

Review of acute care and rehabilitation services for heart attack and stroke in Belarus





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Review of acute care and rehabilitation services for heart attack and stroke in Belarus

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WHO Regional Office for Europe, 2017

Abstract

Reduced life expectancy at birth is a major public health concern in Belarus. As part of an exploration of premature mortality, a WHO review of acute and rehabilitative services for heart attack and stroke was undertaken in September 2016. The review found that although health systems are in transition, significant progress and investment in infrastructure and human resources have already been made. Geographical disparities exist, however, and regional networks need to be further developed. Gains in acute care are at risk of being undermined, particularly by poor tobacco and alcohol control, and lack of identification and management of cardiovascular risk factors. Clinical guidelines and drug formularies need to be updated, and lifesaving drugs made available. Timeliness and appropriateness of care need to be measured and improved. A more patient-centred approach and better use of resources could be achieved through the widespread use of clinical scales. Participation in international registries could give Belarus the opportunity to benchmark performance. Civil society should be empowered to participate in the prevention of cardiovascular diseases and implementation of evidence-based medicine in the system of care. Looking ahead, while a roadmap for cardiology services has been developed, there is also a need for a comprehensive, integrated monitored roadmap for stroke care.

Keywords

Acute Coronary Syndrome
Stroke
Cardiovascular Diseases
Critical Care
Rehabilitation
Evidence-based Practice
Belarus

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Acknowledgements

The authors would like to express their sincere gratitude to the Ministry of Health of Belarus, and the many clinicians, academics, managers, administrators and patients who welcomed us to their facilities, and took the time to participate and be interviewed, sharing their views, ideas, concerns and visions. Valuable comments were also received from the Ministry of Health during the consultation in April/May 2017.

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The contributions to organization of the WHO mission and materials to inform this report are also gratefully acknowledged: Valiantsin Rusovich of the WHO Country Office.

Thanks are also extended to Bandana Malhotra for language editing and to Lars Moller for layout and typesetting the report.

The evaluation was conducted under the overall guidance of Dr Batyr Berdyklychev, WHO Representative of the Country Office in Belarus, and Dr Gauden Galea, Director of the Division of Noncommunicable Diseases and Promoting Health through the Life-course in the WHO Regional Office for Europe.

Preparation of this report was coordinated by the WHO Regional Office for Europe and WHO Country Office in Belarus through the biennial collaborative agreement covering 2016/2017 between the Ministry of Health of Belarus and WHO. The report was financed through a voluntary contribution of the Ministry of Health of the Russian Federation.

Abbreviations

ACS	acute coronary syndrome
AMI	acute myocardial infarction
CI	confidence interval
CIS	Commonwealth of Independent States
CVD	cardiovascular disease
CT	computerized tomography
ECG/EKG	electrocardiograph
EORP	EURObservational Research Programme
ESC	European Society of Cardiology
ESO	European Stroke Organisation
EU	European Union
FAST	Facial drooping, Arm weakness, Speech difficulties and Time to call emergency services
FIM	Functional Independence Measurement
ICU	intensive care unit
ICD	International Classification of Diseases, tenth revision
IT	information technology
IV	intravenous
IHD	ischaemic heart disease
LE	life expectancy
MI	myocardial infarction
MoH	Ministry of Health
MRI	magnetic resonance imaging
NCD	noncommunicable disease
NGO	nongovernmental organization
NIH	National Institutes of Health (Bethesda, USA)
NSTEMI	non-ST-segment elevation myocardial infarction
PCI	percutaneous coronary intervention
RSPC	Republican Scientific and Practical Center
SITS	Safe Implementation of Treatments in Stroke
STEMI	ST-segment elevation myocardial infarction
tPA	tissue plasminogen activator
UNIATF	United Nations Inter-agency Task Force
WHO	World Health Organization
YLL	years of life lost

Executive summary

Reduced life expectancy at birth, and premature mortality among men of working age, are major public health concerns in Belarus. At the request of the Ministry of Health (MoH) of the Republic of Belarus, and as part of an exploration of premature mortality, a WHO review of acute and rehabilitative services for heart attack and stroke was undertaken in September 2016. The draft report was shared with the MoH during a consultation in April/May 2017, which also elicited valuable comments.

In Belarus, premature mortality from the four main noncommunicable diseases (NCDs) is among the highest in the WHO European Region. Cardiovascular disease (CVD) is a major contributor to premature mortality and, while both heart attacks and strokes have been reducing in recent years, the proportion of mortality due to CVD, and specifically acute myocardial infarction (AMI), has risen. Gender differences for NCD mortality are remarkable, with men twenty times more likely to die from an AMI as women, for example. Urban–rural and regional differences also exist. A high prevalence of CVD, and reduction in CVD-related mortality is contributing to a rise in the number of disabled persons in the population. The risk of death or disability within five years of a first stroke is 80%. Biological risk factors such as hypertension and hypercholesterolaemia account for 48% of CVD mortality, and behavioural risk factors such as nutritional causes, and alcohol and tobacco use account for 45% of the mortality.

The State programme for health and demographic security 2016–20 includes a subprogramme for the prevention and control of NCDs. Current implementation of effective policy measures for the prevention of NCDs still have unrealized potential. However, the previous State programme “Cardiology” 2011–15 led to a reorganization of care and showed some positive outcomes. A roadmap for cardiology services has been prepared and, since the mission, a similar roadmap for stroke care is under development.

Protocols and guidelines for diagnosis and management of stroke and acute coronary syndrome (ACS) exist. In accordance with the national format, official protocols are not explicitly evidence-based but the content appears to reflect international standards. Review of clinical guidelines is under way for stroke.

Specialist training to become a neurologist or cardiologist takes 2 years, which is shorter than that recommended at the European level. Subspecialization in cerebrovascular disease or ACS requires training of only a few months or weeks, respectively. Continuing medical education exists and is incentivized but is not linked to a process of revalidation of doctors’ licence to practise.

There are no national personified population-level registers for ACS and stroke. A limited system for monitoring and reporting care is in place but there is further potential for monitoring and assuring the quality of care. Data are collected to monitor a limited set of performance indicators of care for stroke and ACS, and analysed and presented at the regional level. Quality measures are not sufficiently fed back to physicians, professional organizations or regulatory authorities. Quality measures are more focused on checking compliance with the approved clinical protocols in individual cases. Each specialty has its own reporting system and there is little coordination between them. Although improvements in coverage and effectiveness of care have been demonstrated, and care reaches EU-15 standards in some areas, Belarus does not participate in international registries or benchmarking of care for stroke or ACS.

Awareness campaigns on CVDs are carried out via various means of communication, but their efficacy is not measured. Awareness is still not sufficient among the population and health-care professionals about the association between a high prevalence of smoking and harmful use of alcohol in men, and the incidence of AMI and stroke. Primary prevention for CVDs is compromised by the absence of a system of reimbursement to the patient of hypotensive drugs, cholesterol-lowering drugs, anticoagulants (for atrial fibrillation) and nicotine replacement therapy for patients at high risk for CVD. There is an ambulance-centred, countrywide network of emergency care, and availability of specialized evidence-based protocols for ACS and stroke. Availability of specialized ambulance teams (cardiac, trauma or neurological including stroke) is higher in urban areas, especially Minsk. Prehospital thrombolysis is available in all regions of Belarus, and other prehospital interventions, which are essential for emergency care of patients with ACS, are also widely available. There

are two main problems with the organization of prehospital care: a large number of unjustified emergency ambulance calls (more than 300 ambulance visits per 1000 population per year with a very low rate of hospitalization after arrival of the ambulance), and the comparative shortage of staff in the ambulance services. The number of employed physicians in emergency care is inversely associated with mortality due to ischaemic heart disease (IHD).

The health-care system is focused on the provision of highly specialized tertiary care and hospital-based services. Recent years have seen a significant increase in high-tech services. The standard of care for stroke and ACS is on a par with that of the EU-15 countries in the urban centres visited, but a more uniform availability of this care is lacking throughout the country. Access to neuroimaging diagnostic services is uneven, and not all ischaemic stroke patients may be receiving the timely treatment they require.

A clinical pathway for stroke care has been fully adopted. All components of stroke care are in place, though there are disparities in implementation at the geographical level: urban areas are better equipped, coordinated and organized. Clinical and functional assessment scales are not used to their full potential in hospital care or rehabilitation.

The rate of thrombolysis for patients with acute ischaemic stroke (6%) lags behind the EU-15 average (20%). Thrombolysis remains the leading reperfusion strategy for patients with ACS; access to percutaneous coronary intervention (PCI) is undermined by delays in the transfer of patients with ST-segment elevation myocardial infarction (STEMI). In 2015, only 29% of patients with STEMI were referred for primary PCI compared with the European coverage goal of 60%. The ratio of emergency to elective PCI procedures has improved during 2011–15, but the proportion of emergency procedures remains low in some regions. In 2015, radial access for PCI was used in only 15% of cases compared with the EU-15 average of more than 80%.

After discharge, patients with AMI are followed up for up to two years in dedicated cardiological centres. The network of clinics enables rehabilitation of outpatients, their observation in a dispensary, and controlled interventions for secondary prevention after ACS. Similar facilities for patients with stroke are not available or planned. After discharge, patients with stroke are referred back to their polyclinic where neurologists may follow them up.

Medical rehabilitation services are available in all the regions. The coverage of rehabilitation is 60% among patients with NCDs who are of an economically productive age. In recent years, a network of rehabilitation centres has been established for after-care and, if required, these services are provided free of charge. Access to appropriate treatment for secondary prevention of recurrence of cardiovascular events is limited in time; following discharge, prescriptions for life-saving drugs (such as hypotensive drugs, cholesterol-lowering drugs, anticoagulants) are free for only six months. Moreover, drug options for secondary prevention are limited compared with European Union (EU) countries.

In conclusion, health systems are in transition but the considerable progress made has generated a momentum. Investment in infrastructure and human resources is leading to a critical mass. However, geographical disparities exist and regional networks need to be strengthened, and coverage of effective care needs to be expanded. Barriers to cardio-cerebrovascular risk control and implementation of evidence-based care need to be overcome. Gains in acute care risk are being undermined, particularly by insufficient implementation of public health measures for tobacco and alcohol control, and suboptimal identification and management of cardiovascular risk factors. Clinical guidelines and drug formularies need to be updated and availability of life-saving drugs augmented. Measures should be instituted to record promptness and appropriateness of care, particularly for quality of care after stroke and ACS. A more patient-centred approach, and optimum and targeted use of resources could be achieved by customization of care through the widespread use of clinical and functional assessment scales. Participation in international registries could give Belarus the opportunity to benchmark its performance in stroke and ACS care, and attract investments in clinical trials and research, as well as foreign medical students and patients. Civil society should be encouraged to join in the prevention of CVDs and empowered to implement evidence-based care. Looking ahead, while there is a roadmap for cardiology services, there is a need to complete a comprehensive, integrated monitored roadmap for stroke care.

1. Introduction

In Belarus, reduced life expectancy (LE) at birth and premature mortality among men of working age are major public health concerns. Noncommunicable diseases (NCDs) account for 89% of all deaths. Premature mortality due to NCDs (defined as the probability of dying between the ages of 30 and 70 years from cardiovascular diseases (CVDs), diabetes, cancer or chronic respiratory disease) is 26%,¹ i.e. a person has a one in four chance of dying before the age of 70 years, with substantially higher rates for men than for women. Among NCDs, **CVDs are responsible for 63% of mortality; of these, ischaemic heart disease (IHD) and stroke account for the largest share** and, since 1990, have been, respectively, the first and second causes of years of life lost (YLLs) to premature death² (Fig. 1).

