imbrace Immigrants' Vulnerabilities and Adaptation Strategies to Climate Health Effects

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Drivers of Vulnerability to Heat-Related Health impacts for Migrants in European Cities

A scoping review of the existing literature

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1 Introduction

IMBRACE (Embracing Immigrant Knowledges for Just Climate Health Adaptation) is a five-year research initiative funded by the European Research Council.

It explores the intersection of climate change, health, and migration, focusing on racialized migrants from the Majority World (MW)[i] living in European cities. This report marks an early milestone in the project, offering a scoping review of academic literature produced between 2005 and 2025 on how climate change—particularly **extreme heat**—impacts migrant health vulnerability[ii].

Our goal is twofold: to map what's currently known and to build on this foundation through dialogue with local stakeholders, global experts, and participatory research. The upcoming qualitative research will focus on three European cities: Athens, Barcelona, and Berlin. This report is a first step toward co-creating knowledge that centers migrant[iii] experiences and informs more just, inclusive climate health policies.

Extreme heat and heatwaves are now central health concerns in Europe. Heat-related deaths are rising, with an average increase of 17.2 per 100,000 inhabitants between 2003–2012 and 2013–2022.[1] In 2022 alone, there were more than 61,000 heat-attributable deaths in Europe.[2] Heat not only harms health directly but also reduces labor productivity, incomes, and public-health spending.[2] It also interacts with air and noise pollution, making some neighborhoods especially risky. Southern Europe faces the highest vulnerability, with clear geographic and social inequalities.

ILLUSTRATIONS BY
Teresa Aledo

LAYOUT & DESIGN
Ana Cañizares

[i] Majority World (MW) immigrants (Africa, Asia, and Latin America). The term has been coined by Bangladeshi photographer and activist Shahidul Alam, highlighting that the region traditionally known as "the Global South" encompasses most humankind.

[ii] This is one of two reports that examine the intersection of climate change, health and migration in European cities, with the other focusing on the impacts of flooding and extreme precipitation. While in the review of flood-related impacts and related vulnerability we have identified Disaster Risk Reduction as an important category of strategies and actions aimed at minimizing the damage and human suffering caused by flood events, in this report these elements of risk assessment and mapping, prevention measures and preparedness are more reflected in Heat Action Plans and urban planning shifts and adaptations, which are discussed under "Urban Planning and Policy for Climate".

[iii] By 'migrant(s)', we refer to first- and second-generation migrants (as they are facing similar barriers related to cultural exclusion, institutional and systemic racism) in Europe, whether they are documented or undocumented, asylum seekers or hold refugee status. As data by migration is not always available, we have also used proxies such as race, ethnicity, foreigner and minority status for this report.

Introduction

When examining climate change, health, and migration together, most research still focuses on countries of origin, treating climate change as a migration driver and migration as adaptation.[3,4] In destination countries, inequities are acknowledged but studies largely focus on North America. In Europe, health data are rarely disaggregated by race, ethnicity, or migration status. While some studies show migrants' socio-economic and health marginality,[5] the lack of granular data obscures how systemic discrimination, xenophobia, and racism shape climate-related health risks —a major aspect of climate injustice that remains understudied.[6]

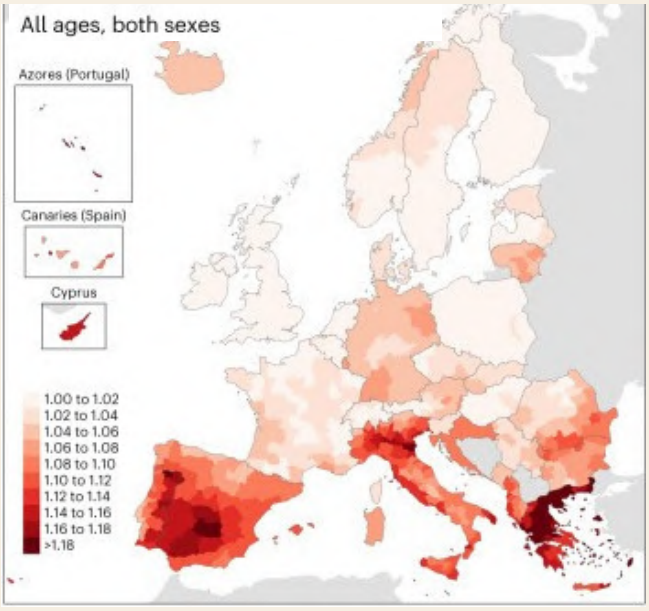
Migrants are often pushed to society's margins, facing poverty, precarious housing, limited healthcare, and policy exclusion. Yet we lack a full picture of how these factors heighten exposure to climate shocks and weaken resilience. This report applies an intersectional lens,[7] identifying eight **drivers of heat-related health vulnerability**. Using an iterative literature review and coding process, we clustered these drivers[iv] from academic and policy sources. Because migrant-specific data in Europe are scarce, we also drew on studies of groups with similar profiles (e.g., low-income, racialized, precariously housed) as proxies.

In 2022 alone, there were more than 61K heat-attributable deaths in Europe.

Insights were then validated with experts—including activists, academics, NGOs, health practitioners, and local officials—during a participatory workshop in Barcelona (June 2025).

The result is a structured set of eight vulnerability drivers, ranging from systemic inequality and discriminatory policy environments to gaps in infrastructure and health systems. The first three drivers (demographics and socio-economic status; migration status and experiences; racism and discrimination) represent structural conditions that shape the next five (housing, healthcare access, urban planning, climate policy, and more). By highlighting these interconnections, this report lays the groundwork for deeper inquiry and action. We aim to move beyond one-size-fits-all metrics toward a justice-centered understanding of vulnerability—one that recognizes migrants as active agents in shaping climate adaptation.

