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Cross-border public health in the Meuse-Rhine Euroregion

Applying a cross-border lens to the Essential Public Health Functions Framework

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Abstract
This report focuses on public health in the Meuse-Rhine Euroregion (EMR), more specifically the border areas between Belgium, Germany and Netherlands (Kingdom of the), and examines a range of public health policies, interventions and activities aimed at improving health in border regions in general. Non-EMR-region case studies and the challenges they pose are also presented to illustrate the range of public health issues that can affect these regions. The report considers the applicability of the WHO Essential Public Health Functions (EPHFs) in addressing these issues. It also emphasizes the need for sustainable solutions to border-related health challenges and better integration of cross-border health initiatives into national frameworks. The analysis calls for the application of a cross-border lens to the EPHF framework, as well as the bolstering of a number of EPHFs to strengthen the effectiveness of public health services in border regions.

Keywords
PUBLIC HEALTH, ENVIRONMENT, SOCIAL VULNERABILITY, HEALTH INEQUITIES

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Contents

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Executive summary

This report examines cross-border public health in the Meuse-Rhine Euroregion (EMR) between Belgium, Germany and Netherlands (Kingdom of the)[1], focusing on public health policies, interventions and activities aimed at improving health and well-being in border regions. It provides an overview of the demographics, health status and lifestyle in the EMR and features case studies from outside the EMR. The report also addresses a range of public health issues that can affect border regions and the challenges they pose.

In considering the applicability of the WHO Essential Public Health Functions (EPHFs) in border contexts, emphasis is placed on determining how these functions can help strengthen public health services, as well as health protection, promotion and prevention, and contribute to universal health coverage and health security. Some case studies illustrate the prioritization of EPHFs through policies and plans, while others highlight the need to consider EPHFs in border settings. The analysis notes that public health governance, workforce planning and community participation are often limited to national areas and do not reflect cross-border dynamics. All case studies point to the need for sustainable solutions to cross-border public health. This is because cooperation is often reliant on short-term funding or EU-funded projects, which are not integrated into

[1] Note that Netherlands (Kingdom of the) comprises six overseas countries and territories and the European mainland area. As data for this Report refers only to the latter, the Report refers to it as the Netherlands throughout.

national frameworks due to a lack of comprehensive policies and sustainable funding. Moreover, the case studies demonstrate the usefulness of EPHFs in identifying strengths and gaps in cross-border public health policies, services, infrastructures and workforces.

While the overall report and the individual case studies confirm the relevance of the EPHF Framework, the examples highlight the need to include a cross-border public health lens or perspective in the Framework. A number of public health functions that need strengthening towards effective cross-border interventions were identified, including the following.

1. **Public health stewardship**
   Strong leadership and governance are essential for coordinating cross-border initiatives and ensuring compliance with health regulations.
2. **Workforce development**
   Qualified personnel with cultural competence and language skills are crucial for implementing cross-border programmes.
3. **Access to medicines and technologies**
   The availability of medicines and innovative technologies, such as telemedicine, is vital for controlling diseases and providing care.
4. **Planning and financing**
   Sustainable funding and joint research projects are necessary if cross-border health programmes are to be effective.
5. **Data and information systems**
   Robust systems for collecting and sharing data are critical for coordinating actions and implementing preventive measures.

Bolstering these functions would not only strengthen the effectiveness of public health services within countries but would also contribute to an integrated and coordinated approach to problems related to cross-border public health.

Introduction

This report centers on cross-border public health in the Meuse-Rhine Euroregion (EMR), a geographical area in Europe established in 1976, which has borders with Belgium, Germany and the Netherlands.[2,3] The main focus of the report is on public health policy to improve the health and well-being of the populations living in or near border regions, as well as interventions, measures and activities carried out to this end. Public health issues arising in border areas, including enablers, challenges and lessons learned, are also addressed. Case studies from outside the EMR are included to illustrate different aspects of cross-border public health within the context of which the applicability of the WHO Essential Public Health Functions (EPHFs) to the contexts and realities of cross-border public health are considered *(1)*. The rationale for using EPHFs is that they represent an integrated and comprehensive approach to strengthening public health and public health services, encompassing health protection, health promotion and prevention, as well as the enabling and cross-cutting functions that contribute to both universal health coverage and health security.

Target audience

The target audience of this publication comprises public health practitioners living in border regions and policy-makers from the central to the regional levels. It is hoped that the evidence captured in this report will shed light on the health-related vulnerabilities of people living and working in border regions in Europe and help strengthen public health interventions in these constituencies.

[2] A Euroregion is a cross-border cooperation of areas located in the European Union (EU). In the Euroregions, projects are carried out with EU grants to contribute to the development and integration of respective regions.

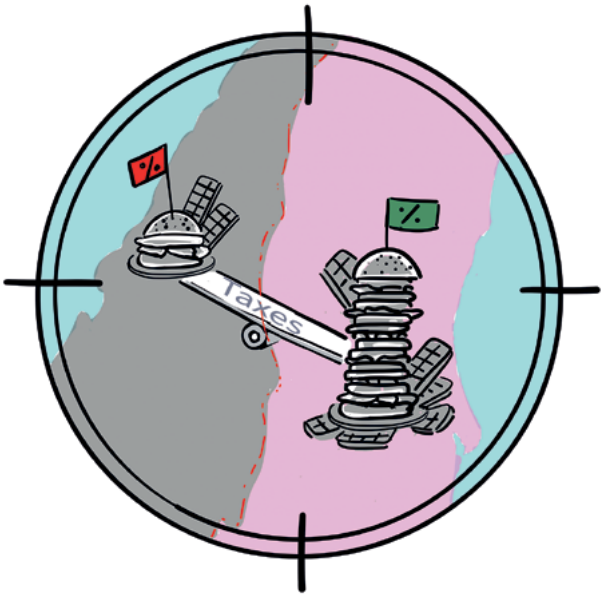
[3] A cross-border working group was established in 1976, and the EMR became a legal entity in 1992.

Why a specific focus on cross-border public health?

Cross-border cooperation for public health was a topic of interest already in 2001 when around 2000 professionals in the field of preventive health came together in a collaborative effort to collect data on risk-taking behaviour in young people and adolescents living in the EMR *(2)*. In 2010, euPrevent, a cross-border network, was created to promote health and set up partnerships to increase the quality of life of residents in the border regions between Belgium, Germany and the Netherlands *(2)*.

Coronavirus disease (COVID-19) illustrated the significance of border regions, especially when many were closed or threatened with closure. Before the pandemic, the EMR borders were fluid – people living in one of the countries might work and spend their leisure time in another. COVID-19 changed this. A study on cross-border movement in the EMR during the pandemic, involving 3543 participants, revealed changes in their movements due to border restrictions: 82% reported the same cross-border movement as before the pandemic, highest in the Netherlands (90%), followed by Germany (81%) and Belgium (63%). Overall, 31% paid at least one visit per month to members of their social networks across the border and 79% paid at least one visit per month for everyday activities *(3)*. During the pandemic, 40% of the participants from Germany and the Netherlands reduced their cross-border movement as compared to 32% of the participants from Belgium. In all three EMR countries, a significant portion of the participants (45%) reported having had a negative experience related to border restrictions, the highest proportion being among the respondents from the Netherlands. Even after restrictions were reduced in autumn 2021, cross-border movement remained lower than that in the pre-pandemic period. Social cross-border movement among the participants from Germany and the Netherlands decreased by 25% in the autumn of 2021, compared to the pre-pandemic period. This showed the impact of routine shifts on citizens' mobility in this period and the structural

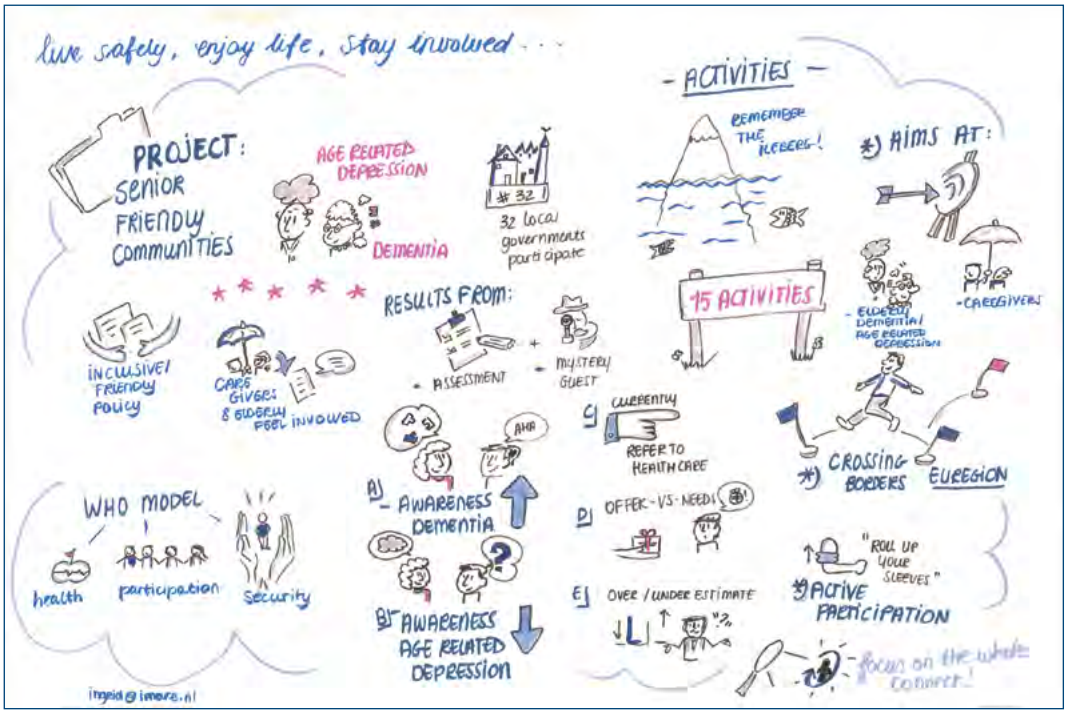
changes they brought about. The study revealed that within the EMR, citizens in the Netherlands were less compliant with border closures and restrictions than their Belgian and German neighbours *(3)*.



