

DELIVERING SAFE SANITATION FOR ALL

AREAS FOR ACTION TO IMPROVE THE SITUATION IN THE PAN-EUROPEAN REGION

Abstract

Sanitation is a fundamental determinant of human health and well-being, and is essential for protecting the environment and enabling economic and social development. Ensuring universal, equitable and sustainable access to safe sanitation in all settings is a political priority in the pan-European region. This publication aims to support implementation of the provisions on sanitation under the Protocol on Water and Health, as well as national and international goals and targets on sanitation by providing an overview of the situation of sanitation and wastewater management in the region, describing current and emerging issues in ensuring access to safe and sustainable sanitation services, and proposing key action areas to strengthen sanitation governance. It is primarily targeted at national decision-makers and supports public health and environment authorities, surveillance agencies, sanitation service providers and other relevant stakeholder.

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SUMMARY OF KEY ACTION MESSAGES

Good governance of sanitation is vital for expanding and maintaining access to safe services. The WHO guidelines on sanitation and health provide evidence-informed recommendations and offer guidance to encourage national and local sanitation policies and good practice actions that enable safe sanitation service delivery and protect public health.

Policies and their implementation at the local level should be transparent; it should be possible to hold those charged with policy formulation and implementation accountable. Devolution of decision-making to the local level helps to create transparency and accountability, but it must be adequately resourced.

National and local governments should prioritize ensuring equitable access to at least basic sanitation services for all in all settings. This should include consideration of different onsite and sewer technology options, with choices made using transparent and accountable processes.

Safely managed sanitation brings the best possible health and environmental gains. To ensure safe sanitation, it is essential to manage health risks systematically along the entire service chain. Governments should establish legal requirements and regulations to adopt risk-based management principles for sanitation services – such as the sanitation safety plan approach recommended by WHO – and scale up their implementation.

Sanitation is vital to community resilience, but may itself be vulnerable to the effects of climate change. Sanitation should be integrated into national adaptation plans and nationally determined contributions, and investment should be made in building resilience of services.

Reuse of treated wastewater should be promoted, with a regulatory framework in place at national and local levels to ensure safety. Wastewater reuse promotes transition to a wider circular economy, aids adaptation to climate change and water scarcity, and has direct climate benefits.

Ensuring systematic collection of data on sanitation and wastewater management is critical for addressing the persistent data gap. This requires national monitoring and information system capacity to be strengthened and country participation in the global instruments for monitoring sanitation-related SDG targets to be scaled up.

The health sector should fulfil core functions to ensure safe sanitation to protect public health. Sanitation should be integrated as an essential component in public health surveillance systems to ensure that resources are targeted at settings with a high disease burden. Such functions require long-term resource allocation. More reliable data on sanitation and wastewater, and on associated disease and environmental contamination, should receive enhanced policy attention and be used in public health decision-making.

Sustainable and resilient sanitation needs financing. It is important that governments establish dedicated budget lines and develop realistic financing plans for delivery of safe sanitation services. Equity, climate resilience and sustainability aspects should be integrated into investment plans.

National sanitation asset registers and asset management plans, integrating current and future climate threats and scenarios, should form the basis for expansion, rehabilitation and replacement planning.

A human resources strategy for sanitation – looking at skills and grades of staff, remuneration, career pathways and professional development – is critical to attract and retain a strong and knowledgeable workforce in both governments and service providers.

The Protocol on Water and Health, through its target-setting and reporting mechanisms, provides an overarching governance framework for countries to address and operationalize key action areas, based on country needs and priorities, and to accelerate efforts to ensure safe, equitable and climate-resilient sanitation services for all in all settings.



INTRODUCTION

Sanitation is a fundamental determinant of human health and well-being, and is essential for protecting the environment and enabling economic and social development. Safe sanitation is associated with improvements in health, including prevention of infectious diseases, reduction of antimicrobial resistance and maintaining mental health and dignity (1).

Owing to this vital role, sanitation – “physical and affordable access to sanitation, in all spheres of life, that is safe, hygienic, secure, socially and culturally acceptable and that provides privacy and ensures dignity” – is recognized as a basic human right (2), of which all dimensions are equally important. Sanitation also has a central place in the 2030 Agenda for Sustainable Development: Sustainable Development Goal (SDG) target 6.2 stipulates that all populations should have access to safely managed sanitation services by 2030, and SDG target 6.3 focuses on reducing the discharge of untreated wastewater and increasing safe reuse (3). Action to achieve these targets creates synergies with and contributes to achieving several other SDGs, including providing basic services (SDG 1), improving health and well-being (SDG 3) and education (SDG 4), and

making cities inclusive, safe, resilient and sustainable (SDG 11) (4).

The WHO guidelines on sanitation and health (1) define a safe sanitation system as one designed and used to separate human excreta from human contact along all steps of the entire sanitation service chain – from toilet capture and containment through emptying, transport, treatment and final disposal or end use (Fig. 1).

Regrettably, provision of safe sanitation is still not a reality in many countries in the pan-European region:¹ over 271 million people lack access to safely managed services, of whom 29 million people lack the most basic sanitation services (5). This poses a considerable risk to human health and the environment. At the current rate of progress, the region is not on track to deliver universal and equitable access to safe sanitation by 2030 (6).

The WHO and United Nations Children’s Fund (UNICEF) global report *State of the world’s sanitation* highlighted that progress has been too slow in reaching SDG sanitation targets, and emphasized that

Fig. 1. Sanitation service chain



Source: modified from WHO (1).

1 This publication uses the term “pan-European region” to refer to the Member States in the WHO European Region and Liechtenstein. The WHO European Region comprises 53 countries: Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Luxembourg, Malta, Monaco, Montenegro, the Netherlands, North Macedonia, Norway, Poland, Portugal, Republic of Moldova, Romania, the Russian Federation, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tajikistan, Türkiye, Turkmenistan, Ukraine, the United Kingdom and Uzbekistan.

sanitation suffers from a chronic lack of prioritization, leadership and capacity, combined with significant underinvestment (7). It urged countries to address these pressing issues through strong government leadership and by using the key progress accelerators defined in the SDG 6 Global Acceleration Framework (8).

Ensuring universal, equitable and sustainable access to safe sanitation in all settings is a political priority in the pan-European region, as underpinned by the Declaration of the Sixth Ministerial Conference on Environment and Health (Ostrava Declaration) (9). The Protocol on Water and Health to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes is a legally binding agreement open for signature by countries in the region (10), which provides a unique regional platform to organize progress and strengthen national capacity to realize global and regional sanitation priorities and commitments set by the SDGs and the Ostrava Declaration.

This publication aims to support implementation of the provisions on sanitation under the Protocol, as well as those of national and international goals and targets on sanitation, by:

- providing an overview of the situation of sanitation and wastewater management in the region;
- highlighting the health and environmental impacts of poor sanitation systems and services;
- describing current and emerging issues related to ensuring access to safe and sustainable sanitation services in the region; and
- proposing key action areas to create an enabling environment for ensuring access to safe and sustainable sanitation services for all.

It is primarily targeted at national decision-makers responsible for developing policies; setting targets and plans related to sanitation service delivery; and coordinating their implementation. It supports them in identifying priorities tailored to country needs and in approaching improvement actions from the policy, institutional, financial, technology and monitoring perspectives, including consideration of increasing resilience to climate change. The publication also supports public health and environment authorities, surveillance agencies, sanitation service providers and other relevant stakeholders and partners in engaging and contributing to the shared goal to deliver safe sanitation services for all people in the region.

SANITATION IN THE CONTEXT OF THE PROTOCOL ON WATER AND HEALTH

The Protocol on Water and Health is an international legally binding agreement, which aims to sustain and protect human health and well-being through improving water management and by preventing, controlling, and reducing water-related diseases (10). It covers the entire water cycle, including all steps of the sanitation service chain. Under the Protocol, sanitation is defined as the collection, transport, treatment and disposal or reuse of human excreta or domestic wastewater, whether through collective systems or by installations serving a single household or undertaking.

Sanitation is further referred to in several core provisions and mechanisms laid out in the Protocol. Article 4 requires all Parties to the Protocol take appropriate measures to ensure “adequate sanitation of a standard, which sufficiently protects human health and the environment. This shall be done in particular through the establishment, improvement and maintenance of collective systems”. Parties are required to pursue the objective of providing sanitation for everyone, with a focus on equitable access for all members of the population – especially vulnerable population groups who suffer disadvantage or social exclusion.

Setting and reviewing intersectoral targets on water, sanitation, hygiene and health regularly, and monitoring their implementation, provide an important accountability mechanism through which Parties fulfil the Protocol’s objectives and obligations. Targets

need to be set in several specific areas covering the key aspects of sanitation chain management, as listed in Article 6 of the Protocol. These include:

- access to sanitation – in terms of both connection to central sewerage and access to decentralized and individual systems;
- levels of performance of collective systems and other sanitation systems (including aspects related to maintenance, renovation and modernization of existing systems, or prevention of leakages and overflows);
- occurrence of discharges of untreated wastewater;
- occurrence of discharges of untreated storm-water overflows from collection systems;
- quality of discharges of water from wastewater treatment installations;
- disposal and reuse of sludge from collective systems or other sanitation installations; and
- quality of wastewater used for irrigation purposes.

Article 8 of the Protocol requires Parties to establish, improve or maintain national and/or local surveillance and early warning systems for water-related diseases.

Overall, the Protocol provides a comprehensive and coherent framework for countries to accelerate action to ensure safe, equitable and sustainable sanitation for

all in all settings and to protect health and the environment. To support implementation of the Protocol's legal obligations, countries work under the framework of triennial programmes of work, which respond to national and regional priorities, and address persistent gaps and emerging challenges. The programme of work addresses sanitation through several thematic areas and activities aimed at, for example:

- ensuring safe management and climate resilience of sanitation systems – including by supporting the uptake of risk-based approaches, such as sanitation safety planning;
- strengthening safe sanitation for small and individual systems;

- promoting equitable access to sanitation services for all;
- ensuring adequate sanitation in institutions, such as schools and health-care facilities; and
- improving sanitation surveillance and contingency planning, including environmental surveillance of wastewater.

Activities under the Protocol's programmes of work include targeted capacity-building at the national and local levels, development of guidance documents and practical tools, and cross-country exchange and cooperation.

PART A. **SITUATION OVERVIEW AND CHALLENGES FOR SANITATION AND HEALTH**

The following sections provide an overview of the current state of sanitation and its potential impact on health and the environment, based on available data. They highlight persistent and emerging issues that require enhanced attention and action at the national and regional levels.

THE SITUATION OF SANITATION SYSTEMS AND SERVICES

Access to basic and safely managed sanitation services

The pan-European region is not on track to achieve universal and equitable access to safely managed sanitation services for all by 2030: and over 271 million people currently lack such services.

Geographical, economic and social inequalities in access to sanitation services persist. Targeted action is needed to achieve universal and equitable access to sanitation for all.

The WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP) service ladders for sanitation (5) are useful to benchmark and compare sanitation service levels across countries and subregions (Fig. 2).² The criteria for basic and safely managed services reflect different components of the human right to sanitation.

Data analysis indicates that, despite progress in extending sanitation services in the past two decades, the pan-European region is not on track to achieve universal access to safely managed sanitation services for all by 2030 (Fig. 3). In 2020, about 97% of the population in the region had access to at least basic sanitation (including both basic and safely managed services), but only 70% relied on safely managed sanitation services, meaning that over 271 million people lacked such services. Further, notable inequalities exist in access to safely managed sanitation services across subregions, ranging from 98% in northern Europe to around 64% in eastern Europe in 2020.

Globally, progress towards universal access to safely managed sanitation services has been alarmingly slow. The current development rates need to quadruple to achieve SDG target 6.2 by 2030 (12). The pan-European region is no exception: between 2015 and 2020, access to safely managed sanitation services increased by 3% across the region, with considerable differences between subregions. In eastern Europe, 64% of the population had access to safely managed sanitation services in 2020 – a rise of only 2% since 2015. In western Asia, this rise was greater (5%), but still only

2 In analysing the data by subregions, countries in the region were grouped according to the geographical subregions established by the United Nations Statistics Division classification system (11). They include the following subregions and countries in the pan-European region:

- central Asia: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan;
- western Asia: Armenia, Azerbaijan, Cyprus, Georgia, Israel, Türkiye;
- eastern Europe: Belarus, Bulgaria, Czechia, Hungary, Poland, Republic of Moldova, Romania, Russian Federation, Slovakia, Ukraine;
- northern Europe: Denmark, Estonia, Finland, Iceland, Ireland, Latvia, Lithuania, Norway, Sweden, United Kingdom of Great Britain and Northern Ireland;
- southern Europe: Albania, Andorra, Bosnia and Herzegovina, Croatia, Greece, Italy, Malta, Montenegro, North Macedonia, Portugal, San Marino, Serbia, Slovenia, Spain;
- western Europe: Austria, Belgium, France, Germany, Luxembourg, Monaco, Netherlands, Switzerland.

Fig. 2. WHO/UNICEF JMP sanitation service ladder and definitions

SERVICE LEVEL	DEFINITION
SAFELY MANAGED	Use of improved facilities that are not shared with other households and where excreta are safely disposed of in situ or removed and treated off-site
BASIC	Use of improved facilities that are not shared with other households
LIMITED	Use of improved facilities that are shared with other households
UNIMPROVED	Use of pit latrines without a slab or platform, hanging latrines or bucket latrines
OPEN DEFECACTION	Disposal of human faeces in fields, forests, bushes, open bodies of water, beaches or other open places, or with solid waste

Notes: Improved sanitation facilities are those designed to hygienically separate excreta from human contact. They include: flush/pour flush toilets connected to piped sewer systems, septic tanks or pit latrines; pit latrines with slabs (including ventilated pit latrines); and composting toilets.

Source: WHO/UNICEF (5).

Fig. 3. Coverage with at least basic and safely managed sanitation services, 2015 and 2020

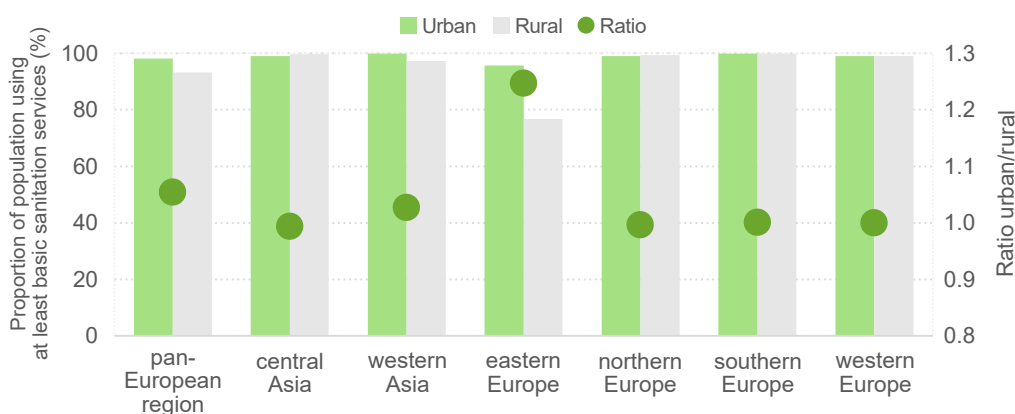
Notes: Data present population-weighted averages in subregions. Data not available for Azerbaijan (western Asia) or Bosnia and Herzegovina (southern Europe). No data available on safely managed sanitation for central Asia.

Source: WHO/UNICEF (5).

79% of the population had access to safely managed sanitation in 2020. In northern, western and southern Europe, coverage was already high in 2015, with over 90% of the population able to access safely managed sanitation, but progress between 2015 and 2020 was less than 1% in all three subregions, illustrating the challenges in closing the gap for hard-to-reach population groups.

Inequalities in access to sanitation services exist in three key dimensions: geographical, economic and social. For instance, about 96% of the urban population in eastern Europe had access to at least basic sanitation services, whereas access rates for the rural population were only 77% (Fig. 4). Such disparities in access between urban and rural settings were not as prominent in central Asia and northern, southern and western Europe (<1%).

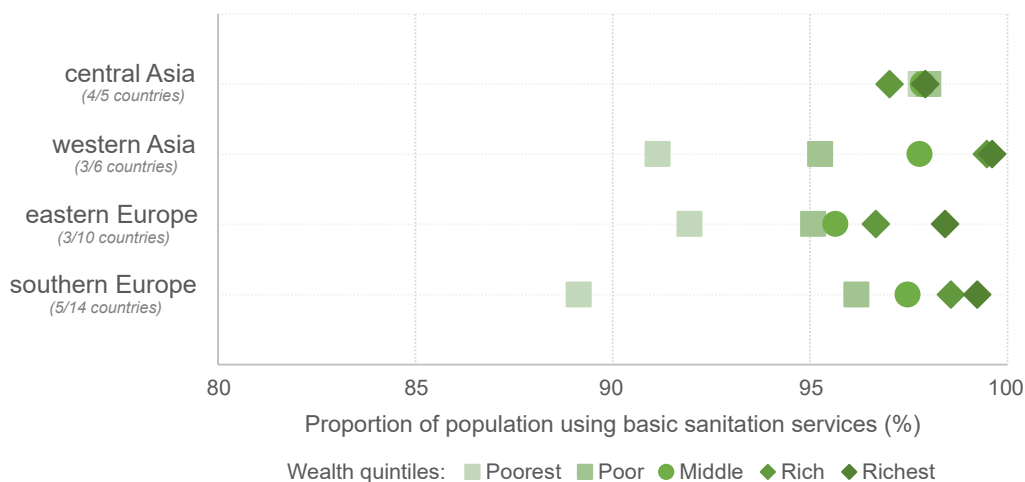
Fig. 4. Population coverage with at least basic sanitation services in urban and rural areas, 2020



Notes: Data present population-weighted averages in subregions. Urban data not available for San Marino or Slovenia (western Europe); rural data not available for Azerbaijan (western Asia), Bosnia and Herzegovina, San Marino and Slovenia (all southern Europe) or Monaco (western Europe).

Source: WHO/UNICEF (5).

Fig. 5. Population coverage with basic sanitation services by wealth quintile, last year of reporting (2018–2020)



Notes: Data present population-weighted averages in subregions. Wealth quintile data only available for 15 countries in four subregions: central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan), western Asia (Armenia, Georgia, Türkiye), eastern Europe (Belarus, Republic of Moldova, Ukraine) and southern Europe (Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, Serbia).

Source: WHO/UNICEF (5).

Rates of access to basic sanitation also varied between income groups. Asset-based wealth quintile data available for 16 countries in four subregions were analysed (Fig. 5). This did not facilitate a fully representative overview of the situation across the region, but it did demonstrate that access to basic sanitation services differed by more than 10% between the poorest and the richest population groups in western Asia and southern Europe. Differences within some countries were as high as 35%. Integrating the data for geographical and economic dimensions revealed that the poorest people – most often those in rural areas – are the most disadvantaged in provision of basic sanitation services.

Information on social inequalities across the region is required to understand prevailing conditions and inform policy and improvement interventions, but no data are collected systematically to facilitate assessment of these factors. Individual studies can provide some insights, however. For instance, a 2020 review showed that Roma communities in the western Balkans had limited to no access to basic sanitation services, and significant gaps in sanitation systems and services were seen between Roma and non-Roma populations in several countries in south-eastern Europe (13). In addition, several countries reported access gaps for people with special physical needs and homeless people (14). Furthermore, sanitation in institutional settings – such as schools and health-care facilities – requires attention (Box 1).

Box 1. Sanitation situation in institutional settings in the pan-European region

The latest JMP data show that among the 31 countries for which data were available, only 22 reported universal coverage of basic sanitation services in schools (improved facilities that are single-sex and usable) at the national level in 2021 (5). More than 10 million pupils in the region lacked access to basic sanitation facilities in schools.

Data on basic sanitation services in health-care facilities were only available for five countries in 2020: no regionwide overview is available. For these countries, coverage of basic sanitation services at the national level varied widely, ranging from 6% to 100%.

Sewer connections, wastewater collection and treatment

Only 67% of domestic wastewater in the pan-European region is collected and safely treated. Significant urban/rural differences exist in connections to centralized sewerage. Combined sewer systems and associated overflows play an important role in some parts of the region.

SDG indicator 6.3.1 focuses on the proportion of domestic and industrial wastewater flows that are safely treated (in compliance with national or local standards) before being discharged or reused (15). Data availability for industrial wastewater is low, so this section focuses on domestic wastewater flows.

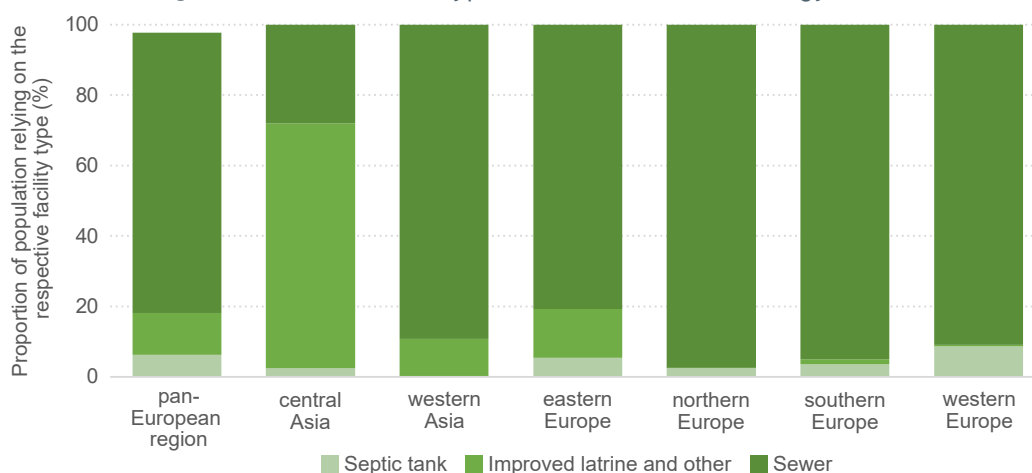
Around 80% of the total population of the pan-European region was connected to sewers in 2020, although connection rates varied between subregions (Fig. 6). More than 95% of the population in northern and southern Europe was connected to a sewer, whereas rates were 81% in eastern Europe and only 28% in central Asia, indicating that the majority of people in this subregion relied on onsite systems rather than sewers. Between 2015 and 2020, sewer connection rates across the region saw a 2% increase. In countries in central and western Asia and eastern Europe, people predominantly used improved latrines and other facilities when there was no connection to a central sewer system, while in northern, southern and western Europe, people mainly used septic tanks when there was no connection.

