The effects of racism, social exclusion, and discrimination on achieving universal safe water and sanitation in high-income countries

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Drinking water and sanitation services in high-income countries typically bring widespread health and other benefits to their populations. Yet gaps in this essential public health infrastructure persist, driven by structural inequalities, racism, poverty, housing instability, migration, climate change, insufficient continued investment, and poor planning. Although the burden of disease attributable to these gaps is mostly uncharacterised in high-income settings, case studies from marginalised communities and data from targeted studies of microbial and chemical contaminants underscore the need for continued investment to realise the human rights to water and sanitation. Delivering on these rights requires: applying a systems approach to the problems; accessible, disaggregated data; new approaches to service provision that centre communities and groups without consistent access; and actionable policies that recognise safe water and sanitation provision as an obligation of government, regardless of factors such as race, ethnicity, gender, ability to pay, citizenship status, disability, land tenure, or property rights.

Lancet Glob Health 2023; 11: e606–14

This online publication has been corrected. The corrected version first appeared at thelancet.com/lancetgh on March 17, 2023

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Introduction

The human rights to water and sanitation[1] and their public health benefits are widely realised in high-income countries (HICs),[2] where centuries of investment in infrastructure and professionalisation of services have reduced the incidence of infectious diseases and supported human and economic development.[3] However, the expansion of water and sanitation infrastructure and services in HICs has been complex, highly variable across settings, and closely linked with the social, cultural, environmental, economic, and policy trends affecting these countries in the modern era,[4] including the systemic exclusion of marginalised groups.[5] Consequently, universal access to safe water and sanitation remains unrealised due to both historical disparities and current challenges in HICs. These challenges have been mostly invisible in the global water, sanitation, and hygiene (WASH) discourse, which focuses primarily on low-income and middle-income countries.[2] Highly visible cases like the lead crisis in Flint, MI, USA—in which more than 100 000 people were exposed to elevated lead levels in drinking water[6]—and inadequate water and sanitation in refugee camps in Greece[7] have shown that gaps in services can deeply affect the health and quality of life of marginalised populations, even in countries with ample resources to address these problems.

In this Review, we describe systemic issues that have contributed to the unfinished work of realising the human rights to water and sanitation in HICs. Given our varied disciplinary backgrounds, we draw on literature on the human rights to water and sanitation, environmental justice, systems thinking,[8] and public health engineering to describe current trends limiting access to drinking water and sanitation, the associated public health burdens related to inadequate water and sanitation, and policy actions that merit further attention. The human rights to water and sanitation entitle everyone to sufficient, safe, acceptable, physically accessible, and affordable water and sanitation services.[1] Non-discrimination—the bedrock principle of human rights law—is of particular relevance in HICs, where only a small share of the population remains excluded from these services.[9] Persistent disparities in access to water and sanitation services in HICs cannot be explained by an absence of resources or capacity, but are driven by environmental discrimination, systemic racism, and social exclusion.

Current trends

Since the mid-19th century, HICs have made substantial progress in delivering drinking water and sanitation services to majorities of their populations, with UN estimates suggesting near universal access to water and sanitation services in many HICs.[9] However, aggregate national statistics obscure two important factors. First, access to services is not distributed equally, with some communities facing persistent gaps in coverage that might not appear in surveys covering a subset of the population living in traditional housing units. Second, data on quality of services—ie, water safety, reliability, safe management of wastewater, and affordability—is often scarce and insufficiently granular to capture disparities at the regional, neighbourhood, or household scales. Consequently, national statistics overlook millions of people in HICs without access to safe water and sanitation services.[10,11] Because voices of affected communities might be overlooked or dismissed, persistent and emerging inequalities in access to high-quality water and sanitation services in HICs have often remained invisible to policy makers until media reports have highlighted them or independent researchers have publicised collected data. Some countries omit (or even

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explicitly prohibit) reporting of disaggregated data by ethnicity, race, national origin, or other characteristics, limiting public awareness and coordinated action.[12,13]

Three interconnected trends are essential to understanding why safe and effective water and sanitation services remain inaccessible for many in HICs. First, systemic racism[14] drives persistent inequality across societies, limiting access to resources and perpetuating social exclusion and poverty. Second, changes to infrastructure financing models have decreased subsidies that could otherwise extend services to people who are without them. Third, many gaps persist because availability and quality of services are tied to housing and property ownership. We explore each of these themes, with illustrative examples of how these trends affect specific populations. Although the public health burdens attributable to gaps in water and sanitation access remain largely unknown in HICs, we describe the current state of evidence. Realising the human rights to water and sanitation in HICs, and delivering universal and equitable access to safe and affordable services as stated in Sustainable Development Goal 6,[9] will require government action to undo inequality and reimagine the future of water and sanitation service delivery.