Cross-border public health was important and merited attention also before the COVID-19 pandemic. Risk factors, such as tobacco, alcohol consumption, sugary drinks and unhealthy foods, are sometimes more accessible in border regions than elsewhere. This points to the importance of viewing cross-border public health beyond pandemic and emergency management, and of drawing attention to everyday health challenges and the need for health promotion and prevention. It also illustrates the relevance of monitoring the populations living in these areas.

Methodology

The aim of this report is to document the experience of the EMR in implementing cross-border public health measures, provide a picture of the public health situation in the EMR, using case studies from other regions as examples, and present a short assessment of the current use of the EPHF Framework. Demographic and health data related to the EMR were gathered where available and comparable. While data were available at the national level, these were often not sufficiently useful for presenting the situation in the border regions. National datasets are typically designed to analyse broad trends in and differences between countries, but they lack the specific details needed to provide an understanding of the dynamics in these areas. The latter have unique characteristics, such as intensive cross-border mobility and specific socioeconomic and cultural contexts that are not adequately reflected in the national data. Case studies from outside the EMR were solicited via the euPrevent networks, using a standardized template; those found relevant to the thematic areas were included and were especially useful where no example for the EMR was available. Although some of the case studies were conducted outside the EMR and lacking data relevant to border regions, they have been included to illustrate different approaches to public health and public health management and their impact on border regions. The original descriptions of all selected cases have been shortened. No formal assessments were made of cross-border public health in the EMR, or of the EMR case studies; rather, a rapid informal assessment was carried out to raise awareness of the gaps in cross-border public health in border regions. This assessment was based on the 12 functions listed in the WHO EPHF Framework as the minimum requirement to be met by the Member States to assure public health in a holistic, integrated and sustainable manner *(1)*.



Definition of cross-border public health

There is a difference between the adjectives, “transnational” and “cross-border”. Used in connection with regions or countries, “transnational” indicates that they are connected through a substantive theme and not necessarily geographically *(4)*. “Cross-border”, on the other hand, implies a connection between regions located in different but geographically connected countries *(5,6)*. While cross-border connections are always transnational, transnational connections are not always cross-border.

In 2003, the European Union (EU) set up the nomenclature of territorial units for statistics (NUTS), which serves for the collection, development and harmonization of European regional statistics and the framing of EU regional policies. NUTS divides each EU country into three levels:

- NUTS 1: major socioeconomic regions
- NUTS 2: basic regions (for regional policies)
- NUTS 3: small regions (for specific diagnoses) *(7)*.

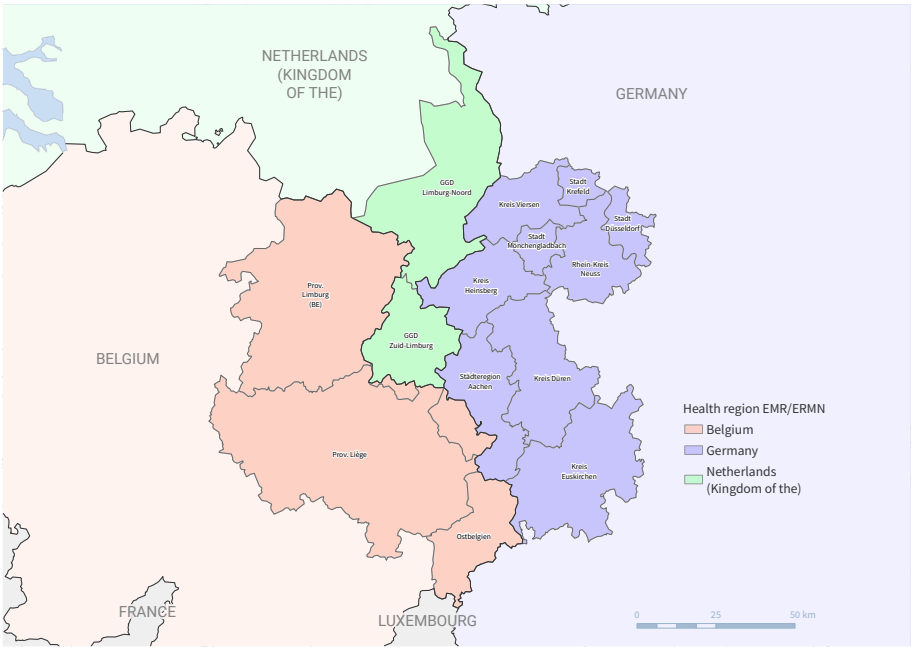
The EU classifies border regions for statistical purposes in the *Methodological manual on territorial typologies – 2018 edition*. NUTS 3 regions comprise "...those regions with a land border, or those regions where more than half of the population lives within 25 km of such a border" *(8)* . This means that the average population in this group of administrative units is between 150 000 and 800 000 *(9)*. In 2016, 463 of the 1348 NUTS 3 regions in the 28 EU Member States, or 35% of all NUTS 3 regions, were members of the EU *(8)*, with around 125 million people living in corresponding border regions.

While Europe has developed as an open market and embraced the free movement of people, goods and services within EU borders, this has not translated to public health. In 1998, the European Court of Justice mandated the free movement of goods and services within Europe, urging the EU to consider health care within its mandate. In the last consolidated version of the *Treaty on the functioning of the European Union* (first version, 2002) *(10)*, the EU formally stated that health care was a matter for the individual Member States, and that the EU's role regarding health could not go beyond supporting, coordinating and complementing national policies *(11)*. Despite the above achievements, cross-border health currently focuses on cure rather than prevention and other areas of public health *(12)*.

The EMR

The EMR covers a geographical area of 11 000 km^2 and has a population of almost four million (Fig. 1).

Fig. 1. The EMR



Note. ERMN = Rhine-Meuse-North Euroregion.
Source: Euroregional Health Atlas *(13)*.

Five border regions (Euregios) in Belgium, Germany and The Netherlands come together to form the EMR. The Netherlands has seven Euregios on its borders with Belgium and Germany. The only Euregio in which Belgium, Germany and The Netherlands work together is the EMR, the region of focus in this publication. The EMR consists of part of the Province of Limburg, as well as the Province of Liège and the German-speaking community in Belgium (also known as Ostbelgien), Zweckverband Aachen in Germany, and part of the Province of Limburg in The Netherlands. The official languages of the three countries are Dutch (in Belgium and The Netherlands), French (in Belgium) and German (in Belgium and Germany).

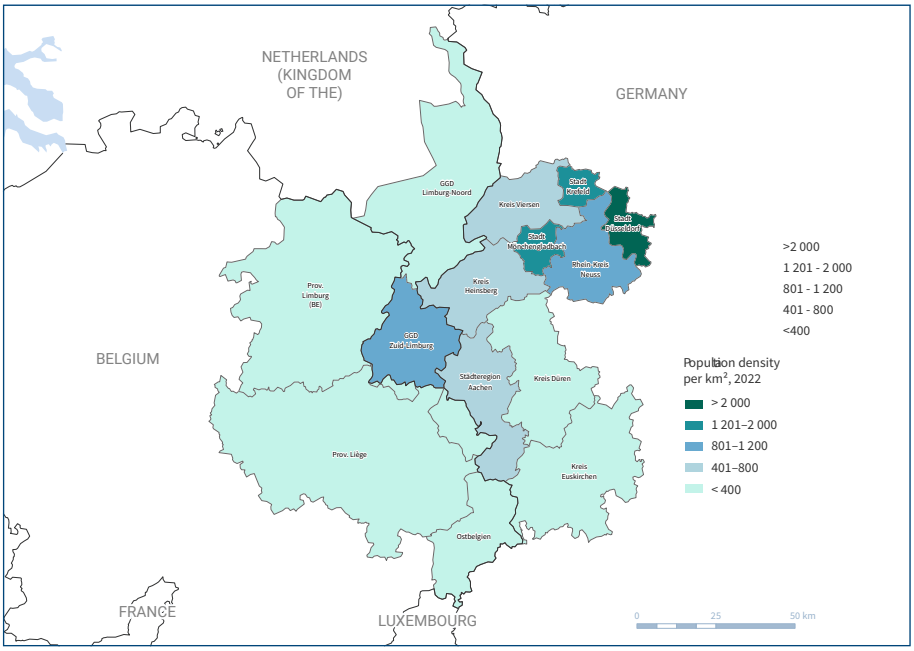
Politically and geographically, the EMR used to be a patchwork of dependent and independent territories, their current borders dating back to 1963. It was divided among various duchies, principalities and small independent lordships, and formed a coherent area between the Meuse and Rhine Rivers. In the period between 750 and 820 under Emperor Charlemagne, the current areas of the EMR formed one political unit; this was also the case between 1794 and 1814 during the French occupation. Despite this relatively short period of administrative cohesion, the EMR is often presented as a region that has always been unified though politically divided by artificial borders.

EMR Demographics

Population

On 1 January 2023, approximately four million people were living in the EMR with a population density of 325 per km^2. The southern part of the Province of Limburg in The Netherlands has the highest population density in the EMR with 619 people per km^2. In contrast, Ostbelgien has a population density of 94 people per km^2, the lowest in the EMR (Fig. 2) *(14)*.

Fig. 2. Population density in the EMR/Meuse-Rhine-North Euroregion, per km^2, 2022



Source: Euregional Health Atlas, 2022 *(13)*.

EMR health status and lifestyle

In the 19th and early 20th centuries, the industrial (mining) regions were among the most prosperous regions in western Europe. In the EMR, mining had a huge impact on society and was predominant in the Province of Limburg and the Province of Liège in Belgium, Zweckverband Aachen in Germany and parts of the Province of Limburg in the Netherlands *(15)*. The work involved caused health problems for the miners who were lower-skilled and foreign workers. Although the mines were closed down, the effects of an economic system based on mining are still evident in the EMR. The section on health status and lifestyle discusses the current health situation in the region.