Fig. 1. Premature mortality in Belarus. Leading causes of years of life lost (YLL) due to premature mortality

	1990 ranking	2013 ranking		% change 1990 to 2013
Ischaemic heart disease	1	1	Ischaemic heart disease	57%
Cerebrovascular disease	2	2	Cerebrovascular disease	32%
Road injuries	3	3	Self-harm	70%
Self-harm	4	4	Lung cancer	22%
COPD	5	5	Road injuries	Minus 6%
Lung cancer	6	6	Stomach cancer	Minus 14%
Stomach cancer	7	7	COPD	Minus 26%
Congenital anomalies	8	8	Cardiomyopathy	107%
Drowning	9	9	Alcohol use disorders	59%
Lower respiratory infections	10	10	Falls	82%
Alcohol use disorders	12	11	Drowning	Minus 17%
Falls	16	16	Lower respiratory infections	Minus 25%
Cardiomyopathy	18	19	Congenital anomalies	Minus 59%

Rankings are based on YLLs per 100 000, all ages, not age-standardized

COPD: chronic obstructive pulmonary disease

Source: Institute of Health Metrics and Evaluation (IHME): Belarus [website] (<http://www.healthdata.org/belarus>, accessed 11 February 2017).

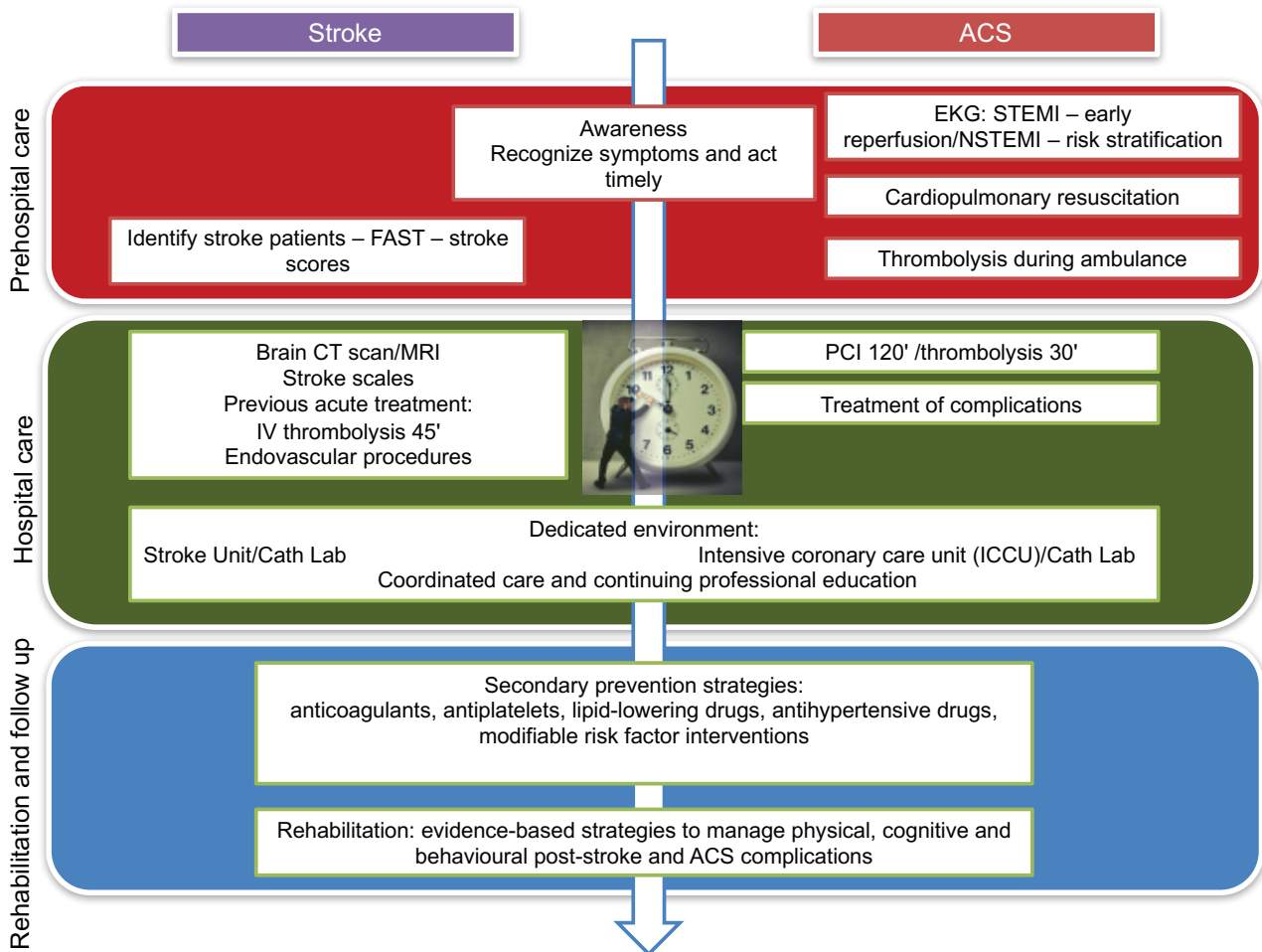
In response to a request from the Minister of Health, **a WHO mission explored the issue of premature mortality, especially among men of working age, due to stroke and acute coronary syndrome (ACS) in Belarus** from 26 to 30 September 2016. The mission focused on acute and rehabilitation services for heart attack and strokes. This was because prevention of NCDs and CVDs at the individual and population level had already been assessed, e.g. a health systems assessment mission³ had taken place in June 2014, followed by a joint mission of the United Nations Interagency Task Force (UNIATF) on the prevention and control of NCDs in July 2014 and followed up in May 2016. An in-depth assessment of tobacco control had also taken place in September 2015.⁴ Moreover, a European Union (EU)-funded project (Belmed) in Belarus aims to strengthen the prevention and control of NCDs in general, and in primary care in particular.

The mission was organized by the WHO Country Office based in Belarus and the WHO European Office for the Prevention and Control of Noncommunicable Diseases (NCDs), based in Moscow, Russian Federation. The work forms part of the WHO NCD project, which is financially supported by a grant from the Ministry of Health (MoH) of the Russian Federation. The European Stroke Organisation (ESO) helped in identifying a technical expert on stroke care services. The Federal Almazov North-West Medical Research Centre, St Petersburg, Russian Federation, and the Federal State Institution National Research Centre for Preventive Medicine of the MoH of the Russian Federation also provided technical support.

2. Methodology

Observations were based on a desk review of documents and data, interviews with policy-makers, health professionals and patients, and visits to health facilities. A programme of field visits is given in Annex 1. Before the visits for data collection, a broad framework for analysis was developed and checklists of performance indicators were created for the care of ACS and stroke. The joint framework for analysis is shown in Fig. 2.

Fig. 2. Joint framework for analysis



ACS: acute coronary syndrome; EKG: electrocardiograph; FAST: Facial drooping, Arm weakness, Speech difficulties and Time to call emergency services; IV: intravenous; NSTEMI: non-ST-segment elevation myocardial infarction; PCI: percutaneous coronary intervention; STEMI: ST-segment elevation myocardial infarction

Source: Authors

Preliminary findings were shared with the MoH at the end of the mission.

3. Epidemiology

In 2014, premature mortality from the four main NCDs in Belarus was among the highest in Europe, at 605.07 per 100 000 persons 30–69 years of age.⁵ Deaths from CVDs were a major contributor to premature mortality.

As in many countries of the WHO European Region, premature mortality due to **both NCDs and CVDs has reduced in recent years in Belarus**. Age-standardized mortality from circulatory diseases (0–64 years) decreased from 236 per 100 000 population in 2002 to 154 per 100 000 in 2014.⁶ **Reductions in mortality rates have been recorded for both stroke and AMI**. According to national statistics, the crude mortality rate for AMI decreased from 6.1 per 100 000 population in 2009 to 4.8 per 100 000 in 2013, and mortality due to stroke reduced from 33.9 per 100 000 population in 2009 to 26.0 per 100 000 in 2013.³

The total number of deaths due to cerebrovascular disease reduced by about 500 from 2014 to 2015. Death rates due to acute cerebrovascular events and chronic cerebrovascular disease have both reduced slightly during 2014–15: for acute events, the standardized rate for 2015 was 100.51 per 100 000 persons, compared with 101.56 per 100 000 for 2014 – a reduction of 1.05%.⁷ For chronic disease, the standardized rate was 44.19 per 100 000 persons in 2015, compared with 48.48 per 100 000 persons in 2014 – a reduction of 4.29%.^a

In recent years, the contribution of CVD to all-cause mortality rate has increased, especially the mortality rate due to AMI in the working-age population. While mortality rates from all causes and CVD are both declining, the contribution of mortality due to CVD to total mortality increased from 52.8% in 2013 to 55.4% in 2015. In the working-age population, the contribution of mortality due to CVD to total mortality rate increased from 32.9% in 2013 to 34.4% in 2015.⁸ The contribution of mortality due to AMI in the working-age population increased from 1.06% in 2013 to 1.46% in 2015. The increase in mortality rate per 100 000 population in the working-age population due to AMI increased by 13.5% from 2014 to 2015 and by 23% from 2013 to 2015.

In 2015, chronic IHD accounted for 69.1% of mortality due to CVD, whereas acute forms of IHD accounted for 3.85%.^a

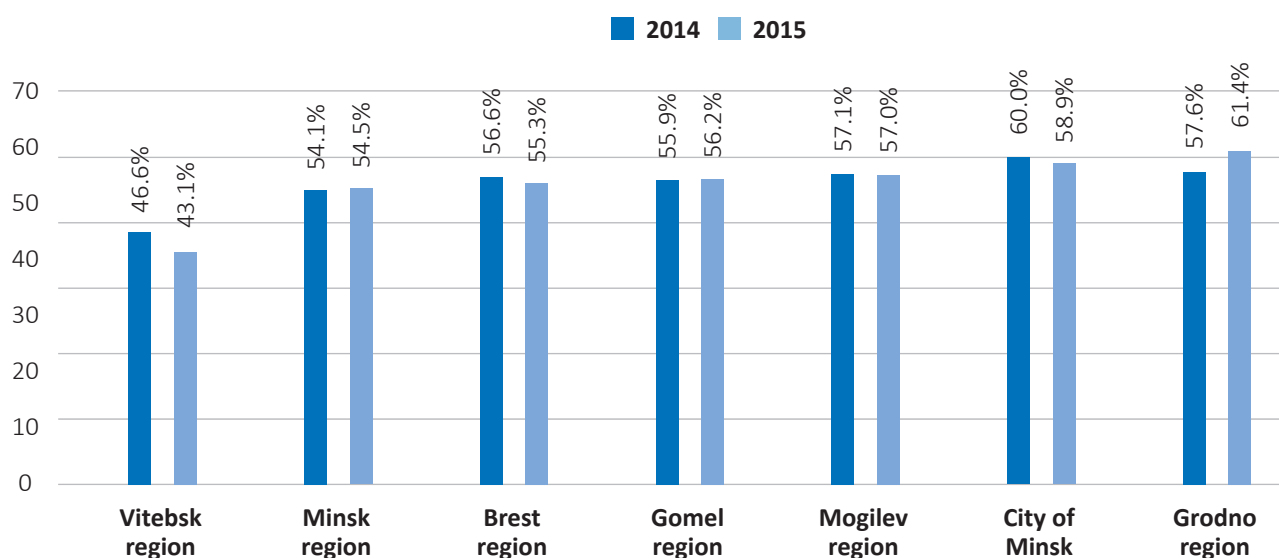
Gender differences in premature death are remarkable: men are about twice more likely to die from major NCDs than women.⁹ In 2014, life expectancy at birth for men (67.86 years) was more than ten years lower than that for women (78.65 years).⁵ According to the Human Development Report (2015), the mortality rate per 1000 people is thrice as high for men (299) than it is for women (100).¹⁰ According to the National Statistical Committee of Belarus, mortality due to CVDs decreased for both women and men between 2009 and 2013 – from 50.3 to 43.6 per 100 000 population for women, and from 285.8 to 245.3 per 100 000 population for men, respectively. In 2013, the most significant gender difference in mortality was associated with AMI – 8.8 per 100 000 population for men and 0.4 per 100 000 population for women (i.e. twentyfold higher for men).

There is a rural/urban gradient in the outcomes of NCDs, with the rural populations of Belarus having lower life expectancies and higher premature mortality rates than persons living in urban areas. In 2013, the life expectancy for males in rural areas was as low as 63.3 years. In 2009, the premature mortality rate was 11% among the urban population and 24.2% among the rural population. There are also geographical (regional) disparities in premature mortality rates, e.g. it is 9.8% for Minsk, 16% for the Minsk region and 16.2% for the Vitebsk region.^a

Regional variation is also seen for the proportion of deaths caused by CVD (Fig. 3).

