World Health Organization

European Region

# **Situational analysis of acute stroke care in Ukraine:** evaluating trends and improving quality

World Health Organization

European Region

# **Situational analysis of acute stroke care in Ukraine:** evaluating trends and improving quality

**Abstract**

This report presents a critical analysis of the rising incidence of stroke-related hospital admissions, which remain significantly higher than the European Union average. It extends the previous situation reports on stroke care in Ukraine published in 2023 and in 2024, incorporates recent health system developments and expands the analysis to monitor trends. The trend, exacerbated by the demographic disruptions caused by war, underscores the urgent need for comprehensive investigation and sustained quality improvement in stroke care. Key areas of focus include the implementation of evidence-based policies, infrastructural enhancements, and quality assurance mechanisms. The report emphasizes the importance of further development of integrated and optimized stroke care networks, improvement and implementation of updated national stroke care guidelines, and the gradual expansion of access to diagnostic, therapeutic, and rehabilitative services across all phases of care. Despite the obvious progress in access to effective revascularization procedures and rehabilitation services, the current health system is under strain, necessitating the expansion of services from acute to community-based long-term rehabilitation. Recent normative advancements in stroke care must be continued and supported through coordinated efforts among national and international stakeholders. Furthermore, the report identifies critical gaps in stroke surveillance and data collection, advocating for the establishment of national monitoring systems to inform policy and optimize resource allocation.

**Keywords**

STROKE; PREVENTION AND CONTROL; DELIVERY OF HEALTH CARE; METHODS; HEALTH SERVICES; UKRAINE

Document number: WHO/EURO:2025-12288-52060-79895 (PDF)



**Suggested citation.** Situational analysis of acute stroke care in Ukraine: evaluating trends and improving quality. Copenhagen: WHO Regional Office for Europe; 2025. Licence: CC BY-NC-SA 3.0 IGO.

Cataloguing-in-Publication (CIP) data. CIP data are available at http://apps.who.int/iris.



Design and layout: Tetiana Kabakova
Cover photo: © WHO

# Contents

# Acknowledgements

This document was produced by the WHO Country Office in Ukraine.

The draft of the document was prepared by Francesca Romana Pezzella and Yuriy Flomin, Consultants to the WHO Country Office in Ukraine from June to December 2024, with oversight and technical guidance from Andrii Skipalskyi (WHO Country Office in Ukraine).

Further technical review and guidance was provided by Jill Farrington (WHO Regional Office for Europe) and data processing was performed by Serhii Voinalovych (WHO Country Office in Ukraine).

Thanks go to all WHO staff who provided technical input, feedback and comments during the process of revising this document, namely to Dene Cairns, Olga Demeshko, Volodymyr Golyk, Triin Habicht, Solomiya Kasyanchuk, Alina Kovalchuk, Marlee Quinn, Paul Toomas and Arkadii Vodianyk.

Jarno Habicht (WHO Country Office in Ukraine ensured) overall technical guidance.

Compilation of the report was greatly assisted by the contributions of multiple stakeholders and technical experts — through their comments and participation at a consultation meeting held in November 2024. WHO acknowledges the support of key partners in the Ministry of Health of Ukraine and the National Health Service of Ukraine, in particular Serhiy Dubrov, Deputy Minister of Health of Ukraine; Tetyana Orabina, Head of the Department of Medical Services, Ministry of Health of Ukraine; and Nataliia Husak, the Head of the National Health Service of Ukraine.

This work was financially supported by a grant from the Government of Denmark.

# Abbreviations

| | |
|---|---|
| AIS | acute ischemic stroke |
| CVD | cardiovascular disease |
| DALYs | disability-adjusted life years |
| EMS | emergency medical services |
| ESO | European Stroke Organisation |
| EU | European Union |
| EVT | endovascular mechanical thrombectomy |
| GBD | global burden of disease |
| ICD | International Statistical Classification of Diseases and Related Health Problems |
| ICH | intracerebral haemorrhage |
| IVT | intravenous thrombolysis |
| MoH | Ministry of Health of Ukraine |
| NCD | noncommunicable disease |
| NHSU | National Health Service of Ukraine |
| PMG | Programme of Medical Guarantees |
| SAH | subarachnoid haemorrhage |
| SAP-E | Stroke Action Plan for Europe |
| TIA | atransient ischemic attack |
| WHO | World Health Organization |

# Executive summary

This report on the situational analysis of acute stroke care in Ukraine is one of the World Health Organization (WHO) publications addressing cardiovascular disease management. Its scope is acute stroke care in Ukraine over the last three and a half years since the full implementation of the Programme of Medical Guarantees (PMG) in 2021. This document describes and assesses acute stroke care in Ukraine based on available data, highlighting current trends and achievements, identifying unmet needs, and outlining recommendations for future action.

The report presents several key findings and recommended actions regarding acute stroke care in Ukraine. It highlights the alarming statistics surrounding stroke incidence, mortality and disability-adjusted life years lost and describes developments in the stroke care system in the context of the current emergency and humanitarian response.

## Key findings

**Increasing hospital admissions.** In the face of challenges posed by the ongoing war, the number of acute stroke admissions in Ukraine rose by 13% in 2023 compared with 2021. This increase may be partially attributed to some positive tendencies observed, such as improved emergency medical service operations, improved patient access to medical care provided by hospitals contracted by the National Health Service of Ukraine (NHSU), and better awareness of stroke as a condition that requires hospitalization. On the other hand, the impact of the war itself and the increasing burden of noncommunicable diseases in the emergency setting are driving factors of neglected vascular risks and underutilization of stroke prevention strategies and services.

**Consolidation of stroke care for better quality.** In 2024, 97% of all acute stroke cases were admitted to hospitals specifically contracted by the NHSU under the PMG and included in the stroke care hospital network, compared with 85% in 2021. Such a positive shift will allow better provision of services to patients and a more effective allocation of government funds for capable facilities.

**Improving the quality of care.** The report highlights a remarkable improvement in access to effective revascularization procedures, such as intravenous thrombolytic therapy and endovascular thrombectomy, in acute ischemic stroke, with rates gradually approaching the WHO European Region average. The rate of intravenous thrombolysis increased 2.5 times, reaching 11.3%, and endovascular thrombectomy application increased 7-fold, exceeding 2% in 2024. These changes have resulted from stable financing of acute stroke care, advancements in diagnostic capabilities and adherence to evidence-based practices.

**Monitoring of quality of care.** The national framework for quality-of-care monitoring in Ukraine remains limited but has been proven feasible. In 2024, the Ministry of Health of Ukraine (MoH), with the support of WHO, conducted a quality-of-care monitoring of 56 hospitals identified according to risk, and the findings were used to further develop the stroke care network in 2025. The NHSU also conducted hospital monitoring checks to ensure compliance with the service procurement requirements of the PMG stroke package. These actions triggered the government's decision to consolidate the stroke care hospital network and enabled the hospitals to implement improvements in service quality.

**Increasing access to rehabilitation services.** Access to rehabilitation services post-stroke has increased significantly, particularly in the subacute phase. In 2024, twice as many patients benefited from inpatient and outpatient rehabilitation services compared with 2021 (13.4% vs 6.2%). This resulted from the establishment of effective referral pathways and active development of rehabilitation services. However, these services are still underutilized, and the need for rehabilitation after stroke remains unmet in the majority of patients.

**Stable mortality rates.** In-hospital and 30-day mortality rates in acute stroke have slightly decreased but remain worrisome, being 2–3 times higher than the European Union average. This alarming situation needs further investigation and deeper analysis if no improvements are demonstrated in 2025–2026.

## Further considerations

- While a stable increase in hospital admissions with stroke was observed, further research is needed to investigate various factors contributing to this situation. Considering the enormous negative demographic shifts caused by the war, the observed increase is even more alarming.
- Quality improvement measures should be applied and sustained to enhance stroke care, including evidence-based policies, infrastructural measures, clinical audits and monitoring, and other quality assurance mechanisms.
- Quality-of-care monitoring measures and the advancement of integrated stroke care networks are gradually increasing access to effective diagnostic services, critical interventions, treatment and rehabilitation throughout the care process.
- While progress has been made in access to rehabilitation services, the health system cannot currently cope with the increased demand for rehabilitation among the population. Nevertheless, it is crucial to expand the provision of services from the acute to subacute rehabilitation phases, both in inpatient and outpatient settings. This should be followed by community-delivered rehabilitation services during the long-term rehabilitation phase, and rehabilitation outcomes monitored at the end of each phase.
- Considerable normative work has been undertaken recently to improve stroke care quality and the system of care. This work should be continued to enable further system changes and address challenges. Achieving sustainable improvements in stroke care will also require coordinated efforts among various stakeholders, including the MoH, WHO, the World Bank, local authorities and health-care providers.
- Current e-Health data on stroke is very much based on services provided, while it also reveals the lack of stroke and noncommunicable disease surveillance and statistics. Establishing national surveillance mechanisms to monitor stroke incidence, stroke care indicators and risk factors is essential for informed policy-making and resource allocation.

# 1. Introduction

Stroke and cerebrovascular disease present a significant health challenge in the WHO European Region, causing high mortality and long-term disability, and imposing considerable social and economic impact on health-care systems, communities, families and individuals. Overall, significant discrepancies in stroke burden exist across the Region: the highest numbers of disability-adjusted life years (DALYs) lost due to stroke are observed in central Asia, followed by eastern Europe. Only a concerted effort can decrease stroke cases and associated mortality, and achieve the Sustainable Development Goal to reduce premature mortality due to noncommunicable diseases (NCDs) by a third by 2030.