Organization of public health in EMR countries

Public health in Belgium

Belgium's public health system is decentralized, with responsibilities shared between the federal government and the regions (Flanders, East Belgium and Wallonia). Each region manages health-care services according to its linguistic, cultural and administrative needs, while the Federal Government oversees general health-care policy, financing and health insurance *(16)*.

At the federal level, the Ministry of Social Affairs and Public Health sets national health policy, regulates pharmaceuticals and oversees health-care financing. Health care is funded through compulsory health insurance and managed by sickness funds or a public health insurer. At the same time, the National Institute for Health and Disability Insurance handles reimbursements *(17)*. Sciensano, the national public health institute, carries out public health monitoring, conducts disease surveillance, epidemiology and vaccination programmes, and ensures food and environmental safety *(18)*.

The regional-level authorities manage health promotion, disease prevention and hospital services. GPs are the first point of contact, although referrals to specialists are not always required. The system is financed through federal taxation, social-security contributions and out-of-pocket payments, with about 78% of the costs covered by public funds.

Public health in Flanders

In Flanders, public health is overseen by the Flemish Agency for Care and Health (Agentschap Zorg en Gezondheid – LOGO). The LOGO networks, which represent one of the unique features of the Flemish health-care system, act as local public health authorities, responsible for health promotion and preventive care. They work closely with the municipalities, schools and health-care providers in implementing public health initiatives, such as vaccination drives, health-education and environmental health programmes. Starting in 2025, the LOGO networks will undergo significant transformation. The aim is to streamline operations by merging smaller LOGO networks into larger regional entities, and to enhance their effectiveness by integrating digital-health tools. This transformation will allow the LOGO networks to provide more accessible, data-driven health campaigns and improve public engagement in preventive health care across Flanders.

Public health in Germany

Germany's public health system is decentralized, combining national, state and local responsibilities, and focuses on universal health care, disease prevention and health promotion. It is based on social solidarity and self-governance, ensuring access to health care for all citizens. At the national level, the Federal Ministry of Health sets health policies, legislates health matters and oversees the health-care system, ensuring the uniform implementation of public health laws *(19)*. It collaborates with institutions, such as the Robert Koch Institute, on disease monitoring and public health emergencies *(20)*.

At the national level, Germany's 16 federal states (*Länder*) manage health-care services, implement national policies, fund local institutions and oversee the regional public health offices. These offices handle vaccination programmes, health education and disease control. At the local level, the municipalities run public health offices (*Gesundheitsämter*), providing vaccinations, health checks and disease control. They respond to local outbreaks and promote healthy behaviours in the communities, coordinating with state and national bodies during crises. General practitioners (GPs) and specialists provide health care. Patients can consult specialists directly without referral from a GP. Both GPs and specialists operate within a self-governance system, ensuring coordination with health insurers *(21)*.

The German health system is funded through statutory health insurance (*Gesetzliche Krankenversicherung*), which covers about 90% of the population through contributions from employers and employees. The remaining 10% are covered by private health insurance. Health insurance is mandatory for all residents *(22)*. Germany's decentralized health-care system adapts public health policies to regional needs while maintaining high standards. It combines statutory health insurance, a robust primary-care network, and collaboration across the national, state and local levels. This structure supports both preventive health measures and responsive health-care services, ensuring universal access and the ability to tackle public health challenges, from chronic diseases to infectious diseases.

Public health in the Netherlands

Public health in the Netherlands is organized through a system that integrates the national, regional and local levels, ensuring comprehensive access to health care for all citizens. The system focuses on both prevention and treatment of disease, the promotion of healthy lifestyles, and the management of public health risks *(22)*. At the national level, the Ministry of Health, Welfare and Sport sets policies, coordinates health initiatives and oversees health-care

financing. The Ministry of Health works closely with several national agencies, the most prominent of which is the National Institute for Public Health and the Environment, which conducts research, monitors infectious diseases, manages vaccination programmes and takes the lead in health-crisis management *(23)*.

Regionally and locally, the public health services (*Gemeentelijke Gezondheidsdiensten*), with 25 regional offices, safeguard public health through preventive services, youth health care, health education, infectious-disease control and outbreak management. Funded by the municipalities, they collaborate with the local governments in addressing specific health needs. Primary-health-care providers, especially GPs, are patients' first point of contact and provide medical advice, treatment and preventive care. Health insurance companies contract health-care providers and reimburse medical costs, ensuring basic health coverage for all residents *(24)*. This multilevel approach allows the Netherlands to maintain a high standard of public health, focusing on prevention and access to care, and addressing both current and emerging health challenges.

Public health in East Belgium

Ostbelgien is autonomous in areas such as education, culture and health care. The Ministry of the German-speaking Community oversees public health services, while more complex curative care is managed within the Walloon framework. The Ministry is responsible for health promotion, disease prevention and the management of local health-care initiatives, tailored to the needs of the German-speaking population. Health-care services in Ostbelgien are closely integrated with regional hospitals and specialists, ensuring that residents have access to comprehensive care while maintaining their own public health initiatives.

Public health in Wallonia

In Wallonia, the public health system is managed by the Agency for Quality of Life (Agence pour une Vie de Qualité (AVIQ)), which oversees public health, social services, disability services and family policies. AVIQ focuses primarily on public health and preventive care, including health-promotion, vaccination and mental-health initiatives. It also provides people with disabilities and their families with support. AVIQ does not manage curative health-care services, such as hospitals, which fall under the broader Walloon health-care structure and are coordinated through the National Institute for Health and Disability Insurance.

In the Province of Liège, which is part of Wallonia, health-care services reflect this structure: AVIQ is responsible for public health, while hospital care and specialist services are managed at the regional level. Public health programmes in the Province of Liège have a strong focus on mental health, care of older people and preventive health care.

Health status

The average overall life expectancy in the EMR is 81.2 years, 79.2 years for males and 83.1 years for females (2022). In comparison, life expectancy for females is comparable to that in the 27 EU countries (EU 27) (Table 1). On the other hand, life expectancy for females is one year lower in Liège (Belgium) than it is in the EU 27 countries. For males, life expectancy in Liège (Belgium) and Cologne (Germany) is 1 to 2 years lower than in EU 27 *(26)*.

Table 1. Life expectancy of males and females, EMR and EU, 2022

2022	Males	Females
EU 27	77.9	83.3
EMR	79.2	83.1
Belgium	79.7	83.9
Germany	78.3	83.0
Netherlands	80.2	83.1
Limburg (Belgium)	81.0	84.5
Liège[a] (Belgium)	77.9	82.0
Cologne[b] (Germany)	78.7	83.0
South Limburg (Netherlands)	80.0	83.3

[a] Liège includes the Province of Liège and East Belgium; [b] Zweckverband Aachen is part of the Region of Cologne.
Source: Eurostat *(26)*.

Crude death rates

Table 2 provides the total crude death rates for the EMR and for each of the EMR regions covered in this report, compared with those for EU 27 (2022). While the crude death rates for all causes of death in the EU 27 countries were higher than those for the EMR, the external death rates for the Province of Limburg (Netherlands) were higher than those for EU 27. The crude death rates from external causes of death in the EMR were higher than those for EU 27. Within the EMR, the Province of Liege (Belgium) and the Province of Limburg (Netherlands) have the highest crude death rates for external causes of death *(27)*.

The death rates from cancer in the Province of Limburg (Netherlands) were higher than for both the EU 27 countries and the EMR. The same goes for diseases of the respiratory system, dementia and mental

and behavioural disorders. The number of deaths from infectious diseases was also highest in the Provinces of Liege (Belgium) and Limburg (Netherlands). Worth noting are the numbers of deaths from drug dependency in the Provinces of Liège (Belgium) and Cologne (Germany), which were three times the EU 27 average.

Table 2. Crude death rates (per 100 000 population), EMR, 2021

Region NUTS 2 level	External causes of death (ICD10: V01–Y89)	All causes of death (ICD10: A00-Y98, excluding S00–t98)	Cancer (ICD10: C00-C97)	Diseases of circulatory system (ICD10: I00–I99)
Province of Limburg (Netherlands)	58.38	1 167.50	313.30	262.40
Province of Limburg (Belgium)	55.28	926.90	225.10	215.85
Province of Liege (Belgium)	77.92	1 108.90	242.30	243.15
Cologne (Germany)	42.73	1 098.40	268.70	329.60
Belgium average	61.96	998.09	227.22	232.48
Germany average	51.21	1 185.12	277.65	406.04
Netherlands average	52.07	932.89	259.21	209.10
EMR average	+/- 56.83	+/- 1 090.90	+/- 267.20	+/- 311.90
EU 27 average	50.17	1 127.64	259.33	375.71

Note: ICD = international classification of diseases.
Source: Statistics | Eurostat *(27)*.

Diseases of respiratory system (ICD10: Y00–99)	Dementia (ICD10: F01–F03)	Mental and behavioural disorders (ICD10: F00–F99)	Infectious diseases (ICD10: AA000–B99)	Drug dependence, toxicomania (ICD10: F11–F16, F18+F19)
89.99	82.50	89.84	25.60	0.57
100.83	42.97	46.90	11.90	–
113.59	24.28	34.25	25.80	0.96
71.37	62.28	70.00	20.00	0.96
91.92	39.41	46.57	17.45	0.41
74.59	61.33	71.17	18.53	0.80
63.77	62.30	69.24	17.73	0.39
+/- 83.10	60.90	53.50	+/- 15.60	+/- 0.75
77.29	36.38	43.16	16.80	0.35

Noncommunicable diseases and risk factors

The risk factors that contribute most to the burden of disease in the three EMR countries are all related to behaviour and unhealthy lifestyles, such as tobacco use, excessive alcohol consumption, unhealthy diet and insufficient physical activity *(28)*. This is a problem shared with other countries with border regions where access to cheap, unhealthy foods is easy, and not enough information about their harmful effects is provided. Furthermore, taxes on sugar and alcohol in neighbouring countries often fluctuate. During periods when the taxes on unhealthy foods and beverages are high in one region and lower across the border, people drive or walk across to purchase their supplies of, for example, sweets, alcohol and sugary drinks, at a lower cost (Box 1).