Geographical differences in sewer connection rates between urban and rural populations across the region were stark, with around 92% of the urban population but only about 46% of the rural population connected to sewers in 2020. This regional disparity is particularly driven by eastern Europe and central Asia, where differences in connection rates between urban and rural areas were around 55 percentage points. The great majority of people in rural central Asia used improved latrines and other facilities (98%), whereas people in

rural eastern Europe relied on both improved latrines and other facilities (41%) and septic tanks (20%).

Profound subregional differences were also observed in 2020 in relation to collection and safe treatment of domestic wastewater (Fig. 7). Across the region, only 67% of domestic wastewater is safely treated (meeting national or local treatment standards for discharge of treated effluents, either in treatment plants or for onsite systems emptied, transported and treated offsite) (15).

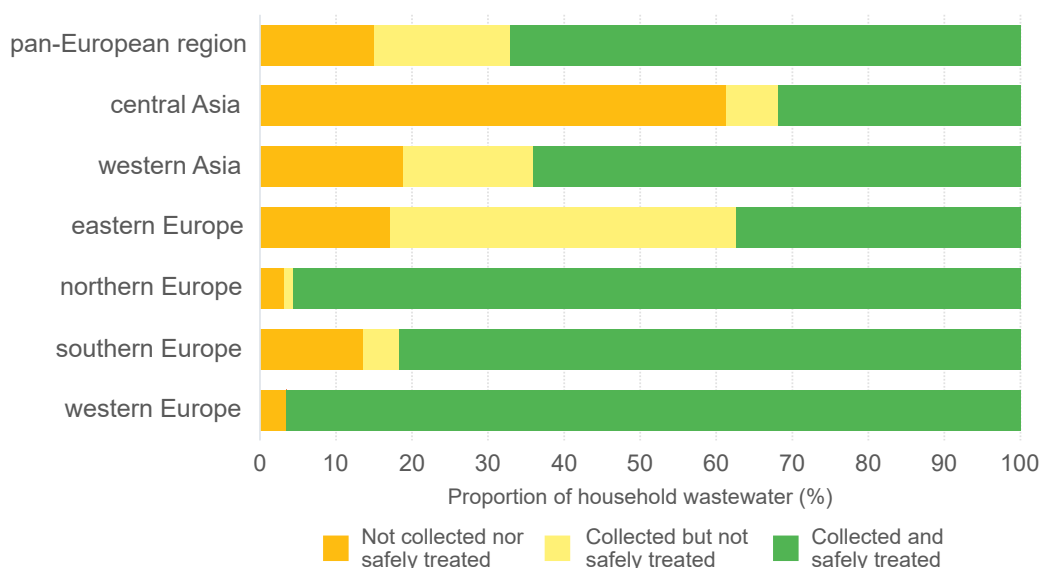
Fig. 6. Use of different types of sanitation technology, 2020



Notes: Data present population-weighted averages in subregions. Data not available for Azerbaijan (western Asia) or Bosnia and Herzegovina (southern Europe).

Source: WHO/UNICEF (5).

Fig. 7. Collection and treatment of household wastewater, 2020



Notes: Data present population-weighted averages in subregions. Data not available for Azerbaijan (western Asia) or Bosnia and Herzegovina (southern Europe).

Source: WHO (16).

While in northern and western Europe more than 95% of all household wastewater is collected and safely treated, rates drop to 37% for eastern Europe and 32% for central Asia.

When examining wastewater collection in sewers, special attention must be paid to combined sewers from a health and environmental point of view. Such systems collect rainwater runoff, domestic sewage and industrial wastewater in the same pipe. During heavy precipitation events, combined sewers may overflow at designated locations and discharge excess wastewater, untreated, into receiving water bodies.

The extent to which combined sewerage systems predominate varies significantly across the region. While systematic regional data are not available, in countries like Hungary (4%), Finland (5%) and Sweden (12%), combined sewers represent a minority of existing wastewater systems, whereas in the Netherlands (68%), Czechia (66–75%), England and Wales, United Kingdom (70%), Spain (87%) and Poland (90%) they are the majority (17). It is estimated that several hundred thousand overflow structures exist for European Union (EU) countries alone.

Regionwide data are also lacking on the occurrence and magnitude of combined sewer overflow events. Individual country reports, however, provide a first indication of the situation. In Thessaloniki, Greece, for example, about 15 overflow incidents occur per year; the region of Flanders in Belgium reported 54 events in 2016; and in mountainous areas of Austria, storm water overflows occur around 20 to 25 times annually. It was estimated that storm water overflows in Riga, Latvia, accounted for 1% of the total amount of wastewater discharged into receiving water bodies; for Helsinki, Finland, this was estimated at 0.1% (17).

Wastewater reuse

Wastewater reuse is well established in some countries in the pan-European region, to take advantage of its benefits. In most other countries, limited available data indicate low rates of reuse.

To achieve SDG target 6.3, countries need to “substantially increase recycling and safe reuse of wastewater by 2030” (3). This is an urgent priority as freshwater resources become increasingly scarce, particularly in the context of a changing climate. Wastewater reuse is practised for different purposes, including for irrigated agriculture (including urine recycling from non-sewered sanitation), industrial processes (such as cooling), non-potable urban uses (such as irrigation of public parks), direct or indirect potable use, and environmental enhancements (for example, stream flow augmentation and groundwater recharge) (18).

Available data show considerable variation in the extent to which wastewater reuse is practised in the region. About 1 billion cubic metres of treated urban wastewater – amounting to 2.4% of total treated urban wastewater effluents – are reused annually in the EU (19), mostly for agricultural irrigation. Israel recycles nearly 90% of its wastewater for reuse – predominantly for agricultural irrigation (20). Cyprus reuses more than 89% and Malta more than 60% of treated wastewater. In contrast, Greece, Italy and Spain reuse between 5% and 12% of their effluents (21).

Sporadic data indicate that less than 1% of wastewater is reused in some countries in these subregions (21,22). Overall, however, the lack of data on wastewater reuse for countries in eastern Europe and central and western Asia is significant. These data gaps hinder policy advocacy and action to increase wastewater reuse.

Implementation of risk-based approaches in sanitation management

Uptake of risk-based approaches in sanitation management – such as sanitation safety plans (SSPs) – in legislation and practice is limited across the pan-European region.

Sanitation safety planning is a risk-based approach to assist in implementation of local risk assessment and management for the sanitation service chain – from containment, conveyance and treatment to end use or disposal (23). The SSP approach is recommended by WHO to ensure the provision of safe sanitation services (1,24).

While no comprehensive overview of SSP implementation in the region is available, limited data from 15 countries – obtained through the 2018/19 Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) reporting cycle (25) – indicate a major gap in the application of this instrument.

- Only one country reported that approved policies and plans requiring SSPs were in place.
- Only four countries reported that policies and plans were in development.
- Most countries reported that no SSPs were in place or development for either urban or rural systems.

HEALTH AND ENVIRONMENTAL IMPACTS OF UNSAFE SANITATION

Health impacts

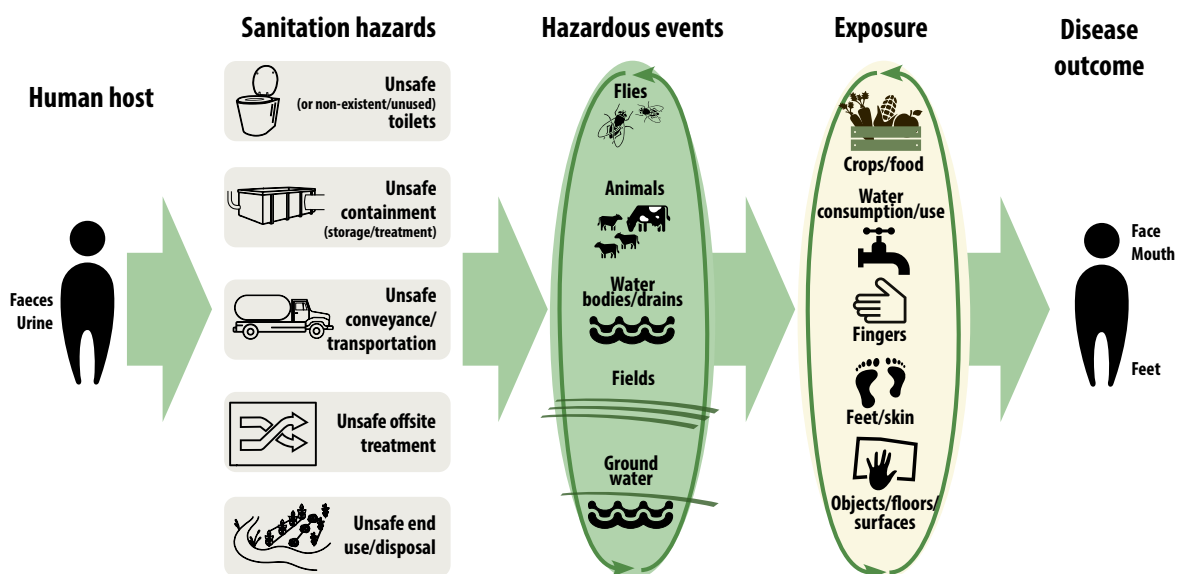
A comprehensive overview of the sanitation-related disease burden in the pan-European region is not available. This is related to the limited capacity of public health surveillance of sanitation services and associated health outcomes.

Unsafe sanitation and excreta management can lead to the presence of human waste in the environment. This may increase exposure to faecal pathogens and can lead to faecal-oral infections, including shigellosis, typhoid, hepatitis A and E, cryptosporidiosis and soil-transmitted helminth infections, as well as

vector-borne diseases. Pathogens are spread from the faeces of the agent into one or more environmental reservoirs (typically fields, fingers, fluids, flies, food and sometimes fomites) through human/animal interaction with the environment and/or natural processes. Subsequent interactions with susceptible people can result in infection (Fig. 8).