The stroke burden has remained a critical public health challenge in Ukraine as stroke incidence and mortality rates are higher than in most countries of the WHO European Region. According to the recent global burden of disease (GBD) estimates, in 2021 Ukraine had 134 283 new acute strokes, 82 352 stroke deaths and 1 631 824 DALYs lost due to stroke *(1)*. Since 2019, at the request of the Ministry of Health of Ukraine (MoH), the WHO Country Office in Ukraine and the WHO Regional Office for Europe have been providing technical support to enhance prevention strategies and services along the continuum of stroke care. In May 2021, the MoH signed the Stroke Action Plan for Europe (SAP-E) Declaration promoted by the European Stroke Organisation (ESO) to confirm its commitment to implementing the SAP-E in Ukraine and reducing the burden of stroke in the country *(2)*. Since then, WHO has contributed to building a comprehensive agenda for stroke in Ukraine and supporting national stroke experts in improving stroke prevention, acute stroke treatment and stroke systems of care *(3)*. WHO has monitored the situation with acute stroke care and prepared two situation analyses by the end of 2024 *(4)*.

This report extends the previous situational analyses *(3,4)*. It aims to measure the impact of health policies and practices on the burden of stroke during the war caused by Russian Federation's full-scale invasion of Ukraine on 24 February 2022. The report highlights recent advances and unmet needs and offers a set of actions/recommended actions to guide policy-makers and stakeholders on future directions for stoke care in Ukraine.

Data on strokes were provided by the e-Health centralized database, courtesy of the National Health Service of Ukraine (NHSU), which is the only reliable source of stroke metrics at the national level. The report is based on the data available for 2021–2023 and the first six months of 2024. The eHealth data were complemented by the qualitative findings of the pilot phase of the clinical stroke audit performed by the MoH in April–June 2024 in six regions of Ukraine. The report's main findings were presented at the Third Technical Meeting on Stroke, "Reducing the burden of stroke in Ukraine: improving quality and health outcomes" held in Kyiv on 6 November 2024. Feedback from the participants was considered while preparing the final version of the report.

## Stroke epidemiology across the WHO European Region and in Ukraine

According to the GBD estimates, the absolute number of incident strokes increased by 2% in the 53 countries of the WHO European Region in 2019 compared with 2010 (1 802 559 vs 1 767 280 new cases), while the absolute number of incident strokes remained stable in the 27 member countries of the European Union (EU), plus the United Kingdom *(5)*.

In 2021, stroke caused 10.7% of total deaths and 5.6% of total DALYs in the Region *(1)*. The highest stroke burden in terms of age-standardized incidence, prevalence, DALYs and mortality has been observed in central Asia, followed by eastern Europe. In the latter, stroke incidence and mortality are up to three times as high as in western Europe. The age-standardized incidence of stroke has been declining in western European countries, possibly due to improvements in stroke prevention strategies, better management of vascular risk factors such as hypertension and diabetes, and advancements in acute stroke care *(6)*.

A subregions analysis in the WHO Region showed that the highest absolute number of incident strokes in 2019 occurred in eastern Europe (629 928 cases), followed by western and central Europe *(5)*. From 2010 to 2019, the number of prevalent strokes increased by 4% with 14 261 365 prevalent cases in 2019 *(5)*. Acute ischemic stroke (AIS) accounted for about 70% of incident strokes, while intracerebral haemorrhage (ICH) and subarachnoid haemorrhage (SAH) accounted for 18% and 12%, respectively *(5)*. In 2019, there were 176 328 deaths due to stroke in the European Region. Although the total number of stroke-related deaths remained stable between 2010 and 2019, the number of DALYs decreased by 7% (from 22 043 161 in 2010 to 20 501 446 in 2019) *(5)*. Between 2017 and 2047, the absolute count of stroke events in the EU is projected to rise by 3% (from 1.12 to 1.16 million), and stroke survivors by 27% (9.53 to 12.11 million) *(7)*. At present, significant disparities in stroke deaths attributable to risk factors exist throughout the European Region. An east-west gradient exists in stroke epidemiology, as well as discrepancies in stroke burden across Europe, with age-standardized death rates in Bulgaria, Croatia, Hungary, Latvia, Lithuania, Romania, Serbia and Slovakia being seven times higher than in Austria, Belgium, France, Luxembourg and Spain *(8)*. Unequal access to specialized stroke care services parallels the east-west epidemiological gradient, increasing the social, health and financial burden of cerebrovascular diseases in the Region.

Ukraine has one of the highest stroke incidences and mortality rates in the Region. According to the recent GBD estimates, in 2021, there were 134 283 new strokes, 82 352 deaths from stroke and 1 631 824 DALYs lost due to stroke. Overall, stroke mortality rates in Ukraine were estimated as being 10–17% higher than in the EU *(5)*.

In Ukraine, along with high prevalence and poor control of vascular risk factors, other conditions could have contributed to the increasing stroke burden, such as the impact of the ongoing war. For populations experiencing conflicts and complex emergencies, this is associated with accelerated ageing, increased health issues and higher mortality rates among people with cardiovascular and cerebrovascular diseases *(9)*. People living near combat zones are at greater risk for cardiovascular diseases (CVD): this population presents a greater risk of developing heart attack, stroke, high blood pressure and high cholesterol, as well as increased consumption of tobacco, alcohol and other psychoactive substances *(10)*.

The impact of the ongoing war on CVDs and CVD risk factors in Ukraine has already been documented. The conflict and its consequences have affected the structure and dynamics of the course of chronic health conditions such as high blood pressure and hypertension and have increase the impact of risk factors such as high tobacco and alcohol consumption, high salt intake, and low fruit and vegetable intake, which were already prevalent in the population *(11,12)*. There is evidence of an increase in patient referrals for hypertensive crises, exacerbations of type 2 diabetes and smoking addiction treatment *(13)*. This goes hand in hand with the reduced availability of medical care caused by the destruction of medical infrastructure, interruptions in the supply of medicines resulting in gaps in treatment, lack of health workforce, a high level of population movement and the loss of medical documentation, which creates difficulties in obtaining consultations and treatment for displaced people *(13)*.

# Organization of stroke care

Globally, stroke care has significantly changed over the last 30 years. Access to appropriate services and treatment has improved patients' prognosis in terms of survival rate and reduction of disability, improving the quality of life of stroke survivors. Large, randomized clinical trials have provided a strong evidence base for treatments and approaches that have led to such improvements, including *(14–20)*:

- the treatment of stroke in a stroke unit
- intravenous thrombolysis (IVT) with alteplase in AIS
- hemicraniectomy for malignant cerebral infarction
- endovascular thrombectomy (EVT) in AIS due to large artery occlusion
- antihypertensive drugs for secondary prevention in all strokes
- antiplatelet therapy or oral anticoagulants along with lipid-lowering for secondary prevention after AIS
- carotid surgery for high-grade symptomatic carotid stenosis
- access to the rehabilitation services, in both inpatient and outpatient settings.

These evidence-backed treatments are integrated into WHO's Tackling NCDs: best buys and other recommended interventions for the prevention and control of noncommunicable diseases *(21)*.

## Stroke care hospital network

Ukraine's professional approach to organizing stroke care has changed significantly over the past decade, shaped by modernization trends and global best practices.

Because historically, stroke care was fragmented and lacked standardized protocols, but recent reforms have led to more coordinated and evidence-based services. For instance, before 2020, only 60–70% of stroke patients were hospitalized; drugs for IVT were not reimbursed; and diagnostic capabilities were limited — as a result of which, neuroimaging was performed in just a fraction of cases within 1–7 days from the onset *(22)*. The utilization of thrombolysis for AIS was hampered by a lack of rapid detection, urgent admission to the appropriate hospital and timely neuroimaging. For example, in 2016, only 306 IVT procedures were performed at 41 hospitals across Ukraine. Other barriers include the lack of medicines reimbursement, necessary decision-making skills, treatment standards and clear patient pathways.

Since 2016, the MoH, academia and professional associations have undertaken several national initiatives to enhance stroke care, expand and strengthen acute stroke services, improve national guidelines and implement best practices.

Acute stroke care services were identified among the five top priorities of the Programme of Medical Guarantees (PMG) launched by the Government of Ukraine on 1 April 2020. Since then, health-care facilities that offer stroke care have been transitioning into contractual relations with the NHSU. In 2020, the NHSU contracted 191 hospitals, which claimed to comply with the package-specific requirements of minimal criteria for stroke care. The number of stroke-contracted facilities has been changing every year: 249 in 2021, 258 in 2022, 232 in 2023, and 227 in 2024 *(23)*.

It is of note that the number of hospitals contracted by the NHSU for acute stroke care has decreased since the start of the war. Some facilities were damaged, and others remain in areas beyond/not under the control of the Government of Ukraine.

In 2023–2024, the MoH and NHSU made considerable efforts to develop and strengthen the stroke care network nationwide, ensuring the equal geographical distribution of stroke-contracted health-care facilities. This network was incorporated into the pre-hospital care provided by the emergency medical services (EMS), which committed to delivering patients within a 60-minute timeframe to the closest stroke-ready hospital.