Box 1. The public health impact of varying sugar and alcohol taxes in border regions

According to WHO, most countries do not use taxation to encourage healthy behaviour *(29)*. The use of various methods of controlling unhealthy behaviour, such as raising taxes on alcohol, tobacco, sweets and other unhealthy products, can have an adverse effect on the health of people living in border regions unless they are accompanied by the introduction of alternative products, or health messaging. While cross-border trade does bring economic benefits, policy-makers often fail to recognize the negative impact of unhealthy products on public health, which should receive more attention through the monitoring of consumption patterns. This is further confounded by differences in the legislative standards of bordering countries, which do not take cross-border-related public health issues into consideration.

In the Netherlands, an alcohol law was introduced in 2014, raising the age for buying and drinking alcohol from 16 to 18 years. Accordingly, youth found in possession of alcohol can be fined or required to do community service. In neighbouring Belgium and Germany, the age limit for drinking is lower; youth can purchase beer and wine at 16 years of age, and hard liquor at 18 years. Youth are also allowed to drink beer or wine from the age of 14 in the presence of a parent. Swedish restrictions on alcohol sales due to a government monopoly and high taxes on alcohol and tobacco have led Swedes to travel to Denmark and Germany to purchase these products.

Box 1. Cont.

In Norway, the sugar tax was abolished in 2021 to reduce trade leakage to neighbouring countries. This resulted in an increase in the purchase of unhealthy foods across the border in Sweden.

Sweden developed a strategy that would benefit the border area between southern Norway and Sweden, a win-win situation for Norwegians looking for cheaper groceries, and a facilitator in establishing business in this part of Sweden. During the years of high Norwegian taxes, many Norwegians made trips to Sweden to buy their sweets, sugar and soft drinks. Health-tax policy aims to lower the consumption of products that increase the risk of noncommunicable diseases by raising the prices of these products, making them less affordable. Consumption is most effectively reduced through specific taxes on the quantity of unhealthy products (e.g., cigarettes) or their harmful ingredients (e.g., alcohol or sugar), rather than taxes based on the value of the product *(29)*.

On average, 52% of the residents in the Dutch and German parts of the EMR are overweight or obese. The proportion of overweight residents is similar for the EMR (within a 10% range). In Belgium, no data are available for the Province of Limburg and the Province de Liège, but on average, 48% of the Flemish population and 50% of the Walloon population are overweight or obese *(30)*. In the Province of Limburg (Netherlands) and Zweckverband Aachen (Germany), the health situation is less favourable. The Province of Liège has the least favourable health status of the entire EMR, revealing pockets of vulnerability in its border regions *(30)*.

Youth lifestyle and behaviour data from border regions between Belgium, Germany and the Netherlands

Living in a border region can lead to exposure to several risk factors related to unhealthy lifestyle, some of which are outside the control of the individual (e.g., environmental pollution). To map young people's lifestyles, the Youth Euregional Scan (YES), a survey involving 25 632 young people aged 14–16 years, was conducted in September 2023 along the border between the Netherlands (Province of Limburg), Belgium (Province of Limburg, Province of Liège and East Belgium)

and Germany (regions of Düren, Düsseldorf, Euskirchen, Kleve, Mönchengladbach and Vierssen). The young people completed a questionnaire, which was also distributed among the same target group throughout the Netherlands. As the survey did not involve Belgium or Germany, the reference data are from the Netherlands only *(31,32)*. According to YES 2023 *(32)*, the majority of young people aged 13–14 years and 15–16 years living in the Belgian, Dutch and German border regions rated their health as good (Netherlands national level: 80.3%;[4] Netherlands border level: 79.9%; Belgium border level: 81.2%; and Germany border level: 75.5%) with little difference between them. When asked about happiness, the following proportions reported feeling happy most of the time: Netherlands national level: 77.1%; Netherlands border level: 77%; Belgium border level: 73.8%; and Germany border level: 66.4%). Nonetheless, over a third of all young people in these three border regions reported feeling stressed in their everyday lives, the differences between them increasing with respect to being stressed about other people's perceptions of them: (Netherlands national level: 20.6%; Netherlands border level: 23.1%; Belgium border level: 26.2%; and Germany border level: 30.2%). Stress deriving from home situations differed among the three border regions (Netherlands national level: 10.0%; Netherlands border level: 12.3%; Belgium border level: 14.8%; and Germany border level: 20.1%) *(32)*.

Alcohol consumption among young people aged 13–14 years and 15–16 years in these border areas differed as did legislation on the purchase and consumption of alcohol. In the Netherlands, a young person may not purchase or consume any type of alcohol before age 18. At the national level in Belgium and Germany, youth are allowed to consume and purchase beer and wine at 16 years of age, and spirits at 18 years.

In the Netherlands, when assessing alcohol consumption among 13–14 and 15–16-year-olds, 50% of the latter group reported having

[4] In the YES survey, national-level data were available only for Netherlands (Kingdom of the).

consumed alcohol in the previous four weeks. The 13–14-year-olds also reported having consumed alcohol in the same period (Netherlands national level: 13.3%; Netherlands border level: 17.2%; Belgium border level: 20.3%; and Germany border level: 18.5%). When asked about sobriety over the previous four weeks, 15.3% of youth at the national level in the Netherlands responded positively, as did 17.9% of those living near the Dutch border, 18.1% near the Belgian border, and 16.9% near the German border. Approximately 17.1% of Dutch youth living in border areas reported being able to buy alcohol themselves (with no information as to whether they crossed the border to do so). It appeared that parents in Germany were more inclined to allow their youth to drink alcohol (48.8%) than those in the Netherlands (37.4%) and Belgium (37.5%) (no national level reference data available for Netherlands (Kingdom of the)) (Fig. 3) *(32)*.

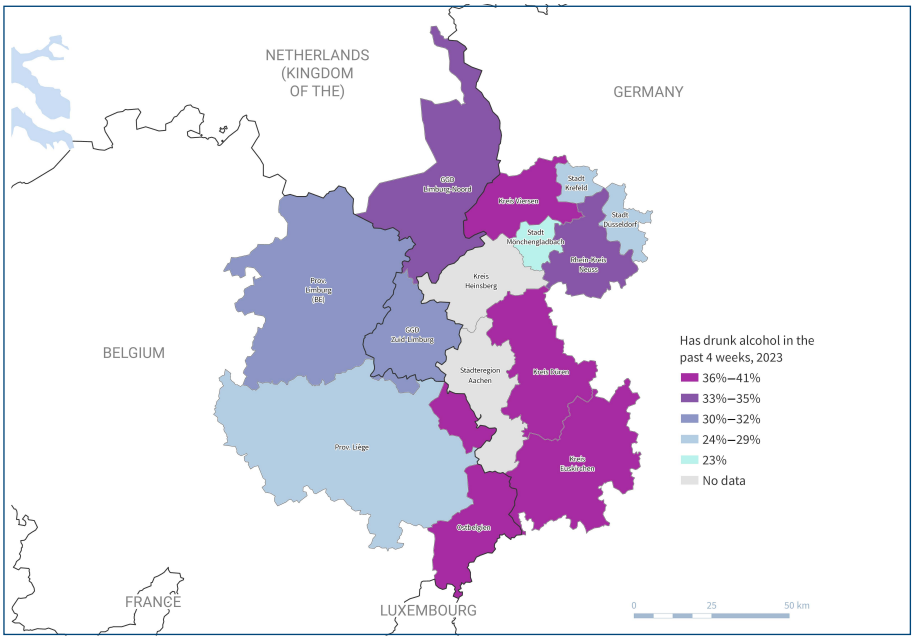
The number of daily smokers among the 13–14-years and 15–16-years age groups in border regions had doubled: 3% of these age groups in the Netherlands and in 6% Germany reported smoking daily. The number of young people engaged in daily vaping in the border regions was higher than that for regular smoking in the same areas (Netherlands national level: 5.4%; Netherlands border level: 6.6%; Belgium border level: 4.5%; and Germany border level: 6.8%) *(32)*.

Regarding the effect of social media on how young people perceive their health, 15.0%, 16% and 21.6%, respectively, of youth living in border areas in the Netherlands, Belgium and Germany saw their use of social media as problematic. They confirmed that social media affected their sleep patterns, and some reported sleep deprivation (Belgium: 17.4%; Germany: 25.7%; and the Netherlands: 18.1%) *(32)*.

Approximately 25% of youth living in border areas reported having an unhealthy weight, with the highest number in Germany and the lowest in the Netherlands. Twice as many youth living in border areas in Germany (17.5%) were overweight than was the case in

the Netherlands (9.5%).[5] Regarding the climate crisis, close to 20% of youth living in border areas expressed concern about being overweight (Netherlands): 18.4%; Belgium: 19.3%; and Germany: 21.5%) *(32)*.

Fig. 3. Youth reporting alcohol consumption over previous 4 weeks, the EMR, 2023



Source: Euregional Health Atlas *(13)*.

Infectious diseases and antimicrobial resistance (AMR)

While rates for infectious diseases are low in the EMR, and comparable data unavailable, occasional outbreaks can threaten the health of the population. The case study on Human Q fever shows how the same infectious disease was managed differently in neighbouring border regions in the EMR (Box 2).

[5] No national-level reference data were available for the Netherlands. This question was included in the YES-survey at the request of the ERMN partners.

Box 2. Cross-border transmission of Human Q fever

In 2009, the Dutch border region of South Limburg experienced a large-scale outbreak of Human Q fever (a zoonotic disease caused by *Coxiella burnetii*)related to a single dairy goat farm. Q fever is transmitted from animals (mostly goats and sheep) to humans. Although this influenza-like illness is usually mild, a substantial proportion of people may suffer long-term effects in the form of Q fever fatigue syndrome.

Q fever is a cross-border public health concern because the infectious agent can be carried by wind over distances of many kilometres. In Germany, only a few cases have been officially reported. Though awareness of the risk of Q-fever is high in the Netherlands, it is also limited because of the focus on establishing a 5-km radius around declared risk areas (usually farms), which does not include the Dutch–German border.