Systemic racism and social exclusion

Historically marginalised people and communities with disproportionately low economic means, including minority racial and ethnic groups, indigenous communities, migrant populations, and people of colour, are more likely to be without access to safe water and sanitation than other communities (panels 1–5).[10,11] Such disparities are a manifestation of systemic racism, the scope of which remains underappreciated because systematically collected data from the communities concerned are scarce.[20,29] In some HICs, disparities in infrastructure access and function have aligned with the development of housing, meaning that substandard household and neighbourhood infrastructure or policies that prevent ownership might be reflected in inadequate water and sanitation services.[39] In the USA, redlining—a common and once state-sponsored discriminatory practice that reinforces segregation of communities by race—has created cities with broadly and persistently unequal access to quality infrastructure, resulting in health, economic, and quality of life disparities.[40–42] In some depopulating US cities with ageing infrastructure, such as Flint, MI, the historical benefits of centralised water systems are overshadowed by their notorious inflexibility—for example, when job-loss-triggered decreases in water demand and razing of housing stock created poor water quality conditions in the most depopulated—and typically poorest—neighbourhoods. This situation creates portions of water systems where the consequences of systemic racism and social exclusion in housing translates into poor water quality, which can have direct and underappreciated health consequences. Disparities are perpetuated through barriers to political participation and representation, evident in unincorporation, underbounding, gerrymandering, and voting rights restrictions. The majority-Black city of Jackson (MS, USA) had a long-term interruption in water supply, from August to September, 2022. The interruption resulted from years of underinvestment,[43] which some residents have attributed to state policies routing available federal funding to smaller communities with a high proportion of white people.

As a result of racist policy and inaction in the USA, Native American households are 19 times more likely, and Black or Latin American households are nearly twice as likely, to be without functional water and wastewater access than households identifying as white.[44] In France, where more than 99% of the population is reported to have piped water on premises,[9] 77% of informal Roma community settlements do not have access to potable water. Furthermore, where piped systems exist, entire settlements might share a single tap. Water access is typically insufficient to meet the demands of residents, restricted to a few hours per day and inaccessible at night.[21] In Slovakia, where drinking water for all is guaranteed by law, water access is inadequate in Roma communities, a function of persistent structural, institutional, and economic discrimination and exclusion[45] (panel 2). People relying on non-household or institutional housing, including individuals who are incarcerated (who are disproportionately members of marginalised communities), often do not have consistent access to high-quality water and sanitation services,[46,47] and might face elevated pathogen exposure risks.[48] People

Panel 1: Underbounded communities of colour (North Carolina, USA)

In the century between the US Civil War and the Civil Rights movement of the 1960s, many US cities and towns drew irregular boundaries that purposefully excluded communities of colour from municipal incorporation, a practice known as racial underbounding.[15,16] Underbounded communities were subsequently excluded from 20th century investments in water and sanitation infrastructure, and many still rely on poor-quality services that differ starkly from their high-income neighbours.[17] One example is the Irongate Drive neighbourhood, bordered by the Town of Apex (NC, USA).[18] Apex is 74% white and 8% Black, compared with a 14% white and 79% Black population in the adjacent Irongate neighbourhood. Until May, 2020, Irongate's residents did not have access to the municipal water and sanitation services provided to the white neighbourhood across the road, which was part of Apex. Each household in Irongate relied on its own backyard well for drinking water and septic system for wastewater disposal. Many of the wells were running dry; 80% of households reported that periodically their wells did not produce enough (or any) water.[18] Residents also complained of malfunctioning septic systems, placing their well water at increased risk of contamination. Water testing by local universities showed 79% of well water samples had detectable bacterial genetic material consistent with contamination from human faecal waste.[19] Only in 2020, with support from local universities and civil rights attorneys, was the community annexed by Apex and connected to the town water system. However, the community is still relying on underperforming septic systems.

who are incarcerated or detained can face unsanitary living conditions, and access to water, sanitation, and hygiene products might be used as a means of control,[46] in violation of human rights.

