	Drought, desertification, environmental degradation, water and land resources shortages	The nature of communal civil violent conflicts in the northeast area of Nigeria, The patterns of the climatically induced violent conflicts, the major actors and the policy implications of the conflict in the sub region A fair critical overview of the weakness and strength of the theoretical postulation of "ecoviolence"
8	Perch-Nielsen <i>et al.</i> ^[24]	2008	Global	Conceptual models	Review	Qualitative	Sea level rise and floods	The connection between climate change and migration via two mechanisms, sea level rise and floods, is investigated and depicted in conceptual model The impact of several factors related to the vulnerability of the people and the region
9	Tacoli ^[11]	2009	Global	Strategies of adaptation	Articles and documentation	Review	Drought, desertification and land degradation, extreme weather events, sea level rise	The impacts of climate change to affect population distribution and mobility

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Author	Title	Year	Society surveyed	Out come	Study tool	Study design	Type of climate change	Conclusion and suggestions
10	Stephenson, <i>et al.</i> ^[25]	2010	Global	Climate change and population dynamics	Review	Qualitative	Extreme climate events, such as storms, floods, heat waves and droughts, land degradation and soil erosion, sea level rise, cyclone	That mobility and migration are key responses to environmental and nonenvironmental Transformations and pressures. The better understanding of the role of local and national institutions in supporting and accommodating mobility The link between climate change and population can be addressed through adaptation (reducing vulnerability to the negative effects of climate change) and through reduction (reducing greenhouse gas emissions) Weakening adaptation to climate change as a result of rapid population growth, human development Nonintegration of population dynamics systematically into the science of climate change
11	Warner <i>et al.</i> ^[26]	2010	Global	Whether migration is a process that reduces or increases vulnerability?	Review	Qualitative	Flooding, desertification, land degradation, water shortages and drought, the potential of sea level rise, and industrial pollution	The increasing and gradual impact of climate change on environmental degradation and environmental economic and social systems, significant population displacement, serious threat to food and health security, environmental, economic and social damage
12	Tacoli ^[27]	2010	Global	Criticism	Review	Editorial	Water-related hazards include floods and water scarcity, droughts	Migration and development: growing interest and polarized perceptions the importance of both

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Author	Title	Year	Society surveyed	Out come	Study tool	Study design	Type of climate change	Conclusion and suggestions
13	Tacoli and Mabala ^[28]	2010	Mali, Nigeria, Tanzania and Vietnam	Policy making and responses	Interviews , questionnaire	Case studies	All type	national and local context in shaping mobility the impact of migration on local development: citizenship, institution and social polarization climate change and cities food security and urbanization To explore the different ways in which migration intersects with the changing relations between rural and urban areas and activities, and in the process transforms livelihoods and the relations between young and older men and women
14	Black <i>et al.</i> ^[29]	2011	Global	A new framework for understanding the effect of environmental change on migration	Review	Qualitative	All type	Provide a practical tool for climate adaptation planning Understanding migration as an important, growing and complex approach and phenomenon
15	Black, <i>et al.</i> ^[30]	2011	Global	Criticism	Review	Editorial	All type	Attention to the impact of migration on vulnerability and resilience to climate change Challenges and opportunities for migration
16	Black, <i>et al.</i> ^[31]	2011	Ghana and Bangladesh	Assessment of sensitivity in migration and climate change	Articles and documentation	Review	Sea-level rise, extreme climatic events such as floods or tropical storms, tropical cyclones and hurricanes, droughts	To address the sensitivity of existing migration drivers in specific contexts to climate change Integrated assessment approach seeks instead to understand to specific locations may change in the future, provide a practical tool for climate adaptation planning