There are two recent regulatory acts to be noted here:

- Cabinet of Ministers of Ukraine Resolution No. 174 of 28 February 2023, "Some issues of organizing a capable network of health-care institutions" *(24)*. This reform led to the creation of hospital districts in each region. Each region was divided into clusters, and the hospital system was restructured into three levels: 1) general hospitals — intended to be located close to where people live and to treat common, uncomplicated conditions; 2) cluster hospitals — handle more complex cases; and 3) above-cluster hospitals — provide highly specialized multidisciplinary medical care and treat the more serious or complicated cases.
- MoH Order No. 1091 of 15 June 2023, "On approval of the procedure for organizing the provision of medical care to patients with acute cerebral stroke" *(25)*: which facilitated the adoption of stroke patients' routing and coordination with EMS. According to this regulation, the regional departments of health, while establishing the regional stroke network, must only select health-care facilities with a specialized stroke department, and 24-hour access to neuroimaging, necessary blood tests, bedside monitoring and IVT, while patients could be referred to other facilities for EVT and open neurosurgical procedures.

As of the end of 2023, 562 institutions were included in the capable network of health-care facilities in 19 oblasts: 123 upper-cluster, 157 cluster and 282 general hospitals *(26)*. In 2024, 227 health-care facilities were contracted with the PMG package "Medical care for acute stroke" (hereafter the "stroke package"), and the average number of NHSU-contracted stroke hospitals per 1 million population was six or more.

By the end of 2024, the MoH, in collaboration with local administrations, was authorized to approve facilities in the stroke care hospital network based on several criteria, such as target indicator achievements, the availability of stroke care treatments such as EVT and IVT, the availability of rehabilitation services, geographical accessibility and others.

## Stroke care NHSU package

In 2024, nearly 97% of all stroke patients were treated in hospitals contracted by the NHSU to treat stroke. Since 2023, to obtain a stroke care contract within the PMG, hospitals have had to check the requirements listed for the stroke package and submit the application with all necessary documents and a valid licence to the NHSU. The basic requirements of the stroke package include the following *(27)*:

- neuroimaging available 24/7
- neurologist/neurosurgeon available 24/7
- intensive care available 24/7
- (at least) four monitored beds with oxygen access

- capability to deliver IVT
- availability of rehabilitation services.

In 2024, of 227 contracted hospitals, 44 providers declared their eligibility to comply with the additional requirements of the so-called "stroke package +", such as EVT capabilities, and were able to claim additional funds for these services.

In 2025, the NHSU obliged all contracted hospitals to comply with two pre-set indicators: the number of treated patients — not less than 70 — and the volume of thrombolytic therapy — not less than 2% of all cases of AIS in the six months from 1 April to 30 September 2024. A few exemptions for this criterion were set for hospitals in organizational transition in 2025 *(28)*.

The contractual procedure for hospitals is based on the "self-declaration" principle. Thus, regular compliance checks, quality monitoring and potentially clinical audits should be employed to ensure the quality of services.

The stroke package is considered financially attractive for health-care facilities, and the NHSU processes reimbursements for each treated case based on diagnosis-related groups; tariffs for 2024 are shown in Table 1 *(29)*. Recently, NHSU officials declared that all types of stroke care provided in health-care facilities without a stroke package would not be reimbursed in 2025 and onwards, but the report's authors have not been able to find any confirmation of this decision in official publications.

**Table 1. Tariffs for services within the stroke package in 2024 (in Ukrainian hryvnias, euros and US dollars)[a]**

| Type of stroke care | Ukrainian hryvnia | euro | US dollar |
|---|---|---|---|
| Basic care | 15 643 | 343.6 | 379.7 |
| Basic care + IVT | 62 565 | 1374.5 | 1518.6 |
| Basic care + EVT +/- IVT | 131 472 | 2888.2 | 3191.1 |

[a] *Exchange rates as of 1 December 2024, according to the National Bank of Ukraine (30).*

*Source: NHSU, unpublished data, 2024.*

## Standards of stroke care

Ukraine has also improved its regulatory framework for stroke care networks and its national clinical guidelines. In June 2024, the MoH finalized, adopted and published Стандарт медичної допомоги «Ішемічний інсульт» [Standard of medical care for ischemic stroke], which provides clinicians and health service managers with a new tool containing updated recommendations, clinical scales and protocols that are useful in the daily clinical management of patients with stroke *(31)*. Together with two other key national standards, this creates up-to-date, evidence-based national guidelines for stroke management that need further promotion and dissemination. Also, the standards laid the ground for revising the PMG stroke package, enabling target indicators to be established for contracted hospitals. However, application of those guidelines leaves much to be desired, as revealed by the recent monitoring of stroke care hospitals.

The above-mentioned standards do not include rehabilitation service delivery, as, by law, standards on rehabilitation care and protocols for rehabilitation in health care are distinct

types of legislation *(32)*. Thus, two separate PMG rehabilitation packages were developed and introduced in 2024, enabling further progress towards the growth of rehabilitation infrastructure and benefiting stroke patients.

Since 2015, national and international stakeholders have implemented a few quality improvement projects in Ukraine to develop and improve stroke care services, enhance educational activities and implement evidence-based stroke guidelines and best practices. These initiatives also supported the overall transformation of Ukraine's health-care sector, initiated in 2017 and fully rolled out by 2021. However, due to the COVID-19 pandemic, followed by the start of the war, significant challenges have been posed to the realization of these reforms.



Photos of stroke care unit facilities in Ukraine.

# 2. Methodology

A group of WHO experts collected and reviewed relevant policies, activities and available data to assess the current situation for acute stroke care in Ukraine. An aggregate data set was received from e-Health, the NHSU centralized database. The data contained information from health-care facilities contracted by the NHSU for any service package, including the stroke package. To retrieve acute stroke cases in the e-Health database, the authors used the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) codes (Table 2). E-Health data concerning the following were aggregated and analysed: number of admissions, age, sex, stroke type, disability at discharge, discharge destination mortality, and coverage by relevant stroke interventions for 2021, 2022, 2023 and the first and second quarters of 2024. Descriptive statistics were created using Microsoft Excel. Further correlation analyses were conducted using IBM SPSS Statistics: (i) a chi-squared test; and (ii) an independent samples t-test.

**Table 2. ICD-10 stroke codes**

| ICD-10 code | Description |
|---|---|
| I60 | Nontraumatic subarachnoid haemorrhage |
| I61 | Nontraumatic intracerebral haemorrhage |
| I62 | Other and unspecified nontraumatic intracranial haemorrhage |
| I63 | Cerebral infarction |
| I 64 | Stroke, not specified as haemorrhage or infarction |
| G45 | Transient ischemic attack |

*Source: NHSU (2023) (27).*

# 3. Findings

## The burden of stroke on the health-care system

The burden of stroke on the health-care system in Ukraine increased, whereas the population dropped between 2021 and 2024. The demographic situation in Ukraine has lately dramatically worsened, demonstrating the impact of war (Fig. 1) *(33)*. In 2023, the number of acute stroke admissions was 13% higher than in 2021 (133 981 vs 118 477 cases), with nearly equal sex distribution (Table 3). However, information from the temporarily occupied territories has not been available since 2022.

The proportion of cases admitted to contracted health-care facilities has been rising since 2021; in the first six months of 2024, 96.6% of cases were admitted to health-care facilities contracted by the NHSU for the stroke package within the PMG (Table 3). The proportion of patient admissions to hospitals contracted by the NHSU for acute stroke care is one indicator used to assess accessibility of medical services, quality of stroke care and health outcomes. The report highlights this positive development, which shows the success of the MoH and NHSU strategies to improve and consolidate the stroke care network. This development also demonstrates the operability of the locally adopted patient pathways and coordinated routes for patients with suspected acute cerebrovascular events, as well as their correct referral to contracted health-care facilities with prehospital stroke care.

**Table 3. Hospital admissions with acute stroke to all health-care facilities in 2021–2024**

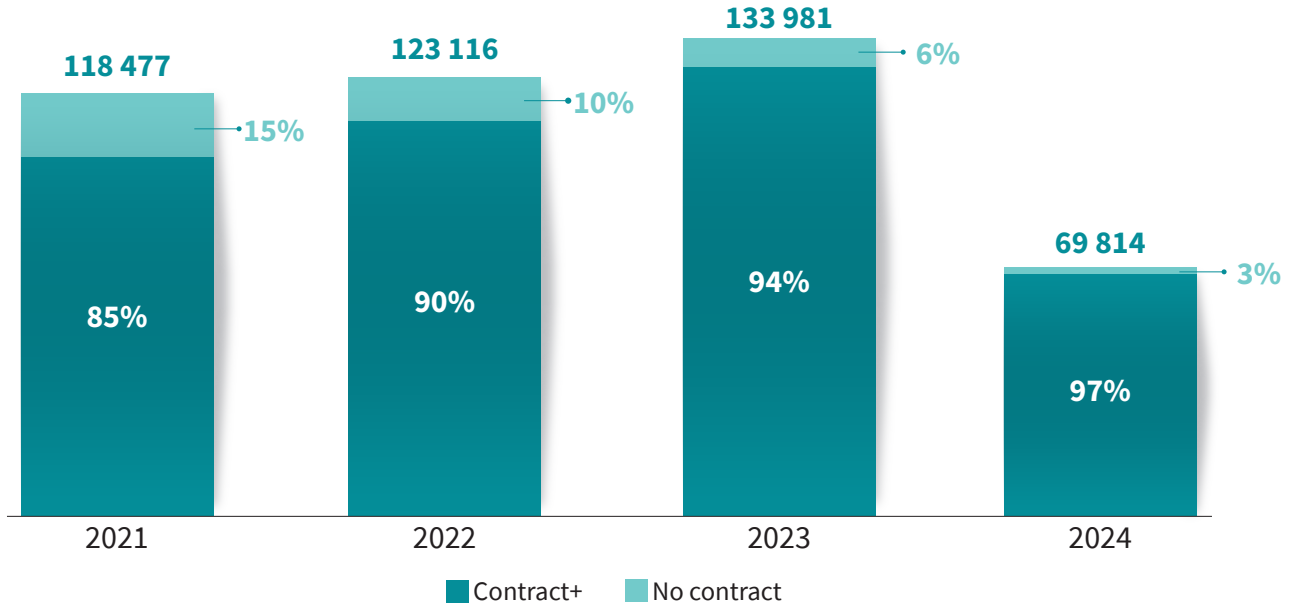
| Stroke type (ICD-10 code) | 2021 | 2022 | 2023 | 2024[a] |
|---|---|---|---|---|
| All acute strokes (I60–64) | 118 477 | 123 116 | 133 981 | 69 814 |
| Acute ischemic stroke (I63) | 99 862 | 105 161 | 115 061 | 60 005 |
| Intracerebral haemorrhage (I61) | 13 625 | 13 774 | 15 261 | 8 069 |
| Subarachnoid haemorrhage (I60) | 2 252 | 2 182 | 2 187 | 1 129 |
| Undifferentiated stroke (I64) | 2 439 | 1 704 | 1 139 | 452 |
| Cases admitted to health-care facilities with a contract for the stroke package, % | 85 | 90 | 94.4 | 96.6 |