Temperature-related risk of death during 2015–2019

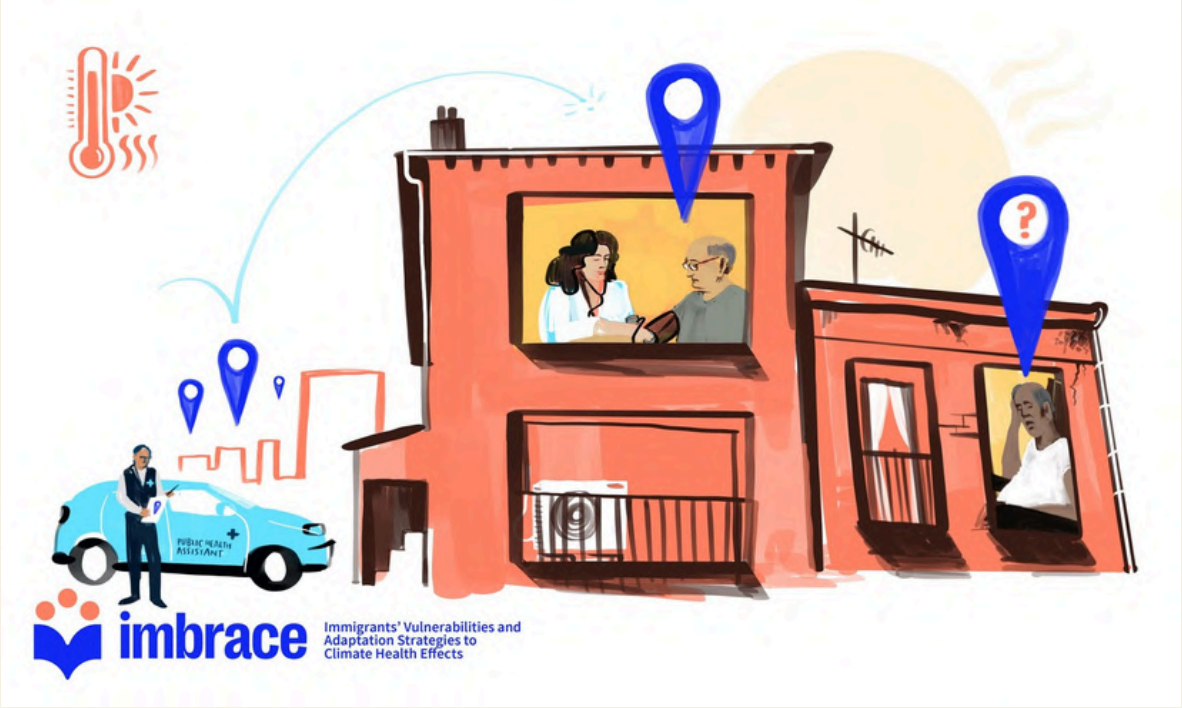


Ballester J, Quijal-Zamorano M, Méndez Turrubiates RF, et al. Heat-related mortality in Europe during the summer of 2022. Nat Med. 2023;29(7):1857–1866.

[iv] We have analyzed a total of 63 publications, mostly peer-reviewed academic articles. Of these, 28 were selected through a Scopus search and 35 have been manually added to complement the data set.

2 Drivers of Vulnerability to Heat-related Health impacts for Migrants in European Cities

2.1 Demographic Characteristics and Socio-Economic Status



Demographic characteristics include age, gender, race, and education level. Socio-economic status covers income, occupation, wealth, and access to resources. These are often used as umbrella categories in studies of differentiated vulnerability—not always referring to migrants directly, but shaping their specific vulnerability (e.g., inequalities linked to gender or age). They also serve as proxies for migrant challenges: for example, more than 45% of non-EU citizens in the EU face poverty or social exclusion.[8]

Studies show that certain groups are particularly affected by extreme heat, including in European cities. Health effects are documented through outcome-based measures such as increased mortality, morbidity, or cardiovascular risk.[1, 9-11] Other studies highlight exposure to the heat island effect and lack of thermal comfort, emphasizing the role of social vulnerability.[12-15]

There is broad consensus on the most heat-sensitive groups: the elderly, children, (pregnant) women, people living alone, urban residents (especially in dense neighborhoods), racial and ethnic minorities, migrants (particularly undocumented), people with low socioeconomic status, and those with pre-existing health conditions.[1,16,17]

Gendered differences are well documented. In Italy and France, heatwaves have produced a marked rise in female deaths.[12] Women are physiologically more susceptible to heat,[18] and may also face greater adaptation barriers tied to employment, income, and resource access.[19] **Pregnant women** face risks such as preterm birth and low birthweight.[12,20] In North America, race/ethnicity and migration background are studied in relation to heat and pregnancy, but in Europe such studies remain rare.

Children are also vulnerable: they dehydrate more quickly, struggle to adapt to heat, and face elevated risks of heat-related illness.[12] Migrant children, in particular, may carry additional health burdens: research shows higher asthma risk among those who migrate before age 5, a critical window for immune development.[21]

Fine-grained studies show how these dynamics intersect. In Bonn, Sandholz et al. (2021) describe heat vulnerability as a composite of exposure, sensitivity, coping, and adaptive capacity.[22] They found that students and young professionals faced higher risks than elderly people, largely due to housing and workplace characteristics. Many demographic markers intersect cumulatively (e.g., elderly people are also more likely to live alone).[19] As discussed further in Section 2.3 on racism and intersectional discrimination, these markers are not only cumulative but mutually constituted and inseparable.

More than 45% of non-EU citizens living in the EU face the risk of poverty or social exclusion.

Race, ethnicity, and migration strongly shape exposure, sensitivity, and adaptation to heat in European cities. Challenges include language barriers, limited social networks, restricted access to services, precarious legal status, and lack of job control.[12, 14, 15, 23] While these issues are not exclusive to migrants, they overlap with lower socioeconomic status. A 2025 study notes that foreign citizens in Europe may face higher heat vulnerability, but research into racial or citizenship-based disparities remains limited.[24] Foreign citizenship should not be used as a proxy for heat risk, since it obscures the diverse realities of migrants. MW migrants vary widely in norms, needs, rights, and risks—depending, for instance, on legal status. Homogenization is problematic: LGBTQ+ migrants fleeing persecution may still be placed in collective housing with people from their region of origin[v], exposing them to further harm.

Education plays a key role. In Brussels and Amsterdam, people with higher education demonstrated greater awareness of heat risks and protective measures.[25] In the UK, lack of education combined with structural racism has contributed to higher skin cancer mortality among Black and minority ethnic groups, linked to lower risk perception and inadequate public health campaigns.[26,27] This is significant since most foreign-born people in Europe have, at most, lower secondary education.[28]

Migration and ethnic background also intersect with living conditions and neighborhood characteristics. In European cities, neighborhoods with higher proportions of racialized or migrant residents often show higher heat-related risks, mortality, and emergency visits.[29] In Oslo, the neighborhoods with the most migrants are also furthest from the waterfront, a key cooling space.[30] In Greece, high migrant density correlates with urban heat vulnerability.[31] As many authors stress, class and status cannot be separated from migration, race, and ethnicity when examining heat vulnerability.[29]

[v] Data from the IMBRACE participatory workshop.

2.2 Migration Status and Experience of Migration

MW migrants in Europe face specific health challenges that heighten their vulnerability to heat. While the term 'MW migrants' is useful as a reference, it includes people from diverse regions such as Asia and Latin America, with vastly different climates and cultures—making their experiences and health vulnerabilities highly heterogeneous.

Pre-migration factors can shape migrant health in destination countries, including latent infections, trauma, and injuries. Yet integration also brings legal and cultural challenges with physical and mental health consequences.[23] Mental health issues from the migration journey are common and often remain unaddressed, particularly among refugees[32] (see also section 2.6 on Healthcare). The importance of adaptation and healthcare access—both legal and cultural—is illustrated by studies in Germany. These show migrant health improves with longer residence, across generations, and with better language proficiency and residency rights.[23] The same study found that disparities between migrants and non-migrants largely disappeared when migrants had permanent or long-term residency, which grants better access to public services, including healthcare.[33]

Migration status therefore directly shapes healthcare access in Europe, which is far from guaranteed. This in turn raises the risk of heat-related health problems—both due to **existing health vulnerabilities and lack of support**.

[vi] Data from the IMBRACE participatory workshop.

Undocumented migrants, refugees, and asylum seekers are especially excluded from healthcare in most European countries.[33] In Italy, for example, those arriving unofficially—often after dangerous Mediterranean crossings—have no dedicated healthcare workers.[32] Even **migrants with formal access face significant barriers**: language and cultural obstacles, underfunded services, limited awareness of rights, complex systems, affordability, distance, or fear of deportation.[21,32–34] Migrants' status can also shift as they move within Europe, sometimes rendering them "illegal" despite previously having legal status.[vi] These barriers also restrict access to essential heat-related information (see section 2.8), compounding vulnerability through precarious housing and employment.[15]

Restrictive migration policies further tie migrants' limited rights to precarious housing conditions, increasing heat exposure, especially among certain subgroups (see section 2.4). Asylum seekers are particularly affected by housing uncertainty and instability. A recent study in Catalonia found the reception program—offering only precarious, collective accommodation—fails to meet demand.[35] In Italy, since 2018, asylum seekers can no longer stay in government shelters, blocking access to sanitary facilities, cultural mediators, and medical visits.[32] In this context, NGOs and support networks play a critical role in shaping housing pathways.[35] These overlapping exclusions place groups such as undocumented migrants, asylum seekers, and refugees in especially precarious conditions, intensifying their vulnerability to extreme heat.