Data from the Global Infectious Disease and Epidemiology Network (GIDEON) (26) indicate that 483 outbreaks of gastrointestinal infectious diseases associated with poor water quality and inadequate sanitation were reported in the pan-European region between 2010 and 2021. Of these, approximately 47% were in northern Europe, 21% in western Europe,

Fig. 8. Transmission pathways for faecal-oral diseases at all steps of the sanitation chain



Source: modified from WHO (1).

17% in southern Europe, 11% in eastern Europe, 4% in western Asia and 1% in central Asia (Fig. 9). The diseases with the highest number of reported outbreaks were shigellosis, *Escherichia coli* infections, hepatitis A and cryptosporidiosis.

Reported outbreak data are unlikely to reflect the state of access to and management of sanitation, however. Low outbreak figures are predominantly caused by underreporting because of insufficient capabilities and mechanisms of surveillance systems to detect and report water- and sanitation-related disease outbreaks and cases, paired with limited capacity for outbreak investigation. The available data therefore indicate that countries in northern and western Europe have higher capacity to detect and report such outbreaks. It should also be noted that the data do not always allow the source of infection to be traced, or distinguish routes of transmission (such as whether the outbreak was associated with poor water quality, inadequate sanitation or unsafe food).

In addition, soil-transmitted helminth (STH) infections contribute to the disease burden in the region. STHs – also known as intestinal worms – are primarily associated with poor excreta management and are transmitted through infectious faecal waste (27). Several factors affect an increase in STH infections, including high rates of reinfection in areas where

sanitation practices are poor due to contamination of soil by helminth eggs, and increased temperatures, exacerbated by climate change (28). Children, women of reproductive age and certain occupational groups (such as tea pickers and miners) are at particular risk.

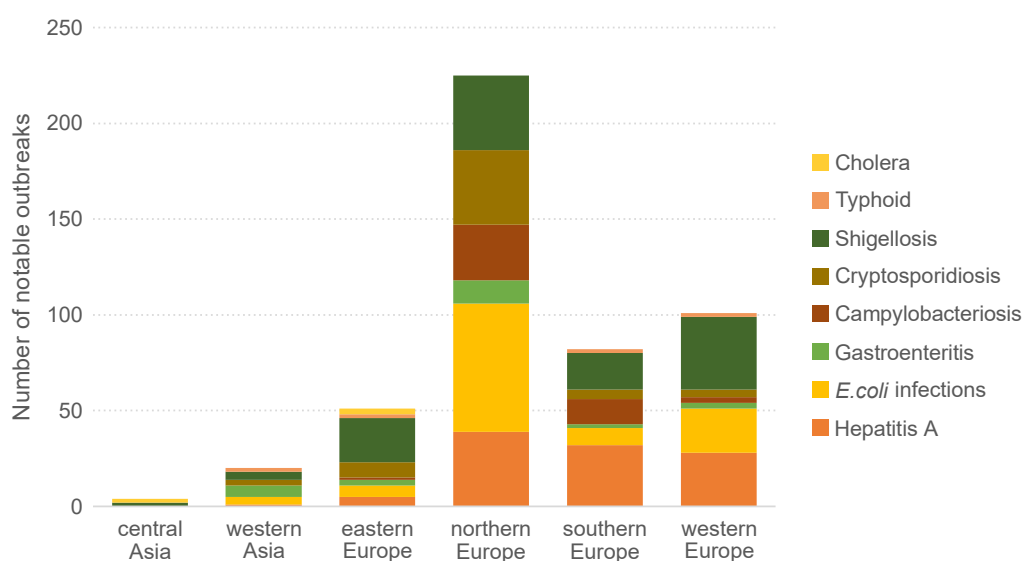
WHO estimates that in 2020 over 6.5 million children in central and western Asia required preventive chemotherapy for STH infections (29). In other parts of the region, STH infections do not contribute significantly to the disease burden.

Environmental impacts

Poorly managed sanitation and discharges of untreated and insufficiently treated wastewater and sludge to water bodies cause environmental damage.

In addition to pathogens, wastewater may include toxic chemicals, nutrients, and organic and inorganic substances, with the potential to have an impact on the environment. Poorly managed sanitation systems and discharges of untreated or insufficiently treated wastewater and sludge into water bodies and the environment deteriorate the quality of freshwater resources, and thereby adversely affect the

Fig. 9. Outbreaks recorded in GIDEON between 2010 and 2021



Source: GIDEON (26).

aquatic environment (30,31). Estimates suggest that over 5 billion cubic metres of untreated wastewater are discharged into the environment annually (16).

Decaying organic matter and debris can use up the dissolved oxygen in the water so that aquatic biota cannot survive. Excessive quantities of nutrients – especially nitrogen or phosphorus compounds – in the aquatic environment (eutrophication) can in turn lead to algal blooms and changes in the balance of organisms (32,33). Sewage exfiltration, for instance, is among the main reasons for rising levels of toxic substances and microbial pollution in groundwater (34).

Wastewater and sludge can also contain a broad array of organic and inorganic chemicals discharged from manufacturing and processing industries. These

may include heavy metals and micropollutants, such as pharmaceuticals, endocrine disruptors and microplastics. They may be discharged to receiving surface waters through untreated or partly treated wastewater, although conventional wastewater treatment processes are rarely designed to remove such substances (35). In the water environment, such substances may adversely affect the aquatic ecology (36).

In addition, combined sewer overflows can be a significant problem in parts of the region, which is likely to increase in the context of climate change and its influence on extreme hydrological events. Such overflows can cause or contribute to water quality impairments, beach and shellfish bed closures, contamination of drinking-water supplies, and other environmental problems (37).

CURRENT AND EMERGING ISSUES IN SANITATION

The sanitation sector faces several challenges to management and delivery of safe services. The most pressing current and emerging sanitation issues pertinent to the pan-European region are outlined in the following sections.

Climate change

The effects of climate variability and change pose risks to the functioning of sanitation systems and exacerbate associated health risks and environmental contamination.

Climate change has become one of the most significant global challenges. It affects hydrological cycles, including sea level rise; alters rainfall patterns; increases

temperatures; and tends to make dry areas drier and wet areas wetter (38). The pan-European region is warming faster than the global average, and some of the hottest and driest years of the last two centuries have been recorded in the last few decades (39). Climate change is one of the main drivers of extreme weather events becoming more intense and frequent (Box 2).

The effects of climate change pose a range of significant risks to sanitation services (43) (Fig. 10). Heavy precipitation and flooding, for instance, can lead to combined sewer overflows, whereby untreated or insufficiently treated sewage is discharged into water bodies (44). This results in environmental pollution and may expose people to higher loads of pathogens and harmful substances in water bodies through recreational activities or polluted drinking-water sources.

Box 2. Extreme weather events in the pan-European region

In the last 50 years, 1673 extreme weather events have led to almost 160 000 deaths and economic losses of US\$ 477 billion in the pan-European region. Floods (38%) and storms (32%) were the most reported cause of weather extremes, but extreme temperatures led to the highest proportion of weather-related deaths (93% of all deaths) (40). Drought spells pose multiple risks for health, enhance the risk of wildfires and threaten water supply and sanitation services (41). More frequent and intense droughts are already striking extended areas across southern, central and northern parts of the region.

About 20% of the territory and 30% of citizens in the region are affected by water stress during an average year due to extreme weather events. Southern Europe is the most affected region: around 30% of the population live in areas with permanent water stress, and up to 70% in areas with seasonal water stress during summer. The situation is expected to worsen, as climate change is increasing the frequency, magnitude and impact of heatwaves, floods and droughts. This will trigger more frequent incidences of high flows during the wet season and low flows during the dry season. Freshwater availability is expected to increase in northern Europe and decrease in southern and south-western Europe, while mixed patterns are expected in central parts. This is due to projected increases in precipitation, including heavy precipitation that creates problems with excess water (such as floods) (42).

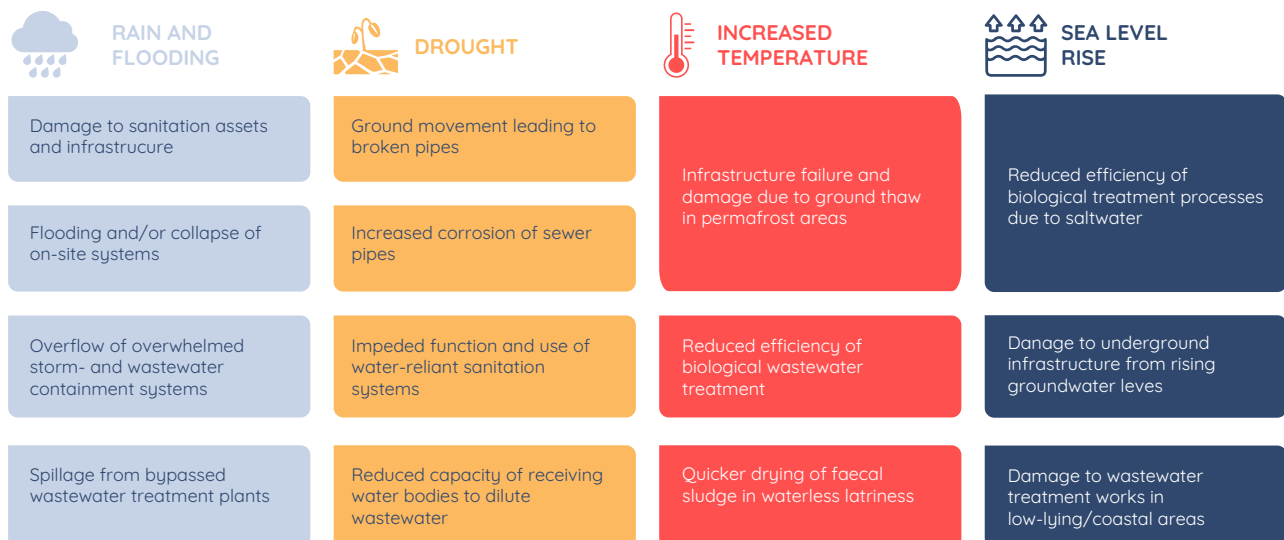
Heavy precipitation and flooding can also damage sanitation infrastructure and disrupt the regular operation of treatment systems (Box 3). Pit latrines and septic tanks can become unusable when flooded with water, which may lead to widespread spillage of faecal matter into the environment and contamination of drinking-water supplies (43,45). Another example is permafrost thawing, which can lead to damage to and failure of sewage pipes, resulting in surface or groundwater contamination (46). Other impacts of climate change include drought, increased temperatures and sea-level rise, all of which can adversely affect sanitation systems and services.

Climate change-related health consequences from sanitation systems generally fit within two overarching categories:

- increased risk of disease or illness from exposure to pathogens and hazardous substances through increased environmental contamination; and
- increased risk of disease or illness resulting from a lack of access to adequate sanitation when systems are destroyed or damaged.