[a] *Data for the first six months of 2024.*

*Source: NHSU, unpublished data, 2024.*

A positive trend in hospitalizations to designated hospitals is also visible in Fig. 1.

**Fig. 1. Acute stroke admissions by contractual status of health-care facilities, 2021–2024**




*Source: NHSU, unpublished data, 2024.*

Despite the positive trend illustrated above, many patients were still admitted to health-care facilities without an NHSU contract, which is not crucial but requires further investigations into the reasons why. In 2024, the NHSU was still reimbursing hospitals' claims for treating stroke patients within other PMG packages, and a decision should be made on whether to stop this practice.

Another key metric of stroke care services is the "mode of arrival" of patients with suspected stroke to health-care facilities. Under-recognition or delays in recognition of stroke symptoms are consistently identified as one of the leading causes of pre-hospital delays in care as they impact the patients' understanding of the need to call EMS, and thus lead to poor clinical outcomes *(34)*.

Since 2023, information on "mode of arrival" to hospital has been available in the e-Health database. It shows that in 2023, 78.5% of stroke patients admitted to contracted hospitals were delivered by EMS, whereas only 38% of patients admitted to non-contracted hospitals were delivered by EMS. Only 3.2% of the patients admitted to contracted hospitals had been referred by family physicians compared with 16% of patients admitted to non-contracted hospitals. This shows a deep discrepancy in the "mode of arrival" metric between the established stroke care network (contracted hospitals) and other hospitals that admitted stroke patients and may question the referral practice in the given facilities or regions. Experts suggested that this picture demonstrates that non-contracted hospitals tend to accept and treat "minor" strokes. Another explanation is that such hospitals were still able to receive reimbursements for such cases from the NHSU.

## Stroke service performance: acute stroke treatment

The numbers and rates of both revascularization procedures, IVT and EVT, have remarkably increased in the last four years. Rates for IVT increased from 4.6% of AIS cases in 2021 to 11.3% in 2024; rates for EVT increased from 0.3% in 2021 to 2.0% in 2024 (Table 4, figures 2, 3 and 4). Importantly, the target indicator for 2% of AIS cases to be treated by EVT is included in the PMG stroke package for 2025, which should provide sustainability for this positive trend. These

rates also suggest that Ukraine is likely to meet the SAP-E indicators in coming years, which is a significant achievement considering the emergency situation.

Revascularization procedures, such as IVT and EVT, are considered the desired standard of care in AIS, as they significantly improve short-term and long-term functional outcomes. IVT and EVT utilization (the number of procedures and speed of delivery) are well-acknowledged performance indicators and quality metrics of acute stroke services in all hospitals admitting acute stroke patients.

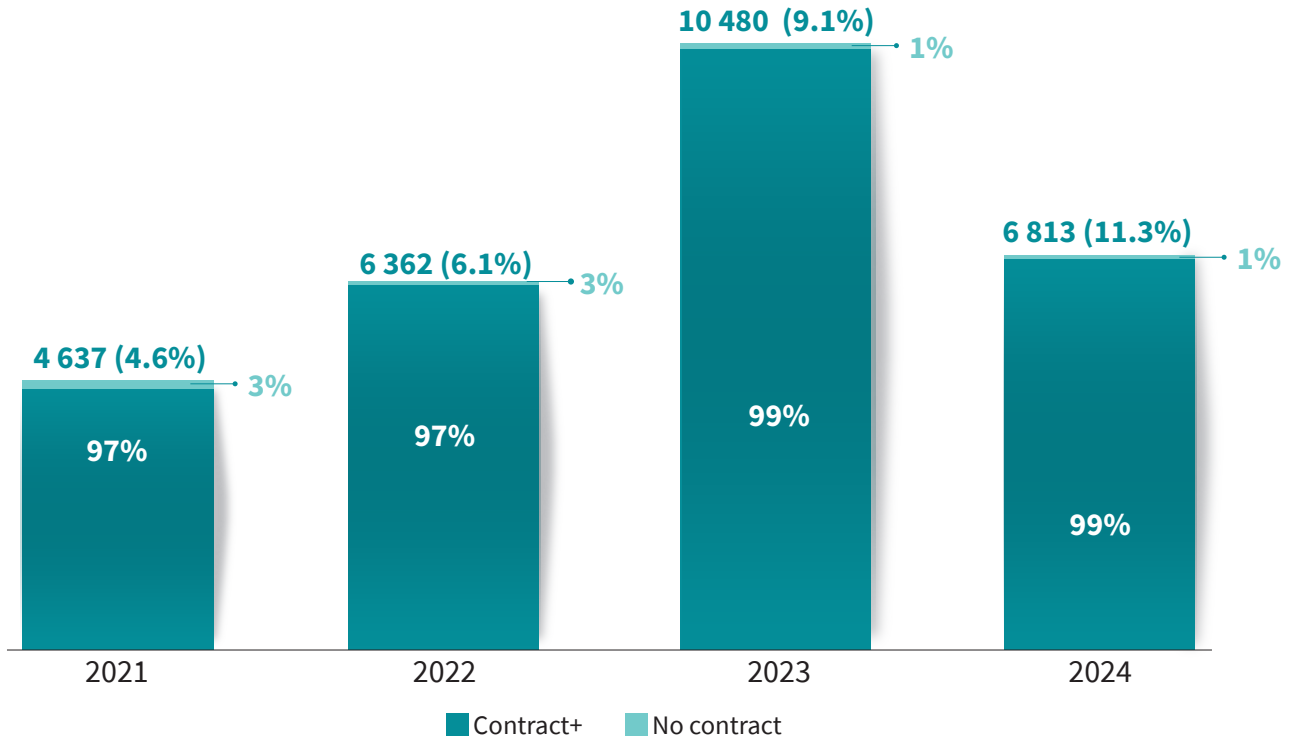
**Table 4. Revascularization procedures in AIS, 2021–2024**

| Number of revascularization procedures | 2021 | 2022 | 2023 | 2024[a] |
|---|---|---|---|---|
| Number of IVT | 4 637 | 6 362 | 10 480 | 6 813 |
| – the proportion of AIS cases treated with IVT | 4.6% | 6.1% | 9.1% | 11.3% |
| Number of EVT | 311 | 661 | 1 476 | 1 213 |
| – the proportion of AIS cases treated with EVT | 0.3 % | 0.6 % | 1.3% | 2.0% |
| Number of IVT + EVT | 127 | 260 | 425 | 311 |