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	Author	Title	Year	Society surveyed	Out come	Study tool	Study design	Type of climate change	Conclusion and suggestions
17	Kartiki ^[32]	Climate change and migration: a case study from rural Bangladesh	2011	Rural Bangladesh	Strategies of adaptation	Included observations, semi-structured interviews, focus group Discussions, and PRA exercises	Case study	Cyclone	People's movements in the aftermath of cyclone Aila
18	Cao and Chen ^[33]	Migration mechanism of climate migrants and analysis of relevant concepts	2012	Global	Analysis of climate migration and related concepts	Review	Qualitative	Sandstorms, hurricanes, snowstorms, droughts, floods and other climatic disasters	To strengthen our understanding and perception of climate migration, and further grasp the essence and law of evolution of climate migration, exploration into how to tackle the challenge of climate migration arising from climate change Mitigate social risks facing climate migration Promote the benign operation and balanced development of society effectively.
19	McMichael, <i>et al.</i> ^[15]	An ill wind? Climate change, migration, and health	2012	Global	Public health and policy responses	Articles and documentation	Review	All type	Climate change and health Role of social conditions Roles for doctors and other health professionals Economic damage caused by climate change
20	Watts <i>et al.</i> ^[1]	Health and climate change: policy responses to protect public health	2015	Global	Responses	Review	Qualitative	All type	Climate change and exposure to health risks action for resilience and adaptation Transition to a low-carbon energy infrastructure delivering a healthy low-carbon future bringing the health voice to climate change

PRA=Participatory rural appraisal

Migration to poor urban and suburban areas (especially unofficial settlements) is often expected as a result of migration from climate change, which in turn will lead to health risks.^[25] There are significant documentation of health inequalities and livelihoods between migrant groups and host populations in developed countries.^[11,17]

Among the health consequences of urban migration can be mentioned the psychoeconomic and environmental impacts of climate change such as floods, water scarcity, droughts, declining farms, and livelihoods, increasing rural migration to developing cities.^[28] The results also show that rural migrants to cities are at risk for chronic diseases such as cancer, hypertension, cardiovascular

disease, and type 2 diabetes. The prevalence of infectious diseases is also increasing, such as tuberculosis, hepatitis B, intestinal infections, HIV, and malaria.^[11,13,28]

Discussion

The aim of this study was to investigate the health effects of migration from climate change. The results of the previous studies have shown that the international discourse on human-induced climate change focuses on the issue of carbon reduction efforts. However, advances have been slow in this regard, and the need for prominent policies and more effective actions by international organizations and countries is felt.^[36]

The need for a prediction plan for future migration caused by climate change is explicitly mentioned in the framework of Concu (2010). Measures are also needed to increase understanding, coordination, and cooperation at the national, regional, and international levels United Nations Framework Convention on Climate Change (UNFCCC).^[37] Migration, which is often viewed as a major problem by policymakers and governments, has been increasingly understood as a part of climate change adaptation.^[28]

The findings of this paper showed that adverse health consequences arise from population displacement caused by climate change. Consistent strategies to reduce risks, can help public health preparedness, create community resilience, and reduce vulnerability to climate change.^[11,22,30]

Migration caused by climate change is often accompanied by health outcomes. Given the complexity and heterogeneity of migration, in terms of motivational factors, time and destination diversity, demographic, social and economic characteristics, all efforts should be directed towards promoting understanding, coordination, and collaboration on population displacement caused by climate change.^[27] Adaptation strategies for mitigating hazards as well as public health preparedness can help create community resilience and reduce vulnerability against climate change. The National Adaptation Programmes of Action (NAPA) for less developed countries provide a way to meet the needs of climate change adaptation.^[38] The analysis of 41 of the 49 existing programs of the NAPA presented in May 2009 to the United Nations Framework Convention on climate change shows that many programs explicitly recognize the link between climate change and human health and 18 programs refer to the link between climate change and migration.^[39]

Given the fact that climate change has a major impact on health and migration of people, adaptation and public health strategies should include different sectors,

including health, water, agriculture, energy, and transportation, and this requires coordinated efforts of local, national, international and nongovernmental organizations. Public health responses and policies related to health risks associated with migration from climate change must be consistent with the nature of the migration and the demographic characteristics of those who migrate. It is important that response policies include: (a) minimizing health inequalities and ensuring access to services; (b) ensuring the health rights of migrants; (c) implementing interventions to reduce (excessive) mortality rate among migrant populations; and (d) minimizing the negative impact of migration on the health outcomes of migrants.^[15,40] Meanwhile, the existing evidence and planned responses should be taken into consideration: the displacement of large populations (for example, after humanitarian crises and catastrophes), resettlement plans and urbanization (especially in the poorer cities of the developing countries). There is a widespread and credible international regime for responding to humanitarian disasters and major environmental crises such as war, drought, and floods. The primary role of public health services and disaster relief services provided by government officials, international humanitarian organizations, united nations agencies, and local and international NGOs is to assess health needs, allocate resources, and provide health services.