In addition, sanitation workers may experience additional risks depending on their work context and level of occupational health and safety (45).

Fig. 10. Possible impacts of climate change on sanitation systems and services



Source: based on WHO (45).

Box 3. The 2021 flooding events in western Europe

Flash flooding followed by heavy rainfall claimed the lives of more than 220 people and caused billions of euros of damage in Belgium, Germany, and the Netherlands in 2021. Previous rainfall records were broken around the rivers Ahr and Erft in Germany and Meuse in Belgium. Some towns in west Germany, such as Ahrweiler, had no drinking-water supply for days because of damaged drinking-water treatment plants. Following the destruction of wastewater treatment facilities, the municipality coordinated and deployed a temporary emergency modular activated sludge treatment plant. Similarly, in the district of Euskirchen, authorities advised residents to boil tap water before drinking, because of the potential of contamination from damaged sewers carrying wastewater (47).

Antimicrobial resistance

The discharge of untreated and treated wastewater and sludge is a pathway for the spread of antimicrobial resistance in the environment, posing a risk to human health.

Antimicrobial resistance (AMR) refers to the ability of microorganisms to withstand antimicrobial treatments. When microorganisms become more resistant to antimicrobials, treatment can become ineffective, posing a serious risk to global public health.

Systematic data on the burden of infections and deaths attributable to AMR are not available for the pan-European region, as many countries still do not collect representative data. Estimates suggest that in central and eastern Europe and central Asia the number of AMR-attributable deaths in 2019 was 73 700 (17.6 per 100 000) (48). In the EU, infections caused by antibiotic-resistant bacteria were responsible for an estimated 33 000 deaths per year (49). AMR cost EU countries over €1.5 billion (50) in health-care costs and productivity loss.

AMR transmission can occur in the environment. Bacteria in water or soil, for example, can develop resistance following contact with other resistant bacteria. The causes of the development and spread of resistance in the environment are complex, however. Both biological and chemical pollutants that enter the environment can fundamentally influence and change AMR development, transmission and spread (51). Wastewater and sludge discharges from municipalities; health-care facilities; pharmaceutical manufacturing; and livestock, crop and aquaculture farms are significant sources of AMR in the environment. Much of the wastewater and sludge produced is released to the environment without treatment, including about 33% of domestic wastewater (see Fig. 7) and a greater but unquantified amount of wastewater from plant, animal and industrial production. Conventional (secondary-level) wastewater treatment plants remove approximately 99.9% of both resistant and non-resistant pathogens, but they are not designed to eliminate all pathogens, resistant bacteria, genes or antimicrobial compounds fully (52). As

a result, microorganisms carrying antibiotic-resistant genes are released into the environment largely prior to but also after treatment, where they can spread resistance and infect new hosts (51,53).

People are at risk of being exposed when they come into contact with contaminated water downstream of point or diffuse sources – for example, through recreational water use or contact with contaminated water. Direct use of inadequately treated wastewater and sludge can also be a contributory factor. Given the widespread detection of AMR microorganisms in human excreta and wastewater, safe management of the entire sanitation chain from communities and health-care facilities (with treatment to at least secondary level, as called for by SDG targets 6.2 and 6.3) – combined with improved wastewater and manure management from animal production and from antimicrobial manufacturing – is needed to reduce the spread of resistant microorganisms.

Human migration and demographics

Human migration and changing demographics can pose challenges for sanitation service providers, as well as for migrants and refugees who may face barriers to accessing sanitation services.

Human mobility and migration have been growing in volume and diversity, and have become a major determinant of public health (54). Failure to meet the water, sanitation and hygiene (WASH) needs of migrants and refugees can contribute to public health problems – particularly when large numbers of people are concentrated in temporary, informal or dilapidated areas (55).

Migrants and refugees can face numerous barriers in accessing sanitation services. Studies include reports of practising open defecation, overflowing toilets and insanitary conditions in reception or transit centres, and occurrence of infectious diseases (55,56). Challenges

in accessing safe sanitation services can also persist after migrants are settled in the host country, as refugees and migrants are more likely to live in informal or underdeveloped areas, with a lack of safely managed sanitation services.

Sanitation service providers, on the other hand, face two significant challenges in relation to in-migration. The problems associated with coping with capacity, mobilizing capital for investment and generating income to sustain sanitation services to new residents can be complex.

- First, there is a need for emergency sanitation provision to reduce the risk of disease transmission where migrants move rapidly into areas and form temporary camps. Such approaches may not be user-funded; they will require political will to support provision of emergency sanitation.
- Second, the mid/long-term problem is the influx of increasing new populations, which create demand for adequate sanitation that exceeds the capacity of current infrastructure and services. This requires longer-term planning and investment, but will typically focus on expansion and enhancement of existing services with a view to future user funding.

In contrast to population growth, some subregions have seen their populations shrink over many decades. A shrinking population – usually the result of rural-to-urban migration – can also have a negative

impact on sanitation systems and services, including sewage stagnation, low flow and foul smell in those communities.

Ageing and maintenance of sanitation infrastructure

Ageing of infrastructure has adverse impacts on sanitation and wastewater system efficiency and service quality, and presents health and environmental risks.

A holistic approach to sustainable sanitation involves not only increasing access to safely managed sanitation by building new sanitation systems and services but also maintaining and upgrading existing systems. Ageing sanitation infrastructure is a key challenge in the pan-European region. The wastewater infrastructure throughout the region is rapidly ageing and in need of repair or replacement to minimize adverse impacts on sanitation system efficiency and reduce wastewater leakages (57). Existing sewers can be 50–100 years old, and may require rehabilitation in the short or medium term (Box 4).

Such ageing infrastructure results in deterioration in the quality of sanitation services, as broken or blocked pipes can discharge untreated sewage into the open environment or local waterways, increasing risks of water- and sanitation-related diseases and negative adverse ecological effects. In the EU alone, 7 million km

Box 4. Operation, maintenance and renovation of the sewerage network in Norway

In Norway, leakages from the sewerage network and sewer overflow may result in the contamination of water bodies and drinking-water sources and networks, constituting a challenge for wastewater management. Substantial geographical variations exist in maintaining and upgrading the sewer network.

In the context of the Protocol on Water and Health, Norway established specific targets and measures to address these challenges. These include obtaining a better overview of the status of the sewer network to assess upgrade needs, mitigating the negative impacts of leaks and overflows over time, and improving the operation, repair and renewal of the network and its branches. It is estimated that increasing the network replacement rate from the current 0.45% to 0.75% (equivalent to 150 km) annually will result in an increase of costs of around 1.5 billion Norwegian kroner per year (60).

of pipes (both water and wastewater) have been operating for over 100 years (58). In addition, wastewater treatment plants constructed since the mid-20th century are not designed for nutrient removal, especially in countries in central and western Asia (59), and this issue can contribute to the eutrophication of local water bodies.

The EU estimated that it will be necessary to invest about €25 billion annually to rehabilitate and construct new sewers and wastewater treatment plants (61). Consolidated figures for other subregions are not available but are likely to illustrate an even higher need. Sanitation infrastructure renewal requires large investments and high expenditure as a proportion of gross domestic product. Maintenance of sanitation infrastructure is also reported to be an issue in many parts of the region. Inadequate maintenance can increase the operational burden and cost for utilities.

Small-scale sanitation systems

A considerable proportion of the population in the pan-European region relies on small-scale sanitation systems. However, insufficient regulations, standards, coordination and surveillance capacities may hinder provision of safe and sustainable services.

Small-scale systems include onsite systems like pit latrines, septic tanks, composting toilets and urine-diverting dry toilets, as well as small collective sewerage

systems with or without wastewater treatment. At least 169 million people in the pan-European region (18% of the population) rely on onsite systems. The majority of these (72%) live in rural and periurban areas – particularly in central and western Asia and in eastern Europe (see Fig. 6).

Onsite sanitation systems have several advantages, including their flexibility, modularity and cost-effectiveness compared to centralized sewerage (62). They can be implemented in stages and built close to where wastewater is generated. Such systems are a viable alternative to centralized sewerage, particularly in remote areas and areas with low population density where the operation of a centralized system is technically and economically unfeasible. Onsite solutions can also be the technology of choice in drought-prone areas where there is insufficient water to operate conventional sewage systems (43). This consideration is of particular importance in areas where climate change is likely to reduce water availability further in the long term.

On the other hand, a number of challenges are related to such systems. Onsite facilities are typically managed by communities or individuals who may be untrained or undertrained, leading to inadequate maintenance and unsafe operation of the system. This is a particular issue when paired with a lack of access to information and advice from competent institutions, technical support by trained technicians and/or replacement parts. Gaps in regulations and standards for small sanitation systems, unclear institutional arrangements and poor coordination lead to shortcomings in management, maintenance and surveillance (63,64).

PART B.

AREAS FOR ACTION

The following sections offer considerations for decision-makers, relevant authorities and stakeholders in planning and implementing strategies and action to ensure safe sanitation services for all, in accordance with the commitments of SDG targets 6.2 and 6.3. It proposes several action areas to improve sanitation and wastewater management by tackling the prevailing and specific issues and challenges presented in Part A. The action areas take into account international frameworks – in particular WHO recommendations on sanitation and health *(1)* – and the key accelerators of progress on sanitation defined by the SDG 6 Global Acceleration Framework *(8)*.

Translating international commitments into national agendas and investment requires targeted policies and a conducive enabling environment that is context- and setting-specific. An enabling environment is understood as the set of favourable conditions necessary to meet safe and equitable sanitation for all; it encompasses national policy and regulatory frameworks, institutional arrangements, service delivery mechanisms, necessary skills and capacity, monitoring and surveillance, and investment and financial arrangements.

CLOSING THE GAP IN DELIVERING SAFE SANITATION FOR ALL

Countries across the pan-European region need to prioritize delivery of at least basic sanitation services for all.

The region is not on track to deliver universal and equitable access to safely managed sanitation services for all in all settings. It is the responsibility of national and subnational decision-makers to fulfil these human rights obligations. Providing sanitation services to all requires strong political will, accountability and economic resources.

Incremental improvements are needed, starting by ending open defecation where it is still practised and making sure that all people have access to basic sanitation services – particularly in countries with low coverage of such services in rural areas, as in southern and eastern Europe and central and western Asia. Such efforts should address the specifics of small-scale sanitation systems and include specific attention to different onsite and sewer technology options. Choices should be made using transparent and accountable processes. In countries where basic sanitation coverage is already high, a gradual transition to safely managed sanitation along the entire service chain – from household facilities through safe containment, collection and transport to onsite or offsite treatment and safe disposal – is needed to achieve the best possible health and environmental gains.

Sanitation safety planning needs to be scaled up.

To ensure safe sanitation, it is essential to manage health risks systematically along the entire service chain to protect users, sanitation workers and communities. For this purpose, the WHO guidelines on sanitation and health (1) recommend the SSP approach (Box 5). SSPs play a pivotal role in incremental progress towards universal access to safely managed sanitation systems and improving the safe use of excreta and wastewater (23).