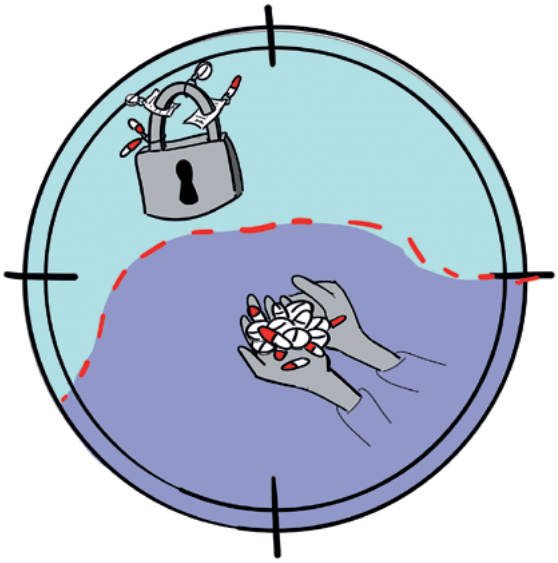
Long-distance airborne spread and human mobility represent important routes of Q-fever transmission along the Dutch–German border since large numbers of German cross-border workers and tourists travel each day to the southern parts of the Netherlands where Q-fever exposure has been highest. Evidence from the border region between Germany and the Netherlands suggests that transmission of *Coxiella burnetii* from a single source may lead to massive numbers of human infections across distances of up to 20 km and more from the source *(33)*. This distance range includes the entire eastern part of the South Limburg region and a large portion of the neighbouring German counties. GPs in the Netherlands played a gatekeeper role and the regional public health authorities kept them informed about aspects of the epidemic, including the epidemiological situation, the clinical presentation of the disease and effective therapies. Nevertheless, lack of awareness among the population of South Limburg and the free movement of people across borders impacted public risk awareness and effective cross-border collaboration and response.

There is an incipient awareness that Q fever poses additional challenges in border regions, but there is no structural solution (yet) to this cross-border public health challenge.

AMR is widespread in the WHO European Region. There are high percentages of resistance to third-generation cepahlosporins and carbapenems in *Klebsiella pneumoniae* (*K. pneumoniae*) and high percentages of carbapenem-resistant *Acinetobacter species* (*Acinetobacter spp.*) in many countries. Many also face challenges regarding treatment options for patients with infections caused by resistant clones of the aforementioned bacteria. Increased

AMR surveillance post COVID-19 has revealed higher numbers of *Streptococcus pneumoniae* (*S. pneumoniae*), possibly due to an increased circulation of respiratory pathogens in the post-lockdown period. Health-care-associated pathogens, such as *Acinetobacter spp* and *E. faecium*, were observed more in 2021 than in the previous period. Currently, countries are more active in developing national action plans on AMR; in the WHO European Region, the number of countries with such plans increased from 68% in 2017 to 85% in 2022.

While no comparable AMR data are available at the regional level (NUTS 3 level) – and thus for the EMR border regions – national-level data provide a snapshot of the situation in Belgium, Germany and the Netherlands. In the three EMR countries, the most common bacterial species is *Escherichia coli* (*E. coli*) split almost equally between males and females, with *Staphylococcus aureus* (*S. aureus*) in second place, affecting males slightly more than females. Regarding age categories, in Belgium, *E. coli* and *S. aureus* mostly affect those over 65 years of age, while *S. pneumoniae* affects 20–64-year-olds and those over 65 equally. In Germany, *E. coli* and *S. aureus* mostly affect those over 65. In the Netherlands, *E. coli* mostly affects people over 65. In 2021, all three countries displayed a higher resistance to aminopenicillin (amoxicillin/ampicillin) treatments for *E. coli* than to other antibiotics (Belgium: 55.2%; Germany: 45.6%; and the Netherlands: 41.4%).



Surveillance is also key to strengthening health-system resilience to and preparedness for AMR to avoid having to seek antibiotics in unregulated ways, as shown in the case study from Bulgaria on

purchasing antibiotics across the border (Box 3). Data from the European Antimicrobial Resistance Surveillance Network show that in 2020 more than 800 000 infections occurred in the EU/European Economic Area due to bacteria resistant to antibiotics, and that over 35 000 people died from such infections in the same year *(34)*.

Box 3. Digital prescription of antibiotics in Bulgaria

AMR is a major public health issue worldwide and a specific public health priority in Bulgaria, which has the highest crude mortality rates in the world for *E. coli* of 7.3 per 100 000 attributable to AMR. An excessive consumption of antibiotics and evidence of its detrimental effect on public health in Bulgaria led the Ministry of Health to require that antibiotics be exclusively prescribed electronically. The aim was to control the population's access to these medications. In October 2023, new rules for the prescription and trade of antibiotics came into effect, making electronic prescriptions mandatory. Doctors and pharmacists did not welcome this change, claiming that it affected the services provided to patients. As a result, many prescriptions were not filled, leaving patients without necessary treatment.

Media sources recently revealed that Bulgarian patients might be travelling to neighbouring Türkiye to find necessary medicines, including antibiotics, that are cheaper and more easily accessible there. Bulgaria has strong geographical and historical connections with Türkiye and high inflation has provided Bulgarians with further financial stimuli to travel there for medicines, among other goods regularly purchased.

While the introduction of the digital prescription of antibiotics in Bulgaria has limited the relatively free access to these medicines, there is nonetheless evidence that Bulgarians have started to buy medicines from pharmacies in neighbouring Turkish cities where Bulgarian paper prescriptions are accepted.

Environmental health concerns

Noise pollution is a priority issue, especially in Germany and the Netherlands, and air quality is a major concern *(31)*. Pollution produced by one country can affect the health of the population in another country, especially in border regions, depending on proximity, prevailing wind directions and the consumption of potentially contaminated resources (e.g., food, water). Epidemiological research shows that air and noise pollution negatively affect public health, including well-being and quality of life.

In South Limburg, life-expectancy and *healthy* life-expectancy averages are considerably less favourable than the Dutch averages, which is also visible in health-care costs *(35)*. This is especially true of air pollution in the municipality of Eijsden-Margraten in the Province of Limburg (Netherlands) (Box 4), which lies on the belt of the most polluted area of the country, as illustrated by the air-pollution maps of the National Institute for Public Health and the Environment (RIVM). According to RIVM research *(36)* and media coverage *(37,38)*, the South Limburg–Randstad region has the worst air quality in the Netherlands.

Box 4. Environmental pollution crosses borders

Due to the prevailing south-west wind direction, the air quality in Wallonia (Belgium) resulting from various industries has a negative impact on the residents of the municipality of Eijsden-Margraten (Netherlands). Various sources of noise pollution are also present in Wallonia. Inhabitants of the Eijsden-Margraten municipality report sleep disorders because of aircraft movements during the night, especially heavy-cargo aircraft from a Belgian airport, which are harmful to health and quality of life *(39)*. In addition, air and noise pollution from motorways, factories, waste incinerators and other cited sources have an impact on the rate of cardiovascular disease *(40)*. Particulate matter and ultrafine particles, which are prevalent in the area, also result in an increased risk of cardiovascular diseases, lung cancer, chronic obstructive pulmonary disease and asthma.

In 2021, Milieu front Eijsden, an action group that advocates for the preservation and monitoring of nature and the landscape, as well as rural and urban development from a natural-history perspective, joined forces with 55 professors from Maastricht University to present a petition to the Prime Minister of the Netherlands. The action group proposed asking the Council of Ministers to consult the Belgian authorities about the expansion plans of Liège-Bierset, the granting of a permit for a biomass power plant and the related marl excavations, and to discuss the consequences for nature, the environment and public health *(41)*.

Box 4. Cont.

Various discussions, involving the local and provincial authorities, took place and official complaints were submitted. Also in 2021, an objection to the granting of a permit for the establishment of a wood-fired power plant was presented to the municipality of Visé. In addition, a request was made that the Maastricht Aachen Airport maintain the WHO noise thresholds of 45 dB during the day and 40 dB at night (instead of the current 50 dB and 45 dB, respectively). Noise accumulation resulting from many sources of noise pollution was also brought up: the Cimenteries et Briqueteries Réunies cement industry, which produces a constant buzzing noise in the surrounding municipalities 24/7; the marl excavations of 107 hectares in Eben-Emael, which generate noise pollution; and the wind farms and Alibaba trading platform, which result in traffic movement and noise near the border region. In 2023, a consortium was formed with Belgian partners to litigate jointly against the granting of a permit to the biomass power plant in Lixhe, among several other issues.

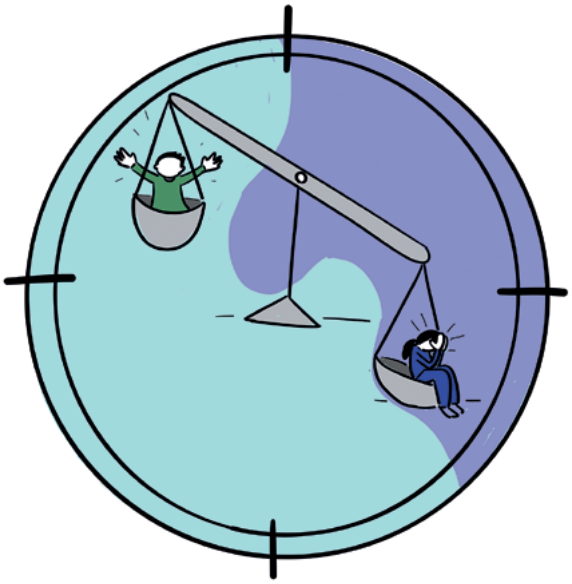
Several factories, airports, a waterway, a motorway and a nuclear power plant surround the municipality of Eijsden-Margraten (Belgium) on the other side of the border to the Netherlands. Political interest in border areas may not be a key priority. There are often language and cultural barriers in border regions, as well as economic consequences for the health of residents in these regions *(42)*.