^a Information from presentation given on 27 September 2016 to the mission team by Alexander Vladimirovich Patseev, Deputy Director, Republican Scientific and Practical Center for Cardiology

Fig. 3. Proportion of deaths caused by cardiovascular disease in Belarus by region for 2014 and 2015 (national average: 55.2% for 2014 and 2015)



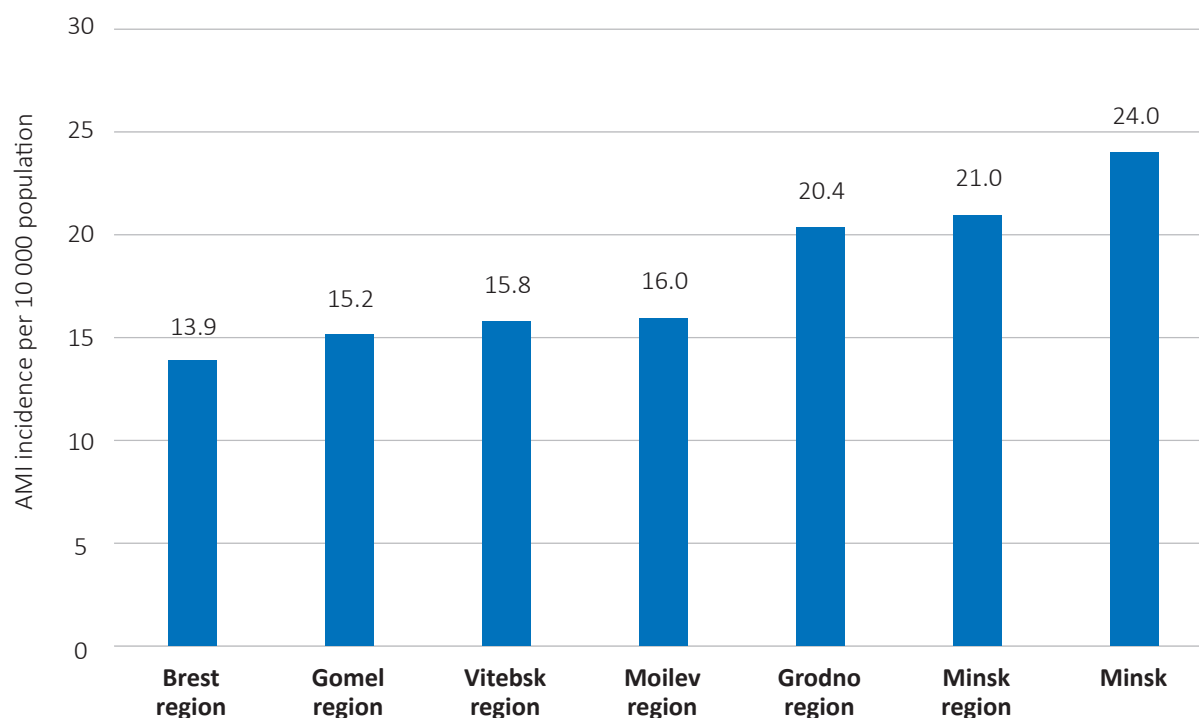
Source: National statistics, 2014 and 2015.

A high prevalence of CVDs and a reduction in CVD-related mortality is leading to an increase in the number of disabled persons in Belarus, besides its ageing population. The MoH statistics¹¹ show that 50 394 persons were newly diagnosed as disabled in 2011, which was 7.3% more than those in 2010. Of these, 47 417 were adults (18 years and above), which was 7.8% more than those in 2010. The number of newly diagnosed disabled persons among the working population in 2011 was 21 011, which was 1.7% more than those in 2010. **The leading causes of disability were diseases of the circulatory system (40.3%).**¹¹ The MoH statistics also reveal that in 2015, a total of 4609 people aged 18 years and above were classified as disabled due to stroke; of these, 1251 were of economically productive age. The rate of primary disability among people aged 18 years and above was 5.99 per 10 000 population; among those in the economically productive age, it was 2.34 per 10 000 population.

As there is no national register, a subnational population-based stroke register was set up in Grodno in 2001, to determine the incidence of and case-fatality due to stroke.¹² Results of the first three years showed that the incidence adjusted to the European standard population and to the WHO world standard population was 287 per 100 000 (95% confidence interval [CI]: 274–301) and 220 per 100 000 (95% CI: 210–231), respectively. Significant gender differences were observed, with men having a higher chance of suffering a stroke. Patients with first-ever stroke were younger than those in population-based studies from high-income countries. In the Grodno study, the 28-day case-fatality rate was 26.1%, at 3 months it was 32.2%, at 12 months it was 37.4% and at 5 years it was 58.8%. At 5 years, of the 269 survivors, 130 (48.3%) were independent (modified Rankin score 0–2), and 139 (51.7%) were disabled (modified Rankin score ≥ 3). At 5 years, the cumulative risk of death or disability after first-ever-in-a-lifetime stroke was 80.1%.¹³

While data are available through the subcommissions, **a formal national population-based register for ACS does not exist.** According to national statistics, diseases of the circulatory system showed an almost tenfold increase over the past 35 years, and there was a 40% increase in CVD morbidity due to IHD over the past 10 years. The MoH statistics showed that a total of 34 907 cases of ACS were reported in 2015; among these, 15 659 were of myocardial infarction (MI) (10 184 with ST-segment elevation). The incidence of MI varies by region (Fig. 4). Whereas the average incidence of MI in Belarus in 2015 was 18.4 cases per 10 000 adult population, this ranged from 13.9 in the Brest region to 24 per 10 000 adults in Minsk city.

Fig. 4. Incidence of acute myocardial infarction in Belarus by region, 2015



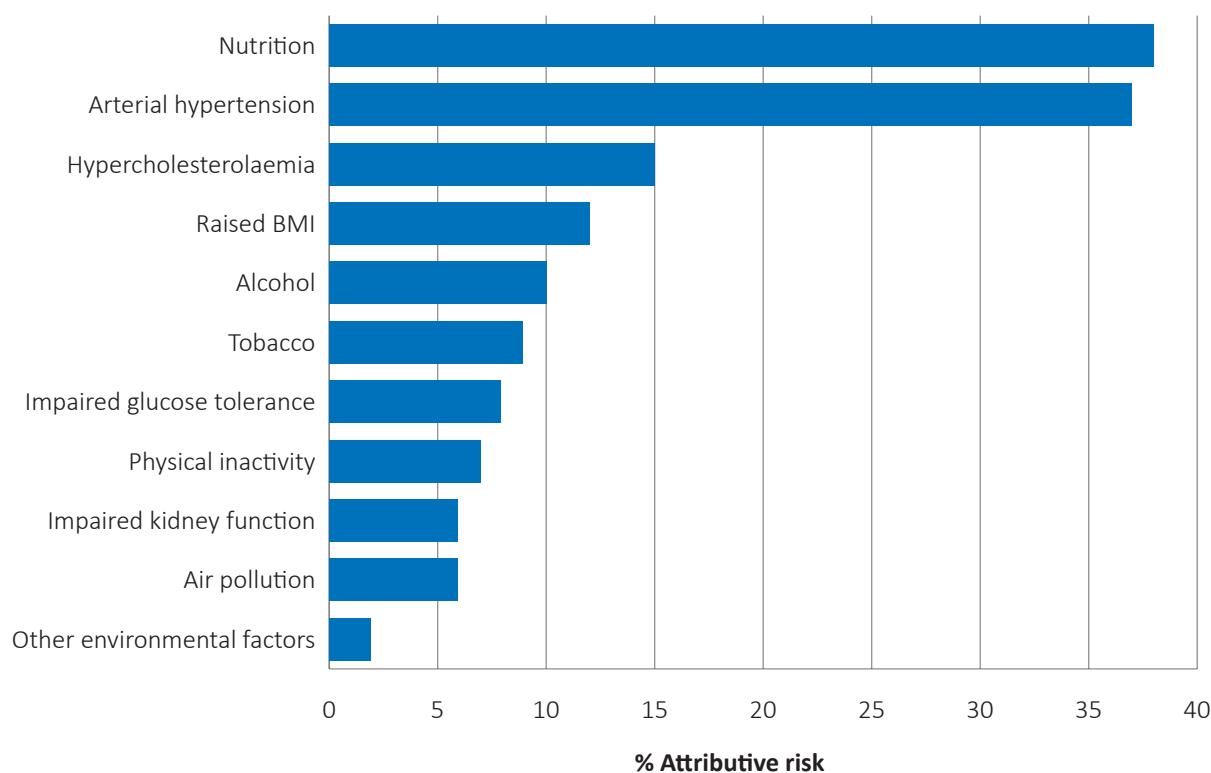
Source: National statistics, 2015.

According to the Grodno stroke register,¹² among the risk factors for stroke, hypertension was the most prevalent comorbidity (87.5%), followed by active smoking (25.6%), atrial fibrillation (23.1%), clinical history of acute myocardial infarction (AMI, 19.1%), hypercholesterolaemia (22.1%) and diabetes mellitus (14.7%). Notably, alcohol abuse was not considered a potential risk factor in the registry.

According to the Institute of Health Metrics and Evaluation, biological factors account for 47.94% of mortality and behavioural factors for 45.27% (Fig. 5).

The prevalence of smoking and alcohol use among men is among the highest in the WHO European Region and seems to be among the main contributing factors to the 10-year shortage in life expectancy compared with women.

In recent years, some reduction has been observed in current smoking rates among men (from 55% in 1998 to 51% in 2011), but smoking has increased nearly threefold among women (3.6% in 1995 to 11% in 2011). Alcohol consumption remains a significant public health issue, with per capita adult (15 years and older) consumption estimates of 27.5 and 9.1 L of pure alcohol in men and women, respectively, per annum (average 17.5 L for both sexes) in 2008–2010, which is among the highest globally. The pattern of heavy episodic drinking (consuming at least 60 g of pure alcohol on at least one occasion in the past 30 days), which is most commonly regarded as a risk factor for stroke, is widely prevalent in Belarus. This pattern is seen in 47.8% of men and 7.5% of women in the general population (2010).¹⁴ In accordance with the recent WHO report, nearly every third (29%) death from CVD in Belarus is considered to be alcohol attributable (overall age-standardized mortality rate from CVDs for Belarus is 4183.6 deaths per million population, with 1214.4 alcohol-attributable causes for CVD deaths per million population).¹⁵ Nearly one in four adults is obese.

Fig. 5. Risk factors influencing CVD mortality in Belarus

BMI: body mass index

Source: Institute of Health Metrics and evaluation

4. Policy framework and NCD context

In March 2016, the Government of Belarus approved the 2016–2020 State Programme entitled “Health and Demographic Safety of the Republic of Belarus” with the Edict of the Council of Ministers №200. This Programme aims to improve the health of its citizens by promoting a healthy lifestyle, strengthening family values, decreasing the overall mortality rate, increasing life expectancy, and improving the quality and availability of medical services.

The Programme has seven subprogrammes: family and childhood; prevention and control of NCDs; prevention and treatment of alcoholism; prevention and treatment of tuberculosis; prevention and treatment of HIV; internal migration; functioning of the Belarus National Healthcare Service. As one of these subprogrammes relates to NCDs, there is no separate national strategy or action plan on NCDs.

Tobacco and alcohol control measures present a mixed picture.^{3,4} For tobacco control, there are moderate taxation levels; bans on all advertising, promotion and sponsorship with moderate enforcement; and a point-of-sale ban has been recently introduced. For alcohol control, taxation and restrictions on advertising and promotion are limited, retail restrictions exist but are not well enforced. There are no population-level interventions to reduce salt intake and no population monitoring of salt intake, nor is there a regulatory framework supporting elimination of trans-fats or evidence of their reduction in the diet.