[a] *Data for the first six months of 2024.*

*Source: NHSU, unpublished data, 2024.*

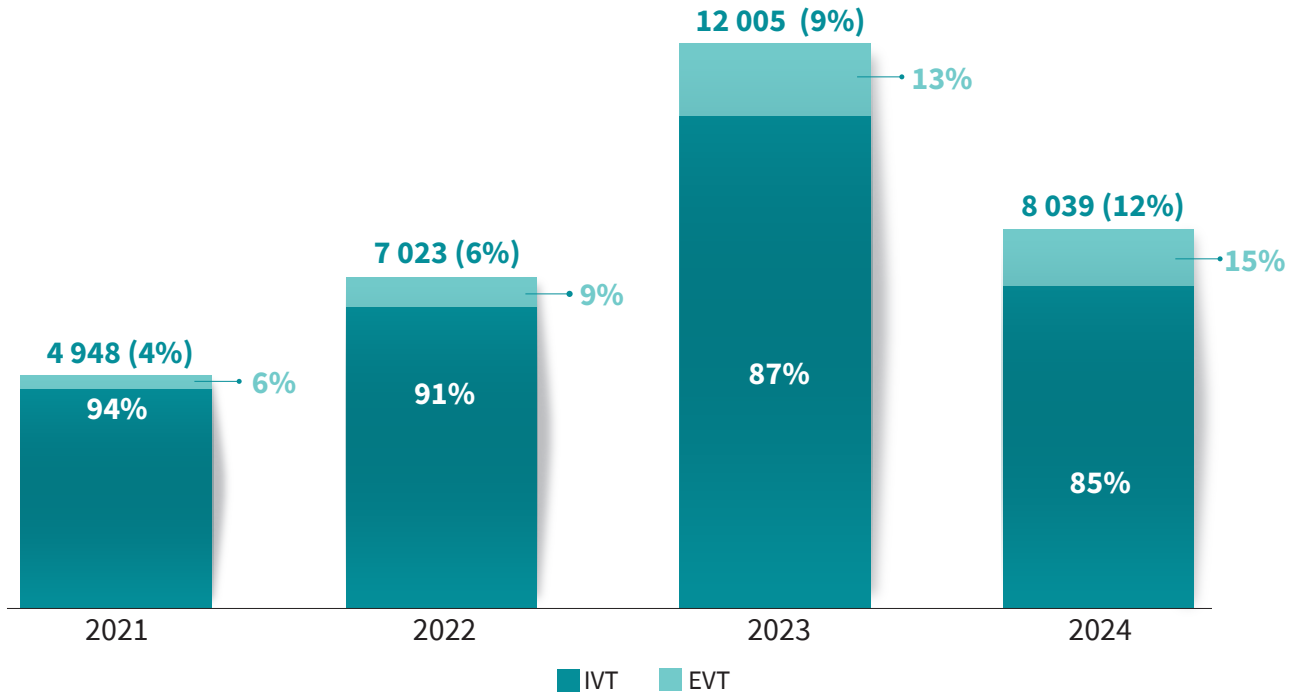
**Fig. 2. Total number of thrombolysis procedures per year, by contractual status of health-care facility, 2021–2024**




*Note: (%) refers to the proportion of ischemic strokes treated with IVT.*

*Source: NHSU, unpublished data, 2024.*

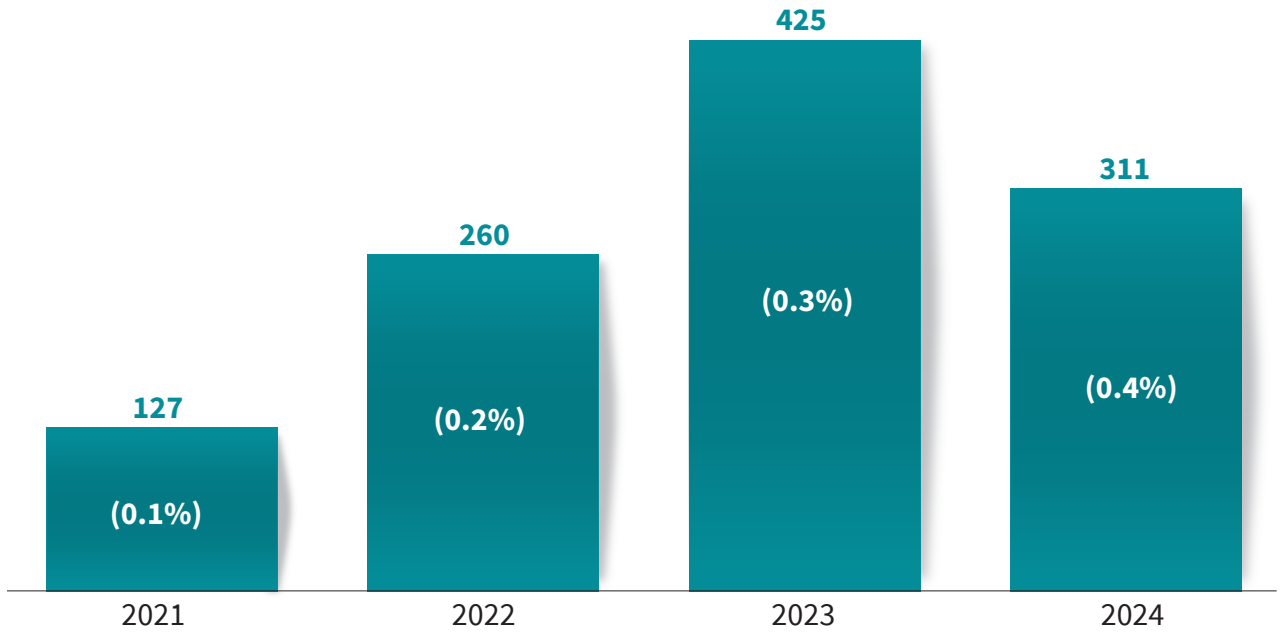
**Fig. 3. Total number that received either IVT or EVT, 2021–2024**




*Note: (%) refers to the proportion of acute ischemic strokes treated with either IVT or EVT.*

*Source: NHSU, unpublished data, 2024.*

**Fig. 4. Total number of thrombolysis plus thrombectomy procedures per year, 2021–2024**




*Note: (%) refers to the proportion of acute ischemic strokes treated with both IVT and EVT.*

*Source: NHSU, unpublished data, 2024.*

# Stroke service performance: rehabilitation and destination at discharge

There is a stable positive trend of increased access to inpatient rehabilitation services, at least during the subacute rehabilitation phase after discharge from acute stroke settings, rising from 4.8% in 2022 to 13.4% in 2024. The previous WHO report from 2024 found low access to rehabilitation services across all stages *(4)*.

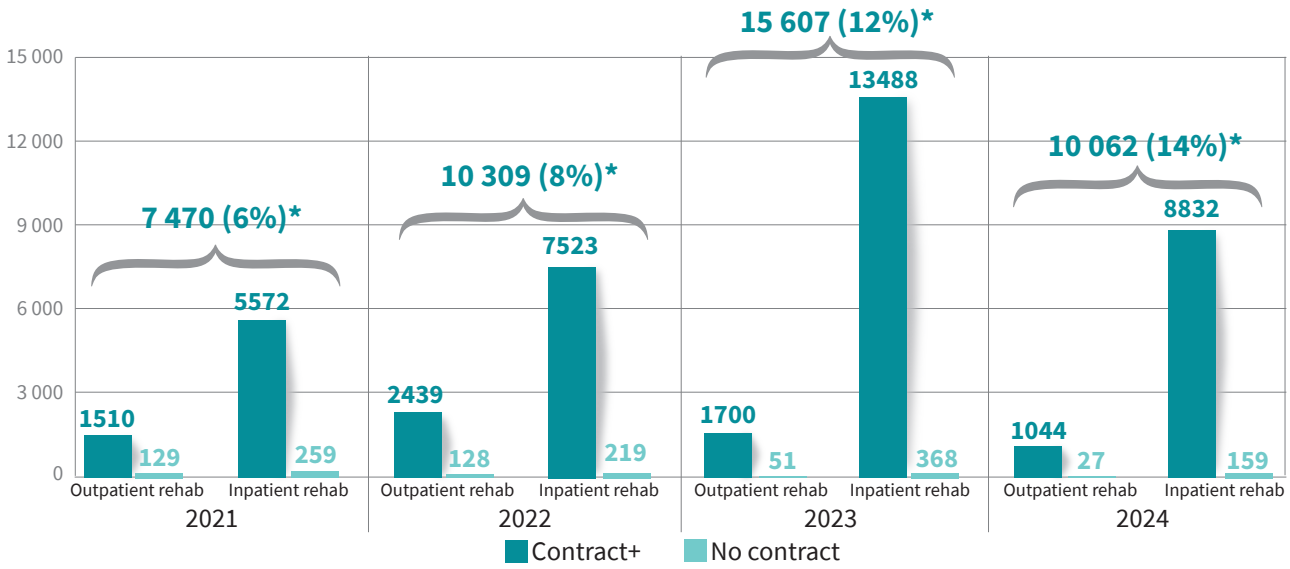
Stroke rehabilitation is a core component of the comprehensive rehabilitation system currently being developed in Ukraine. It is integrated into the hospital network and delivered during acute and subacute rehabilitation phases by rehabilitation professionals employed in non-specialized inpatient rehabilitation departments at the same hospitals. Since 2023, separate inpatient and outpatient rehabilitation packages, including rehabilitation for stroke during the subacute phase, were introduced in the PMG. The NHSU requirements for contracting health-care facilities for the stroke package include the provision of early rehabilitation.

According to eHealth data, subacute inpatient rehabilitation was provided to 4.8% (5727/118 477) of hospitalized stroke patients in 2021, 6.2% (7661/123 116) in 2022 and 10.3% (13 748/133 981) in 2023. In the first six months of 2024, 12.8% of stroke patients (8939/69 814) benefited from such inpatient and outpatient services.

This notable growth trend demonstrates the increasing access of patients to stroke-related rehabilitation services and better functioning stroke rehabilitation pathways. In particular, better referrals from acute to subacute rehabilitation and use of rehabilitation service packages in PMG were observed.

However, less optimistic data concerns outpatient rehabilitation outside the inpatient setting after discharge. This service was provided for just 1.4% (1609/118 477) of acute stroke cases in 2021; 2.1% (2544/123 116) in 2022; 1.3% (1737/133 981) in 2023; and 1.5% (1062/69 814) in the first half of 2024 (Fig. 5). It is noteworthy that data on disability measured with the modified Rankin scale has been recently introduced, and it is available only for 2023 and the first six months of 2024.