Movement across borders

The geographical living area of people residing in border regions may not always work in favour of their public health needs. There may be mismatches between the living areas of citizens and the ambit of and coverage by public health authorities. In Belgium and Germany, there is a certain acceptable travel distance from the border regions to the larger cities; in such cases, commuting across borders is commonplace. For example, Antwerp and Brussels are an hour's travel distance from Limburg (Belgium), as is Zweckverband Aachen (Germany), which is close to Düsseldorf and Cologne. For Limburg (Netherlands), these four major cities in neighbouring countries are also at an acceptable distance. However, border barriers can

be prohibitive owing to differing laws and regulations and lack of infrastructure between the countries. Also, public transport options are often fewer, and distances longer, making cross-border transportation less accessible.

In border-related studies, many scholars have argued that borders are cultural, economic, political and social constructs. Formal, national and political borders become less important than everyday cross-border socioeconomic relations *(43)*. In some countries, borders are rather fluid *(6)*. The EU is characterized by "multiple, fluid spaces of regions, markets and cities connected by networks of communication and transport and traversed by flows of goods, people, information and capital" *(44)*. While a geopolitical perspective on borders, such as country demarcations, is dominant in the domains of policy and law, developing adequate policies requires a focus on the fluidity of borders in everyday life *(12, 44)*. Studies of life in border regions also indicate that living with different governance systems close at hand provides flexibility and freedom: if parents do not like the national educational system, they can put their children in schools in a neighbouring country; and if some groceries are very expensive in the home country, people can cross the border to shop or tank up with fuel *(12)*.



From a health and health-inequality perspective, living in a border region can have a negative impact. For example, people living in the centre of Belgium, Germany or the Netherlands can choose (public) health care anywhere around their places of residence. If the same people were living in a border area, this would not be possible. In such cases, citizens are faced with choosing (public) health care within 180 degrees of where they live.

This in itself creates inequality when compared to the possibilities of people living in the middle of the country. The Community Health Sync (CoH) project (2018–2021) provides an example of how health inequalities in border regions can be reduced (Box 5).

Box 5. The CoH-Sync project: reducing health inequalities in border regions

Inequalities at all levels are a major problem in the border area between Ireland and Northern Ireland (United Kingdom). According to data from 2015–2016, people living in these border areas are affected to a greater degree by obesity, physical inactivity, smoking, alcohol misuse, depression and anxiety than people living in other parts of these countries. One fifth of the population of Northern Ireland lives in relative poverty, and coronary heart disease, cancer and respiratory disease continue to be the main causes of death for both sexes *(45)*. In Ireland, the border region of Donegal is the second most disadvantaged local-authority area in the country with 94% of its population living at below-average affluence levels *(46)*. Disadvantaged communities tend to have poorer health and make less use of the health-improvement services.

The CoH-Sync project (2018–2021) aimed to address health inequalities in some of the most deprived areas of the border regions between Ireland and Northern Ireland, and in western Scotland through the creation of eight locally based health and well-being hubs. The project focused on increasing resilience and social capital by building up the community's strengths and enabling people to assist each other through:

- the development of community champions, local expertise and leadership for health and well-being;
- work at the grass-roots level to build community capacity and bring about cultural and behavioural change; and
- increasing the skills and employability of local people within community-led health and well-being projects.

Over 100 000 citizens received programme support that lasted between 6 and 12 weeks, including signposting about services available in the community and online, such as, online book clubs, creative writing classes, arts and craft tutorials, physical-activity classes, online cooking classes, and mindfulness and life coaching. The project, which also strengthened public health institutional structures for the coordination, integration and delivery of public health services, took place through the development of joint cross-border standards in both jurisdictions and a focus on sustainment of the project beyond EU funding.

With the conclusion of the CoH-Sync project, the challenge remains of continuing efforts to ensure that health inequalities between Ireland and Northern Ireland are addressed in a sustainable way.

For some people, it may be culturally or linguistically more appropriate to receive care in a neighbouring country. For example, German-speaking people living in the German-speaking parts of Belgium sometimes use services offered in the French-speaking part of the country even if it might be more appropriate for them to receive treatment in their own language in Germany. The national systems in Belgium, Germany and the Netherlands assume the principle of equality, and not necessarily equity, when it comes to access to (public) health care. If the well-being and interests of citizens are truly at stake, health policy in a border region should also assume equity by taking their living environments into account. To match the geographically based lives of people in border areas, it may be best to develop policies that take into account the fluidity of borders in their daily lives. In the light of the fact that over 30% of the EU population resides in a border area, failing to consider the geographical demographic factor leaves the population at a disadvantage.

Strengthened cross-border public health within the WHO EPHF Framework

As seen in the previous sections of this report, cross-border public health challenges, such as infectious diseases, environmental pollution, risk-taking behaviour (e.g., smoking, eating unhealthy foods, and alcohol consumption) and population migration, are prominent in border regions. Public health services play a crucial role in addressing these challenges by creating robust cross-border partnerships for public health. This could be achieved by aligning health policies, sharing information and coordinating response measures at the supranational level. The EPHF Framework provides an evidence-based structure for planning public health interventions and assessing cross-border public health action.

The EPHF Framework and cross-border public health

In 1998, WHO proposed the first global reference list of EPHF against which countries could benchmark their public health capacities in support of work being carried out to achieve Health for All *(1)*. In 2022, WHO and the Working Group on EPHF of the International Association of National Public Health Institutes signed a memorandum of understanding, outlining their joint efforts to strengthen public health functions at the global, regional and country levels while advocating greater equity, inclusiveness and coherence *(1)*. As part of their joint work, the Working Group and WHO reviewed the list of EPHFs and developed an updated list of 12, emphasizing their interdependence and cross-sectorality and the linkages between them. It also underscored the distribution of public health functions and services (social care, environmental health, veterinary issues, land-use planning, and food and road safety) between the health and allied sectors towards strengthening public health (Box 6).

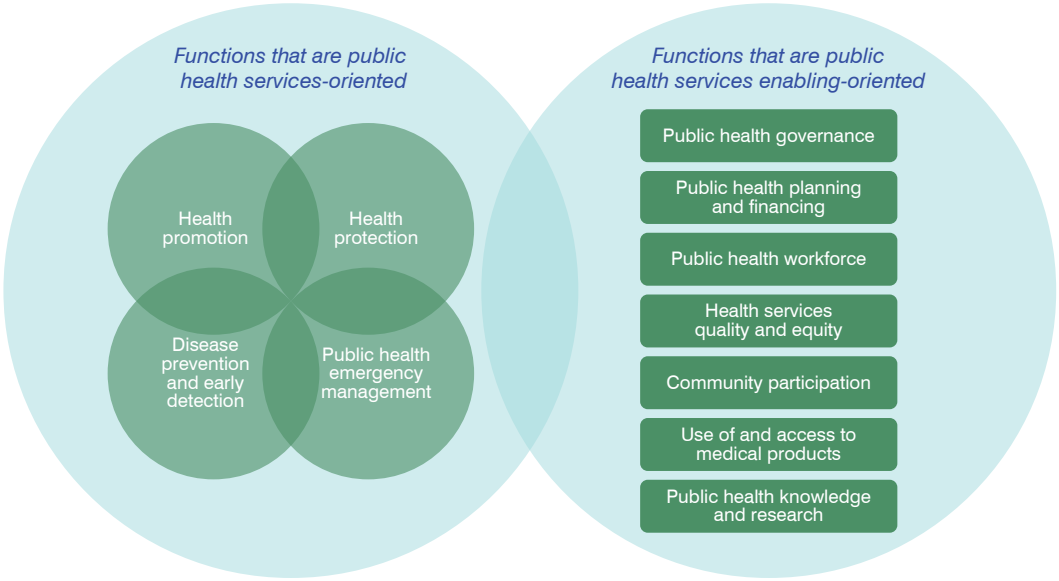
Box 6. Unified list of WHO EPHFs

1. Public health surveillance and monitoring
2. Public health emergency management
3. Public health stewardship
4. Multisectoral planning, financing and management for public health
5. Health protection
6. Disease prevention and early detection
7. Health promotion
8. Community engagement and social participation
9. Public health workforce development
10. Health service quality and equity
11. Public health research, evaluation and knowledge
12. Access to and utilization of health products, supplies, equipment and technologies.

Source: Application of the essential public health functions: an integrated and comprehensive approach to public health (1).

The 12 EPHFs capture the various conceptualizations of and approaches to delivering public health in different countries. Governments are primarily responsible for planning, coordinating and facilitating their comprehensive delivery, which can occur through their departments and institutes, as well as private entities, individuals or professional groups in the health and allied sectors, from the national to the community levels. The 12 EPHFs can be grouped under two domains, namely: (i) functions oriented to public health services; and (ii) functions that enable public health services (Fig. 4).

Fig. 4. Interlinked EPHFs



Source: Zhang et al *(47)*.

As seen in Fig 4, action outlined in the EPHF Framework towards the delivery of public health services focuses primarily on achieving a positive impact on population health, including health equity, while reducing health risks and promoting health at the individual level. The EPHFs address wider issues in health promotion and protection, such as policies, legislation and advocacy, as well as the health effects of the work of other sectors, such as those for agriculture, education and transport. Like the implementation of public health functions, public health services can be provided by, among others, governments, organizations, communities, the private sector, health facilities, schools, civil-society groups and faith-based groups, as well as the health and care workforce, community members and the broader public health workforce *(1)*. Enablers of the EPHF Framework's public health system are the building blocks or elements of a public health service without which it cannot be delivered. They include leadership and governance, workforce, medicines and technologies, and financing and information systems.