There was a State Programme for Cardiovascular Diseases 2011–15¹⁶ (inclusive of stroke), which was named “Cardiology” and adopted by the Council of Ministers (Decree No. 268 of 04.03.2011). This had the following goals:

- Prevention and early detection of CVDs
- Introduction of modern medical technologies in the provision of cardiac and neurological care for patients with ACS and stroke
- Introduction of modern organizational technologies in providing ambulance and emergency care to patients with CVDs
- Improving the system of providing arrhythmia care to patients with CVDs
- Improving the system of providing interventional care to patients with CVDs
- Improving the system of providing cardiosurgical care to patients with CVDs.

A national evaluation of the Programme found reductions in mortality due to CVD by 9.9% in 2014 (701 per 100 000), relative to the baseline of 2010 (778 per 100 000), with specific reductions for IHD of 6.3%, and for AMI of 22.8%. Mortality due to CVD reduced by 19.0% in the working-age population. There was no reduction in morbidity due to general CVD, which rose by 7.4%, with specific increases for arterial hypertension of 12.4%, and IHD of 4.7%. This was thought to be caused by the ageing population and increased life expectancy.

A roadmap for cardiological services has been prepared. It has the strategic goal of ensuring a reduction in mortality from ACS. Its objectives are as follows:

- development of an endovascular surgery service to achieve the level of percutaneous coronary intervention (PCI) that would be comparable with the European standard (up to 600 PCI procedures performed in ACSs/1 million population per year);
- ensuring the availability of modern treatment of ACS in rural and remote areas – increasing the volume of thrombolytic therapy with modern thrombolytic agents in areas remote from the centres of interventional cardiology, followed by transfer of patients for PCI;
- abandoning thrombolytic therapy with the increase in accessibility of endovascular surgery in some districts of a region;
- increasing and balancing the interregional accessibility of PCI in non-ST segment elevation myocardial infarction (NSTEMI) (small focal MI and unstable angina) – prevention of recurrent MI and sudden death;
- primary and secondary prevention of ACS through State prevention programmes;
- education of health professionals;
- encouraging patients to seek timely medical care through educating them in self-management and mutual aid.

Since the mission, development has begun of a similar roadmap for stroke care services. Its main objectives will include creating a network of inter-district stroke care departments with the intensive care units at the premises of health-care facilities. These stroke care centres will possibly be equipped with neurovisualization facilities (such as computerized tomography [CT], magnetic resonance imaging [MRI]) and the ability to implement thrombolysis. This is aimed at decreasing the influence of geographical factors (such as distance) in stroke care.

5. Evidence-based practice and evidence-based interventions

Clinical guidelines

Protocols and guidelines exist for the diagnosis and management of stroke and ACS. In accordance with the national format, official protocols are not explicitly evidence-based but their content appears to reflect international standards

Review of clinical guidelines is under way for stroke.

In the Republic of Belarus, priority is given to diagnostic and treatment protocols approved by the MoH over recommendations developed by professional associations. Diagnostic and treatment protocols are legally significant documents and their implementation is mandatory by medical specialists of all health organizations of the country. National recommendations of nongovernmental medical societies such as the Belarusian Scientific Society of Cardiology, as well as the recommendations of other similar societies in the Republic of Belarus, are referred to as supporting documents, and are of an auxiliary nature. The format of diagnostic and treatment protocols adopted in the country does not include references to the literature, evidence justifications, etc. For educational purposes, the recommendations of international cardiological societies (links to them) are posted on the websites of BelMAPO, RNPTS “Cardiology”, regional cardiology centres, etc.

Evidence-based protocols and clinical guidelines on stroke are available, and produced and disseminated by the MoH. Implementation of these guidelines is monitored within the framework of the State Programme on Public Health and Demographic Security. There is a subcommission accountable for reviewing medical certificates of death due to chronic cerebrovascular disease and acute stroke; medical records of outpatients who are enrolled in drug dispensary follow up, medical records of inpatients, numbers and types of thrombolysis, infrastructure and availability of technology such as CT scan, etc. Media communication activities concerning healthy lifestyle are monitored by the same subcommission. Reviews are conducted on a monthly basis. Stroke clinical guidelines were under review at the time of our mission; nevertheless, we had the opportunity to examine a draft. This was organized as a **protocol and though levels of evidence were not presented, the content reflected international standards and was evidence based**. In some countries belonging to the Commonwealth of Independent States (CIS), stroke guidelines and protocols recommend the use of drugs that have a poor evidence base, such as neuroprotective drugs (e.g. actovighin, citicolin), but in Belarus these were not included among recommended procedures either for acute or chronic cerebrovascular disease.

The current diagnostic and treatment protocol on ACS was approved by the MoH (Order of the Ministry of Health of 30 December 2014 No. 117) and corresponds to the main provisions of the recommendations of the European Society of Cardiology for STEMI. The main regulatory documentation on the topic of diagnosis and treatment of ACS are “The clinical protocol of diagnosis and treatment of myocardial infarction and unstable angina” and “Roadmap of medical care for patients with acute coronary syndrome at all levels”.

The National Cardiological Society has endorsed the guidelines of the European Society of Cardiology (ESC).¹⁷ It produced national guidelines for ACS,¹⁸ which cover both STEMI and NSTEMI diagnosis and treatment. These were developed by the National Scientific and Practical Center “Cardiology” and National Cardiological Society in 2005, and were revised in 2010 but are considered as additional supportive documents only.

Making explicit reference to necessary scientific and evidence-based information could be useful to enable health workers to make informed and correct decisions in everyday practice.

There is a large professional community of cardiologists and specialists in emergency care in Belarus. Professional societies could potentially take on a more central role in the production of clinical guidelines, control of quality of care and educational activities.

Differences in incidence, mortality and disability rates of stroke and AMI throughout European countries may reflect different degrees of implementation of evidence-based interventions in CVD prevention and care. Implementation of evidence-based interventions may be carried out with different instruments. Table 1 summarizes those observed for stroke and ACS during this mission in Belarus.

Table 1. Presence of implementation strategies for ACS and stroke in Belarus

Implementation strategy ¹⁹	Presence (Yes/No)
Opinion leaders	Yes
Multi-professional collaboration	Yes
Multifaceted interventions	No
Stroke patient associations	No
National and regional policies	
● Mandatory	Yes
● Non-mandatory	No
Financial incentives	
● Public	Yes
● Private	No
Educational strategies	
● Printed/electronic educational material	Yes
● Educational meetings and workshops	Yes
● Educational outreach visits	Yes
● Educational campaigns	Yes
● Guidelines	Yes
Audits and feedback	No
Reminders	
● Electronic reminders	No
● Written reminders	Yes
Computerized decision-support systems	No

Some explanatory notes to the table are as follows:

- Public financial incentives are provided to physicians to encourage them to attend courses to upgrade their knowledge, at least to the minimal requirement level.
- Some private incentives support educational strategies such as meetings, workshops and conferences.
- Death reviews on stroke cases in working-age people are not reported to clinicians but mostly reported to those in administrative and organizational positions. Therefore, not surprisingly, indicators chosen to monitor the performance and outcome of stroke care meet needs other than those of informing clinicians on their failures or successes.
- Educational campaigns by various means (TV, radio, printed materials) are planned, organized and monitored by regional authorities, and the role of nongovernmental organizations (NGOs) such as patient and/or professional associations in these initiatives is not clear, or at least, it seems to be occasional and not structured or consistent over time. Awareness is still not sufficient among the public and health-care professionals about the association between a high prevalence of smoking and harmful use of alcohol in men, and the incidence of AMI and stroke.
- Concurrent or intervisit reminders to professionals about desired actions such as screening or other preventive services or administrative support (e.g. follow-up appointment system, or stickers on charts) are in use in the primary care services; there are no specific reminders for patients with stroke. Patient-specific reminders are also in place. These include letters/postcards/phone calls to remind clients of future examinations; and general reminders for patients such as posters, especially in primary care services.

Professional education

Four medical universities in Belarus provide basic medical training for doctors (in Grodno, Gomel, Vitebsk and the Belarusian State Medical University in Minsk). A separate institution, BelMAPO, coordinates all postgraduate education as well as continuing medical education for doctors and for some nursing specializations. The medical faculty is organized in eight main courses, and the Curative Faculty must be completed before specialty training. The Curative Faculty provides basic medical education (six years in duration) for doctors who will treat adults. Medical universities in Belarus also offer a six-year basic medical education in English,²⁰ although it is more expensive than the Russian-language version.²¹

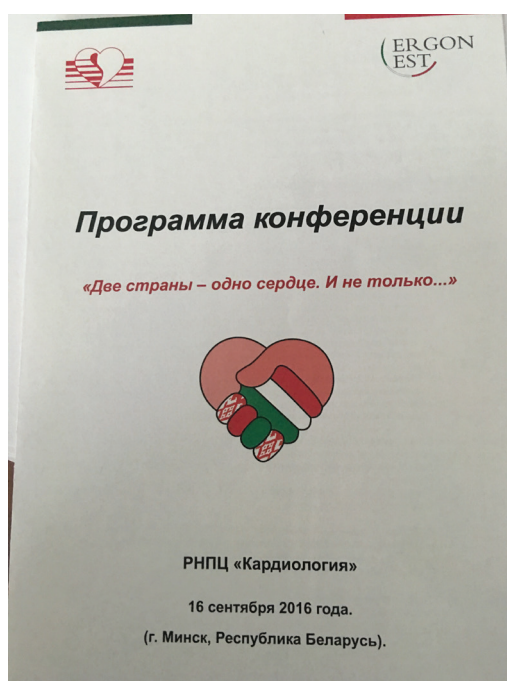
Specialist clinical training is shorter than that recommended at the European level. The residency programme to become a neurologist takes 2 years, rather than the minimum four years recommended internationally,²² and it takes around 1–2 months to gain “cerebrovascular disease subspecialization”. Specialist training in cardiology in Belarus takes 2–4 years to obtain a specialty diploma²³ compared with the European recommendations of a minimum of four years.²⁴

There are minimum standards for continuing medical education of all practising doctors. Physicians are obliged to follow two 14-day upgrading courses, with a minimum of 80 learning hours, in every 5-year period. BelMAPO trains or retrain around 15 000 clinicians annually. There are financial incentives to attend upgrading courses, at least at the minimal requirement level. However, **continuing medical education is not linked to a process of revalidation or maintenance of specialization.**

Continuing medical education for cardiologists is provided by the Department of Cardiology and Rheumatology of BelMAPO, based on City Clinical Hospital #1. The Department, among others, offers a 12-day full-time education programme “Acute coronary syndrome” for physicians and chiefs of intensive cardiac care units twice a year for 24 participants each, according to the annual educational plan approved by the MoH.²⁵ The BelMAPO also provides distant online education services, including the module “Acute coronary syndrome with ST-segment elevation”.²⁶

The number of people attending conferences and participating in international events is increasing. The Minsk emergency hospital developed a close relationship with Canadian endovascular neuroradiologists and neurosurgeons; the hospital also participated in international trials such as ARTEMIDA,²⁷ CASSIOPEA,²⁸ TIMI 25.²⁹ The Republican Scientific and Practical Center for Cardiology is also active in organizing and promoting international meetings and workshops (Fig. 6).

Fig. 6. Conference organized by the Republican Center of Cardiology, Minsk. On the pamphlet, there is the logo of the ERGON-EST Belarusian firm that produces medical devices with Italian capital.



6. Quality control and performance management

Uptake of the best evidence-based clinical practice should be improved through monitoring quality metrics (including performance measures) of all components of the care continuum. In Belarus, a complex reporting system to individuals and institutions is responsible for monitoring the functioning of the health-care system. **Each specialty has its own reporting system and there is little coordination between them**, e.g. between the institutions/subcommission reporting on cerebrovascular disease and those reporting on CVD.

Although there have been demonstrable improvements in the coverage and effectiveness of care, Belarus does not participate in international registries or benchmarking of care for stroke or ACS.