A further challenge is the high and growing level of justified distrust among consumers in the safety of water delivered by utilities—a perception that might be elevated in historically marginalised populations.[49] National surveys from the USA reported that drinking water safety concerns were substantially higher among people who do not identify as white.[50,51] The Flint water crisis is an example of how a cascade of failures by utilities and Government officials who refused to listen to community concerns exacerbated a loss of trust in water systems, both in Flint and across the USA.[52,53] In some areas, trust has further been eroded by criminalising failures to comply with public health regulations that place the responsibility to install septic systems on individuals. There might also be cultural preferences that result from historical exclusion. In Indigenous communities of rural Australia, distrust in the so-called white fella (ie, white people) or town drinking water is common,[54] with consumers preferring non-chlorinated (thus untreated) rainwater as a traditional or natural option that can be trusted.[55] governments, utilities, and other service providers have an obligation to foster equitable partnerships with community members that reflect community values, creating a pathway towards trust in services. Not doing so carries the risk that declining willingness to pay tariffs will lead to further system deficiencies and a cycle of declining revenues and services—a well known low-level equilibrium trap that threatens the sustainability of infrastructure.[55,56]

Systemic racism underpins and reinforces social exclusion of various kinds, and drives income inequality and access to property in HICs. Therefore, systemic racism is a primary reason why changes to financing models and linking access to property have caused disproportionately low access to safe water and sanitation by some groups in HICs.

Changes to financing models affecting access and affordability

Arguments for the expansion of water and sanitation infrastructure in the British Victorian era emphasised the shared health of populations and that "various forms of epidemic, endemic, and other disease… chiefly amongst the labouring classes"[57] were a drain on society, limiting economic prosperity and collective wellbeing. Clean and plentiful water, effective sanitation, domestic and personal hygiene, and redesign of the built environment were seen as key for the creation of a healthy and hard-working labour force that a modern capitalist economy required. Water and sanitation infrastructure in HICs was historically highly subsidised by public funding,[4] with massive expansion of infrastructure in the late 19th and early 20th centuries resulting in major and long-term benefits to public health.[3] More than a century later, some countries have ageing water and sewer infrastructure that is costly to operate, maintain, repair, and replace,[58] and investments have not kept pace as costs have increased sharply in real terms.[59] Water and sanitation infrastructure is mostly located underground; therefore, deficits are not easy to observe and are expensive to reach. As the frequency of large waterborne disease outbreaks has declined, and as endemic and sporadic diseases persist unnoticed—primarily because they disproportionately affect marginalised populations—the public health investment case for this infrastructure has become less prominent.

Concurrently, infrastructure financing models have evolved. Full-cost pricing is now the norm in many HICs, which is a movement towards complete cost recovery of services delivered, inclusive of debt service and capital investment, from rate payers primarily via tariffs.[39] This strategy for financing services and encouraging lower

Panel 2: Roma communities (Europe)

The Roma are a heterogeneous ethnic group believed to have migrated to Europe from northern India beginning in the medieval period and now living mainly in southeastern Europe. They form Europe's largest minority ethnic group, at 11 million people, or 1·35% of Europe's total population. Their history has been shaped in part by political, economic, social, and cultural marginalisation, stigmatisation, and discrimination.[20,21] Roma often live in segregated communities that are geographically isolated from the majority population with substandard living conditions without basic physical infrastructure. Roma communities therefore face challenges with respect to access to water and sanitation infrastructure, waste management, and hygienic living environments.[20] A study done in Turin, Italy, and Marseille, France, found that Roma cope without water access by using public fountains for personal hygiene and laundry. Occupation of spaces without formal property rights and building self-managed sanitation or water systems via unconventional connection to water distribution systems is a common adaptive strategy. Rather than improving access to services, authorities commonly use unhealthy, unhygienic, and unsafe living conditions as a pretext for discouraging settlement and evicting Roma communities.[21]

Panel 3: People experiencing homelessness (California, USA)

Displacement and unstable housing drive inconsistent access to safe water and sanitation,[22] affecting more than a million people living in HICs.[23] Skid Row, which covers 2·7 square miles of downtown Los Angeles, was home to nearly 5000 people experiencing homelessness in 2020. A 2017 audit of Skid Row found only nine public toilets were available during night-time hours and 40 were intermittently available during the day.[24,25] As a result, open defecation is common, personal hygiene (including handwashing) might be poor, and health and wellbeing might suffer. These conditions can lead to an elevated risk of enteric infection,[26] as has been observed in a 2016 multistate outbreak of hepatitis A virus among people experiencing homelessness.[27]