All 12 EPHFs are important in addressing cross-border public health issues, yet the handful of case studies featured in this report do not use them to the extent they could. It would not be fair to evaluate the application of EPHFs within these case studies since they were compiled in parallel to this analysis and have been implemented or exist independently. Rather, efforts have been made to find some links between issues that are being addressed in border areas and the EPHFs. Some of the case studies show that several EPHFs are being prioritized and implemented through policies and plans related to cross-border public health, while others speak to the need to consider the EPHFs in border settings. As shown in Table 3, the EPHFs that are most relevant to the featured cross-border public health case studies are oriented towards public health services, including health promotion (EPHF 7), health protection (EPHF 5), and disease prevention and early detection (EPHF 6). The EPHFs enabling the delivery of public health that are most relevant to cross-border public health are public health stewardship (EPHF 3), access to and utilization of health products, supplies, equipment and technologies (EPHF 12), community engagement and social participation (EPHF 8) and public health research, evaluation and knowledge (EPHF 11).

Table 3. The intersections between case studies and EPHFs

EPHFs	Case studies				
	Sugar and alcohol tax	**Environmental pollution**	**Cross-border transmission of human Q fever**	**Electronic prescriptions to prevent AMR**	**CoH-Sync and reduction of inequalities**
1. Public health surveillance and monitoring	–	x	x	x	–
2. Public health emergency management	–	–	x	–	–

Table 3. Cont.

EPHFs	Case studies				
	Sugar and alcohol tax	**Environmental pollution**	**Cross-border transmission of human Q fever**	**Electronic prescriptions to prevent AMR**	**CoH-Sync and reduction of inequalities**
3. Public health stewardship	–	–	–	x	x
4. Multisectoral planning, financing and management of public health	x	–	–	–	–
5. Health protection	-	-	x	x	x
6. Disease prevention and early detection	–	–	x	–	x
7. Health promotion	x	–	–	x	x
8. Community engagement and social participation	–	x	–	–	x
9. Public health workforce development	–	–	x	x	x
10. Health service quality and equity	–	–	–	–	x
11. Public health research, evaluation and knowledge	–	x	–	–	x

Table 3. Cont.

EPHFs	Case studies				
	Sugar and alcohol tax	Environmental pollution	Cross-border transmission of human Q fever	Electronic prescriptions to prevent AMR	CoH-Sync and reduction of inequalities
12. Access to and utilization of health products, supplies, equipment and technologies	–	–	–	x	–

A case in point for the use of and access to medical products and the need to increase public health research, evaluation and knowledge is illustrated in the Bulgaria case study on prescribing digital antibiotics (EPHFs 11 and 12) (Box 3). While Bulgaria seeks to address excessive consumption of antibiotics due to high *E. coli* mortality by limiting access to antibiotics through electronic prescribing (e.g., EPHF 3: public health stewardship), people living in areas bordering Türkiye – where prescription requirements are less rigid – may choose to cross the border to have their prescriptions filled, to the possible detriment of their own health.

The case study on the public health impact of a varying sugar and alcohol tax in border regions (Box 1) illustrates the importance of strengthening health promotion for and the public health knowledge of people living in border regions who may opt to purchase and consume unhealthy foods and beverages across the border. The public health issue of ease of access to sugary and/or unhealthy foods and inexpensive alcohol is presented without delving into why the countries are imposing taxes, the reasons for this ranging from monetary to health issues.

The case studies on environmental pollution (Boxes 3 and 4) show the importance of strengthening public health governance in border regions and illustrate how community participation can begin to make a dent in public- and private-sector awareness of environmental risks in border regions (EPHF 8: community engagement and social participation). They also speak to the importance of strengthening health-protection services to provide environmental and occupational health services for the management of cross-border environmental hazards (EPHF 5: health protection). The experience of the border regions of Ireland and Northern Ireland, as implemented through the CoH-Sync project (Box 5), shows the importance of health promotion, disease prevention and community participation (and involvement) (EPHFs 6, 7 and 8). Although the CoH-Sync project was concluded in 2021 and the challenge of addressing health inequalities remains, it raised awareness of the possibility of improving public health in border regions through effective action. Finally, the Q fever case study (Box 2) illustrated an awareness that infectious diseases can cross borders and that mechanisms to counter this are in place (in this case, only in the Netherlands), though the level of this awareness in Germany remains low. It also underlines the need to share and compare data across borders while applying a public health lens (EPHF 1: public health surveillance and monitoring; and EPHF 6: disease prevention and early detection). For example, if GPs in the Netherlands acted as gatekeepers for Q fever and this were not the case across the border in Germany, the result could be a lack of, or incomparable data.

Discussion

The current situation in the EMR highlights significant gaps in the collection and use of data to enhance public health knowledge and support research (EPHF 1: public health surveillance and monitoring). These are critical to informing policy development on and implementing evidence-based interventions for health promotion and disease prevention (EPHF 4: multisectoral policy), which is currently in need of strengthening. A notable limitation is the lack of public health data available at the NUTS 3 level, the most accessible data being restricted to the member-state level. However, these national-level datasets often fail to adequately capture the unique characteristics and specific needs of regions, including border regions. It was a challenge to obtain comparable demographic data for the EMR. For some health-related topics, NUTS-3-level data were available, but this was not the case for all of them. Worth noting is chapter 5 of the youth survey conducted in the EMR in 2023 *(32)* where cross-border comparisons were feasible because data collection was standardized in terms of timing and survey questions. Nevertheless, such efforts are heavily dependent on public health governance structures and willingness to invest in cross-border research.

In short, there appears to be a misalignment between community and government in border regions, which has significant implications for public health governance, workforce planning and community participation (EPHFs 3 and 8). As mentioned in the introduction, individuals frequently cross borders for various reasons. Nevertheless, the public health governance structure in each country is still limited to the national geographical area (e.g., as can be seen when a public health worker crosses the border to work for a region in a neighbouring country). This shows that individual behaviours are not necessarily aligned with public health governance structures. To improve this situation and address these challenges, public health governance must consider and integrate cross-border dynamics,

lifestyles and public health services, which increasingly shape public health outcomes.

Furthermore, the case studies consistently reveal the absence of structural and sustainable solutions to addressing both the positive and the negative aspects of cross-border public health (EPHF 3: public health stewardship; and EPHF 4: multisectoral policies). Notably, the cases illustrate how citizens often leverage differences between health-care systems to their perceived personal advantage, despite government efforts to discourage certain behaviours. Existing cooperation is largely reliant on short-term, EU-funded projects, as highlighted by the Northern Ireland example (Box 4). However, integrating the outcomes and initiatives of these projects into existing national frameworks remains challenging, if not impossible. Multiple factors exacerbate this situation, with the lack of comprehensive policies for cross-border cooperation and sustainable funding mechanisms at the forefront of obstacles to long-term integration and success.

The case studies confirm the relevance of the EPHF Framework and its functions, yet at the same time stress the need to integrate a geographical cross-border public health lens into the Framework (e.g., by developing relevant sub-functions and public health services based on population health needs). They also substantiate the utility of EPHFs in providing a strategic, comprehensive framework for the identification of key areas of gaps and strengths in policies on cross-border public health, as well as in services, infrastructures and workforces.

Conclusions

This report has sought to illustrate what cross-border public health is, using the EMR as the primary example and snapshots from other countries to highlight the breadth of issues that affect people living and working in border regions. At the same time, some public health functions emerge as being vital to ensuring and strengthening the effectiveness and efficiency of cross-border public health interventions and policies. Currently, the functions listed below need to be strengthened or introduced within the context of cross-border public health by implementers, local policy-makers and public health practitioners.

1. **Public health stewardship**
   Strong leadership and good governance are crucial to coordinating cross-border public health initiatives. They provide for the establishment of frameworks and protocols for cross-border cooperation, ensure compliance with international and European health regulations, and lead the response to health crises that may also affect neighbouring countries. Effective leadership also facilitates cooperation with neighbouring countries, allowing the development of common strategies for disease control and health promotion, and the alignment of national legislation.

2. **Development of the public health workforce**
   Qualified public health personnel are essential for implementing cross-border public health programmes. Public health workers should be familiar with each other's public health guidelines and standards as they often need to be able to operate flexibly in countries other than their own with different public health care systems. The ability to communicate effectively with different populations requires cultural competence and language abilities as well as medical, social and technical skills.

3. **Access to medicines and technologies**
   The availability of medicines and technologies plays a crucial role in cross-border public health, especially in the control of infectious diseases and the provision of vaccinations. Innovative technologies, such as telemedicine, can also be used to provide care for patients in remote areas or resource-constrained regions, as well as to prevent isolation.

4. **Health-sector and multisectoral planning and financing**
   Adequate and sustainable funding is essential for implementing cross-border public health programmes. This includes joint research projects, emergency health-crisis funds, and investment in infrastructure that benefits cross-border public health. Cross-border cooperation can be strengthened through mechanisms, such as joint funds and grants that are specifically focused on implementing cross-border-prevention and health-promotion programmes.

5. **Data and Information systems**
   Robust information systems are indispensable for collecting, analysing and sharing public health data across national borders. These systems enable the timely and accurate exchange of information on outbreaks, disease patterns, lifestyle differences and public health risks, which is essential for coordinating action. Data sharing between countries and border areas helps identify trends and implement preventive action. It also supports monitoring and evaluating the impact of interventions. For this reason, the harmonization and alignment of data is needed in border regions to enable policy-makers to design comparable and effective interventions.

These system inputs not only strengthen the effectiveness of public health services within countries but also contribute to an integrated and coordinated approach to problems related to cross-border public health. They ensure that public health services are resilient and adaptive, even in the face of challenges, such as pandemics, natural

disasters, or large-scale migration, and that all people, regardless of location, have access to the health care they need.

Another important aspect of cross-border public health is coordination between the different countries to ensure coherence between guidelines and standards, not only at the national level but also in consideration of shared borders. Public health services on both sides of the border can contribute to the development of such guidelines and thus a faster and more efficient response to health crises, such as pandemics, and the effects of differences in health policies, laws and regulations. They can also do so by sharing research and data and supporting cross-border programmes on infectious-disease surveillance, as well as vaccination campaigns, which are essential for controlling the spread of infectious diseases. In addition, they have the possibility of taking joint action to address environmental and climate-related public health challenges (such as vector-borne disease) and promote lifestyle changes necessary to enable the population to live more healthily.