Adopting and scaling up SSPs in regulations and in practice throughout the region can help to ensure safe management along the entire sanitation chain (Box 6), addressing both (small) decentralized and (larger) centralized sanitation systems.

Action to close the inequity gap is vital.

Inequitable access to sanitation remains prevalent in the region, as evidenced by urban/rural, social or wealth disparities. In delivering access to sanitation for all, governments should prioritize ensuring equitable progress in line with the principles of the human right to sanitation, including reducing geographical disparities, overcoming the barriers faced by vulnerable and marginalized groups, and addressing affordability concerns.

Box 5. Sanitation safety planning

The SSP approach is a step-by-step risk assessment and management tool for sanitation systems (Fig. 11). It is targeted for use by local authorities, wastewater utility managers, sanitation enterprises and farmers. It guides users to:

- identify and manage locally specific health risks along the sanitation service chain systematically, including climate-related risks;
- guide and prioritize investments based on actual risks, to promote health benefits and minimize adverse health impacts; and
- provide assurance to authorities and the public on the safety of sanitation-related products and events.

Fig. 11. Steps in the SSP approach



Source: WHO (23).

Box 6. SSP implementation in Finland

Two wastewater treatment plants serve a population of 2 million residents in the city of Helsinki, Finland. The local authority that manages the water and sanitation sector for the area developed its own web-based health and environmental risk management tool for 2012–2015, based on the SSP approach. The tool aims to manage risk along the whole wastewater cycle from collection through treatment to receiving surface water bodies.

The first SSP implementation identified nearly 800 control measures, of which 600 were implemented. The following year, only 180 control measures were identified. The web-based tool has undergone several improvements to make it user-friendly and to minimize errors. SSP implementation has helped the city identify critical risks in the networks and control measures – either specific or universal. This example shows how well designed and targeted SSPs can be instrumental in managing risks in the sanitation service chain (65).

Systematic equity assessments and subsequent action plans can guide country efforts to achieve equitable access to sanitation by identifying priority actions and effective approaches to their implementation. The Protocol on Water and Health provides several practical tools that support policy processes to achieve equitable access, including the Equitable Access Scorecard – a self-assessment tool to identify inequalities in access to sanitation in a country, city or region (66).

Provision of basic sanitation in institutional settings and public places should be assured.

Ensuring universal and equitable access to at least basic sanitation services requires provision in places such as schools, health-care facilities, workplaces and public places – including markets and transportation facilities. Sanitation facilities in these settings should meet standard requirements for availability, accessibility, privacy and menstrual hygiene management.

STRENGTHENING NATIONAL POLICIES AND REGULATORY FRAMEWORKS

There is a need to build governance mechanisms and political leadership.

Access to safe and sustainable sanitation for all is still not a reality in many parts of the pan-European region. Good governance of sanitation is vital to expand and maintain access to safe services. The WHO guidelines on sanitation and health (1) provide evidence-informed recommendations and offer guidance to encourage national and local sanitation policies and good practice that enable safe sanitation service delivery and protect public health.

It is the responsibility of national decision-makers to establish targets and actionable road maps, and to strengthen policies and regulatory frameworks governing access to sanitation, affordability of services, safe management along the entire sanitation chain – including consideration of resilience to climate change – and performance of service providers (67). The roles and responsibilities of different ministries, service providers and stakeholders related to sanitation governance and service management should be defined clearly.

To develop effective policies, strategies and plans on sanitation, it is essential to have a clear understanding of the prevailing situation and needs in the country. A comprehensive national analysis and assessment

can help to identify high-risk areas, settings and population groups, and define priority interventions. Targeted policies in sanitation must serve all community members in an inclusive manner, irrespective of geographical region, wealth and gender.

Local governance should be empowered.

Decentralized governance mechanisms led by local implementers and decision-makers, who have authority over financial and human resources, are crucial to addressing local challenges successfully. Devolution of decision-making to the local level helps to create transparency and accountability, but it must be adequately resourced.

Coordination between appropriate institutions, clearly defined mandates – including for resource planning and management – and accountability for fulfilment of mandates are key sanitation governance functions (Box 7). A holistic approach and systems thinking must be taken into account rather than relying on standalone action. Sanitation should be included in local planning and development processes (including land use, water supply and drainage, solid waste management and transport) and provided as part of locally delivered services (1).

Box 7. Governance for onsite sanitation in Norway

In Norway, municipalities are responsible for supervising, inspecting and reporting on implementation of onsite sanitation systems. Operators of systems serving more than 50 population equivalents (mostly municipalities but also private people and communities) report to the Norwegian Environment Agency, while operators of systems serving fewer than 50 population equivalents report to Statistics Norway, which produces yearly reports on the data gathered.

Municipalities cover their management costs in part by collecting fees for issuing permits and receiving funds from central government to cover the tasks they perform. The role of the various actors involved is well described, and regulations support the actions of the local government entities (68).

Regulations and standards should be established.

Governments should create a positive and supportive regulatory environment that protects public health and the environment. Regulations, standards and guidelines for sanitation and wastewater treatment and discharge should be developed or updated, and reviewed regularly. Such instruments should cover all components of the sanitation service chain and include minimum requirements for design and management of containment, conveyance, treatment and disposal or reuse. This includes standards for wastewater treatment and water quality targets for surface waters receiving wastewater discharges, considering discharges of pathogens, organic matter, nutrients and chemical pollutants derived both from industrial and commercial activity and from domestic/personal use to minimize health risks and protect the aquatic environment. Regulations and standards should also address occupational health risks and the obligations of sanitation service providers for protection of workers' health.

Especially in countries where onsite sanitation is used at scale, regulations and standards should also consider the differing needs of sewered and non-sewered sanitation systems and services – for example, in terms of institutional responsibilities, registration and licensing, sanitation technology design, effluent standards, and surveillance and reporting requirements.

Action is needed to promote safe wastewater reuse and establish a regulatory framework.

The planned reuse of wastewater presents health, environmental, economic and social benefits and risks. These depend on the quality of treated wastewater, the reuse application, the level of exposure and geography, among other criteria (69).

Reuse of wastewater may offer a wider benefit to resilience by increasing availability of freshwater for multiple uses. Particularly in areas affected by water stress, wastewater reuse can improve adaptation to climate change by preventing use of freshwater for agricultural and landscape irrigation and industrial processes. It supports conservation of freshwater resources and managed aquifer recharge, and contributes to sustaining food security and agricultural employment.

Wastewater reuse also promotes transition to a wider circular economy, because it can recover significant amounts of energy and nutrients. Resource recovery from products of sanitation systems (such as urine and sludge) is an important pillar of creating sustainable circular economy models at the local level. A circular economy intends to change traditional financial models by making sanitation systems and services self-sustaining and value-adding, thereby increasing the return on investment (70).

On the other hand, unsafe reuse practices pose threats to public health and constitute pressure on the aquatic environment. To harvest all benefits of wastewater reuse, a supportive enabling environment and proper reuse management are vital. National regulations and enforcement mechanisms should establish:

- quality standards that are fit for the intended reuse purpose, considering both human and ecological health;

- risk assessment and management requirements to manage health risks associated with pathogens and toxic chemicals; and
- barriers to limit contamination and exposure.

WHO's guidelines for the safe use of wastewater, excreta and greywater (24) provide health-based information and guidance that support establishing such regulatory frameworks, and the SSP approach provides a practical, risk-based tool for managing reuse safely (23). Box 8 gives examples of national and supra-national regulations that set benchmarks for safe reuse.

Box 8. Examples of policies for wastewater reuse in agriculture

On 28 January 2021, the Russian Federation approved a decree for wastewater reuse for agricultural purposes. The decree explicitly permits the use of wastewater for irrigation purposes if it meets the microbiological and parasitological indicators/requirements set by the state. In addition, specific requirements were also developed for use of sewage sludge as fertilizer (71).

A new regulation on minimum requirements for water reuse for agricultural irrigation purposes has also entered into force for EU countries, applicable from 26 June 2023. The regulation sets out harmonized minimum water quality and monitoring requirements, risk management provisions to assess and address potential health risks and environmental risks, and permission requirements for agricultural irrigation (72).

Sanitation and wastewater management should be integrated into AMR action.

AMR continues to pose a growing threat to human health, and has significant public health and socio-economic implications. The environment can be an important pathway for spread of and exposure to antimicrobials and resistant pathogens, but it has often been overlooked. National AMR strategies and action plans should therefore aim to address and strengthen the environmental dimension of AMR and take progressive measures to reduce antimicrobial discharges into the environment. National action plans and AMR-sensitive environmental policies should prioritize and promote:

- development of legislation, guidelines, codes of good practice and standards to better control and minimize environmental releases of AMR, including through the discharge

of untreated wastewater and sludge from municipal systems, hospitals, antimicrobial manufacturing facilities, food-producing animal farms, aquaculture farms and runoff from crop fields;

- the most suitable wastewater treatment and management options that complement local civil infrastructure and resources, and promote the application of risk-based prevention and management measures to minimize the impacts of environmental discharges; and
- integration of environmental monitoring data (including from monitoring of wastewater treatment and discharge, and surface water) in existing AMR surveillance frameworks (51,73).

Very few countries currently include sanitation and wastewater management as essential components of national action plans (Box 9).

Box 9. Integrating WASH and wastewater considerations in the national AMR action plan in Tajikistan

In 2018, the Ministry of Health and Social Protection, Ministry of Agriculture and Committee for Food Security jointly adopted the National Action Plan to Tackle Antimicrobial Resistance in Tajikistan. The strategic objectives of the plan include improving infection prevention and control through adequate measures in water supply, sanitation and hygiene, and strengthening national surveillance of AMR in the health and environment sectors. Priority activities are to review and strengthen regulatory frameworks on AMR; improve water supply, sanitation and hygiene in health-care facilities; establish a national curriculum for professional education; ensure exchange of data from veterinary, agriculture and environment (wastewater treatment and disposal) sectors; and promote safe sanitation and personal hygiene by social mobilization and behavioural change support activities (74).

Sanitation should be an integral part of climate change planning.

Sanitation is vital to community resilience, but may itself be vulnerable to the effects of climate change. Sanitation should be integrated into national climate change adaptation plans and nationally determined contributions, and investment should be made to build the resilience of services.

Managing the threats from climate change requires concerted action by sanitation policy-makers and managers. Climate change requires rethinking the design and operation of sanitation systems to adapt to more frequent events such as floods, drought spells and torrential rains, as well as long-term hydrological changes. Incorporation of climate change adaptation objectives into sectoral development strategies and planning is therefore vital to build resilience of sanitation systems to climate change, taking into consideration the domestic scale (like pit latrines), conveyance scale (like sewers) and urban scale (like wastewater treatment plans). Sanitation-related considerations should also become an integral part of national adaptation plans for climate change, which may also be developed at the regional, city or municipality levels (Box 10).