2.3 Racism and Intersectional Discrimination

Uneven heat vulnerability in Europe is arguably a continuation of environmental racism, visible in racialized patterns of thermal inequality.[29] This appears in disparities such as higher heat-related mortality among racial and ethnic minorities[24] (see also section 2.1), and greater risks for racially marginalized women, including more adverse outcomes from gestational heat exposure.

In the UK, many healthcare professionals still rely on racialized assumptions about skin color and UV radiation exposure—for instance, the misconception that brown skin rarely burns and black skin never burns[27]—leading to lower survival rates for skin cancer among Black and Minority Ethnic (BME) people, who are often diagnosed at later stages.[26] Yet, and perhaps reflecting limited political will, studies explicitly connecting race and/or migration status with heat-related health outcomes in Europe remain scarce.[24]

These outcomes reflect racialized patterns of heat vulnerability embedded in European institutions, where legal and citizenship-related restrictions push migrants and BME people toward precarity and informality.[36] In the Bucharest metropolitan area, for example, Roma people face territorial and socio-economic exclusion that limits access to housing, jobs, and education, significantly increasing heat vulnerability.[37]

Racial discrimination also restricts BME people's access to public spaces offering thermal relief, such as parks, pools, or libraries. In Barcelona's Raval neighborhood, many Pakistani and Moroccan residents describe these as "white spaces" exclusionary of their sociocultural practices and uses of public space.[29] Similarly, migrant women in other contexts reported feeling unsafe or discriminated against in cooling centers, for instance when wearing a headscarf.[38] In these cases, places meant to provide thermal comfort may not feel emotionally safe or welcoming, due to intersecting forms of racial, class, gender, and cultural discrimination.[39]

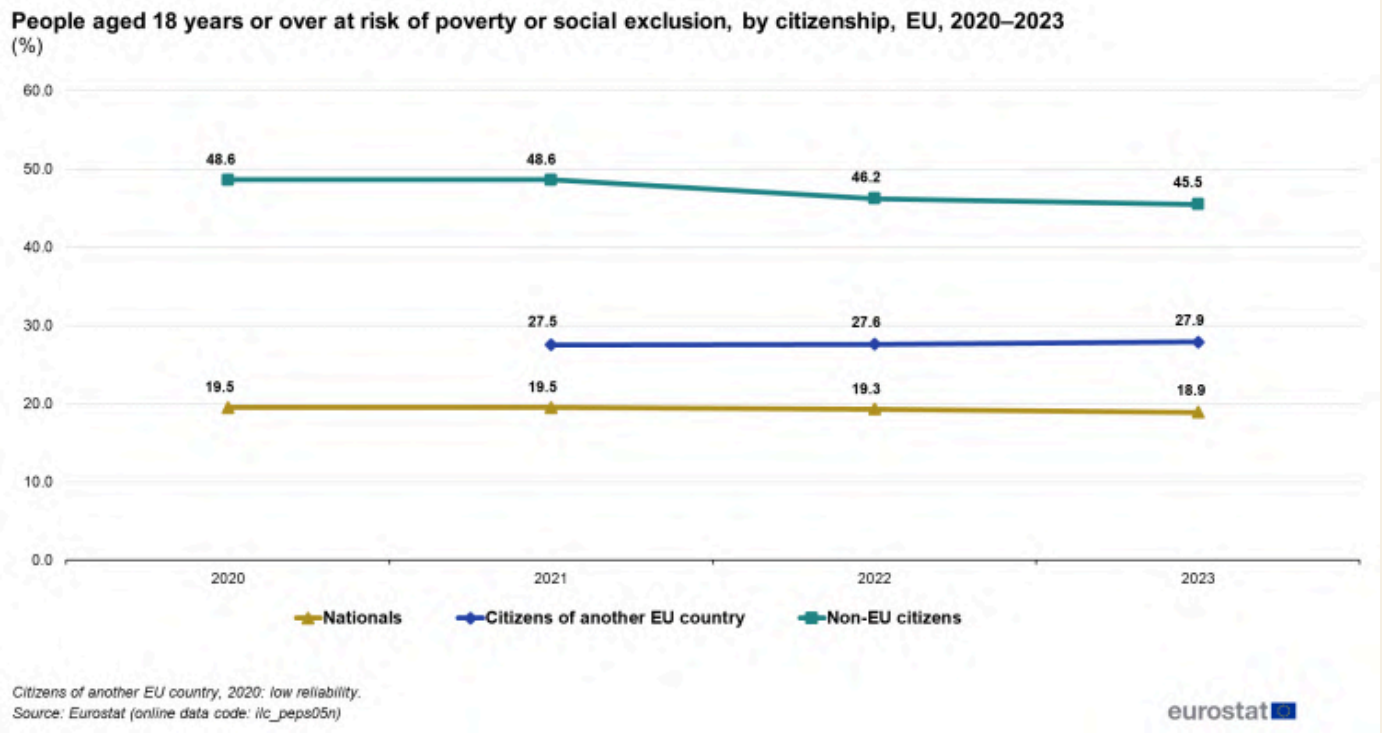
Uneven heat vulnerability in Europe is arguably a continuation of environmental racism, visible in racialized patterns of thermal inequality.

Intersectional discrimination refers to how different forms of inequality—racism, sexism, classism, ableism, and others—interact and reinforce each other, creating compounded disadvantage. Studies in Spain and the UK have documented links between high temperatures and increases in domestic violence and sexual assault against women.[40,41]

In Catalonia, women asylum seekers were more likely than men to report prejudice from landlords.[35] In Germany, migrant women are especially affected by the clash between traditional values and dominant cultural norms, which has been linked to mental health struggles and loss of self-esteem.[23]

Intersectional discrimination refers to how different forms of inequality—racism, sexism, classism, ableism, and others—interact and reinforce each other, creating compounded disadvantage. Studies in Spain and the UK have documented links between high temperatures and increases in domestic violence and sexual assault against women.

Women and LGBTQ+ individuals also face unique barriers in accessing cooling spaces, often requiring group self-organization for safety—something not always feasible for recent migrants.[vii] Women additionally need heat relief closer to home due to domestic care responsibilities that limit their mobility. Gender and racial/ethnic discrimination thus intersect to create highly precarious conditions for certain migrant subgroups. These forms of intersectional discrimination reverberate across daily life, shaping housing, employment, and healthcare access, as explored in sections 2.4–2.6.



[vii] Data from the IMBRACE participatory workshop.

2.4 Housing Conditions and Access to Housing

Housing conditions and access to housing are key social determinants of health and well-being for migrant and refugee populations in high-income countries, including in Europe.[42] Substandard housing conditions—such as overcrowding and poor ventilation—have been linked to both physical and mental health risks. Moreover, both the type of housing tenure and the neighborhood's characteristics influence physical and mental well-being for migrants.[42] According to available data, most non-EU citizens living in Europe are renters, 34.2% live in overcrowded conditions, and 21% spend a significant share of their disposable income on housing costs.[28] These factors contribute to higher overall health vulnerability for precariously housed migrants, with direct implications for heat-related health risks.