**Fig. 5. Access to rehabilitation services, 2021–2024**




*Note: (%) refers to the proportion of AIS cases that received rehabilitation; total per year may not align with the distribution by contract type due to the data verification process.*

*Source: NHSU, unpublished data, 2024.*

In general, the positive trend of a nearly three-fold increase in inpatient rehabilitation services provided for stroke patients demonstrates a significant step forward; however, access to rehabilitation remains limited. According to eHealth data, out of 227 health-care facilities with stroke package contracts in 2024, 137 (60.3%) had a contract for an inpatient rehabilitation package, 143 (62.9%) had a contract for an outpatient rehabilitation package, and 125 (55.0%) had contracts for both in- and outpatient rehabilitation packages.

## Evaluation of outcomes: mortality and disability at discharge

Both in-hospital and 30-day mortality rates for stroke patients remained high and unchanged in 2021 – 2024. Evaluation of clinical outcomes is critical to ensuring the quality of stroke care. Stroke mortality and disability are essential measures to ensure sustainable, evidence-based care (Table 5).

**Table 5. In-hospital and 30-day stroke mortality, 2021–2024**

| Stroke type (ICD-10 code) | In-hospital mortality, % | | | |
|---|---|---|---|---|
| | 2021 | 2022 | 2023 | 2024[a] |
| – all acute strokes (I60–I64) | 17.5 | 17.3 | 16.5 | 16.9 |
| – AIS (I63) | 14.2 | 14.2 | 13.6 | 13.9 |
| – ICH (I61) | 37.3 | 37.8 | 37.0 | 36.9 |
| – SAH (I60) | 20.2 | 20.2 | 21.3 | 24.4 |
| – undifferentiated stroke (I64) | 39.5 | 35.4 | 28.6 | 32.5 |
| 30-day mortality, % | 25.3 | 24.5 | 24.0 | 24.0 |

[a] *First six months of 2024.*

*Source: NHSU, unpublished data, 2024; WHO Ukraine analysis.*

# 4. Discussion

## The increasing burden of stroke

The burden of stroke on the health-care system in Ukraine is increasing, whereas the population has decreased since 2021. Compared with GBD estimates of the number of acute strokes (134 283 cases), the official number of stroke admissions in Ukraine in 2021 was 12% lower (118 477 cases). This may indicate that 10–15% of stroke patients are not admitted to hospital. Furthermore, the war caused a significant loss of the population of Ukraine through the dramatic outflow of refugees (estimated currently at 5–7 million) and people who live in temporarily occupied territories. According to the World Bank, the population of Ukraine in 2023 was estimated at 37.7 million *(35)*. With 133 981 acute stroke admissions in 2023, stroke incidence in Ukraine was 362.1 per 100 000 population of all ages, which is significantly higher than in most European Region countries. This could reflect a current increase in CVD burden in the population related to the war, as has been recently demonstrated by an epidemiological study, where the authors observed an increasing trend in stroke admissions since 2020, with a notable 22.4% increase in 2023, mainly due to ischemic stroke occurrence *(36)*.

The findings of this report showed an increase of 13% in stroke admissions between 2021 and 2023, which may represent both positive and alarming trends. Moreover, in 2023, the total number of hospitalizations with stroke in Ukraine was 30% higher than in 2021*(37)*. There are several possible explanations for this situation. The stroke burden has increased due to a combination of factors directly linked to the ongoing war, and those typical for stroke burden including: (i) financial barriers that may limit peoples' access to chronic cardiovascular disease treatment; (ii) delays in NCDs treatment and poor NCD management; (iii) low stroke awareness and symptom recognition; (iv) a negligent attitude towards personal health; and (v) constant stress, anxiety and an overall increasing mental health burden. There are also real concerns about possible data management fraud at health-care facilities, as the stroke package remains financially attractive to the managers of health-care facilities. At the same time, some positive progress has been made, including better patient referrals and routing, enhanced coordination between pre-hospital and in-hospital systems, the establishment of clear and sustainable financial incentives for hospitals and better preparedness to provide treatment.

There is a growing body of evidence that armed conflict is associated with increased coronary and cerebrovascular diseases primarily due to elevated blood pressure and cholesterol, higher alcohol consumption and tobacco use, as well as psychosocial stress (38,39). This is one of the significant contributing factors to increased stroke incidence during wartime, as both acute and chronic stress independently contribute to stroke pathogenesis by dysregulating the sympathetic nervous system and fostering unhealthy behaviours that generate stroke risk factors. Post-traumatic stress disorder, or the psychological response to trauma exposure, acts as a chief mediator of the relationship between wartime service, trauma exposure and cardiovascular conditions, including stroke, especially in women (9,39,40). Therefore, understanding the direct negative impact of war-related psychological stress on cerebrovascular health and assigning early mental health treatment to affected individuals are important aspects of stroke prevention.

## Progress in stroke care services


Panel discussion of stroke care network during the Technical Meeting “Reducing the burden of stroke in Ukraine: focus on improving quality and outcomes” (November 6, 2024, Kyiv, Ukraine).

In the face of the ongoing war, significant progress has been made in Ukraine concerning stroke care services. This has been achieved through a variety of means, including: the operational functioning of the PMG and the stroke package in particular; systemic work on stroke care network establishment and improvements; adoption of modernized stroke care national standards and protocols; and an increasing number of evidence-based AIS treatment procedures (IVT and/or EVT). Remarkably, the rate of IVT in AIS in Ukraine has recently exceeded 11% and become close to the mean European Region rate of about 14% recently reported in the SAP-E Stroke Service Tracker data *(41)*. However, the rate of both revascularization procedures has remained very low (below 1%), although it is variable across the country.

The stable growth of the IVT and EVT rates is likely to reflect the progress made in financing the acute revascularization procedures and enhancing diagnostic capabilities of health-care facilities. This might be attributable to both MoH and NHSU efforts, such as the implementation of evidence-based national medical standards of care and continuing educational activities provided by national professional associations in collaboration with international organizations like WHO, the World Bank, ESO and others.

## Positive treatment outcomes remain illusive

The above-mentioned positive findings should lead to positive health and treatment outcomes, which is still not the case in Ukraine, where in-hospital and 30-day mortality remain stable, and rehabilitation is difficult to access. In this situation, the joint launch in 2024 of a quality monitoring instrument by the MoH and WHO is timely. The pilot clinical audit conducted in May–June 2024 showed that there were regions where EVT was unavailable, and up-to-date stroke care was not fully implemented in routine clinical practice. The low rate of EVT is probably due to a lack of health-care facilities capable of endovascular treatment, a lack of professional workforce and a failure to select and refer the patients to EVT-capable health-care facilities. This highlights the drawbacks of the established stroke care network, which needs constant improvement to eliminate the fragmentation of care. Coordination of care across stroke care providers is a complex process requiring focused attention and improvements. It impacts, for instance, timely access to complex medical procedures such as EVT. Service providers might not be incentivized to refer admitted patients to other health-care facilities with better stroke care capacities. Once a patient is admitted to a hospital, it then receives funding from the NHSU for the treatment provided according to the tariffs. Therefore, if a patient were eligible for EVT, the facility would rather have the incentive to retain the patient than to refer them to health-care facilities with endovascular procedure capability. This issue may lead to fragmented services and suboptimal success in appropriate care, and requires strengthening of governance and care models.

The clinical audit also revealed inadequate staffing in many of the health-care facilities visited, even though these facilities declare full staff availability as required by the NHSU stroke package. This often may be due to either a shortage of doctors of certain specialties or too many health-care facilities included in the network in one geographical region. There is a significant deficit in nursing staff nationwide, as highlighted in a recent WHO report *(42)*; however, this workforce issue was not specifically addressed in the pilot clinical audit and merits further research.

## Cooperation and coordination with the EMS

Effective cooperation and coordination with the EMS in managing the stroke network have been recently reviewed and improved. However, the war and its consequences may impact the implementation, especially in areas near the front line. Regular monitoring of the cooperation mechanisms between health-care facilities and the EMS would benefit the system. In implementing a series of stroke quality-of-care improvement activities and exploring the feasibility of clinical audits in stroke care, the MoH with its partners has laid a foundation to continue crucial quality assessment work. In April–June 2024, the MoH selected experts and, with technical support from WHO, conducted a pilot clinical audit that allowed the collection of stroke care quality-related data from over 50 health-care facilities in six regions of Ukraine. The project's outcomes were turned into regional action plans to improve quality of care and were disseminated to regional health-care departments. This enabled internal structural changes in the selected regions and improved the understanding of the local authorities of the stroke network development approach.

## Shortcomings in reporting and coding in acute stroke

IVT procedures, and more rarely EVT (and even both), were reported not only for AIS (ICD-10 code I63) but also for other conditions, such as SAH (ICD-10 code I60), ICH (ICD-10 code I61), undifferentiated stroke (ICD-10 code I64) and TIA (ICD-10 code G45). Since it seems very unlikely that ICH and SAH were actually treated with IVT, two explanations are possible for this: (i) the patient with AIS treated with IVT had a post-thrombolytic haemorrhagic complication (ICH, SAH or both); or (ii) it was a coding error. In addition, according to Ukrainian legislation, the ICD-10 codes used to refer to acute stroke events should be updated to ensure compliance with ICD-10 guidelines and international practice (e.g. the ICD-10 code I62 is unlikely to represent acute stroke, and ICD-10 code I67.6 (Nonpyogenic thrombosis of intracranial venous system) is redundant as it is covered by ICD-10 code I63.6 (Cerebral


A debriefing on stroke care after a monitoring group visit to a hospital, June 2024.

infarction due to cerebral venous thrombosis, nonpyogenic) and should thus be excluded) (5,43). Thus, accurately identifying the major types of stroke using coded administrative data is essential for various administrative and economic purposes. ICD-10 coding quality is crucial, and actions to assist ICD-10 coders in elevating their work efficiency and quality would be useful.