Evidence that improving the management of existing sanitation infrastructure and systems is critical to building resilience is becoming increasingly strong (76). Building new infrastructure or deploying new technology may be needed in some cases, but even there investment timelines demand that existing services are

managed as effectively as possible. This requires adaptive management, with ongoing assessment of changes in the nature and intensity of climate threats and planning of remedial action. The SSP approach supports local-level risk assessment and management; it provides a framework to identify, prioritize and manage climate-related risks, and to integrate these considerations into local management, policies and programming – including consideration of the implications of climate variability and change.

Sanitation system planning needs to anticipate demographic changes.

Demographic change (such as population growth) inflicts stress on existing sanitation systems and services and requires effective planning and management to accommodate sanitation services for new residents or to maintain quality of service provision for long-term residents. Local governments and service providers should strengthen existing services and prepare for future projections to cope efficiently with the impacts of demographic change on services, including possible influxes of migrants or refugees.

Achieving universal access for all requires policy-makers to address the needs of migrants and refugees. Governments and service providers should guarantee their rights and entitlements to water and sanitation services; mitigate financial barriers to sanitation provision; and ensure that the specific WASH needs of vulnerable migrant subgroups are met – including those of children, disabled people and menstruating women (55).

Box 10. Lisbon resilience action plan

The city of Lisbon, Portugal, has developed a resilience action plan with a focus on urban water management – particularly reducing vulnerability to extreme events induced by climate change (75). The plan considers wastewater drainage and treatment and waste collection to manage associated risks during extreme weather events.

The process of developing the plan included simulating climate change scenarios; conducting hazard and resilience assessments based on such scenarios; and conducting an analysis of strengths, weaknesses, opportunities and threats. This resulted in development of resilience strategies, which will be implemented at the city level, including identification of specific strategies that reduce threats, overcome weaknesses, and exploit strengths and opportunities in Lisbon. The plan also includes further strategies to be implemented, such as adapting green infrastructure, promoting urban resilience, and strengthening collaboration between the Lisbon metropolitan area and parishes, municipalities and others.

The next step includes addressing co-benefits of identified strategies and prioritizing and reviewing key strategies. Strategies like these in cities and villages make stakeholders and citizens aware of the potential risks of climate-induced disasters, and help to provide responders with adequate time and resources.

IMPROVING SURVEILLANCE SYSTEMS FOR EVIDENCE-INFORMED INTERVENTIONS

Outbreaks and incidence of infectious diseases associated with poor water and sanitation services occur frequently, but data on the true burden in the pan-European region are lacking owing to underreporting and inadequate capacity for public health surveillance. Surveillance is the ongoing systematic collection, analysis and interpretation of health-related data for use in planning, implementing and evaluating public health policies and practices. In the context of sanitation and health, public health surveillance should encompass three key aspects:

- monitoring the quality of sanitation service provision and using a risk-based approach to surveillance across the entire sanitation service chain;
- integrating sanitation within existing national public health surveillance systems to target resources to high-risk areas; and
- using surveillance data to improve sanitation services and thereby prevent sanitation-related diseases.

Adequate monitoring mechanisms should be established and maintained.

It is vital to track progress in access to sanitation; assess the quality of services covering the entire sanitation service chain; evaluate the effectiveness of policies,

regulations and standards; and understand gaps and needs. Such monitoring should become an essential component of public health surveillance, and should receive increased policy attention and long-term funding.

Setting up an independent body responsible for surveillance of sanitation service delivery is an important step in ensuring safe sanitation services. Its roles may include defining monitoring requirements, designing monitoring programmes, providing public health oversight for enforcement of regulations and standards, engaging in outbreak investigations, communicating risks to communities and stakeholders, and planning control measures.

Sanitation surveillance should rely on existing structures, and should link to reporting and accountability structures at the local and national levels. Surveillance agencies should monitor service quality for all steps of the sanitation service chain from collection to transport, treatment and disposal of human excreta and wastewater, based on local health risk assessment and management. This includes monitoring of collection and management of faecal sludge from septic tanks and pit latrines. These technologies are predominantly used in rural areas, and often receive less attention than conventional sewerage systems (Box 11).

Box 11. Improving surveillance of onsite sanitation systems in Serbia

A pilot study in Serbia undertook an analysis of the legal framework and institutional mechanisms for ensuring safely managed onsite sanitation systems. The study collected comprehensive evidence on types of prevailing technologies. In addition, a systematic situation analysis and assessment of small onsite sanitation facilities was undertaken through onsite sanitary inspections, considering various types of technologies and existing practices applied in containment, emptying and transportation, treatment and safe disposal of faecal sludge and liquid effluent from households and institutional settings, such as schools and health-care facilities.

The assessment findings pointed to the need to set and enforce national and local regulatory requirements for onsite sanitation systems, defining the roles and responsibilities for different players sharing responsibility along the sanitation chain, establishing local registers, developing a national methodology for surveillance of onsite sanitation systems – including monitoring indicators – and enforcing these requirements in practice (77).

Service providers, both formal and informal, should be subject to monitoring to confirm proper application of relevant legislation and to verify that they meet national and local standards for availability, accessibility, quality, affordability and acceptability (1). Support should be provided to small-scale and informal service providers to help them to monitor the services they provide.

Programmes for environmental surveillance of wastewater should be established.

Environmental surveillance of pathogens in wastewater has proved effective in providing important information on the circulation of disease in a community (78,79). Establishing and scaling up environmental surveillance systems at the national and local levels requires investment in laboratory and testing capacity and technical workforce to collect and analyse wastewater samples.

Such surveillance represents a complementary adjunct to clinical testing to assess infection trends in the wider community. Given the multiple benefits of environmental surveillance (considering efforts around poliovirus, SARS-CoV-2 and AMR), development of such monitoring programmes can be of added value in detecting and tracking disease, and thus providing important information to facilitate public health decision-making and measures.

Sanitation should be integrated into public health surveillance frameworks.

The health sector should fulfil core functions to ensure safe sanitation to protect public health. Ideally, appropriate surveillance capacities should be put in place at the national and local levels to understand the true extent of water- and sanitation-related diseases, to ensure that resources are targeted at settings with a high disease burden, and to identify prevention and control strategies.

Sanitation interventions designed for different transmission pathways can reduce the burden of sanitation-related diseases. The WHO guidelines on sanitation and health (1) recommend that national public health strategies and legislation should specifically include sanitation as a core component, highlighting the importance of sanitation as a basis for primary prevention, and the need to generate evidence on the health risks and burden of poor sanitation.

Surveillance should be conducted for diseases and conditions of public health importance. Depending on the objectives of the surveillance system, priority diseases should be identified and reviewed regularly to ensure that they remain relevant and important in the national context (80). Integrating water- and sanitation-related infectious disease surveillance into existing national surveillance frameworks and health information systems allows:

- the disease burden and trends to be monitored, to identify priority pathogens and detect outbreaks of such diseases, and to facilitate implementation of response measures (Box 12); and
- risk factors to be identified for sanitation-related diseases, to inform investment priorities and intervention planning, and to target resources to populations with a high disease burden.

Important components in setting up a functional national surveillance system for sanitation and health are establishment of legal requirements and defining formal procedures for notification and surveillance of water- and sanitation-related diseases, as well as building adequate surveillance infrastructure (institutional capacities, data management and communication).

Data on sanitation and health should be generated for use in planning.

Comprehensive, reliable and consistent data are required to track progress against national sanitation and health targets. Such information is critical for evidence-based, policy implementation and public health decision-making. It requires the following to be in place:

- an information management system on sanitation and sanitation-related health and epidemiological data, accessible at the national and local levels;
- an efficient mechanism for sharing data between health, environment and other relevant sectors and authorities; and
- procedures for using the surveillance data in decision-making on public health planning, developing national regulations and standards, targeting surveillance activities and allocating resources (67).

Box 12. Waterborne disease surveillance in Czechia: investigation of an outbreak linked to contamination from sewage

In Czechia, the surveillance and outbreak management of water-related disease is regulated by Act 258/2000 on Protection of Public Health and several decrees. Reporting of communicable diseases is mandatory (81).

In May 2016 a waterborne outbreak occurred in Prague. It turned out to be the biggest in Czechia since 1959, with an estimated 32 000 people exposed and 11 000 cases. Environmental and epidemiological investigations revealed a high norovirus load in drinking-water samples taken before disinfection of the water supply system and in stool specimens taken from ill people. A detailed technical investigation found an unusual crossing of a sewerage collector and drinking-water pipes. The sewerage pipe was located above drinking-water pipes, and cracks were found in both a water distribution pipe under repair and the sewer. The Prague Water Supply and Sewerage Company was not aware that sewers ran above the drinking-water main pipe, as the old water management maps did not include information on the depth of pipes. During normal operation, water pressure in the drinking-water pipe would have prevented ingress of contamination; however, when the main supply pipe was empty because of the repair, contaminated water was able to flow into the pipe, of which the last part (about 10 m) was not flushed properly before restoring normal operation (82).

A national workshop following the outbreak recommended a range of priority activities to strengthen water-related disease surveillance and outbreak management systems, including development of a national guidance document, standard operating procedures and regional outbreak preparedness plans; improving coordination of stakeholders; and capacity-building on risk communication.

MAKING USE OF APPROPRIATE AND INNOVATIVE SANITATION SOLUTIONS

Locally appropriate solutions are required.

The sanitation sector has a long record of wasted infrastructure investment as a result of poor planning and implementation. Choosing the right sanitation systems and technologies is crucial for any sanitation project (83). To make evidence-based and transparent choices about sanitation systems and technology, clearly defined performance criteria for locally appropriate sanitation technologies and solutions should be established and incorporated into planning frameworks (Box 13). Selection criteria include socioeconomic and environmental conditions, preferences of stakeholders, current and future climate change threats and scenarios, demographic change, and available financial and management resources. Several planning tools and

guidelines are available to assist engineers and planners in system planning and technology choices, such as the *Compendium of sanitation systems and technologies* (84).

Sanitation asset registers and management plans should be established and maintained.

Assets refer to the physical components of sanitation systems; asset management plans ensure that services are maintained at agreed levels. Current understanding of the condition, performance and associated risk of failure for each asset or system is a key component in planning operation, maintenance and long-term financing to ensure the continuity of the sanitation services provided.

Box 13. Rural sanitation improvement plan in the Republic of Moldova – selecting locally appropriate solutions

More than half of the rural population in the Republic of Moldova relies on unimproved pit latrines. Wastewater generated is either pre-treated and infiltrated into the environment, or infiltrated into the subsurface directly without treatment. The government has adopted a strategy to provide both rural and urban residents with adequate sanitation services by 2028.

In rural areas, the government has implemented low-cost decentralized and individual sanitation systems, such as septic tanks, urine-diverting dry toilets and constructed wetlands to achieve this goal. These unique and decentralized sanitation systems are ideal for sparsely populated areas, as the investment to connect to a centralized sewer system could increase the sanitation service cost for households (85).