Heat-related health vulnerability is strongly shaped by building characteristics and living conditions, which influence both exposure to heat and the capacity to cope with it. Relevant factors include building age and size, household density, apartment location within the building, thermal insulation quality, building orientation, and availability of air conditioning.[12,16,19,22,31,43–46] Elevated indoor temperatures in residential buildings have been associated with higher heat-related diseases, mortality and morbidity rates.[12,43,44] A recent report by the European Environment Agency noted that people living in poorly insulated dwellings are disproportionately exposed to health-related risks during heatwaves.[47]

In European cities migrants and other minorities are more likely to live in inadequate housing.[24] In Vienna, for instance, migrants report smaller apartment sizes and higher household density than non-migrants.[17] Similarly in Spain, "citizens of non-EU countries experienced over three times more objective overcrowding than citizens of Spain or other EU countries".[36] In general, there is a clear connection between migration, substandard housing and higher rates of heat-related deaths and health problems.[48] Several studies have also shown that housing conditions and migration status are associated with living in neighborhoods lacking green spaces and other forms of cooling infrastructure.[49]

Housing conditions are significantly mediated by tenure status, with tenants facing greater risks of health impacts associated with heat stress.[49] One explanation is what Seebauer refers to as "the tenant-landlord dilemma in building refurbishment", where tenants are unable to make climate-adaptive changes to make their homes more heat resilient.[19] This is particularly relevant for migrants and ethnic minority groups, who are overrepresented among tenants.[50] Furthermore, non-EU migrants have been found to pay significantly higher rents for similar dwellings than non-migrant populations, exacerbating issues of housing affordability.[36]

In Vienna, for example, access to publicly managed affordable housing "requires a two-year registered residency in the city, effectively excluding many migrant residents and leaving them with precarious (and hotter) living conditions".[29] Another significant barrier to housing access for migrants is the common requirement by landlords for long-term employment contracts in cities such as Berlin and Barcelona.[viii] This poses a challenge for many migrants, as securing stable employment is often hindered by language barriers as well as discriminatory practices in the labor market (see section 2.5).

Access and affordability constraints often push migrants into housing precariousness and displacement, further increasing their vulnerability to heat.[24,36] In Spain during the 2010s, most evictions and foreclosures occurred in neighborhoods with high proportions of non-EU citizens.[36] In some cases, this leads to homelessness, especially among those facing overlapping forms of discrimination and precarity. LGBTQ+ migrants, for instance, experience heightened levels of discrimination and marginalization and are at an increased risk of homelessness. This vulnerability is exacerbated by their greater reliance on community networks, which are often disrupted or entirely lost, paritculalrly in cases of forced migration.[ix] Recent studies, for instance, have pointed to "alarmingly high rates of rough sleeping and residential mobility among recent asylum seekers in Catalonia"[51] concluding that Spain's asylum reception program is not only overburdened but also exposes participants to homelessness.[35] People experiencing homelessness, in turn, commonly experience disproportionate risks of heat-related morbidity, mortality, and mental health challenges.[52]

Clearly, heat vulnerability linked to housing is deeply connected to class disparities and socioeconomic inequality. While wealthier populations can afford to live in thermally comfortable homes or invest in adaptive measures, lower income groups are often stuck in poorly insulated dwellings and may struggle to find alternative shelter during extreme heat events.[12,19] One recent study concluded that in "European cities, the possibility of choosing a home with high thermal comfort is a privilege for few".[49]

This has been referred to as "**heat gentrification**",[29] a process in which residential heat adaptation such as retrofitting or proximity to new green/blue infrastructure, raises housing prices displacing residents with fewer economic resources. Heat gentrification has been documented in both rental and ownership markets, and across public and private housing, but the outcome is often the same: migrants and other low-income residents are pushed into more heat-vulnerable homes and neighborhoods. The same study also points out that "public and health services and access are increasingly jeopardized and thinned in gentrifying areas, including those that can act as climate refuges".[29]

As discussed further in section 2.8, this presents a serious challenge for wider urban planning and policy on adaptation. For example, policies that promote retrofitting among homeowners do not reach the most vulnerable groups, such as migrants.[22] To effectively address heat gentrification, authors stress, policymakers must develop strategies that simultaneously support building and neighborhood cooling, and protect residents from speculation and displacement.[29]

Heat gentrification pushes migrants into more heat-vulnerable homes and neighborhoods.

[viii] Insights from the IMBRACE participatory workshop.
[ix] Insights from the IMBRACE participatory workshop.

2.5 Employment and Labor Conditions

Employment is a central driver of heat vulnerability for migrants in Europe as their precarious legal status and working conditions increase their exposure to the harmful effects of extreme heat. On one hand, higher levels of unemployment act as a strong proxy for socioeconomic and housing precarity,[37] which—as discussed in Sections 2.1 and 2.4— are associated with heightened heat vulnerability. The construction sector, which disproportionately employs migrants in Europe, is one of the most affected in times of crisis. During the 2008 financial crisis, the number of migrant workers in Spain's construction sector fell by 70% between 2008 and 2012, while the immigrant unemployment rate soared to 36.5%.[36]

On the other hand, employment itself can also be a source of risk when working conditions are **exploitative**, which migrants are likely to face partly due to their legal status (see section 2.2), and which also expose them to heat-related stress. Common challenges include legal restrictions on work permits,[35] insecure job contracts,[53] shifting work contracts,[15] and the widespread lack of skills recognition in host countries.[33] As a result, migrants are often compelled to accept lower-paying jobs with longer hours, **minimal occupational safety, and inadequate health-related training**.

Migrants often work in **jobs they are overqualified for**, driven by economic pressures and the need to support families back home.[32] Even when employed under seemingly stable contracts, the financial burden of remittances often limits their ability to save, thereby affecting their living conditions and reducing their capacity to implement adaptive measures for heat relief.[x] They are also more frequently employed under **piece-rate payment schemes** where workers are paid based on the amount of work they complete, rather than the number of hours they work, which can appear attractive due to their earning potential.[32] Such employment contracts not only limit career growth but can also result in higher risks of injury or disease, as workers are likely to take fewer breaks or reduce their water intake. This further exacerbates heat stress and increases health risks for migrant workers who are physically inactive, overweight, or have pre-existing health conditions, such as diabetes or high cholesterol.[15,21]

In Italy for example:

"Migrants and racial minorities may face obstacles such as language barriers, residency constraints, and lack of job control and autonomy, which limit their access to heat-related training and medical care as well as control of harsh working conditions like mandatory long working hours."[15(p10)]

[x] Data from the IMBRACE participatory workshop.

Migrant's heat-related health vulnerability is also shaped by the specific **sectors in which they are more likely to be employed**. These typically include transport, tourism, agriculture, horticulture, domestic work and cleaning[21] — jobs often associated with high levels of physical exertion and exposure to heat, which is known to increase risks of fatigue, cardiovascular disorders, tachycardia, cardiac strain, hypertension, respiratory diseases including asthma and breathing difficulties, and in some cases spinal cord and brain injuries.[12,15,54] In Austria, for example, nearly half of the migrant population is employed in manual labor jobs in construction, production, trade, and tourism.[53] Urban outdoor workers, in particular, face elevated risks due to the Urban Heat Island (UHI) effects,[12] resulting in both health and economic consequences that reduce migrants' productivity and quality of life. Acute and chronic exposure to heat in working environments has also been linked to acute kidney injury and chronic kidney disease.[55]