Despite massive efforts to improve acute medical care for stroke, functional outcomes of stroke survivors and their return to independent life in the community and, ultimately, remunerative employment, fully depended on the availability and quality of rehabilitation services. Such therapies should be started as early as possible during the acute rehabilitation phase and continued across the subacute rehabilitation phase in both in- and outpatient settings, followed by community-delivered rehabilitation through the long-term rehabilitation phase.

To enable the above, more regulatory actions are needed, in particular, organizing effective and evidence-based acute rehabilitation services at stroke units in NHSU-contracted hospitals. This should be followed by mandatory referrals to subacute rehabilitation services (in-/outpatient/community-delivered) or long-term services (e.g. nursing care) tailored to the person's functioning status upon discharge from the stroke unit.

Additionally, the provision of assistive technologies, starting from the acute rehabilitation phase, is an essential component of rehabilitation care, and gaps must be addressed in this during the acute rehabilitation phase and upon discharge from the in-hospital rehabilitation service. A number of solutions for further implementation via regulations, such as linking the stroke package with rehabilitation packages and implementing stroke-specific functional assessment tools across both in- and outpatient rehabilitation packages are being discussed and considered by policy-makers. The introduction of rehabilitation pathways for stroke patients was also among the topics discussed during the technical meeting on stroke, "Reducing the burden of stroke in Ukraine: improving quality and health outcomes", in 2024.

## The role of rehabilitation in improving outcomes and quality of life

Along with acute stroke care, rehabilitation plays a major role in improving stroke outcomes and the quality of life of stroke survivors. In patients with limitations in activities related to daily living, rehabilitation should be started in the acute setting and continue through subacute and long-term rehabilitation phases. All patients disabled after a stroke should be referred to subacute rehabilitation services or long-term care facilities. Developing comprehensive national guidelines and protocols for post-stroke rehabilitation will help enhance quality and ensure better outcomes.

## Behavioural and metabolic risk factors

Although not fully addressed in the report, stroke behavioural and metabolic risk factors have a direct impact on the increasing epidemiological trend and poor treatment outcomes. For example, based on a recent Health Index report, 25% of Ukrainians had been diagnosed with hypertension, but only 66% of these patients regularly take the prescribed medications; nearly 4% of the population stated that they had had a stroke *(44)*. Moreover, pre-war data from the STEPS 2019 study highlighted that over a quarter of the population (27.7%) had been informed by health-care workers that they had raised blood pressure or hypertension *(12)*. Adding tobacco and alcohol consumption, poor diets and high body mass index among the adult population as risk factors contributing to stroke occurrence, stroke prevention measures should be highly prioritized.

# 5. Conclusions

The report highlights the progress made in organizing and delivering medical care for acute stroke in Ukraine following the implementation of the PMG. Overall, access to and the quality of acute stroke care have significantly improved.

A key factor in this advancement has been the introduction of standardized hospital requirements that must be met to secure a contract with the NHSU under the PMG package. This has facilitated greater access to modern stroke care across the country. In addition, fair financing of acute stroke care, including incentives for revascularization procedures and acute care, followed by subacute stroke rehabilitation services, have played a major role.

Since 2023, a structured regional EMS system and stroke patient routing protocols have been in place. This initiative has led to a higher proportion of patients with suspected stroke being transported directly to hospitals that hold NHSU contracts for stroke care, ensuring timely and specialized attention.

Despite the ongoing war, the rate of revascularization procedures for AIS has significantly increased over the past three years. However, in-hospital stroke mortality remains high, with minimal improvement. This underscores the urgent need to investigate the causes of high case-fatality rates and further invest in stroke care system development. For instance, establishing and sustaining stroke units to provide standardized acute stroke care is proven to reduce both morbidity and mortality regardless of stroke type and severity.

The pilot clinical audit revealed, besides other things, poor coordination of stroke care across the regions. This finding highlights the necessity of applying the hub-and-spoke model to the regional stroke networks, ensuring better governance and care integration *(45)*. However, this requires additional technical and administrative resources and seems infeasible for 2025.

To further improve stroke care and outcomes, Ukraine should consider establishing a national-level framework for regularly monitoring stroke burden and epidemiology, assessing stroke risk factors, and evaluating stroke-related health-care services *(46)*. This can be achieved through community-based surveys and the utilization of electronic health records, enabling data-driven policy and clinical improvements.

Vascular risk factor control and stroke prevention require special attention and continued efforts to reduce the burden of stroke in Ukraine. Arterial hypertension, the main stroke risk factor, will be the subject of a separate report, which will look at the area in more detail.


Participants of the Technical Meeting “Reducing the burden of stroke in Ukraine: focus on improving quality and outcomes” (November 6, 2024, Kyiv, Ukraine).

# 6. References[1]


1. Global Burden of Disease [website]. Institute for Health Metrics and Evaluation; 2025 (https://vizhub.healthdata.org/gbd-compare/).
2. Signed declarations [website]. Stroke Action Plan for Europe (SAP-E); 2025 (https://actionplan.eso-stroke.org/signed-declarations).
3. Building a stroke agenda for Ukraine: situation analysis 2021. Copenhagen: WHO Regional Office for Europe; 2022 (https://iris.who.int/handle/10665/358461). Licence: CC BY-NC-SA 3.0 IGO.
4. Report on situational analysis results of acute stroke care in Ukraine. Copenhagen: WHO Regional Office for Europe; 2024 (https://iris.who.int/handle/10665/376740). Licence: CC BY-NC-SA 3.0 IGO.
5. Prendes CF, Rantner B, Hamwi T, Stana J, Feigin VL, Stavroulakis K et al. Burden of stroke in Europe: an analysis of the Global Burden of Disease study findings from 2010 to 2019. Stroke. 2024;55(2):432–42 (https://doi.org/10.1161/strokeaha.122.042022).
6. GBD 2021 Stroke Risk Factor Collaborators. Global, regional, and national burden of stroke and its risk factors, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021. Lancet Neurol. 2024;23(10):973–1003 (https://doi.org/10.1016/s1474-4422(24)00369-7).
7. Wafa HA, Wolfe CDA, Emmett E, Roth GA, Johnson CO, Wang Y. Burden of stroke in Europe: thirty-year projections of incidence, prevalence, deaths, and disability-adjusted life years. Stroke. 2020;51(8):2418–27 (https://doi.org/10.1161/strokeaha.120.029606).
8. Stevens E, Emmett E, Wang Y, McKevitt C, Wolfe C. The burden of stroke in Europe: the challenge for policy-makers. London: Stroke Alliance for Europe; 2017 (https://www.stroke.org.uk/sites/default/files/the_burden_of_stroke_in_europe_-_challenges_for_policy_makers.pdf, accessed 25 April 2025).
9. Korinek K, Young Y, Teerawichitchainan B, Kim Chuc NT, Kovnick M, Zimmer Z. Is war hard on the heart? Gender, wartime stress and late life cardiovascular conditions in a population of Vietnamese older adults. Soc Sci Med. 2020;265:113380 (https://doi.org/10.1016/j.socscimed.2020.113380).
10. Mahase E. Living in a war zone increases heart disease and stroke risk years after conflict ends, study finds. BMJ. 2019;365:12367 (https://doi.org/10.1136/bmj.l2367).
11. Kiro L, Zak M, Chernyshov O. Structure and dynamics of the course of chronic non-infectious somatic diseases in patients during war events on the territory of Ukraine. BMC Public Health. 2023;23(1):1464 (https://doi.org/10.1186/s12889-023-16394-0).
12. STEPS: prevalence of noncommunicable disease risk factors in Ukraine 2019. Copenhagen: WHO Regional Office for Europe; 2020 (https://iris.who.int/handle/10665/336642). Licence: CC BY-NC-SA 3.0 IGO.
13. Alessi J, Yankiv M. War in Ukraine and barriers to diabetes care. Lancet. 2022;399(10334):1465–66 (https://doi.org/10.1016/S0140-6736(22)00480-9).


[1] All reference were accessed 26 May 2025.

14. Dawson J, Béjot Y, Christensen LM, De Marchis GM, Dichgans M, Hagberg G et al. European Stroke Organisation (ESO) guideline on pharmacological interventions for long-term secondary prevention after ischaemic stroke or transient ischaemic attack. Eur Stroke J. 2022;7(3):I–II (https://doi.org/10.1177/23969873221100032).

15. Klijn CJ, Paciaroni M, Berge E, Korompoki E, Kõrv J, Lal A et al. Antithrombotic treatment for secondary prevention of stroke and other thromboembolic events in patients with stroke or transient ischemic attack and non-valvular atrial fibrillation: a European Stroke Organisation guideline. Eur Stroke J. 2019;4(3):198–223 (https://doi.org/10.1177/2396987319841187).

16. Bonati LH, Kakkos S, Berkefeld J, de Borst GJ, Bulbulia R, Halliday A et al. European Stroke Organisation guideline on endarterectomy and stenting for carotid artery stenosis. Eur Stroke J. 2021;6(2):I–XLVII (https://doi.org/10.1177/23969873211012121).