The influence of public health services on cross-border public health is reflected in the role of the services in promoting health equity and access to care, something that is not evident in many border areas. Public health services on both sides of the border can work to reduce this inequality by collaborating to ensure adequate health facilities, as well as support for these facilities and the populations living and working in the border areas.

By investing in these building blocks and including a cross-border public health lens, countries can strengthen their capacities to meet shared public health challenges and contribute to a global public health system that is effective and equitable.

Public health functions in border regions are impacted by proximity with advantages and disadvantages. The positive aspects of living in border areas may include the possibility of purchasing cheaper products in the neighbouring country, but this advantage also has disadvantages. These include not having the same opportunities

regarding access to public health as people living in larger, more centrally located towns or cities, and a greater consumption of alcohol and unhealthy food. For this reason, in considering living environments and access to public health services in border regions, it is imperative to add a cross-border lens to the WHO EPHF Framework. From a national perspective, both the positive aspects of border regions and the challenges in these regions that can lead to health problems and health inequalities should be considered in policy-making.

Given the huge economic and public health significance of cross-border public health, it would be prudent for the European Commission to consider developing a programmatic approach to this concept, using the EHPFs as a reference point. This would ensure adequate attention to: developing policy and capacity towards filling existing gaps in public health capability; meeting current and future population health needs; incorporating interoperability into public health information management for early warning, reporting and response; ensuring local surge capacity; and promoting cooperation between the responsible authorities.

Key messages

The following key messages relate to the areas where support is needed to strengthen cross-border public health action.

- **Systematically consider the cross-border implications of policies and regulations related to public health**

  This entails taking the specifics of border regions (e.g., lifestyle, commuting distances, customs of border populations) into consideration in policy-making, and strengthening governance and institutional capacity for public health.

  Not only should this apply to policies and regulations directly related to public health, but it should also take other areas into account, such as trade, commerce, industries and development. This can be ensured by reviewing the public health implications of the commercial determinants of health, differences in the rules of bordering countries, equity in relation to the provisions of the EPHF Framework, and public health services in communities living in cross-border contexts.

- **Understand the need for comparable data in decision-making**

  Border regions need their public health data to be included in public health decision-making. At present, it is a challenge to compare data across borders as they are limited.

- **Engage authorities in decision-making affecting "their" borders**

  This could be initiated by providing decision-makers with a set of questions to bear in mind when developing new policies at the central to subnational levels. These could relate, for example, to ways of prioritizing and setting up a long-term plan, and structurally integrating the topic of border regions into public health policy-making and the development of institutional capacity.

A cross-border lens could be applied in creating policy or legislation to emphasize the importance of improving citizens' health in border regions, taking their everyday movements into consideration.

- **Strengthen subnational public health services tailored to population-health needs in border regions**

  Typically, institutional capacity for public health declines from the national to the subnational level and, in the cross-border context, various legal set-ups can create further complications in public health messaging and services. To address this, the border authorities of the countries in question could join forces in assessing the current and future burden of diseases, including risk and vulnerability and bottlenecks, with the aim of jointly building up public health capacity and service delivery.

- **Invest in research on cross-border public health**

  Currently, cross-border public health initiatives are not sustainable due to time-limited funding. The identification of national or regional structural funds to ensure cross-border public health would help progress towards more sustainability. This can be achieved by documenting experiences in cross-border public health in peer-reviewed literature to strengthen the evidence base. To identify solutions, more investment should be dedicated to operational research into cross-border public health.

- **Consider systematically applying the WHO EPHF framework in cross border public health operations**

  This includes, in particular:
  - public health stewardship
  - development of a qualified public health workforce
  - access to medicines and technologies
  - health-sector and multisectoral planning and financing, and
  - data and information systems *(1)*.

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Annex

Adding a cross-border lens to the Essential Public Health Functions (EPHF) Framework – a concept of cross-border cooperation

This annex proposes a potential addition to the WHO EPHF Framework, its purpose being to allow users of the Framework to understand it without having to read this report first.

Proposed addition to the WHO EPHF Framework

Public health services focus on having a positive impact on population health, including the reduction of health risks and the promotion of health at the individual level towards achieving health equity. Public health services address wider issues within health promotion and protection, such as policies, legislation, advocacy and the health effects of work in other sectors, including those for agriculture, education and transport. The report, *Application of the essential public health functions: an integrated and comprehensive approach to public health*,[7] states that public health services can be provided by, among others, governments, organizations, communities, the private sector, health facilities and schools, as well as by individuals, such as community members and the members of the health and care workforce.

[7] Application of the essential public health functions: an integrated and comprehensive approach to public health. Geneva: World Health Organization; 2024. (https://iris.who.int/bitstream/handle/10665/375864/9789240088306-eng.pdf?sequence=1, accessed 4 December 2024), Licence: CC BY-NC-SA 3.0 IGO

Cross-border public health challenges are now more prominent and public health services need robust cross-border partnerships. Health-policy alignment, information sharing and the coordination of response measures at the supranational level are all necessary. Coordination between the work being carried out in different countries is also needed, as is the promotion of health equity and access to care, something that is not evident in border areas. The following questions can be asked in relation to cross-border public health and the EPHFs.

1. **How well is cross-border collaboration among public health institutions aligned to ensure a consistent and integrated approach to fulfilling the EPHFs on both sides of the border?**

   Responses to this question enable assessment of the level of coordination and integration between public health systems in neighbouring countries, ensuring that public health efforts are acknowledged across the borders.

2. **What barriers exist to the effective implementation of the EPHFs in a cross-border context, and how can these be addressed to improve health outcomes for populations in border regions?**

   This question aims to identify the specific challenges and obstacles – such as legal, logistical, or resource-related issues – that hinder the successful implementation of public health functions in cross-border regions, thus providing an insight into potential solutions to overcoming these barriers.

3. **How regularly and effectively do public health organizations in border regions communicate and collaborate with their counterparts in neighbouring countries, and what mechanisms are in place to facilitate this contact?**

   This question examines the frequency and quality of cross-border communication and the strength of collaboration between border regions, ensuring the coordination of their public health efforts and a shared response to regional health challenges.

4. **To what extent is it necessary for the public health authorities in one border region to establish contact with those in neighbouring regions, inform them of initiatives being taken, and gather information to support the effective implementation of cross-border public health?**

   This question focuses on the necessity for collaboration, information sharing and communication among neighbouring countries to ensure that public health initiatives on both sides of a border are well coordinated and supported by relevant cross-border stakeholders.

Specific EPHF-related questions

The questions listed in Table A1 can identify the state of cross-border health in relation to each EPHF, providing an insight into the effectiveness of current systems and identifying areas requiring improvement.

Table A1. Specific EPHF-related questions

EPHFs	Questions
EPHF 1. Public health surveillance and monitoring • monitoring and surveillance of population health status, risks, protective and promotive factors, threats to health, health-system performance and service utilization.	How are health data from both sides of the border being integrated and shared with the aim of monitoring overall population health and well-being in the border region?
EPHF 2. Public health emergency management • managing public health emergencies for international and national health security.	What mechanisms are in place to ensure countries in border regions coordinate public health emergency responses? How well do they function during cross-border crises?

Table A1. Cont.

EPHFs	Questions
EPHF 3. Public health stewardship • establishing effective public health institutional structures, leadership, coordination, accountability, regulations and laws.	Do cross-border institutional structures, leadership and regulations exist? How well are they aligned to ensure accountability and effective public health governance in the border region?
EPHF 4. Multisectoral planning, financing and management for public health • supporting effective and efficient health systems and multisectoral planning, financing and management for public health.	Are there cross-border health initiatives in place? How well are they integrated into multisectoral planning and financing strategies to ensure the efficient management of public health across borders?
EPHF 5. Health protection • protecting populations against health threats, for example, environmental and occupational hazards, communicable and noncommunicable diseases (including mental-health conditions), food insecurity, and chemical and radiation hazards.	What collaborative measures are in place to protect populations in border regions from (cross-border) health threats, such as environmental hazards, communicable diseases and occupational risks? How effectively are these threats addressed?
EPHF 6. Disease prevention and early detection • prevention and the early detection of communicable and noncommunicable diseases, including mental-health conditions and the prevention of injuries.	Are cross-border programmes for the prevention and early detection of communicable and noncommunicable diseases in place? How well are they coordinated? Are there gaps in these efforts?

Table A1. Cont.

EPHFs	Questions
EPHF 7. Health promotion • promoting health and well-being and taking action to address the wider determinants of health and inequity.	Are health-promotion efforts in place in border regions? How effectively do they address the shared social determinants of health and health inequities? How well are these efforts aligned between neighbouring countries?
EPHF 8. Community engagement and social participation • strengthening community engagement, participation and social mobilization for health and well-being.	To what extent are communities in border regions actively engaged in public health initiatives, and how is social participation facilitated across borders?
EPHF 9. Public health workforce development • developing and maintaining an adequate and competent public health workforce.	Are public health workforce development initiatives across borders in place? How coordinated are these initiatives? How well are public health professionals trained to address the unique challenges of cross-border health?
EPHF 10. Health-service quality and equity • improving appropriateness, quality and equity in the provision of and access to health services.	Are cross-border health-care services in place? How well are they coordinated to ensure equitable access and high-quality care for populations in border regions?

Table A1. Cont.

EPHFs	Questions
EPHF 11. Public health research, evaluation and knowledge • advancing public health research and knowledge development.	Are cross-border public health research initiatives in place? How well are they structured? How effectively are research findings shared and applied to inform public health policies and practice in border regions?
EPHF 12. Access to and utilization of health products, supplies, equipment and technologies • promoting equitable access to and the rational use of safe, effective and quality-assured health products, supplies, equipment and technologies.	Are essential health products, supplies and technologies accessible and utilized across borders? How easily can they be accessed and utilized? What barriers exist to ensuring equitable access for populations in neighbouring countries?

The WHO Regional Office for Europe

The World Health Organization (WHO) is a specialized agency of the United Nations created in 1948 with the primary responsibility for international health matters and public health. The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health conditions of the countries it serves.

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