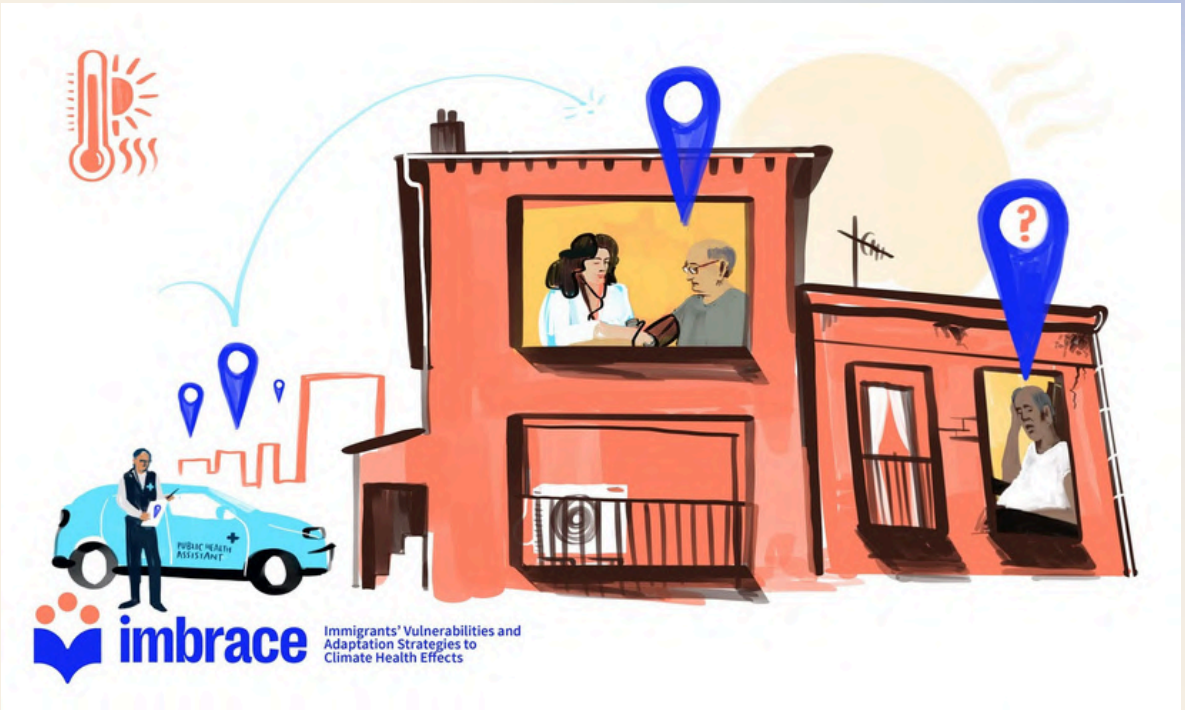
Migrants often work in jobs they are overqualified for, driven by economic pressures and the need to support families back home.

A particularly relevant case is that of food delivery riders, with an overrepresentation of migrants in most European cities. This type of employment exacerbates workers' precarity as it involves being outdoors for prolonged periods – including waiting in extreme heat on the streets between deliveries – as well as due to the type of contracts. Food delivery companies operating in Spain and Greece have been fined for exploitative labor practices and pressuring delivery workers to accept freelance or false self-employed contracts,[xi] which deprive them of employment benefits such as health insurance and paid leave in cases of sickness or injury.[56,57]

Heat-related occupational health risks also vary by gender. Women, for instance, are more vulnerable due to their high concentration in service and care sectors, which often involve strenuous indoor labor under poor thermal conditions.[14] In one study in Catalonia, asylum-seeking women were found to experience particularly adverse labor conditions, impacting their ability to secure housing and increasing pressure to accept exploitative work arrangements and unhealthy or risky conditions.[35]

[xi] Insights from the IMBRACE participatory workshop.

2.6 Health Histories and Healthcare



While this study has identified drivers of heat-related health vulnerability overall, this section on health and healthcare discusses direct physical impacts of heat on well-being and mental health, as well as access to healthcare for migrants. Heat waves cause a variety of heat-related disorders and exacerbations of cardiovascular diseases, respiratory disorders, and other chronic conditions. They also impact work productivity and activities of daily life especially for urban populations, through direct physical effects like cramps, heat exhaustion, and heatstroke, skin rashes or itchy, or prickly skin, high core body temperature, muscle spasm, nausea, nose bleeds, loss of coordination or fainting.[9,15] Hot weather and extreme temperatures also affect well-being and mental health, causing poor sleep, depression, an increase in hostility, suicide rate and hospitalization for mental conditions. Eventually, heatwaves may lead to elevated mortality and morbidity rates.[45] The summer of 2022 marked 60,000 premature deaths attributed to heat across Europe.[2]

How migrants are affected by the impacts of climate, and specifically heat, depends strongly on **how their health is already conditioned**, both due to their migration trajectories and the type of healthcare that they can access in the places of migration destination.

There is ample literature on how migration itself is a social determinant of health. While the "healthy migrant" narrative stands in some cases, with mortality being lower among migrants in certain contexts, this is not true for all migrant sub-groups, many of whom experience higher mortality.[23] Moreover, this advantage tends to decline significantly with age.[23] Increased morbidity is especially common in relation to communicable diseases such as tuberculosis, HIV/AIDS, and hepatitis, some non-communicable diseases such as diabetes, occupational diseases, poor mental health, and maternal and child health problems. These are often linked to discrimination, gender inequalities and exclusion from health and social services (see also section 2.3),[23,33] frequently experienced by racialized migrants in Europe This is crucial because an individual's underlying health status significantly affects how the human body will react to conditions of heat stress. Patients with preexisting conditions such as diabetes and cardiovascular disease, for example, are more prone to heat-related illness.[55]

As mentioned in previous sections (2.1 and 2.2), recent studies show that country of origin is a driver of heat vulnerability in Europe. **Foreign citizens may face increased heat vulnerability** due to intersecting factors such as lower socioeconomic status, language barriers, limited healthcare access, and precarious housing or working conditions.[24]

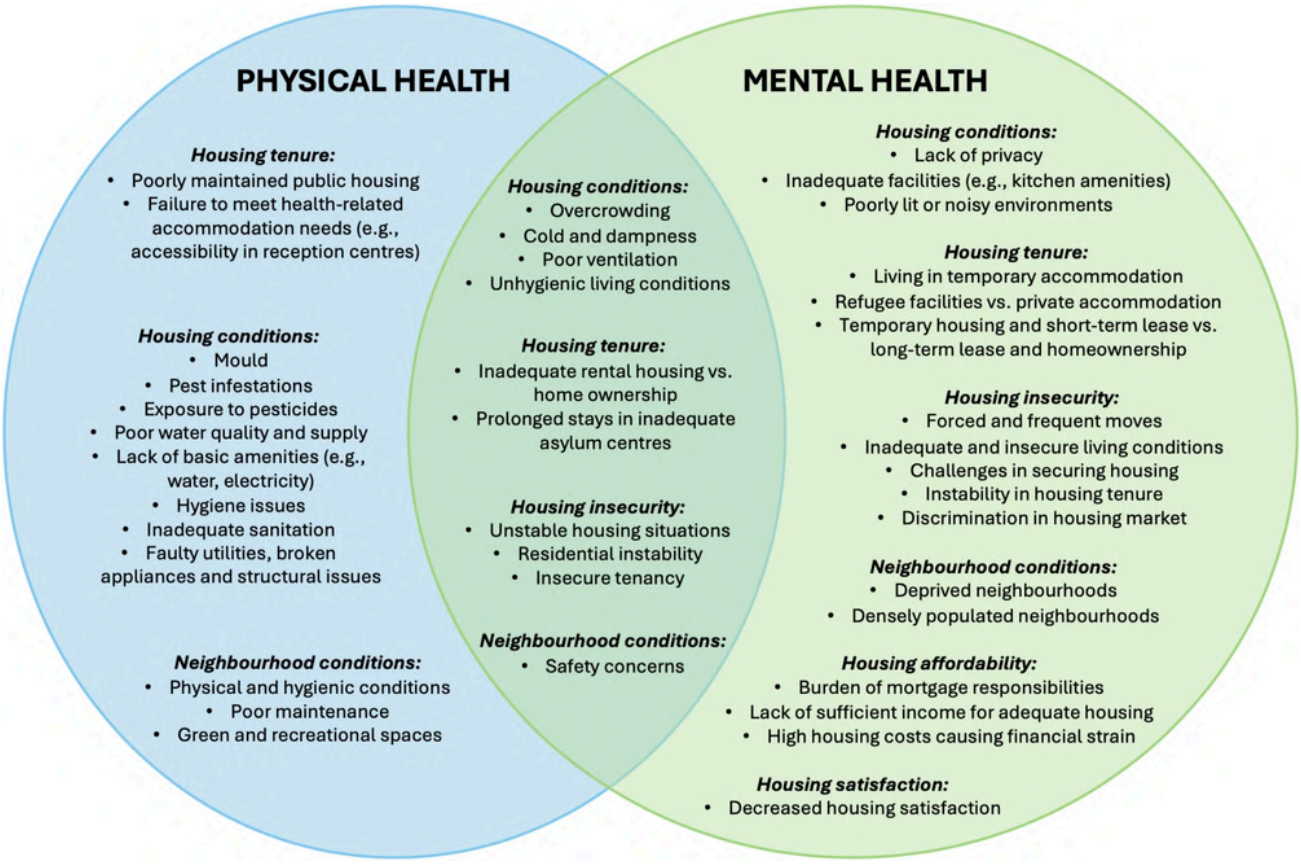
Living in urban environments and having foreign citizenship emerge as crucial factors of vulnerability to heat across Europe,[24] while heat-related deaths occur disproportionately in urban areas with high numbers of immigrants and substandard housing (see also section 2.4).[48] However, systematic investigations into racial or foreign status disparities in environmental and heat-related health in Europe remain scarce.[24]