Monitoring the performance of stroke care services

A limited system for monitoring and reporting care is in place. The MoH of the Republic of Belarus monitors and ensures the quality of medical care in case of stroke as follows. In accordance with the order of the Ministry of Health №212 of 04.03.2011, “Subcommission #3 on neurology and neurosurgery” has been established and functioning, consisting of neurologists and neurosurgeons with high qualifications (staff of the Republican Scientific and Practical Center for Neurology and Neurosurgery, departments of medical universities). This Subcommission #3 within the State Programme on Public Health and Demographic Security is a task force unit that monitors and reviews death cases due to trauma and neurological conditions. Quarterly, each supervisor/curator, together with the chief specialist of the regional health department, conducts an in-depth analysis of information on morbidity and mortality in the region, identifies the operational situation in the region, and travels to areas where the indicators show an increase.

The Subcommission is responsible for monitoring mortality due to stroke and craniocerebral injuries, reviewing death records of the working-age population due to stroke and craniocerebral injuries, and implementation of thrombolytic treatment at the regional and local levels. Data are collected on the following:

- mortality due to acute cerebrovascular events
- mortality due to chronic cerebrovascular disease
- number and types of thrombolysis
- available technology (intra-hospital network, number of personal computers, CT scan, ultrasound system and machines)
- available resources: beds in stroke centres or neurology ward/neurologists
- number and types of communication initiatives (TV shows, radio shows, publications in the regional printed media) with content related to a healthy lifestyle, stroke prevention, recognition of the early signs of stroke and what to do in case of suspected stroke.

Results are summarized in a monthly “information letter”. Local health authorities are provided with specific recommendations to solve emerging problems.

The tenth revision of the International Classification of Diseases (ICD-10) was adopted in 2002, which since then has been the basis for coding of diagnoses.

Mortality is considered from a working-age perspective (i.e. 15–64 years for men, 15–60 for women) as this is the productive component of the demographic structure. The Medical Review Board of the Health Department is responsible for reviewing certificates of death due to stroke in the working-age population, and medical records of both inpatient and outpatient settings of care according to the patient profile group (grade of disability). This evaluation ensures compliance with the protocol on the basis of diagnosis and is graded on a 5-point scale. At the time of our mission, the stroke protocol was under revision. An older version, which dated back to 2005–06, with some updates in 2011 and 2014 (list of essential drugs), was still in use.

This information is collected, summarized and presented for each region/oblast of Belarus. The Subcommission #3 describes the trend of the evaluated parameters; it takes into account problems and possible causes, as well as corrective actions that could be implemented.

There is further potential for monitoring and assuring the quality of care in Belarus. Epidemiological and demographic indicators are used to assess health-care system performance at a regional/local level whereas data on population health and volume of services are collected to assess the implementation of State programmes. Indicators, such as time-based metrics, and other quality measures are not used to provide feedback to either physicians or local professional organizations or regulatory authorities.

Stroke audits or registries do not exist to provide information on the quality of acute hospital care or rehabilitation care for the local population; therefore, it is not possible to implement regular benchmarking activities by comparing measures of quality of care between the centres at international, national or regional levels.

Although in recent years experience has grown in both endovascular thrombolysis and mechanical thrombectomy, **stroke centres in Belarus do not participate in international registries**, such as the Safe Implementation of Treatments in Stroke (SITS) Thrombolysis Registry³⁰ – a research-driven, independent, international collaboration with the participation of all EU-15 and other countries. A personified population-level stroke register has not been established at the national or regional level, apart from the Stroke Registry in the Grodno region.

Monitoring the performance of services for ACS

The chief cardiologist supervises the performance of units in different regions. The annual statistical data on ACS care can be obtained from the monitoring of 41 indicators named “Departmental Reporting” approved by the MoH. This report contains only general data on the number of patients from different groups, time from onset of symptoms to hospitalization, type of reperfusion therapy, the number of interventions performed and mortality. The real-life data that would enable individual analysis of each case of care (registry data) are not collected, even in limited groups of patients.

In 2015, in all regions of Belarus, a total of 33 970 patients with ACS were hospitalized. Their number varied from 3017 patients in the Gomel region to 6712 patients in Minsk city. Only 30% of hospitalized ACS patients presented with STEMI, and only 28.4% of ACS patients were of working age.

Around half (53.6%) of STEMI patients and around a third (37.8%) of NSTEMI patients were admitted within 6 hours of onset of symptoms, with small differences between regions. There was a trend towards early admission in those with STEMI in the Grodno region (58.9% within first 6 hours) and late admissions in the Minsk region (49.6% within first 6 hours).

Diagnostic performance was measured by the proportion that used the quantitative troponin test according to international standards. Quality laboratory diagnostics were applied in 99.5% of cases in Minsk but in only 53.6% of cases in Mogilev, 69.2% of cases in Vitebsk and 72% of cases in Gomel.

In 40.4% of STEMI patients, the administration of a thrombolytic agent was the first reperfusion strategy, and thrombolytics of the third generation were used in only 24.2% of cases (locally produced medication of the first-generation streptokinase is widely available). In the Brest and Grodno regions and in Minsk city, from 31.2% to 44.5% of thrombolytic administrations were performed at the prehospital stage of care, but in other regions, only about 10% received prehospital thrombolytic administration. **The proportion of patients with STEMI subjected to reperfusion therapy in 2015 – primary PCI, pharmacoinvasive strategy or thrombolytic administration only – was high**, and varied from 58.2% in the Gomel region to 66.2% in Minsk.

As for the previous two years, the registered **in-hospital mortality from MI in 2015 was low in all regions** with small differences (from 4.40% to 5.82%). When the data from the National Statistical Committee³¹ on the number of deaths due to MI in 2015 (1327 cases) were compared to that from departmental statistics of deaths due to MI in hospitals (800 cases), it appears that 39.7% of deaths from MI occurred outside of specialized hospitals, which may also explain the low level

of hospital mortality. It can be assumed that the decrease in mortality from MI requires not only improving the quality of inpatient care, but also significantly increasing the coverage of AMI cases by hospital care.

As seen above, the range of differences between regions for the incidence of MI is almost twofold. The higher life expectancy and incidence of CVD in big cities is known and matched to the better capability of their health-care system, but the regional capacities in early identification of patients with MI may also influence these indicators. Centralization of health care can be a problem in many post-Soviet countries, but there were some indications that this was changing; for example, from 2010 to 2015, the proportion of procedures (surgeries on the heart and aorta) undertaken in the regions increased from 56.6% to 84.2%. The data from departmental monitoring in the first 6 months of 2016 show **significantly positive dynamics in the quality of emergency diagnostics and care in patients with ACS, especially in the number of invasive procedures** – for STEMI patients there was a growth from 11% in the Gomel region to 175% in the Brest region.

International initiatives in ACS care such as the “Stent for Life” programme or international registers, such as the EURObservational Research Programme (EORP) of the European Society of Cardiology (ESC), are not present in Belarus. These international initiatives would help in overcoming barriers to effective health care, which at present are most relevant for Belarus.

A national personified population-level register for ACS has not been established.

7. Clinical pathway

Structure of services

Prevention and control of NCDs is carried out through a series of actions at multiple levels coordinated by the MoH. Primary prevention of CVDs is compromised by the absence of a system of reimbursement of hypotensive drugs, cholesterol-lowering drugs and nicotine-replacement therapy for patients at high risk for CVD. The government health-care system provides a centralized model of care with high adherence to the established policies. The emergency system is regionalized, and primary care services, such as outpatient rehabilitation, dispensary observation and controlled secondary prevention, are provided through the network of government outpatient clinics (polyclinics). Both the acute stroke care and ACS care network and pathways are embedded in the emergency system (ambulance and hospitals).

Cardiology services

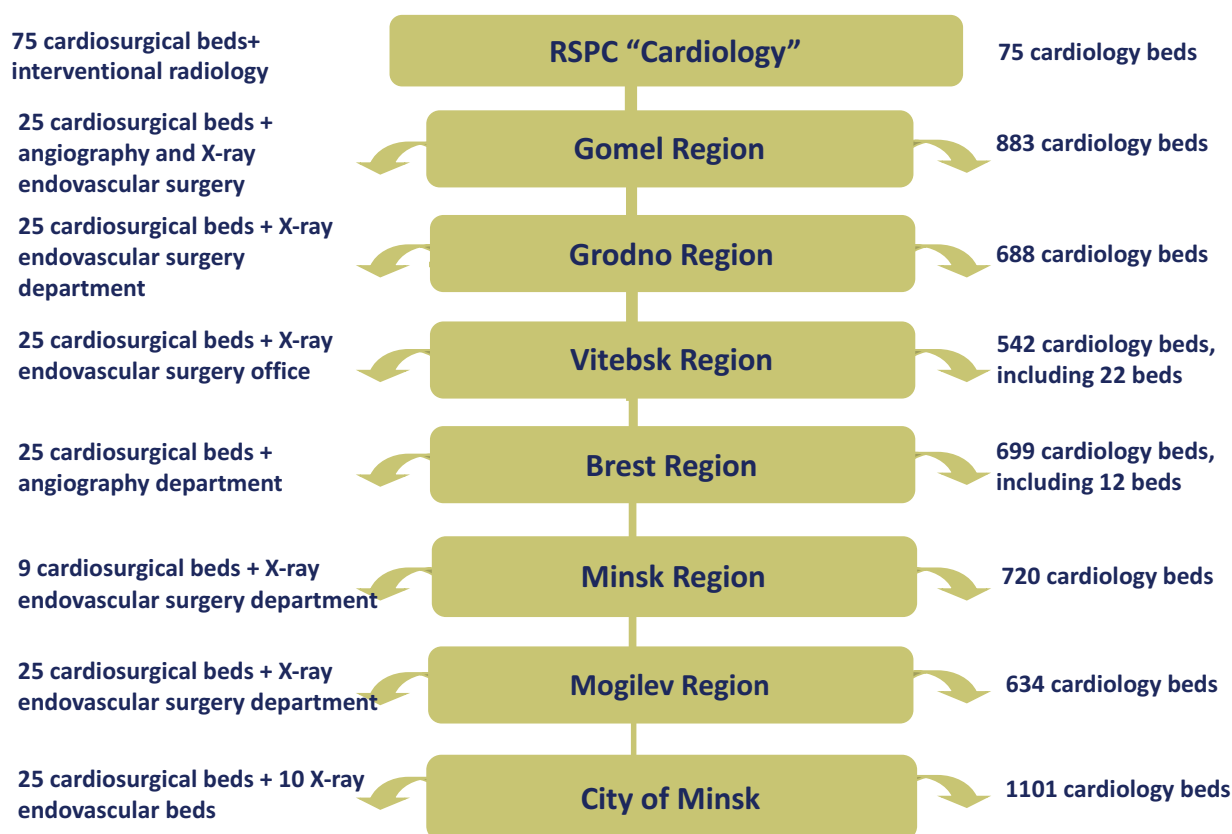
The modern approach to organize effective emergency care for patients with ACS includes the creation of regional networks, high availability of early reperfusion therapy and percutaneous interventions, and medical therapy with new potent drugs. It also includes the availability of rehabilitation programmes and effective interventions for secondary prevention.^{32,33}

The development of the structure of regional ACS networks in Belarus was one of the goals of the State 5-year programme “Cardiology” (2011–2015). This programme provided training of medical staff, and opened new catheterization laboratories (five in different regions in the past 3 years). **Since the start of programme in 2011, all PCI centres are working 24x7.**

Care and services for patients with ACS are organized according to a three-level referral system. Beyond those that have already been mentioned, which constitute the first two levels, the highest level of care is the National Center of Cardiology. This level represents the highest level of expertise, performs a large volume of clinical care, and contributes to guidelines and policies for cardiological care. No equivalent is available for stroke care.

Fig. 7 describes the general characteristics of the cardiology service.^b The service includes 224 cardiology offices at city outpatient clinics. In Minsk, there are nine district cardiology centres in all administrative districts of the city. There are 79 cardiology and 10 cardiosurgical departments at regional and city hospitals, including three cardiology departments and three cardiosurgical departments in the Republican Scientific and Practical Center (RSPC) “Cardiology” and two cardiosurgical departments for children. There are 17 departments (offices) of X-ray endovascular surgery.