Preemptive planning can increase the impact of international assistance.^[15,22,41] In response to the growing potential for major disasters, preparations, responses, and improvements are required to be established based on the existing framework for public health in situations of massive displacement.^[1,15,42] In order to improve health outcomes, urban policymakers, and service providers in low- and middle-income countries should focus on improving the environmental conditions and access to health services among the people living in deprived regions.^[22,28,32] In particular, urban planning and public health programs should promote access to healthy food (including local food products), good air quality, land conservation and destruction, high noise protection, good and healthy water, physical activity, social coherence, housing quality, access to employment facilities, community, road safety, and poverty alleviation.^[28,43] Therefore, the arrival of migrants and displaced persons in health systems requires multilateral and effective cooperation between nongovernmental organizations, UN agencies, and governments. A key component, especially in low-income countries, is to support the capacity and practice of public health through the care and data collection system.

Migration to poor urban areas is often predicted as a frequent consequence of climate change. The UN

reported that there were large disparities in health care between vulnerable groups of immigrants in developed countries (United Nations Development Programme 2009). Therefore, public policymakers and managers in low- and middle-income countries should focus on improving environmental conditions and access to health services, including emerging health issues such as chronic noncommunicable diseases among poor urban people.^[11,13,28] The World Web for Urban Health Research 2010 stated that urban planning and public health should have promote access to healthy foods (including local food production), good air quality, protection and prevention of land contamination, protection against noise pollution, raise quality water and proper sewage system, social cohesion, housing quality, access to work centers, community and road safety, and poverty alleviation.^[13,28,43]

The health needs of displaced populations due to climate change depend on the nature of the migration process and the reception capacity of host communities and countries. There are many innovative policies and interventions that address health issues and access to health care for international migrants. However, international migration accounts for only a small portion of the total current population movement. Most population mobility is likely to be due to internal climatic conditions. Likely to occur in developing areas that lack the resources to fully meet health needs.^[34]

Ultimately, there is a strong need for research and data collection systems that can collect information on population displacement and the health indicators of migrants. It should be pointed that access to displaced populations may be difficult, since they may move inside and across multiple (formal and informal) geographical boundaries. The key role of data-gathering systems among migrants can be defined as the identifying ways to reduce vulnerability in communities affected by climate change to reduce the likelihood of displacement and maintain their health, understanding the health risks during migration and resettlement among populations under the influence of climate change, identifying and evaluating the interventions and policies that improve health outcomes.

Conclusion

Based on research and studies reviewed, it can be concluded that if climate change continues in its current direction, there is likely to be an increase in the number of refugees and future crises in the forthcoming decades. Although the extent and volume of health risks caused by the displacement of a population associated with future climate change cannot be clearly predicted, evidence of the health outcomes of similar movements in human

populations indicates that health risks will prevail over health benefits. This issue has salient geopolitical, moral, and economic significance. Resettlement and planned migration are usually the options ahead. Accordingly, effective policymaking should facilitate people's dislocation and seek to increase prosperity and economic and social development in both source and target destinations. Beyond the existing ethical challenges, it is a fact that historically, rich industrialized countries have a greater role in taking greenhouse gas emissions into the atmosphere. Therefore, they should accept their responsibility to manage migrations caused by climate change. Reducing climate change by reducing greenhouse gas emissions is a major goal of governments and communities. The full understanding of a wide range of health hazards caused by climate change, including climate change risks, can strengthen effective measures to tackle climate change. Ultimately, by reducing global greenhouse gas emissions, along with social and environmental adaptation strategies, migration from climate change and health risks and the resulting crises can be greatly reduced. Due to the lack of clear scope of health hazards caused by displacement of population associated with climate change, further studies for effective planning and response in different areas are recommended.

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Conflicts of interest

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