17. Dawson J, Merwick Á, Webb A, Dennis M, Ferrari J, Fonseca AC. European Stroke Organisation expedited recommendation for the use of short-term dual antiplatelet therapy early after minor stroke and high-risk TIA. Eur Stroke J. 2021;6(2):CLXXXVII–CXCI (https://doi.org/10.1177/23969873211000877).

18. van der Worp HB, Hofmeijer J, Jüttler E, Lal A, Michel P, Santalucia P et al. European Stroke Organisation (ESO) guidelines on the management of space-occupying brain infarction. Eur Stroke J. 2021;6(2):XC–CX (https://doi.org/10.1177/23969873211014112).

19. Turc G, Bhogal P, Fischer U, Khatri P, Lobotesis K, Mazighi M et al. European Stroke Organisation (ESO) — European Society for Minimally Invasive Neurological Therapy (ESMINT) guidelines on mechanical thrombectomy in acute ischemic stroke. J Neurointerv Surg. 2023;15(8):e8. (https://doi.org/10.1136/neurintsurg-2018-014569).

20. Kwakkel G, Stinear C, Essers B, Munoz-Novoa M, Branscheidt M, Cabanas-Valdés R, et al. Motor rehabilitation after stroke: European Stroke Organisation (ESO) consensus-based definition and guiding framework. Eur Stroke J. 2023;8(4):880–94 (https://doi.org/10.1177/23969873231191304).

21. Tackling NCDs: best buys and other recommended interventions for the prevention and control of noncommunicable diseases, second edition. Geneva: World Health Organization; 2024. (https://iris.who.int/handle/10665/376624). Licence: CC BY-NC-SA 3.0 IGO.

22. Stroke care in Ukraine: resilience, creativity and big potential [news release]. Angels; 29 December 2023 (https://www.angels-initiative.com/angels-community/stories/stroke-care-ukraine-resilience-creativity-and-big-potential, accessed 25 April 2025).

23. Укладені договори про медичне обслуговування населення за програмою медичних гарантій [Concluded contracts for medical care for the population under the Programme of Medical Guarantees]. National Health Service of Ukraine; 2025 (https://edata.e-health.gov.ua/e-data/dashboard/pmg-contracts, accessed 25 April 2025) (in Ukrainian).

24. Деякі питання організації спроможної мережі закладів охорони здоров'я. Постанова від 28 лютого 2023 року №174 [Some issues of organizing a capable network of health-care institutions. Resolution of February 28, 2023 No. 174]. Cabinet of Ministers of Ukraine; 2023 (https://zakon.rada.gov.ua/laws/show/174-2023-%D0%BF#Text, accessed 25 April 2025) (in Ukrainian).

25. Про затвердження Порядку організації надання медичної допомоги пацієнтам із гострим мозковим інсультом. Наказ від 15.06.2023 №1091 [On approval of the Procedure for interregional routing of patients in the emergency medical care system. Order of June 15, 2023 No 1091]. Ministry of Health of Ukraine; 2023 (https://ips.ligazakon.net/document/RE40174?an=1, accessed 25 April 2025) (in Ukrainian).

26. Спроможна мережа медзакладів [Capable network of medical facilities]. Ministry of Health of Ukraine; 2024 (https://moz.gov.ua/uk/spromozhna-merezha, accessed 25 April 2025) (in Ukrainian).

27. Оголошення про укладення договорів про медичне обслуговування населення за програмою медичних гарантій за пакетом «Медична допомога при гострому мозковому інсульті» від 8 березня 2023 року [Announcement on the conclusion of contracts for medical care for the population under the Programme of Medical Guarantees under the package “Medical care for acute cerebral stroke” of March 8, 2023]. National Health Service of Ukraine; 2023 (https://contracting.nszu.gov.ua/kontraktuvannya/kontraktuvannya-2023/ogoloshennya-2023/ogoloshennya-insult-vid-08032023, accessed 25 April 2025) (in Ukrainian).

28. Вимоги ПМГ 2025 [PMG 2025 requirements]. National Health Service of Ukraine; 2025 (https://contracting.nszu.gov.ua/kontraktuvannya/kontraktuvannya-2025/vymogy-pmg-2025-1720109713, accessed 25 April 2025) (in Ukrainian).

29. Деякі питання реалізації програми державних гарантій медичного обслуговування населення у 2024 році. Постанова від 22.12.2023 № 1394 [Some issues of implementing the Programme of Medical Guarantees in 2024. Resolution of December 22, 2023 No. 1394]. Cabinet of Ministers of Ukraine; 2023 (https://zakon.rada.gov.ua/laws/show/1394-2023-%D0%BF#n41, accessed 25 April 2025) (in Ukrainian).

30. Офіційний курс гривні щодо іноземних валют [Official exchange rate of the hryvnia against foreign currencies]. National Bank of Ukraine; 2024 (https://bank.gov.ua/ua/markets/exchangerates?date=01.12.2024&period=daily, accessed 25 April 2025) (in Ukrainian).

31. Стандарт медичної допомоги «Ішемічний інсульт» [Standards of Medical Care “Ischemic stroke”]. National Expert Center of the Ministry of Health of Ukraine; 2024 (https://www.dec.gov.ua/mtd/ishemichnyj-insult/, accessed 25 April 2025) (in Ukrainian).

32. Закон України. Основи законодавства україни про охорону здоров’я [Law of Ukraine. Fundamentals of Ukrainian legislation on health care]. Verkhovna Rada of Ukraine; 2024 (https://zakon.rada.gov.ua/laws/show/2801-12/page#Text, accessed 25 April 2025) (in Ukrainian).

33. Ukraine’s alarming demographics. Stockholm: Stockholm Centre for Eastern European Studies (SCEES); 2023 (SCEEUS Report Series on Ukrainian Domestic Affairs, No. 7, 2023; https://sceeus.se/en/publications/ukraines-alarming-demographics/, accessed 25 April 2025).

34. Botelho A, Rios J, Fidalgo AP, Ferreira E, Nzwalo H. Organizational factors determining access to reperfusion therapies in ischemic stroke — systematic literature review. Int J Environ Res Public Health. 2022;19(23):16357 (https://doi.org/10.3390/ijerph192316357).

35. Population, total — Ukraine [website]. World Bank; 2025 (https://data.worldbank.org/indicator/SP.POP.TOTL?locations=UA, accessed 25 April 2025).

36. Shkoruta DP, Senkiv V, Vovchuk V, Popadynets O, Kotyk T. Impact of war on stroke incidence in Ivano-Frankivsk, Ukraine. Sci Rep. 2024;14(1):18996 (https://doi.org/10.1038/s41598-024-70270-4).

37. Health financing in Ukraine: reform, resilience and recovery. Copenhagen: WHO Regional Office for Europe; 2024 (https://iris.who.int/handle/10665/379548). Licence: CC BY-NC-SA 3.0 IGO.

38. Jawad M, Vamos EP, Najim M, Roberts B, Millett C. Impact of armed conflict on cardiovascular disease risk: a systematic review. Heart. 2019;105(18):1388–94 (https://doi.org/10.1136/heartjnl-2018-314459).

39. Korinek K, Young Y, Schmidt J, Toan TK, Zimmer Z. War-related life course stress and late-life subjective age in northern Vietnam. Innov Aging. 2024;8(6):igae048 (https://doi.org/10.1093/geroni/igae048).

40. Flomin Y, Dubenko A, Dubenko O, Sokolova L, Slobodin T, Shepotinnyk Y et al. Neurological practice in the time of war: perspectives and experiences from Ukraine. Semin Neurol. 2024;44(2):225–32 (https://doi.org/10.1055/s-0044-1782515).

41. Key Performance Indicators: KPI 7a. Basel: Stroke Action Plan for Europe (SAP-E); 2025 (https://actionplan.eso-stroke.org/kpi/kpi-7a, accessed 7 February 2025).

42. Results of initial health labour market analysis in Ukraine. Copenhagen: WHO Regional Office for Europe; 2024 (https://iris.who.int/handle/10665/379429). Licence: CC BY-NC-SA 3.0 IGO.

43. Columbo JA, Daya N, Colantonio LD, Wang Z, Foti K, Hyacinth HI et al. Derivation and validation of ICD-10 codes for identifying incident stroke. JAMA Neurol. 2024;81(8):875–81 (https://doi.org/10.1001/jamaneurol.2024.2044).

44. Health Index Ukraine 2023: results of a national study. Kyiv: Health Index; 2024. (https://healthindex.com.ua/reports, accessed 25 April 2025).

45. Batino LKJ, Cinco MTT, Navarro JC. Hub-and-spoke stroke system: enhancing acute ischemic stroke care in the Philippines. Cerebrovasc Dis Extra. 2024;14(1):95–100 (https://doi.org/10.1159/000540484).

46. Framework for the care of acute coronary syndrome and stroke. Geneva: World Health Organization; 2024 (https://iris.who.int/handle/10665/380065). Licence: CC BY-NC-SA 3.0 IGO.

## 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.

## Member States

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
Netherlands (Kingdom of the)
North Macedonia
Norway
Poland
Portugal
Republic of Moldova
Romania
Russian Federation
San Marino
Serbia
Slovakia
Slovenia
Spain
Sweden
Switzerland
Tajikistan
Türkiye
Turkmenistan
Ukraine
United Kingdom
Uzbekistan

## WHO Country Office in Ukraine

9B, Hrushevskoho Street Kyiv, 01021, Ukraine

Tel.: +380 44 428 55 55

Email: eurowhoukr@who.int

Website: www.who.int/ukraine

WHO/EURO:2025-12288-52060-79895 (PDF)