Fig. 7. Structure of the cardiology service in Belarus (situation as of 31 December 2014)



The number of cardiology beds on 31 December 2014 was 5342 (a reduction of 125 beds since 2013), including 34 day-patient beds. This gives a ratio of 7.1 beds per 10 000 adult population. In 2015, 199 200 patients were treated by the cardiology services with an average stay of 9.6 days (range 8.8–10.6 days). On 31 December 2014, there were 274 cardiosurgical beds (same as in 2013). Overall, there are 680 cardiologists (status as of 1 January 2016). This gives a ratio of 0.12 cardiac surgeons per 10 000 population (0.12 in 2014) and a ratio of 0.13 X-ray endovascular surgeons per 10 000 population (0.1 in 2014).

Stroke care services

Since 2000, a staged health-care approach for patients with stroke has been adopted in Belarus; i.e. all patients with suspected stroke should be referred to specialized stroke/neurological departments (in large cities, i.e. Minsk) or smaller neurological/stroke centres. **A clinical pathway for stroke care has been fully adopted; all stroke care components are in place even if at different levels of implementation and with a geographical gradient**, with urban areas having the advantage of being better equipped, coordinated and organized. Stroke unit care is available in Belarus,^{34–36} which constitutes providing thrombolytic therapy within 4.5 hours from the onset of ischaemic stroke³⁷ and/or intra-arterial thrombolysis,³⁸ leading to lower rates of mortality and disability. Access to this care is granted by an **ambulance service that has adopted a stroke protocol and pre-notification system, which is partially in place**. Rehabilitation therapies are essential parts of the stroke care continuum as they consist of different evidence-based interventions that enable patients with stroke to regain independence in daily life.³⁹ Secondary prevention strategies aimed at avoiding recurrence of stroke

^b Information from presentation given on 27 September 2016 by Alexander Vladimirovich Patseev, Deputy Director, Republican Scientific and Practical Center for Cardiology.

and AMI are only partially implemented; **prescriptions for life-savings drugs are free for a limited period of time** (6 months after an episode of AMI or stroke) or continuously (reimbursement of 90% of cost) if the patient is graded as having first- or second-degree disability after stroke; monitoring and control of modifiable risk factors, including tobacco and alcohol use, are carried out by primary care services. For patients with severe neurological impairment, home services and nursing home facilities have been also made available.

Prehospital setting

Early diagnosis of stroke is essential for accessing the best treatment options, which in turn provides gains in terms of years in good health and reduces both the long-term disability of patients and the economic impact on society. Prehospital stroke care is focused on ambulance services and awareness campaigns aimed at educating the general population on recognizing and responding to the symptoms of stroke. Primary prevention of stroke is compromised by the absence of a system of reimbursement to the patient of hypotensive drugs, cholesterol-lowering drugs, anticoagulants (for atrial fibrillation) and nicotine-replacement therapy for patients with a high risk of stroke. (Only those who have had an episode of stroke are given free drugs for 6 months and those who receive a first- or second-degree disability allowance are eligible for 90% reimbursement of prescription medicines).

In Belarus, **there is a countrywide, ambulance-centred system of emergency care**, which also covers out-of-hours primary care. Hence, coverage is available 24 hours a day, 365 days a year. In 2011, the ambulance service consisted of 24 stations, 29 substations, 117 departments and 90 emergency care posts distributed throughout the country.⁴⁰ Ambulance stations are usually situated in a separate building away from the hospital in large cities or are connected to hospitals or polyclinics in smaller district centres. **Specialized evidence-based protocols for AMI and stroke are available.** Availability of specialized ambulance teams (cardiac, trauma or neurological, including stroke) is higher in urban areas, especially in Minsk, than in rural areas.

In case of patients with suspected stroke in the Minsk Oblast area, they are taken to one of the five local hospitals that provide fibrinolytic therapy. According to emergency protocols, the dispatch should ask for specific information on whether the patient is experiencing symptoms of stroke or AMI before sending an ambulance. Additionally, the ambulance team needs to communicate to the admitting hospital that a possible patient with stroke/AMI is arriving. The AMI/emergency ambulance team may provide tele-ECG and early treatment, including reperfusion therapy with a thrombolytic agent and/or transfer to PCI at appropriate time intervals. Outpatient clinics are approved and equipped to provide the first stage of care in ACS (in case of visit of a patient in acute condition) and have on-duty emergency care teams that allow provision of early and effective care.

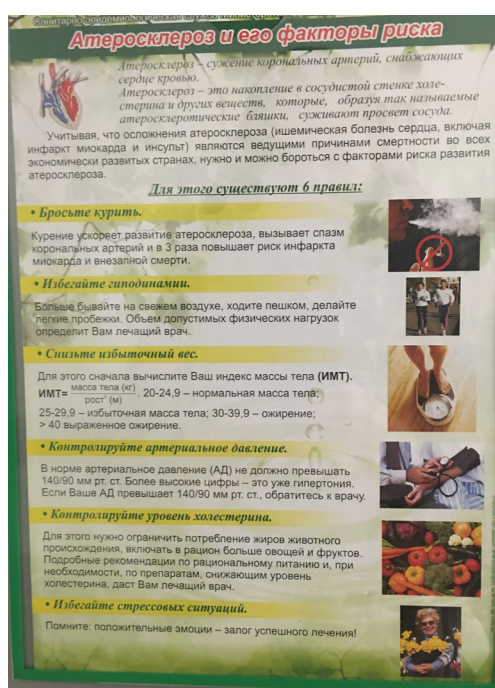
The current countrywide network for ACS consists of 852 ambulance teams (170 mobile intensive care units [ICUs], and 99 of them with a physician on board), working system of ECG transmission, 63 hospitals (19 of them with PCI facility and 14 of them working 24x7); eight hospitals have cardiosurgery departments. **Prehospital thrombolysis as a first reperfusion strategy in STEMI patients is available in all regions of Belarus.** The other prehospital interventions that are essential for emergency care for patients with ACS – defibrillation, basic life support, pain relief, administration of loading doses of antiplatelet drugs and heparin – are also widely available. Emergency care in ACS at the prehospital stage is explained in detail by “The clinical protocol of diagnosis and treatment of MI and unstable angina”, approved by the MoH, including the responsibility of medical workers, required diagnostic procedures, medical treatment with the recommended dosing of drugs and the order or transfer of patients with ACS to hospitals.

Cardiovascular emergencies are the most common reason for calling an ambulance in Belarus (32.6% of calls). However, there is overall a very large number of ambulance calls (more than 300 ambulance visits per 1000 population per year, or **every third person calls an ambulance at least once per year** with a very low rate of hospitalization after arrival of the ambulance). A significant proportion of the ambulance calls is related to “high blood pressure”, which would not happen if patients had free and uninterrupted access to hypotensive drugs. **The main problem in organization of prehospital care, therefore, is the comparative lack of medical staff:** in 2013, positions of 33.6% of physicians and 16.4% of medical assistants were vacant.⁴¹ The number of physicians employed in emergency care is inversely associated with mortality from IHD among the population of Belarus.⁴²

Awareness campaigns on CVDs are carried out by means of various types of communication, but their efficacy is not measured (Fig. 8). Awareness campaigns on prevention, treatment and diagnosis of NCDs are organized by national and regional authorities at different levels, and through various means of communication:

- national and regional television programmes
- regional and local radio campaigns
- web campaigns (information available on hospitals websites)
- booklets, magazines
- screening campaigns held at public places (i.e. supermarkets measuring BP for stroke prevention day)
- stroke prevention day.

Fig. 8. Educational campaign promoted by the MoH on coronary artery disease awareness and risk factor control



These campaigns are monitored by subcommissions. Subcommission #3 on Neurology and Neurosurgery is responsible for monitoring and reporting on the types and numbers of initiatives/campaigns that address health-related issues concerning stroke and AMI and, more generally, on prevention, diagnosis and treatment of NCDs (such as diet, measurement of hypertension, healthy lifestyle, etc.). Nevertheless, **it is not clear whether awareness campaigns and content diffusion are coordinated, and whether change in population attitude is measured to evaluate their efficacy.** Awareness is still not sufficient among the population and health-care professionals about the association between a high prevalence of smoking and harmful use of alcohol in men and the incidence of AMI and stroke. Primary prevention for CVDs is compromised by the absence of a system of reimbursement to the patient of hypotensive drugs, cholesterol-lowering drugs, anticoagulants (for atrial fibrillation) and nicotine-replacement therapy for patients at high risk for CVD.

Hospital care

Belarus has preserved the publicly controlled Semashko health-care system, which is organized on a territorial basis and in a hierarchical way. The health-care system is focused on the provision of highly specialized tertiary care and hospital-based services:⁴³ Belarus had 37.6 physicians per 10 000 people in 2003–2012⁴⁴ (39.4 in 2013), and 8.9 hospital beds per 1000 people in 2013. District hospitals provide general secondary care services; regional hospitals deal with more complex cases and offer a wider choice of care. At the same time, each district and region has an outpatient polyclinic, which delivers

specialized care for patients in the community. In recent years, there has been a significant increase in the implementation of high-tech services in the health system – this has been a result of a specific policy (Fig. 9). Most of these high-tech procedures are conducted in highly specialized republican centres where we met health-care leaders and appreciated new technology, infrastructure and information technology (IT) solutions for patients with stroke and AMI. Some regional hospitals also have high-tech centres.

Fig. 9. 3.0 Tesla MRI facility at the Republic Center of Cardiology, Belarus



The standard of stroke care and ACS technologies and infrastructure is on a par with that of the EU-15 countries.

However, such care is not uniformly available throughout the country; neuroimaging diagnostic facilities are on average 70 km distant from one another; only 80 CT scan centres are there throughout the country, 18 are placed in republican/regional hospitals, which are equipped with a stroke centre or neurological unit. Consequently, not all patients with ischaemic stroke may be receiving the timely assessment they require.

In Minsk, there are six stroke centres, two of which are located in the Emergency Hospital of Minsk,⁴⁵ Belarus which is equipped with high standard technologies for diagnosis, treatment and management of stroke and AMI. There are 150 stroke beds available, 12 ICU beds for severely impaired patients, and multiprofessional stroke teams. An early rehabilitation programme and secondary prevention are in place, and the standard of inpatient care is on a par with that of the EU-15 countries.

Clinical and functional assessment scales are not used to their full potential. Clinical scales such as the National Institutes of Health (NIH) Stroke Scale are used only if patients undergo thrombolysis, and not in everyday clinical practice. International outcome measures such as the Barthel index or modified Rankin scale are not currently adopted. The modified Rankin scale was adopted in the Grodno registry. Even if stroke physicians are aware of it and of other stroke scales, these tools are currently underused. The average length of stay of a stroke patient is 10–15 days, which is consistent in stroke centres throughout the country. Paid services are available to both Belarusian and foreign citizens,⁴⁵ and a comprehensive price list is available on the hospital website. Information on the hospital website, as well as signposting at the site, are in both English and Russian.

The thrombolysis rate for patients with acute ischaemic stroke lags behind the EU-15 average. Systemic thrombolysis was first introduced and made available in Belarus in 2006 and, since then, the number of patients receiving this treatment has increased annually. At present, only 6% of ischaemic stroke patients receive thrombolysis. Nonetheless, this treatment

rate lags far behind the EU-15 average of 20%. Over the first two months of 2016, the total number of thrombolytic procedures performed in the Republic of Belarus was 14.

Thrombolysis remains the leading reperfusion strategy for patients with ACS. Access to primary PCI is undermined by delays in transfer of patients with STEMI. Facilities equipped to deliver coronary interventions for ACS are available throughout the country. In 2015, 19 centres with catheterization laboratories performed 732 PCIs in ACS patients per 1 million population, but transfer delays in patients with STEMI are significant, and the main reperfusion strategy remains thrombolysis (41%). Only 29% of patients with STEMI were forwarded to receive a primary PCI in 2015. This is below the goal for STEMI care and the current European standard, established in the “Stent for Life” initiative, of 60% coverage of STEMI patients by primary PCI, and performing more than 600 primary interventions in STEMI per 1 million population per year.⁴⁶ Since the start of the “Cardiology” programme in 2011, the proportion of all PCIs that were elective/scheduled (for stable IHD patients) and emergency PCI (for ACS patients) shifted to become 38.1% for elective and 61.9% for emergency PCI in 2015. In some regions of Belarus, however, the proportion of emergency PCI procedures among the total number of PCIs remains low and the majority of regions perform PCI more often in case of chronic stable IHD. Overall, there has been some decentralization of services. An increasing proportion of procedures has been taking place in the regions, from 56.6% in 2010 to 84.2% in 2015.