Migrant workers are particularly at risk of heat-related impacts, yet their health is often overlooked due to the assumption that they are "young and healthy".[55] This assumption is increasingly challenged by evidence. In terms of sun exposure, studies from the UK show that skin cancer poses a significant risk to Black and Minority Ethnic (BME) groups who are also at greater risks of conditions such as rickets, schizophrenia, diabetes and multiple sclerosis which are often linked to vitamin D deficiency.[26] Not only outdoors migrant workers (typically men) but also those working indoors **in care roles** (typically women), **who encounter** compounding health problems that can worsen with extreme heat:

"I feel very old and exhausted and have the impression that it gets worse because my pain increases. My foot hurts and I suffer from head and back pain and I am constantly tired, because I work as a cleaner and that involves high physical strain. Additionally, I cannot sleep well during the night, thus I am not recovering well. I take medicines on a daily basis." (Mother in the Turkish household, Vienna)[53]

Women who work in hot environments may experience vaginal infections, fetal distress, racing heart and mortality (see also section 2.5).[15,58]

Access to healthcare is problematic for migrants, especially for certain sub-groups. Undocumented migrants often face limited access, leading to worse health outcomes compared to those with legal status.[33] In the EU, most countries offer only emergency care, with broader access largely restricted or reliant on charities. Migrants often encounter additional challenges, including **language barriers, cultural differences** in expressing symptoms, and a limited understanding of healthcare systems.



Rana K, Kent JL, Page A. Housing inequalities and health outcomes among migrant and refugee populations in high-income countries: a mixed-methods systematic review. BMC Public Health. 2025;25(1):1098.

These factors reduce healthcare utilization, as documented in Germany.[23] Migrants are also more likely to face cost-related barriers, long distances to services, and lower quality of care.[32] In Norway, access is mostly guaranteed in emergencies or when public health is at risk.[33] In Italy, since October 2018, shelters serve only refugees and unaccompanied minors, excluding asylum seekers—even those with temporary documents. As a result, there is no dedicated healthcare for these migrants, with potentially serious consequences.[32]

In 2012, Spain restricted undocumented migrants' healthcare access with Royal Decree Law 16/2012. This was reversed in 2018, restoring access based on residency, not legal status, though universal coverage has not been fully reinstated.[59] **Access to mental health services** is particularly problematic for migrants. In Europe, such services are nearly unavailable for refugees with post-traumatic stress disorder (PTSD) or other psychological problems.[34] Contributing factors include stigma, language barriers, and lack of culturally competent providers.[34] The requirement of referrals from primary care providers to access mental health care serves is an additional barrier, particularly for migrants.[34] This also applies to other conditions such as dementia. In Europe, diagnostic evaluation of migrant patients was reported as challenging in 64% of the centers, contributing in part to lower diagnosis rates among migrants compared to natives.[32] We have also found that migrants in Europe face higher risk of forced or involuntary psychiatric interventions.[32] Importantly, untreated mental health conditions can also negatively affect physical health and treatment outcomes.[32] Poor sleep following trauma, for example, is an independent factor for PTSD, affecting nearly 10% of refugees.[21]

Racialized groups also face broader aspects of discrimination in healthcare, considering how many conditions—such as those associated with sun/heat exposure—have primarily been studied in white Caucasian populations. This leads to knowledge gaps around aetiology, symptoms and treatments, as seen with skin cancer in the UK.[26] Furthermore, Western healthcare approaches may conflict with migrants own health beliefs, leading to challenges in understanding or adhering to treatments. Grasser and colleagues (2022) suggest that the use of traditional practices or reinforcing cultural ties can be more effective.

For some groups, rituals like storytelling, music, dance, and art serve as emotional outlets, foster connection, and aid trauma recovery.

Overall, assessing migrants' vulnerability to heat-related health risks requires consideration of not only health systems and individual health status, but also migrants' experiences, habits, and perceptions of risk in various urban settings. These factors, beyond the built environment, are key to developing tailored adaptation strategies.[22,60]

Health access issues that contribute to migrants' vulnerability to heat-related impacts also include **aspects of health communication**. For example, knowledge of risk-reducing behaviors during heatwaves is useful[50] but may not be accessible to migrants due to language constraints or limited public health campaigns.[13] Our review revealed overall uncertainty about whether public health messages related to heat reach the most vulnerable,[61] which was also confirmed during our discussions with local experts. For example, the Catalan healthcare system has denied calls by healthcare workers to translate emergency alerts for heatwaves into common languages used in migrant neighborhoods– such as Urdu for the Pakistani migrants in the Raval neighborhood in Barcelona. Consequently, the burden of translating often falls on practitioners.[xii]

A study on migrants and vector-borne disease—also related to climatic changes and prolonged heat—found that when information is tailored for migrants, awareness and prevention increases.[62] It has also been observed that when heat-related messages target specific sub-groups (e.g. outdoor workers, children left in cars), individuals outside these groups may be less likely to take precautions.[61] An untapped resource is community health and care workers who can not only help to improve emergency and heat-related preparedness, but also help inform responsive capacity of healthcare services to heatwaves.[xiii]

Migrant workers are particularly at risk of heat-related impacts.

[xii] Insights from the IMBRACE participatory workshop.

[xiii] Insights from the IMBRACE participatory workshop.