Panel 4: Indigenous communities (Central and northern Australia)

Approximately 20% of Aboriginal and Torres Strait Islander populations live in remote communities, often characterised by unreliable access to safe drinking water and sanitation, poorly maintained rainwater systems and other household infrastructure, and inadequate hygiene facilities linked to overcrowded living conditions.[28] Several complex, systemic, and inter-related factors have led to poor water and sanitation services, including provision of culturally, environmentally, technically, and socially inappropriate infrastructure; inadequate community consultation and communication; and limited capacity building to achieve local resilience.[28,29] The challenges faced by these communities are exacerbated by low-quality housing, crowding, obstacles to good governance, environmental vulnerabilities compounded by climate change, and absence of political and economic visibility that limits effective advocacy for change.[30,31] These communities share commonalities with other Indigenous populations in the USA[32] and Canada,[33] where the legacies of colonialism, genocide, exclusion, and oppression have resulted in generally poor governance and barriers to accessing resources.

Panel 5: Migrant populations (USA and Europe)

Poor access to safe water and sanitation services has also been documented in the context of displacement and forced migration, affecting migrant and refugee camps as well as detention centres in France,[34] Greece,[7] the USA,[35] and other HICs. With the arrival of more than a million refugees and asylum seekers in Europe in 2015–16, many refugees live in overcrowded camps, such as the former Moria camp on Lesbos, Greece. Women and girls often face particular challenges due to both the need to take care of their bodies when menstruating and the risks to their personal security when seeking to access sanitation facilities.[36] A camp at Calais, France, was characterised by unsanitary conditions and the global water, sanitation, and hygiene (WASH) services that would not meet minimum humanitarian standards.[37] Government efforts have focused on the demolition of the camp, rather than providing services to residents, ostensibly justified by the perception of refugees as a public health threat.[34] The current war in Ukraine stands to increase the refugee population in Europe by millions. Ensuring basic needs like access to safe WASH services for them will require a vigorous response from governments and substantial investment in infrastructure.[38]

consumption—the pursuit of economic efficiency to achieve long-term sustainability—has been accompanied by a reduction in public subsidies for the construction, expansion, operation, maintenance, and management of infrastructure.[59] This trend has led to two primary effects that limit the realisation of the human rights to water and sanitation within HICs with marked economic inequalities. First, fees are tied to the financial cost of infrastructure services, irrespective of affordability or the broader societal benefits, including public health protection.[59] The costs of service provision are rising relative to incomes, and increasing economic inequality drives persistent disparities in access to services[5] because poorer households are vulnerable to disconnection.[60] Second, unsubsidised full-cost financing models constrain the development and extension of infrastructure, effectively preventing expansion of existing services to reach historically unserved and underserved communities whose ability to pay might be insufficient to cover the full cost of service delivery. This financing mode can prevent poorer communities from receiving service connections, resulting in differential access to water and sanitation based on income or property values (panel 1). In some countries, the principle of full-cost pricing is supplemented with proactive approaches to delivering infrastructure when gaps persist,[61,62] but such programmes might not be sufficiently broad to fully redress historical and growing disparities. These problems might be exacerbated by privatisation, which can erode public accountability and result in trade-offs between the public good and profitability.[63–65] Despite concerns about increasingly unaffordable costs, most HICs do not collect data on utility pricing in nationally representative surveys, so the full scope of this problem in marginalised communities is poorly understood.

Linking property ownership and access to service provision

People living in poverty in HICs bear the overwhelming burden of inconsistent access to safe water and sanitation because this access depends on economic means, including access to property. Because of systemic racism and social exclusion, people without sufficient economic means are more likely to be members of marginalised groups who might also be without political capital.

In HICs, access to water and sanitation is closely tied to housing,[31] with financing, regulation, and important responsibilities for maintaining quality services falling to property owners. People without fixed property might therefore be excluded from water and sanitation services (panels 2, 3, and 5), as are those owning property but without the economic means to provide for services themselves, which is common in rural areas (panel 4). The linking of property to water and sanitation services is a policy choice that disadvantages migrant populations, including nomadic populations, displaced people, people experiencing homelessness or in unstable housing, people living in poverty in rural areas, people who are incarcerated, and people without access to housing with functioning indoor plumbing. In settings where this is the norm, tenants' water and sanitation access depend on the property owners' investment in, and maintenance of, infrastructure.