Radial access for PCI was used in only 15% of cases in 2015. The use of radial access instead of femoral leads to a significant decrease in bleeding and increase in survival of patients. In the EU-15 standard, radial access is used in more than 80% of interventions.

Thus, the regional network plan presented in the “Roadmap of medical care for ACS patients at all levels of care” approved by the MoH, will improve care mainly in patients with STEMI. The plan was aimed at the development of a routing system and opening of new centres in regions with lower availability of primary PCI.

Secondary prevention

Access to appropriate treatment for secondary prevention of cardiovascular events is limited in time and drug options.

After discharge, patients with stroke are referred back to their polyclinic, where medications, even life-saving drugs (hypotensive drugs, cholesterol-lowering drugs, anticoagulants), are free of charge only for six months after the event (see Box 1). Patients with the highest grade of disability of the first or second grade (bedridden or not able to work, respectively) may continue to receive 90% subsidized prescriptions of life-saving drugs; other disabled categories of patients may receive some free-of-charge prescriptions. The list of free-of-charge drugs is regularly approved by the MoH. The majority of drugs are now delivered in pharmacies with a doctor’s prescription; pharmacists insist on providing Belarusian drugs.

Box 1. Clinical case

On one of the cardiology wards, we met a woman aged 59 years, who was recovering from a procedure. She had been diagnosed in her polyclinic with hypertension and hypercholesterolaemia. She had been prescribed five drugs. She could afford only three of these and chose which ones to take. The cost of the five drugs each month would have been about 10% of a teacher’s salary per month if generic drugs were used, and possibly up to 25% of a monthly salary if branded.

She was admitted with an MI. On admission, she was also found to have a high blood sugar level. She was treated initially with thrombolysis, then received three stents through PCI in the catheterization laboratory.

On discharge, she will get free drugs for only 6 months. Not only was this admission and expensive set of interventions potentially avoidable, but without adequate secondary prevention, she is also at risk for recurrence and further hospitalization.

Neurological follow up is organized at the patient's polyclinic, where all patient information is recorded in an e-health passport and a hard copy is also available. The follow-up period lasts for 6 to 12 months and during this period the **patient may receive free-of-charge rehabilitation services if needed**. There are 1200 neurologists in Belarus and every polyclinic has 2–3 neurologists who do outpatient work, including follow up of patients with stroke.

After discharge, post-AMI patients are followed up in dedicated outpatient cardiology centres. Such centres (dispancers) are available in each regional city. In the city of Minsk, such district cardiology centres were established in 2006 on the premises of some polyclinics. Presently, there are nine cardiology centres (one is based in Polyclinic No. 32 in Minsk) where AMI patients are followed up for two years after the event. In regions, at the district level, follow up is organized by cardiologists of the Central district polyclinics. The network of government outpatient clinics facilitates the process of outpatient rehabilitation, dispensary observation and controlled interventions for secondary prevention in patients after ACS. Similar facilities for patients with stroke are not available and not likely in the near future.

Coverage of patients after ACS with dual antiplatelet therapy is 99% at the moment of discharge from hospital, but new and potent antiplatelet drugs such as prasugrel and ticagrelor, recommended by international guidelines as the first line of therapy, are not available in Belarus. New oral anticoagulants for primary and secondary prevention of stroke in patients with atrial fibrillation are available only if paid for by the patients.

Rehabilitation

Rehabilitation coverage is 60% among patients of economically productive age affected by the consequences of NCDs.

In recent years, the MoH has been actively developing rehabilitation services by founding rehabilitation centres, to which patients can be referred for aftercare following various conditions. In Belarus, the use of hospital beds for social- and long-term care has been formalized, and many rural hospitals have now been converted into hospitals for nursing care. There are 317 medical rehabilitation departments:

- 49 are inpatient departments in hospitals (45 for adults, 4 for children);
- 36 are inpatient departments in medical rehabilitation centres (32 for children and 4 for adults)
- 232 are outpatient departments/clinics (187 for adults and 45 for children) in polyclinics or based in primary rural service.

Overall, there are 4500 rehabilitation beds in the country, 2500 beds for adults, 2000 for children.

The lead research institute for medical rehabilitation in Belarus is the Republican Scientific Research Center for Medical Assessment and Rehabilitation.

Post-stroke rehabilitation of patients is conducted in the wards for medical rehabilitation of patients with neurological disorders.⁴⁷

As of 31 December 2015, there were 1111 rehabilitation beds for patients with neurological disorders in the Republic of Belarus. The duration of medical rehabilitation of patients after a stroke is 28 days, and 16–18 days for post-AMI patients. For post-traumatic conditions or orthopaedic surgery, the rehabilitation cycle may last 21–24 days.⁴⁷

To measure the medical and social consequences of stroke and its impact on daily living, evaluate clinical improvement and assess adaptation in social and daily living activities, the following scales should be used: Barthel index, Functional Independence Measurement (FIM), and Rankin scale. Nevertheless, **the implementation of international scales or scores in rehabilitation lags far behind the EU standard**, and physicians are reluctant to adopt these. Treatments provided to patients with stroke are evidence-based and consist of speech therapy, cognitive therapy, occupational therapy and physiotherapy; in addition, modern robotics rehabilitation technology is available in some centres.

As of 31 December 2015, a total of 11 057 patients have undergone medical rehabilitation after stroke in the medical rehabilitation departments for post-stroke patients.

According to Annex 8 of the State Programme on Public Health and Demographic Security in the Republic of Belarus for 2016–2020, rehabilitation coverage among patients of economically productive age after an MI, acute cerebrovascular event, other types of NCDs, and following surgery for malignant, neurosurgical and traumatological causes should be increased and reach 80% by 2020 (in 2015–2016, it is at 60%).

For this mission, we visited the Republican Clinical Hospital of Medical Rehabilitation, Aksakovschina.⁴⁸ This leading rehabilitation centre offers a wide range of inpatient rehabilitation services, most of which are evidence-based. The centre offers a comprehensive multiprofessional approach to stroke patients who are transferred here after acute events from hospitals in the Minsk region. Full diagnostic services are also available to inpatients and for patients who are referred from public services. Both inpatient and diagnostic facilities are available, as are paid services. The price list and full information are easily accessible on the Aksakovschina website (Russian language).

In the Republic of Belarus, medical rehabilitation services are provided in inpatient and outpatient departments at the district, city, regional and national levels. In 2012, there were 590 beds in 48 hospital departments for cardiological and cardiosurgical rehabilitation of adults, and 193 outpatient departments for rehabilitation of adults.⁴⁹

Conclusions

The scope and purpose of this exploration of premature mortality in Belarus was confined to a review of acute and rehabilitative services for heart attacks (ACS) and stroke. Its conclusions and recommendations are as follows.

The team found many strengths. **Health systems are in transition but significant progress has been made and a momentum has been generated.** All currently recommended components of the CVD care cycle have been adopted, though they are at different stages of development and implementation. Monitoring programmes for risk factors, including tobacco and alcohol use, have been implemented, and campaigns initiated, which focus on the merits of a healthy diet and physical activity. Health-care services are easily accessible (i.e. convenient opening hours of polyclinics, availability of physicians and nurses, facilities for diagnostics).

Investment in infrastructure and human resources is leading to a critical mass. Health-care leaders are passionate and well-trained, and the standards of care are on a par with EU-15 countries in some areas. Since 2000, Belarus has been investing in infrastructure and human resources to face emergencies such as stroke, and significant progress has been made, especially in acute care, with partial improvement in the outcomes of patients with stroke. The “Cardiology” programme 2011–2015 has introduced new technology, infrastructure and IT solutions, which have made prehospital thrombolysis available in all regions, and PCI units operate 24x7. Yet, the availability of these services is lacking in rural, compared to urban, areas, which is reflected in the epidemiological findings. Regional networks need to be further developed, and coverage of effective care needs to be extended in the regions.

Nevertheless, **there are barriers to controlling the risks of cardio-/cerebrovascular disease and implementation of evidence-based care, which need to be overcome. Gains in acute care are at risk of being undermined.** The specific weaknesses identified were the prevalence of unhealthy behaviours and poor control of risk factors. Actions have been taken at multiple levels to reduce the impact of cardiovascular risk factors on the population. These include tobacco control, healthy lifestyle campaigns, and detection of hypertension and diabetes. Though Belarus has made some progress in the area of alcohol control, it still remains among the countries with the highest per capita alcohol consumption in Europe. Alcohol consumption appears to be the *silent uninvited guest* in interventions for improving public health and reducing the burden of stroke. For example, in the Grodno study,¹³ it was not even considered among the risk factors examined for first-ever stroke. Clearly, systematic interventions to reduce premature mortality and disability among the male working-age population should address alcohol consumption from the perspectives of both core population interventions (such as tax increases and restricted access to retail alcohol, with bans on alcohol advertising) and individual services. Moreover,

effective tobacco control measures such as further tax increases and an enforced ban on public smoking can help reduce acute coronary events.⁵⁰

Some clinical guidelines and drug formularies need to be updated, and availability of life-saving drugs needs to be augmented. Individual access to health-care services is variable, both for primary and hospital care; nevertheless, patients once diagnosed, even those at high cardiovascular risk, may not have complete access to appropriate treatment for prevention of cardiovascular events. Absence of a system of (full or partial) reimbursement for hypotensive, cholesterol-lowering and anticoagulant drugs, and nicotine-replacement therapy is another major obstacle to the primary prevention of AMI and stroke, resulting in a higher prevalence of AMI and stroke, and increase in expenditure at the level of specialized care. In case of occurrence of acute stroke and/or AMI, drugs for secondary prevention are provided free for only 6 months and access to new drugs is limited, such as newer oral anticoagulant and antiplatelet drugs. Patients with severe disabilities are entitled to a subsidy of 90% on prescription medicines; those without disabilities or with minor neurological deficit have limited free access to secondary prevention. Patients with vascular risk factors may not be able to afford adequate therapy, thus increasing their cerebrovascular risk. In addition, long-term drug therapy for patients with chronic conditions remains very expensive and thus out of reach for most of the population.

Timeliness and appropriateness of care need to be measured and improved. In countries where hospital-based national registries for quality clinical care for stroke or ACS have been set up, analysis and reporting of the data collected have led to improvements in the quality of care, patient outcomes, and health policy. For instance, monitoring of stroke care performance has contributed to improving the quality of care. In Belarus, a limited national system focused on monitoring and reporting the quality stroke care exists, and there is potential for strengthening monitoring and quality assurance. Otherwise, this may impact on strategic planning for efficacious and efficient stroke care at multiple levels, such as coordination across providers, timely access to quality medicines and care, health system management and the establishment of effective models of service delivery. The current method of assessment for the quality of ACS care is formal in character, which is neither based on rating nor is it competitive, and therefore not conducive to the system of care. Therefore, we suggest a system to establish measurement of the quality of stroke and ACS care as an integral part of the process of quality improvement. Such a system would provide a powerful insight into the performance of different components of care, measure and report on the quality of care in individual regions, facilitate identification of best practices and their implementation at the national level, and help to explain differences in health-care outcomes. A more patient-centred approach and better use of resources could be achieved through the widespread use of clinical scales enabling customization of care, and more effective and targeted use of resources.

It is evident that institutions in Belarus are interested in attracting foreign patients, foreign students and foreign investments in the medical field. **Participation in international registries could give Belarus the opportunity to benchmark performance in stroke and ACS care,** attract clinical trials and research investments, foreign medical students and patients (e.g. for post-stroke rehabilitation). The annex gives a list of common indicators used for acute stroke and ACS care, which may contribute to meaningful regional, national and international comparisons of the quality of care.