2.7 Neighborhood, Social and Urban Infrastructures

With rising temperatures and more frequent and prolonged heatwaves, migrants in European cities face high heat vulnerability due to the morphology, design, density and other characteristics of their neighborhoods. Dense urban areas with little greenery, high buildings, and air pollution trap heat and result in the Urban Heat Island (UHI) effect, which makes cities – and dense areas in particular – warmer than their surroundings.[10,31] Studies of the 2003 heatwave in Europe, show that the design of buildings, such as their height, orientation, materials and insulation, can either exacerbate or mitigate the UHI effect, directly influencing heatwave mortality and morbidity.[16,20,46]

For migrants, heat-related deaths and health risks are strongly linked to **poor housing and neighborhood conditions**, underlying health conditions, and socioeconomic status. The majority living in rented homes often cannot afford or are not allowed to make adaptations —like installing air conditioning, planting vegetation, or making changes to the built structure.[14,22,29] In Barcelona, migrants have expressed feeling trapped in unbearably hot homes, without access to cooler public spaces.[25]

"Hence, those residents most exposed to heat stress are also more vulnerable due to their limited capacity to implement indoor cooling measures.

The most affected groups by UHI effects are least able to afford air conditioning (active cooling) and less flexible to adapt their homes as tenants (passive cooling)." [49]

UHI effects are unevenly distributed across cities, reflecting **legacies of segregation and exclusionary development in cities**.[29] Migrants often live in older, low-quality buildings in underinvested areas with limited green space—conditions that increase heat vulnerability and emergency room visits during heatwaves.[24,29,63] In Mediterranean cities, immigrants from the Majority World often live below the poverty line in overcrowded, poorly ventilated homes with low energy efficiency, while also facing direct discrimination in housing markets.[29] In Greece, heat vulnerability is highest in Athens, followed by Thessaloniki, **in dense neighborhoods with many low-income residents, elderly people, and migrants**.[31] Similar patterns appear in Cologne, Germany, where wealthier households moved to the city's green belts during the 1980s, leaving lower-income and other vulnerable groups concentrated in hotter, denser inner-city areas.[10]

This is also evident in the case of Vienna:

"Migrant groups from Turkey and the Balkan states often live in small apartments in urban heat islands in densely populated areas, have a poorer health condition and may suffer from worse health outcomes due to heat." [17]

Literature also reveals that uneven proximity to heat relief spaces in European cities is strongly influenced by factors such as income and migration status. Proximity to green and blue spaces is directly proportional to housing prices, making it unaffordable and inaccessible for most migrants. In Oslo, the proportion of migrants increases by 3% with every 100 meters farther from water bodies.[30] In the Netherlands, dwellings within 500m to 7 km to green space are between 1.6% to 16% more expensive.[14] This link between migration status, lower income and poor access to cooling spaces is also visible in cities such as Paris and Berlin.[49] Even when heat relief spaces are geographically accessible, the de facto access for migrants remains challenging. Berlin, for instance, has numerous green spaces and parks but migrants, and specifically subgroups including Muslims, women and LGBTQ+ individuals report feeling unwelcome or unsafe.[xiv] Similarly, despite the abundance of lakes in and around Berlin, these areas remain inaccessible to migrants due to concerns about safety and previous incidents of racial violence.[xv]

We have also found greening and other adaptation efforts in cities to worsen these inequalities. **Heat gentrification** is a form of climate gentrification that results in heat relief for some residents at the expense of marginalized groups, making neighborhoods with greening interventions less affordable in the process. For example, the new Elephant Park project in London, marketed as the UK's first 'climate positive development' and a step to address the city's housing crisis, has displaced over 3,000 low-income and minority residents.[29]

Our review also shows that **social infrastructures** such as community networks play a crucial role in coping with heat and increasing adapting capacity. People who are socially isolated are less likely to receive help or timely information during heatwaves.[10,20,50] In cities like London, Bonn, and across Catalonia, many immigrants and asylum seekers often have weak social networks, which severely affects their ability to find employment or housing, thus increasing their vulnerability to heat (see also 2.4 and 2.5).[16,22,35]

Therefore, some studies emphasize the importance of social considerations—such as strengthening social networks—to minimize the risk of heat-related morbidity and mortality. For example, the Bristol Climate Hub is working closely with existing community leaders and networks and leveraging their local expertise to co-develop climate action plans tailored to their communities.[xvi] Social infrastructures are also affected by processes of heat gentrification, as migrants who are not directly displaced and can manage to stay in their neighborhoods still lose their community support systems. This impact is particularly worse for LGBTQ+ migrants who rely heavily on community networks for solidarity and emotional support.[xvii]

Heat gentrification is a form of climate gentrification that results in heat relief for some residents at the expense of marginalized groups.

[xiv] Data from the IMBRACE participatory workshop.

[xv] Data from the IMBRACE participatory workshop.

[xvi] Insights from the IMBRACE participatory workshop.

[xvii] Insights from the IMBRACE participatory workshop.

2.8 Urban Planning and Policy for Climate Adaptation

Responses to the health impacts of extreme heat in cities are typically addressed through urban planning interventions. These include the creation of green and shaded areas, permeable surfaces, design that facilitates airflow, and reflective surfaces. Other measures involve expanding access to cooling centers and hydration stations, subsidizing heat-resilient housing, and devising heat action plans.[64] Many of those plans to reduce the Urban Heat Island effect and heat-related health risk are supported by EU and national climate adaptation strategies—such as the 2013 and 2021 EU strategies on adaptation to climate change—by integrating green and blue infrastructure like parks, water channels, trees, and green roofs into urban design. Such so called nature-based solutions can significantly lower urban temperatures: parks can be 5–12 °C cooler than surrounding areas, and tree cover over a third of the surface area can reduce temperatures by about 1 °C.[13]

As discussed earlier, heat vulnerability is strongly shaped by factors such as demographic characteristics and socio-economic factors, histories of migration, housing access and neighborhood characteristics.[12,13,22,29,31] However, urban climate and heat adaptation planning in Europe often fails to take these asymmetries into account, focusing mainly on the physical characteristics of urban environments.[13]

Several studies point to how urban adaptation planning approaches that ignore historical and structural inequalities end up reinforcing them. [1,12,29,48] In the case of Antwerp, urban planning decisions of how and where to "green" and develop, have created enduring contradictions in the city, with socio-economically marginalized communities being relegated into less green and thus hotter neighborhoods, leading to higher incidences of poor health during heatwaves.[48] Furthermore, political polarization in relation to climate change and migration, brings in misinformation and limits the human rights approach in policy and planning for heat adaptation.[xviii]

Ironically, when greening and heat adaptation are implemented precisely in these previously neglected, working-class and minority neighborhoods, they can trigger processes of green, climate or heat gentrification and displacement (see also section 2.2, 2.6 and 2.7).[29] To navigate this paradox, some authors suggest avoiding large flagship projects in select neighborhoods and promoting spatially distributed measures, such as city-wide tree cover.[49] However, not all neighborhoods have the same socio-environmental needs, and thus some studies advise against one-size-fits-all policies and instead recommend localized interventions that address the specific local circumstances that create such inequalities.[14,15]

[xviii] Insights from the IMBRACE participatory workshop.

In addition to the spatial distribution of heat adaptation interventions, migrants often do not see themselves, their communities, or their everyday realities and needs reflected in the implementation, form, and development of such measures. Municipal governments and departments often lack awareness of how migrants are uniquely vulnerable to heat, both indoors and outdoors, because they are excluded from **participatory planning** processes.[17] This exclusion is a major reason why migrants do not benefit from heat adaptation initiatives.[xix] In Berlin's Neukölln neighborhood, spaces of heat relief like pools, parks, and public libraries may be technically accessible but emotionally unwelcoming for migrants, who associate them with past experiences of intersectional discrimination and oppression.[39] In the case of Barcelona, a municipal network of over 350 climate shelters for heat (and cold) remains unknown, inaccessible or unwelcoming to many migrants.[62] According to local experts, climate shelters can be more helpful if extended to include already existing gathering places such as mosques or other spaces of worship.[xx]

While socioeconomic deprivation and poor housing are strong indicators of vulnerability (see sections 2.1 and 2.4), it is also vital to consider how these intersect with **risk perception**. People may fear not only the health risks of heat but also the risks associated with neighborhood change, gentrification, or with experiencing stigma, harassment, or racist attacks in so-called "shelter" spaces (see also section 2.3 on Racism).