For people without stable housing, public infrastructure, such as shelters and free public toilets, is essential for accessing water and sanitation services. These facilities have become less common. In the USA and the UK, the number of freely accessible public toilets has been decreasing since the mid-1900s due to cuts in public funding and concerns about illicit activity like drug use and prostitution.[66] Without access, some people must resort to public urination or defecation,[67] which is criminalised in some places. Although regulations against open defecation and urination are ostensibly motivated by public health concerns, such policies are discriminatory and contribute to the criminalisation of poverty.[68]

Rural water supply and decentralised sanitation do not benefit from the economies of scale for construction,

operation, maintenance, monitoring, and regulation that is associated with dense urban centres. As such, inadequate access to high-quality water and sanitation in HICs can be most visible in rural and remote areas, where the responsibility for service provision can fall to households who often rely on wells or small water supplies and onsite sanitation infrastructure, such as septic systems. Many rural communities in the USA do not have functional wastewater services,[56] or have no wastewater system at all where conventional septic systems are unworkable.[69] Only 74% of households in Australia had access to safely managed sanitation services in 2020.[9] Private well water is not subject to any meaningful safety monitoring at scale in the USA and in most other countries. In South Korea, as of 2014, an estimated 700 000 people,[70] primarily in rural areas, did not have access to drinking water that met safety standards. Too often, rural populations in HICs are on their own when it comes to water and sanitation services.

Burden of disease

Global burden of disease estimates assume negligible risk attributable to water and sanitation deficits in HICs,[71,72] despite a wealth of evidence that persistent coverage gaps and poor-quality services create major health burdens, especially in marginalised populations. Global burden of disease estimation methods assume that populations with access to water supplies and sanitation receive high-quality services and commensurate protection from disease, regardless of how effectively infrastructure is monitored or maintained.[73] This assumption might not generally hold.

The Institute for Health Metrics and Evaluation's most recent (ie, 2019) estimates for the burden of disease attributable to unsafe water, sanitation, and hygiene in countries with a high social development index posit an all-cause burden of $2{\cdot}5\times10^{-4}$ disability-adjusted life-years (DALYs) per person-year (95% uncertainty interval $1{\cdot}7–3{\cdot}5\times10^{-4}$).[74] However, national-scale estimates from selected HICs suggest a far higher burden. For example, a 2021 US estimate is 7·15 million gastrointestinal illnesses per year,[75] and approximately $1{\cdot}5\times10^{-3}$ DALYs per person-year. In Australia, in 2010, 820 000 gastrointestinal illness cases—about $2{\cdot}7\times10^{-3}$ DALYs per person-year—were attributed to selected waterborne pathogens.[76] These estimates are dramatically higher than WHO's normative risk-based guideline of no more than 1×10^{-6} DALYs per person-year.[77]

Although they exceed the Institute for Health Metrics and Evaluation estimates, existing national-scale estimates of the disease burden attributable to water, sanitation, and hygiene gaps in HICs might also be too low. These estimates exclude respiratory and other illnesses arising from biofilm-associated pathogens such as *Legionella*, non-tuberculous mycobacteria, and *Pseudomonas*; evidence from the USA suggests that these pathogens cause widespread drinking-water-associated hospitalisations and deaths.[75] The estimates also overlook hygiene risks occurring when low-income households lose water service because they cannot afford their bills.[60] Importantly, these estimates ignore chemical contaminants, despite growing evidence of their associations with acute and chronic disease.[78] A few studies have estimated the disease burden attributable to individual chemical contaminants (eg, arsenic[79]) or contaminant classes (eg, disinfection byproducts[80]) in HICs. However, such studies have not been incorporated into holistic assessments of the health burden from gaps in water, sanitation, and hygiene infrastructure in HICs.