Civil society should be empowered to participate in the prevention of CVDs and implementation of evidence-based medicine in the system of care. Professional associations are present in Belarus; nevertheless, their expertise could be better used by different means, e.g. by the participation of key opinion leaders in awareness campaigns, formulation and dissemination of national guidelines, visits for educational outreach in rural hospitals and outpatient clinics. There is limited experience of patient associations focusing on stroke or CVD; these are often promoted and run by professionals and not by patients or their carers.

Looking ahead, while a roadmap for cardiology services has been developed, **there is equally a need for a comprehensive, integrated monitored roadmap for stroke care.** Stroke management and prevention strategies are fragmented and neither integrated nor monitored. The components of clinical pathways for stroke care are not balanced. The considerable investments made so far in the acute phase may be undermined by barriers to control of cerebrovascular risk factors at multiple levels.

Annex 1: Mission programme

26.09.2016 Monday

Time	Activities	Venue
11.00–19.00	Arrival at the airport, transport to the hotel <i>Minsk</i>	
15.00–17.00	Meeting with specialists in cardiology and neurology Jill Farrington, Francesca Pezzella, Alexey Yakovlev, Oxana Rotar	WHO Country Office, Fabritsiusa St, 28, room 401
17.00–19.00	Meeting of international experts in the WHO Country Office. All international experts	WHO Country Office, Fabritsiusa St, 28, room 401

27.09.2016 Tuesday

Time	Activities	Venue
9.30– 11.00	Meeting in the Ministry of Health, introduction of the mission members, clarification of the mission programme Participants: all international experts	Myasnikova St, 39, Minsk
11.00–13.00	Working with the experts of the Department on Analysis, Planning and Funding of the Office of Economic Analysis and Development of Health Sector, Ministry of Health Participants: Oxana Rotar, experts of the Ministry of Health	Myasnikova St, 39, Minsk,
11.00–13.00	Visiting the Minsk City polyclinic N 39 (prevention of infarctions and strokes) Participants: Jill Farrington, Francesca Pezzella, Alexei Yakovlev, experts of the Ministry of Health	Polyclinic N 39 Minsk city
14.00– 17.00	Visiting the Center of Medical Technologies Department of Medical Statistics and Monitoring of Public Health Participants: Oxana Rotar, experts of the Ministry of Health	P. Brovka St, 7a
14.00– 17.00	Visiting the Cardiology Center Participants: Jill Farrington, Francesca Pezzella, Alexei Yakovlev, experts of the Ministry of Health	Republican Scientific and Practical Center for Cardiology

28.09.2016 Wednesday

Time	Activities	Venue
10.00– 13.00	Visiting the National Statistics Committee Participants: Oxana Rotar, Valiantsin Rusovic, experts of the Ministry of Health, National Statistics Committee	National Statistics Committee
10.00–13.00	Visiting the Republican Center for Neurology Participants: Jill Farrington, Francesca Pezzella, Batyr Berdklychev, joined later by Oxana Rotar, Valiantsin Rusovic, experts of the Ministry of Health	Republican Scientific and Practical Center for Neurology
14.00–17.00	Visiting the Center for Rehabilitation (after infarctions and strokes) Participants: Jill Farrington, Francesca Pezzella, Valiantsin Rusovic, experts of the Ministry of Health	Medical Center for Rehabilitation Axakovschina, Minsk region

29.09.2015 Thursday

Time	Activities	Venue
09:30–13:00	Visit to inter-rayon hospital, Soligorsk Participants: Jill Farrington, Francesca Romana Pezzella, Batyr Berdklychev, Valiantsin Rusovic	Soligorsk
15:00–17:30	Visit to Emergency Services Hospital, Minsk Participants: Jill Farrington, Francesca Romana Pezzella, Batyr Berdklychev, Valiantsin Rusovic	Minsk

30.09.2015 Friday

Time	Activities	Venue
9.30– 11.30	Debriefing of experts in the Ministry of Health Republic of Belarus: Participants: all international experts	Myasnikova St, 39, Minsk, Phone (017)222-65-98
12.00–13.00	Meeting with UN agencies Participants: all international experts	Minsk. Kirova St, 7
13:00–15:00	Departures to airport – various times	

Annex 2: Checklist of performance indicators for stroke care

No values were obtained during or after the mission concerning the following indicators. As previously mentioned, summaries are not available of physician performance/stroke team/ward/department/hospital or patient outcomes (by chart audit, utilization review, analysis of patient findings, etc.), followed by feedback to the clinicians, including information about their performance or patient data in the area of stroke. Nevertheless, other indicators are monitored and reported:

- total number of patients treated with thrombolysis over a period of time in each region
 - type of thrombolysis
- in-hospital cases of stroke death in the working-age population reviewed by the Subcommission in each region
 - adherence to protocol (%)
 - possible errors detected.

Clearly, in Belarus, there is a strong interest in improving the overall quality of stroke care; timeliness of care seems not to be measured; whereas implementation of policies, protocols, guidelines and strategies is not evaluated in terms of effectiveness in reducing stroke morbidity and consequences; mortality being the most commonly used outcome indicator.

Even though among EU-15 countries there are large variations in monitoring of stroke care and a Europe-wide consensus is yet to be achieved on quality indicators for acute stroke care or the methodology for collecting information, timeliness measures, scales to measure disability and stroke severity, and other quality measures are standardized.

Quality measures regarding the timeliness of interventions for ACS are lacking too (see the following tables), suggesting that apart from appropriateness of care, there is a need to encourage the development and implementation of time-dependent quality measures in the emergency care setting.

Acute care performance indicators		Value
Access of stroke patients: number of accesses at A&E	Percentage of patients who receive a diagnosis of stroke in the emergency room among overall number of accesses at the A&E	
IV tPA 3.5 hours	Intravenous recombinant tissue plasminogen activator (IV tPA) in patients who arrive within 3.5 hours of onset of symptoms and treated within 4.5 hours of onset of symptoms (IV tPA 3.5 hours) (ischaemic stroke only)	
Door-to-needle time	Time from access to intravenous recombinant tPA	
Door-to-CT time	Time from access to brain CT imaging	
Antithrombotic therapy – antiplatelet medication within 48 hours of onset of stroke	Percentage of patients after ischaemic stroke or TIA treated with antiplatelets within 48 hours of onset of stroke if an intracranial haemorrhage and contraindications to antiplatelet drugs are excluded	
In-hospital stroke management performance indicators		
Early rehabilitation – speech therapy	Percentage of patients with aphasia or dysarthria on admission who are seen or treated by a speech therapist within the first 2 days of admission	

Early rehabilitation – physiotherapy/occupational therapy	Percentage of patients with documented paresis on admission and substantial functional deficit (Rankin scale ≥ 3 or Barthel index ≤ 70 within first 24 hours after admission) who were seen or treated by a physiotherapist or occupational therapist within the first 2 days of admission	
Brain imaging in patients with stroke	Percentage of patients with brain imaging (CT scan or MR scan) among those suspected to have a stroke or TIA	
Vascular imaging in patients with ischaemic stroke or TIA	Percentage of patients with ischaemic stroke or TIA who received vascular imaging of extracranial arteries during hospitalization	
Screening of patients for swallowing disorders	Percentage of patients with stroke who were screened for dysphagia using a standardized protocol	
Stroke education provided	Stroke education provided to patient and/or caregiver, all five components: modifiable risk factors, stroke warning signs and symptoms, how to activate emergency medical services, need for follow up, medications prescribed	
Discharge indicators		
Discharge destination (%)	Percentage of discharged patients with stroke: 1 home; 2 rehabilitation centre; 3 nursing home/long-term care facilities; 4 died	
Antithrombotic therapy – antiplatelet medication at discharge	Percentage of surviving patients after ischaemic stroke or TIA treated with antiplatelets at discharge who had no contraindication to antiplatelets	
Anticoagulation at discharge in patients with atrial fibrillation	Percentage of patients with ischaemic stroke or TIA and atrial fibrillation receiving anticoagulation at discharge who are sent home or to an inpatient rehabilitation unit or long-term care facility	
Smoking	Percentage of smoking cessation interventions (counselling or medication) at discharge for current or recent smokers (all patients)	
Alcohol	Alcohol consumption cessation intervention (counselling or medication or referral to dedicated service) at discharge	
Cholesterol-reducing medication	Percentage of patients with ischaemic stroke or TIA receiving cholesterol-reducing medication at discharge	
Outcome		
Mortality	Mortality at 3, 6 and 12 months (proportion of patients with stroke dead 90 days after stroke, 6 and 12 months after stroke) reported separately for ischaemic stroke and primary intracerebral haemorrhage	
Disability (measured with modified Rankin scale)	Disability at 3, 6, and 12 months (proportion of patients dependent – modified Rankin scale score from 3 to 5 at 3, 6 and 12 months after stroke) reported separately for ischaemic stroke and primary intracerebral haemorrhage	

Annex 3: Acute coronary syndrome health-care system checklist

No	Indicator	Value
1	Population of the country	9 489 616
2	The urban population	7 347 512
3	The rural population	2 142 104
4	Administrative division	NA
5	All-cause mortality	12 0026
6	All-cause mortality rate per 100 000 inhabitants	1264.8
7	Mortality from CVD	66 456
8	The mortality rate from CVD per 100 000 inhabitants	700.3
9	The number of reported cases of ACS	34 907
10	The number of reported cases of AMI	15 659
11	The number of deaths from ACS (I20–I22)	1327
12	The number of fatal outcomes in ACS in the first 24 hours of the disease	7498
13	The number of fatal outcomes from ACS in hospitals	803
14	The number of autopsies in fatal outcomes from ACS	NA
15	The number of the divergences of diagnoses by autopsy	NA
16	The number of deaths from AMI (I21–I22)	1327
17	The rate of mortality from AMI per 100 000 inhabitants	14.0
18	The number of registered cases of ACS with ST-segment elevation on ECG	10 184
19	The number of ambulance crews	852
20	The number of ambulance physician teams	99
21	The number of specialized ambulance teams (resuscitation/intensive care)	170
22	A single call number for ambulance	“103”
23	A system for routing of ACS patients (policies, regulatory documents, dispatchers)	Yes
24	The availability of ECG in the prehospital setting	Yes
25	Remote transmission of the ECG	444
26	The availability of thrombolysis in the prehospital setting	Yes
27	The availability of defibrillation in the prehospital setting	Yes
28	The availability of antithrombotic therapy in the prehospital setting	Yes
29	The number of cases of prehospital thrombolysis per year	891
30	The number of hospitals providing care for ACS	63
31	The number of monitored beds for the management of ACS	2024
32	The number of doctors assisting in ACS care	124
33	The number of nurses assisting in ACS care	NA

34	The number of hospitals with the possibility of thrombolysis, but without PCI facility	NA
35	The number of hospitals with on-site PCI facility during working hours	19
36	The number of hospitals with 24x7 on-site PCI facility	14
37	The number of hospitals with PCI and surgery (coronary artery bypass grafting [CABG]) on-site facility	8
38	The number of cases of thrombolysis in hospitals per year	3253
39	The number of cases of thrombolysis + PCI per year	8427
40	The number of primary PCIs per year	2137
41	The population in areas with available primary PCI	NA
42	The number of CABG in ACS per year	75
43	Frequency of use of drug-eluting stents in PCI for ACS	44% (from 6058)
44	The frequency of use of radial access in PCI for ACS	15%
45	Presence of national registry for ACS	No
46	Presence of regional registers for ACS	No
47	A system for assessment/monitoring of quality of care in ACS	3-level system
48	The number of cases in which the quality of care control was carried out, per year	100%
49	Time delay "symptom – call to ambulance"	NA
50	Ambulance arrival time	15–30'
51	The "door-to-needle" time for thrombolysis	NA
52	The "door-to-balloon" time for primary PCI	NA
53	The use of double antiplatelet therapy	99%
54	The use of parenteral anticoagulants in acute phase of ACS	NA
55	The use of angiotension-converting enzyme (ACE) inhibitors	95%
56	The use of statins	90%
57	The availability of rehabilitation programmes	NA
58	Presence of programmes for the development of a regional network for ACS management	Yes
59	Presence of programmes for preferential provision of medicines	NA
60	Presence of programmes for informing the population about the symptoms of AMI and early treatment	NA

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