Asset registers and management plans provide important instruments that facilitate strategic planning of the expansion, rehabilitation and/or replacement of existing sanitation systems. They also help to optimize system performance while minimizing costs and risk of failure. Introducing such instruments in rural areas is likely to require external support – probably at the level of the service authority, which in most cases is the local government (86).

Organizational and regulatory models need to be created for small-scale systems.

In addition to appropriate technology choices, innovations in organizational and regulatory models may also be important. For example, small-scale systems, dispersed in large numbers over large areas, require a more flexible operation and maintenance response – such as centralized management of a large fleet of decentralized schemes (for example, through a contracting scheme) (87). Such arrangements help with pooling of knowledge and experience of staff; they can thereby lead to higher levels of professionalism and better conditions for improved management and operation of small-scale systems, as well as rationalization in procurement of equipment and spare parts. Recent

advances in sensor and communication technology also enable new management interfaces, where central operators can monitor large fleets of small-scale facilities (64).

Sanitation infrastructure management should consider the effects of climate change.

Climate change and increasing water stress have led to an urgent need to manage existing infrastructure and technology more effectively to cope with increased climate threats (for example, by climate-resilient sanitation safety planning) while at the same time keeping greenhouse gas emissions to a minimum. This element is increasingly important, given the growing evidence of the contribution of sanitation systems to greenhouse gas emissions – in particular, methane. In some situations, there may also be a case to develop more cost-effective and resource-efficient sanitation systems, but this should be backed by evidence that existing systems cannot deliver the improvements required. New systems need to deliver the desired urban water management services without the prohibiting constraints of the conventional centralized system.

IMPROVING AND SUSTAINING FINANCING FOR SANITATION

Dedicated budget lines need to be established.

Safe, sustainable and resilient sanitation needs sufficient financing. The current level of financing is not sufficient to meet the SDG targets for sanitation, including in the pan-European region (Box 14), and a radical increase is required (88). Investment in sanitation and wastewater management supports creation of healthier, more productive and resilient communities and a cleaner environment. While addressing sanitation challenges requires significant public investment, it is estimated that, globally, every US\$ 1 spent on improving sanitation yields a return of US\$ 5 by improving people's livelihoods and health (89).

To resolve persistent and emerging challenges in the sanitation sector in countries across the pan-European region, it is important to establish dedicated budget lines for sanitation at the national and local levels, to develop corresponding financing plans, and to identify and mobilize appropriate funding sources. National legislation and regulations should specify tariff schemes, access to subsidies and other sources of financing.

Sustainable financing strategies and plans should be developed.

Sustainable financing strategies and plans for sanitation services need to be developed in line with overall national targets, while identifying critical gaps and determining the costs of achieving those targets. Such strategies should be based on a life-cycle cost approach of sanitation systems and services, considering:

- capital expenditure (hardware and software expenditure on fixed assets);
- recurrent operating and minor maintenance expenditure (such as labour/staff, fuel, energy and materials);
- capital maintenance expenditure (renewal and rehabilitation costs that go beyond maintenance);
- expenditure on direct support (such as ongoing support by local government);
- expenditure on indirect support (such as government planning, policy-making and regulation); and
- cost of capital (90,91).

Box 14. Financing situation reported through GLAAS

Among the 15 countries in eastern Europe and central and western Asia that participated in the 2018/19 GLAAS reporting cycle, around 20% either did not have any financial plans for sanitation or had one in development. Further, one third of the countries reported a financial gap of over 50% of their needs to implement national plans. Ageing infrastructure and related maintenance continue to add a burden to an inadequate financial landscape for sanitation systems and services (25).

Financing strategies and plans should be underpinned by national registers of sanitation assets and asset management plans to allow prioritization of investment in infrastructure, including for renewal and rehabilitation of ageing infrastructure. Aspects such as long-term demographic changes and ensuring equitable access to sanitation services should be fully integrated into financial planning. The publication *Making water and sanitation affordable for all* (92) reflects on why affordability matters, how it is defined, what policy and social protection options and measures are available to ensure it, and how to finance them.

When planning investment in sanitation systems and services, current and future climate threats also need to be considered, ideally based on risk mapping linked to climate scenarios, to develop action and investment

plans to reduce risks and increase climate resilience of sanitation systems. Such approaches support the adaptive management that will be required to cope with future climate threats and support transparent, accountable decision-making on sanitation investment.

The best financing strategy will differ across countries, and will depend on a country's context, needs and available resources. Overall, tariffs, taxes and transfers are the three main sources of revenue for sanitation services. Tariffs are fees paid by users of services; taxes are funds raised by governments; and transfers are payments from foreign sources. In developing a sustainable financing strategy, sources and flows of finance need to be identified and tracked, and policy-makers need to assess the extent to which different sources of finance can cover each of the life-cycle costs (91,93).

DEVELOPING CAPACITY FOR SANITATION AND WASTEWATER MANAGEMENT

A human resources strategy for sanitation should be established.

National and local government staff need knowledge and skills to develop effective sanitation strategies and regulations, and to provide monitoring and regulatory oversight for sustained sanitation service provision. The safe management and operation of sanitation along the entire service chain requires a well qualified and motivated workforce.

Developing capacity in delivery of sanitation services entails human resource development, including organizational development and resourcing. In developing a human resources strategy it is vital to:

- assess institutional capacity and staff needs at all levels, and identify staff development and training needs; and
- develop strategic human and financial resource development plans for sanitation to ensure adequate capacity to deliver safe and resilient sanitation, setting out:

- how many staff at different levels and grades are needed to make the sanitation system function efficiently and effectively;
- what remuneration packages are required to attract and retain staff;
- how to develop career paths in sanitation that attract people; and
- what ongoing training and professional standards are required to ensure that sanitation services are delivered correctly.

Capacity development should be a priority at the local level, including training of new employees and continual re-training of existing staff. Peer-to-peer learning within and outside institutions can also play an important role, and training can be organized through national or regional capacity development networks (Box 15). At the international level, the International Network of Drinking-water and Sanitation Regulators provides opportunities for mutual exchange of experiences and peer-to-peer learning (Box 16).

Box 15. The Regional Capacity Development Network for Water and Sanitation Services

The Regional Capacity Development Network for Water and Sanitation Services (RCDN) connects local government units, utilities and their associations from six countries in south-eastern Europe to work together on developing the capacity of the water and sanitation service sector. RCDN is a partnership of 16 national associations – seven associations of local government units and nine associations of water and sanitation utilities. It aims to improve the performance of water and sanitation service delivery to citizens by enriching regional capacity, building partnerships and creating an enabling environment for capacity development (94).

Box 16. The International Network of Drinking-water and Sanitation Regulators

The International Network of Drinking-water and Sanitation Regulators (RegNet) is a global forum to share and promote good practice in regulation of drinking-water and sanitation services. Its objectives are to:

- promote improvement of regulations to better protect public health as it relates to drinking-water and sanitation;
- support development of internationally recognized guidance on the use of drinking-water and sanitation regulations to protect public health; and
- provide support and guidance to regulators wishing to establish, update or amend their regulatory frameworks (95).

BUILDING ON THE PROTOCOL ON WATER AND HEALTH

The areas for action listed in the previous sections are wide-ranging and require close cooperation between different sectors and stakeholders. The Protocol on Water and Health, with its integrated approach to the sanitation service chain, can serve as a coherent framework for countries to accelerate efforts on sanitation.

In the area of strengthening sanitation governance, transparency and accountability, the Protocol offers the mechanism of target setting, which allows countries to devise concrete and measurable objectives in various areas relating to sanitation. Targets are developed through an intersectoral process, involving several ministries and stakeholders, and they are typically submitted for public consultation. Once adopted by the government, they are made publicly accessible, monitored and regularly reported on through the Protocol's triennial reporting cycles (96). Targets can also be useful to channel investment, particularly if accompanied by action plans that clearly indicate sources of funding. The guidelines on the setting of targets, evaluation of progress and reporting under the Protocol on Water and Health (97) support countries with the target-setting process. These are complemented by a collection of good practices and lessons learned on target setting and reporting under the Protocol on Water and Health (98), providing a compilation of success stories, challenges and diverse approaches applied by countries within the framework of the Protocol. The publication *Protocol on Water and Health and the 2030 Agenda: a practical guide for joint implementation* (99) provides background information on the synergies between

the instruments and step-by-step advice on how to bring together implementation of the Protocol and the SDGs at the national level.

The Protocol reporting system is a useful tool to collect sanitation data across sectors contributing to analysing and showcasing regional trends and identifying challenges, gaps and areas for action at national and regional level. The Protocol can also help countries to prioritize universal and equitable access to sanitation for all in all settings. Under its triennial programmes of work, dedicated activities take place in the areas of:

- equitable access to water and sanitation, focusing on tackling geographical disparities, addressing the special needs of vulnerable and marginalized groups and ensuring the affordability of services;
- provision of WASH services in institutions – particularly schools and health-care facilities; and
- support for small-scale water supply and sanitation systems to address the challenges associated with their regulation, management and surveillance.

Within these areas, the Protocol offers a wide range of background information and provides evidence, guidance and practical tools that support countries to undertake systematic assessments and to develop targeted responses and interventions (Box 17).

Box 17. Selection of technical resources developed under the Protocol on Water and Health

Equitable access

- The Equitable Access Score-card: supporting policy processes to achieve the human right to water and sanitation (66)
- Guidance note on the development of action plans to ensure equitable access to water and sanitation (100)
- Making water and sanitation affordable for all: policy options and good practices to ensure the affordability of safe drinking-water and sanitation services in the pan-European region (92)

WASH in institutions

- Improving quality of care through better water, sanitation and hygiene: a pan-European perspective (101)
- Water, sanitation and hygiene in health-care facilities: a practical tool for situation assessment and improvement planning (102)
- Prioritizing pupils' education, health and well-being: water, sanitation and hygiene in schools in the pan-European region (103)
- Surveillance of water, sanitation and hygiene in schools: a practical tool (104)
- Improving health and learning through better water, sanitation and hygiene in schools: an information package for school staff (105)

Small-scale water supply and sanitation services

- Taking policy action to improve small-scale water supply and sanitation systems: tools and good practices from the pan-European region (64)
- Costing and financing of small-scale water supply and sanitation services (91)

The Protocol's programme also includes areas of work on safe sanitation management and increasing resilience to climate change. These comprise activities such as promotion of risk-based approaches – such as sanitation safety planning – and development of targeted guidelines on climate-resilient water and sanitation services.

Finally, as the Protocol is an intersectoral instrument that combines environmental protection with promotion of human health, working within its framework reinforces the role of the health sector in ensuring safe sanitation. At the institutional level, the Protocol is typically implemented through establishment of interministerial working groups, which provide a long-standing institutional framework for health and environment authorities to cooperate in the area of sanitation.

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