Despite the limitations of available estimates, the evidence is that some populations in HICs face health risks from inadequate water, sanitation, and hygiene infrastructure that are unacceptably high by normative standards. At the root of this preventable disease burden are policies that have resulted in uneven and inequitable government investment in water and sanitation infrastructure. For example, the Flint water crisis arose from insufficient funds to operate and maintain the water system in this majority-Black city.[6]

Inability to afford monitoring and treatment systems can also increase risks of exposure to lead in unregulated private wells.[81,82] Private wells are the primary water source not only in many low-income rural areas, but also in some periurban areas where communities of colour have no connections to nearby municipal water and sanitation infrastructure due to a history of racial exclusion in the delineation of municipal boundaries (panel 1). Low-income and minority communities also face higher risks of relying on contaminated source water without economic capacity to build water treatment systems. For example, Australian Indigenous communities are at an increased risk of exposure to nitrate, uranium, lead, and other heavy metal contamination in water.[83,84] Also, low-income communities and communities of colour in HICs are more likely to experience water shutoffs due to inability to afford water bills; this problem is particularly acute in shrinking cities (like Flint that have become majority-minority as a result of so-called white flight to the suburbs [ie, the movement of white people to suburban neighbourhoods]), leading to an insufficient customer base to afford system maintenance.[85] Involuntary water shutoffs arising from overdue water bills leave households completely without water and sanitation service, compromising their ability to practise routine hygiene behaviours, like handwashing.

Overall, although comprehensive estimates of the disease burden attributable to water, sanitation, and hygiene gaps are unavailable, the existing studies illustrate the public health consequences of assuming that provision of safe water and sanitation services are the financial responsibility of individual households and communities, rather than a larger, collective social responsibility.

Path forward

Realising the human rights to water and sanitation in HICs will require meaningful change from the status quo. We make the following recommendations to governments and policy makers.

Recognise the problem

When taking a systems approach to improving access to water and sanitation in HICs, an essential first step is acknowledging the underlying causes of disparities, including active discrimination, deliberate neglect, exclusionary policies, institutionalised marginalisation, and racism. Recognising and understanding that the sociopolitical landscapes that have resulted in the societal marginalisation of specific populations are reproduced in the water and sanitation sector is essential for creating transformative approaches that seek to actively and explicitly address inequalities.[86]

Take responsibility for providing services to all, proactively reducing persistent disparities

For safe water and sanitation to be accessible to all in HICs, governments should live up to their human rights obligations and reclaim their identities as guarantors of necessary social goods. To do so, major and targeted public investment in water and sanitation infrastructure—along with support for operating and maintaining this infrastructure—should be a key component for both large-scale centralised systems and for small-scale, decentralised infrastructure. Explicit mechanisms should be established (eg, legislatively) to ensure that disproportionately affected, chronically neglected, and underserved communities are prioritised in the distribution and transparent management of funds. These mechanisms could take the form of grants, not loans, to improve infrastructure and provide the technical assistance necessary to implement solutions. When infrastructure improvements are made, dedicated funds and proactive policies should be included to ensure that low-income, fixed-income (ie, people receiving pensions or on public assistance), and no-income customers have access to water and sanitation, regardless of ability to pay, housing status, property tenure, or other factors. Compelling models exist for achieving equitable access[62] and should be more widely adopted.

Collect specific, representative, disaggregated data on access to and quality of water and sanitation services and their attributable disease burdens

Major gaps in the realisation of the human rights to water and sanitation in HICs remain mostly hidden due to a lack of systematically collected, appropriately disaggregated data on communities experiencing disparities in access to water and sanitation, and an incomplete accounting of attributable disease burdens. The myth of universal service provision[87]—ie, that HICs have already achieved safe water and sanitation for all—results in major underinvestment in providing water and sanitation services for populations for whom access is limited, inadequate, or non-existent. The global WASH community's justified focus on unserved and underserved populations in countries without advanced infrastructure, where the problems and health burdens are concentrated, has not included communities and populations in HICs where the human rights to water and sanitation remain unrealised. More data are essential to raising the visibility of persistent gaps in services and creating political will to close them. Ultimately, to realise the rights to universal access to safe water and sanitation services globally, HICs must work proactively to extend services to historically excluded groups,[59,88] and any solutions require a better understanding of the access gaps and their impact on public health and wellbeing. Governments should establish or reinstate national-scale, representative monitoring on water and sanitation services that includes disaggregation by race, ethnicity, income, property ownership, housing status, and other variables associated with restricted consistent access to high-quality water and sanitation services.