Migrants often do not see their everyday realities and needs reflected in heat adaptation interventions.

Fear of violence has been cited as a reason why racial minorities avoid cooling centers and keep the windows closed during heatwaves.[61] Relatedly, another study revealed that migrants use green spaces, forests, rivers and lakes, and beer gardens/outdoor cafes less often than non-migrants.[17]

Several European countries have **heatwave early warning systems or national heat plans**, aimed at reducing the health toll of heatwaves through professional training (e.g. doctors, nurses, etc.) and **public awareness campaigns**. These campaigns often target groups according to documented heat-related health impacts—such as the elderly—and use traditional communication channels like television and community care services.[25] However, migrants are typically left out, partly because disaggregated health data by migration status is rarely available.[24] Communication strategies also tend to ignore community networks and organizations that work with migrant populations as channels of communication.[31] While EU guidance recommends standardized formats for early warnings (in terms of phrasing, alert frequency or visual design),[65] from a migrant-centered perspective it is crucial to consider language, cultural diversity, and alternative communication channels.

Moreover, many heat-related health communication campaigns focus on individual or household level adaptations, such as wearing light clothing and a hat, staying hydrated, passive cooling strategies like shading and ventilating homes, using air conditioning, and avoiding outdoor activities during peak heat hours.[19,44] However, the ability to adopt such **adaptive behaviors** depends heavily on income, education, integration, language proficiency, housing tenure, and overall risk perception. Moreover, populations in cities with less frequent heat events are at greater risk due to underdeveloped response and recovery mechanisms.[20]

[xvi] Insights from the IMBRACE participatory workshop.

[xvii] Insights from the IMBRACE participatory workshop.

Air conditioning, for example, which is increasingly becoming the dominant heat-mitigation strategy, remains financially inaccessible for many who cannot afford to install or run one.[66] In Germany, many public buildings have not installed air conditioning yet, and older buildings often cannot accommodate air conditioning due to heritage restrictions. Other strategies, such as escaping the city to **vacation homes or hotels**, are entirely out of reach for many migrants and low-income groups that must endure heatwaves in crowded and poorly ventilated homes.[12]

Homeownership in a privileged neighborhood that receives more attention from local authorities, also increases capacity to adapt to heat—by installing air conditioning, benefiting from surrounding vegetation and irrigation systems, or retrofitting.[16,19] As discussed in section 2.2, such options are rarely available to most migrants living in European cities. Furthermore, **public transport**, often the only mobility option for low-income residents, is a hotspot of high heat exposure and thermal discomfort.[22]

In terms of **risk perception**, research in Brussels and Amsterdam stresses that heat-awareness needs to be strengthened, especially among vulnerable groups with less formal education.[25] An intersectional perspective reveals wide variations in behavior and perception: some elderly residents may downplay the risks or resist adaptation, while younger individuals may underestimate their vulnerability despite high exposure.[22] As authors stress, in the German context:

"While many German cities have adopted climate change adaptation plans or are in the process of doing so, reducing risk from urban heat still receives comparably little attention... Even less attention is paid to urban inhabitants' perception of heat and its impacts on individual adaptation and coping.[22]

Finally, the literature highlights a **lack of coordination** between urban planning, environmental management, and the health and social services sectors when devising policies and strategies to address heat vulnerability. This fragmentation limits the improvement of social–environmental conditions and the effectiveness of heat-related interventions in cities.[22]

In Cologne, Germany, for example, better connectivity between the city and surrounding green areas could provide easier access to nature for vulnerable residents living in the city center.[10,50] Yet in many climate adaptation plans, health remains a lower priority than at the national level, partly due to limited competencies of sub-national authorities on the issue.[65] A truly integrated and holistic approach would combine city planning and early warning systems with broader measures addressing labor protection[1] or poverty alleviation.[67]

3 Insights and Future Directions

This report has identified eight key drivers of heat-related health vulnerability for majority-world migrants in European cities: demographic characteristics, migration status, racism and intersectional discrimination, housing, employment, health, neighborhood infrastructure, and urban planning. Together, they highlight the urgent need to go beyond reactive climate adaptation and address the deeper, structural inequalities that shape climate vulnerability.

While analytically distinct, these drivers often overlap and reinforce each other, creating complex and compounding forms of vulnerability. Structural forces, such as racism, class inequality, and migration policy, play a central role in shaping the institutional and environmental conditions migrants face. These structural drivers span domains like labor, housing, healthcare and public space—deepening exposure to heat-related risks and creating boundaries for migrants seeking heat relief. A Vienna-based study, for instance, found that multiple compounding factors contributed to the heat vulnerability of the people of Turkish origin, concluding that "the link between ethnic status and potential poor health conditions is multidimensional". 53 As the literature shows, migrants are often disproportionately affected by extreme heat, not because of any single attribute, but due to their position within broader systems of discrimination. For example, insights from the expert workshop we held indicate how many migrants assess whether to access a public institution or seek for help in relation to other risks this decision might entail, like deportation, harassment or discrimination experiences.

Methodologically, we found that most studies on the topic rely on proxies—like socioeconomic status or housing type—to infer migrant vulnerability, often without **disaggregated data** by race, country of origin, or legal category. This limits our capacity to evaluate racial/intersectional inequalities around heat vulnerability across Europe. Additionally, there is a notable **lack of situated, empirical, and participatory research** centered on migrants' own perspectives. While both quantitative and qualitative studies exist, few are based on lived experience or co-produced with affected communities. As a result, we miss key dimensions of vulnerability, particularly emotional, cultural, and embodied aspects—that traditional metrics overlook. We also see a lack of intersectional approaches that would focus on, for example, queer or trans migrants and impacts of climate, or specific sub-groups like refugees or asylum-seekers.

We, thus, call for a more holistic understanding of vulnerability**, combining outcome-based metrics (e.g., excess mortality) with context-based analysis (e.g., housing or employment conditions), and placing migrants' voices and experiences at the core of analysis.** This type of research, and resulting policy- and action- related outputs, should also consider the non-homogeneity of the "migrants" category and the unique intersectional challenges different sub-groups are facing.

We also stress the importance of temporality: **vulnerability is not static**. Legal status can change, living conditions evolve, and communities adapt. Labeling people as "vulnerable" without recognizing the structural causes of that vulnerability or the agency and resilience of affected communities, can be both politically and ethically problematic. Migrants are not passive victims; they are active agents who navigate, resist and respond to heat risks through everyday strategies, collective organizing, and creative adaptation.

Urban planning and policy must reflect this dynamic reality. This means moving beyond neoliberal/individualized and infrastructure-heavy notions of "resilience," and towards justice-based support systems that value vernacular, bottom-up knowledge, and ones that invest in social infrastructures and welfare systems that empower communities to transform their realities.

We also recognize the limitations in this review, particularly the fact that we did not look at literature produced outside academic institutions—such as reports, insights, and reflections from NGOs, grassroots organizations, and migrant communities themselves. While this focus was intentional in the aim to map the current *academic* landscape, it inevitably narrows the scope of perspectives captured. Our keyword choices may have missed relevant research that used different terminology but was still highly relevant. And centering on climate-related studies, we may have overlooked health research—such as occupational studies on migrant workers—that could add vital context.

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