Develop new approaches to water and sanitation service delivery

Due to explicit policy choices, most high-income residents of HICs have consistent access to safe water and sanitation. Too often, people living in poverty do not, in part because of environmental discrimination and policy inaction. Reversing the current reality of entrenched and growing inequalities caused by systemic racism and exclusion will require the upending of financing models that rely on market forces and full-cost pricing for ratepayers to fix, maintain, and create water and sanitation infrastructure to meet community needs. Although the real costs of service provision are rising, economically advanced countries can deliver universally safe water and sanitation, provided there is political will. New models for service provision that can address gaps in coverage at low cost, such as hybrid or decentralised water and sanitation networks and treatment systems,[89,90] are also needed.[91] New technologies will help, but addressing persistent inequalities requires systemic changes that centre people and communities[49] with a focus on unmet needs. These changes will be challenging for a sector that has too often been focused primarily on technology and built infrastructure. Pipes and treatment works are only parts of many essential components needed to deliver universally safe water and sanitation services in HICs, deficiencies of which point to systemic failures.

To achieve systemic change, focus on systems

The next century of water and sanitation services is likely to differ substantially from what came before, as global migration, conflicts, disease and pandemics, climate change, and resource constraints threaten to exacerbate

Search strategy and selection criteria

We searched the databases PubMed, Web of Science, and Scopus using the search terms given in the appendix (pp 1–3). There were no date or language restrictions. We also included key reports, government documents, and UN resolutions where these directly inform our analysis. Our Review is also informed by our collective experiences in working with underserved communities in high-income countries.

disparities and create new challenges. Advancing the water and sanitation sector in HICs will require better coordination between sectors—water, sanitation, and hygiene often appear in regulatory and policy siloes—and engagement with other sectors that are important to human and ecological wellbeing. HICs should move towards sustainable models of infrastructure development and reimagine the relationships among water, sanitation, public health, and the environment, in which justice and substantive equality are central. Strengthening water and sanitation services in HICs in this way will require flexibility and recognition of the hyper-local nature of water and sanitation systems; accounting for, and correction of, disparities; as well as building of trust, accountability, and mechanisms for shared decision making informed by human rights principles. Impacts of climate change on resource availability, and the growing collapse of existing infrastructure in some HICs due to lack of investment, make recognising and solving the water and sanitation crisis in HICs an urgent priority. Using bold, system-wide solutions that focus on community needs—with a focus on the most marginalised—can prevent a future in which historical gains in the progressive realisation of human rights to water and sanitation are undone.

Contributors

JB, KPF, JMG, KGL, and HMM wrote the original draft. JB and OC conceptualised and administered the project. All authors were responsible for conceptualising, writing, reviewing, and editing the Review.

Declaration of interests

JB received research funding on topics covered in this Review from the Bill and Melinda Gates Foundation, Columbia World Projects, and the US Centers for Disease Control and Prevention. He is a contributing commissioner in the *Lancet* Commission on Water, Sanitation, Hygiene, and Health. CSA holds grants for environmental justice research related to the topics covered in this Review from the California Air Resources Board and University of California Institute of Transportation Studies. She has received honoraria from the 2022 Yale New Horizons in Conservation Conference on related work. OC received grants from the Bill and Melinda Gates Foundation and the UK Foreign, Commonwealth and Development Office for related work. He is a contributing commissioner in the *Lancet* Commission on Water, Sanitation, Hygiene, and Health. JMG received funding for related work from the US Environmental Protection Agency, the US Department of Housing and Urban Development, the US National Science Foundation, and the Association of Environmental Engineering and Science Professors. She serves as a Council Member (elected), Society for Risk Analysis. NGL is the recipient of two small grants internally funded within the University of Michigan focused on water and sanitation and environmental justice in Flint, MI. Her proposal that has been funded from the US National Science Foundation focused on trust building around point-of-use water hydration stations in schools in Flint, MI (grant number 2228345). She reports past support via the Kappe Lecture from the American Academy of Environmental Engineers and Scientists. KJM received fellowships from Fort Lewis College and funding from the US National Science Foundation on related work. HMM reports funding for related research and travel support by the by the National Institutes of Health, the Canada Research Chairs Program, the Canadian Foundation for Innovation, and the Canada Research Chairs programme. She serves as a member of the International Joint Commission's Health Professionals Advisory Board, which makes recommendations about public health issues in the area of transboundary environmental health, specifically related to water. ITW received funding from the Norwegian Research Council for a project on the right to water completed in 2022. She served as lead on the US case study and received limited funding through the grant. She receives royalties from Bloomsbury/Hart Publishing for a book on the right to water published in 2012. She serves as an advisory group member of the Universal Rights Group, Geneva, Switzerland. All other authors declare no competing interests. No authors received support for their contributions to this manuscript, and its production was not supported financially.

See **Online** for appendix

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