World Health Organization
REGIONAL OFFICE FOR Europe

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

WHO European Office for the Prevention and Control of Noncommunicable Diseases

9 Leontyevsky Pereulok
125009 Moscow, Russian Federation
Email: NCDoffice@who.int

Website:
www.euro.who.int/en/NCDoffice

World Health Organization
REGIONAL OFFICE FOR Europe

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

Jill Farrington, Francesca Romana Pezzella, Alexei Yakovlev, Oxana Rotar

WHO Regional Office for Europe, 2017

Abstract

Cardiovascular diseases are responsible for half the number of deaths in Kyrgyzstan and are a major theme of the national health reform programme 2012–2016 "Den Sooluk". A WHO review of acute and rehabilitative services for heart attack and stroke took place in October 2016. There are services in place for these, more developed for the former than the latter, and more concentrated in the capital. Clinical guidelines exist and are largely evidence-based but implementation is impeded by gaps in resources and infrastructure, design of services, fragmented clinical pathways and networks, and limited performance management. There was some indication of the use of non-evidence-based medicine and opportunities for release of resources. There appears to be a growing gap between what is possible in the private sector and the public sector. Fragmentation of the clinical pathway and charges (formal and informal) place a heavy cost on the patient, both financially and in terms of clinical outcome. Nevertheless, there are good and emerging practices, developing international networks, and investment opportunities. A more strategic approach and roadmap for the development of these services could capitalize on the strengths and upcoming opportunities. A number of key messages are proposed, which are summarized as: manage the existing resources effectively; design the system and direct further investment; and demonstrate success.

Keywords
Acute coronary syndrome
Stroke
Cardiovascular diseases
Critical care
Rehabilitation
Evidence-based practice
Kyrgyzstan

Address requests about publications of the WHO Regional Office for Europe to:

Publications
WHO Regional Office for Europe
UN City, Marmorvej 51
DK-2100 Copenhagen Ø, Denmark

Alternatively, complete an online request form for documentation, health information, or for permission to quote or translate, on the Regional Office website (http://www.euro.who.int/pubrequest).

Contents

Acknowledgements iv
Acronyms and abbreviations v
Executive summary vi
1. Introduction 1
2. Methodology 2
3. Epidemiology 3
4. Policy framework and NCD context 5
5. Evidence-based practice 5
Clinical guidelines 5
Professional education 6
6. Quality control and performance management 8
7. Clinical pathway 9
Prehospital setting 10
Evidence-based interventions 10
Strengths 11
Gaps 14
Hospital care 15
Evidence-based interventions 15
Strengths 17
Gaps 21
Secondary prevention and rehabilitation 22
Evidence-based interventions 23
Strengths and gaps 24
8. Patient involvement 25
9. Monitoring and evaluation 25
10. Conclusions and key messages 26
Annex 1: Mission programme 29
Annex 2: Checklist of performance indicators for stroke care 30
Annex 3: Acute coronary syndrome health-care system checklist 32
Annex 4: Achievement of "Den Sooluk" CVD indicators 34
References 36

Acknowledgements

The authors would like to express their sincere gratitude to the Ministry of Health of Kyrgyzstan, and the many clinicians, academics, managers, administrators and patients who welcomed us to their facilities and who took the time to participate in this study and be interviewed, sharing their views, ideas, concerns and visions. Valuable comments were received during and after the consultation with the Ministry of Health, CVD Working Group, PEN working group and other participants of workshops that took place in Bishkek during 9–10 March 2017.

Contributions to the report were made by Jill Farrington, WHO Regional Office for Europe, Denmark; Francesca Romana Pezzella, Neurologist, Stroke Unit, San Camillo Forlanini, Rome, Italy and European Stroke Organisation; Alexei Yakovlev, Cardiologist and Oxana Rotar, Cardiologist and Epidemiologist, Federal Almazov North-West Medical Research Centre, St Petersburg, Russian Federation.

Contributions to organization of the WHO mission and materials to inform this report are also gratefully acknowledged: Oskonbek Moldokulov and Seide Isamadyrova of the WHO Country Office for Kyrgyzstan.

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

The evaluation was produced under the overall guidance of Dr Jarno Habicht, WHO Representative of the Country Office in Kyrgyzstan, 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 Kyrgyzstan through the biennial collaborative agreement covering 2016/2017 between the Ministry of Health of Kyrgyzstan and WHO. The report was financed through a voluntary contribution of the Ministry of Health of the Russian Federation.

Acronyms and abbreviations

ABC	airways–breathing–circulation
ACS	acute coronary syndrome
ADL	activities of daily living
AHA	American Heart Association
AMI	acute myocardial infarction
CABG	coronary artery bypass grafting
CVD	cardiovascular disease
CIS	Commonwealth of Independent States
CPSS	Cincinnati Pre-hospital Stroke Scale
CT	computerized tomography
ECG/EKG	electrocardiograph
EORP	EURObservational Research Programme
ESO	European Stroke Organisation
ER	emergency room
FAST	Facial drooping, Arm weakness, Speech difficulties and Time to call emergency services
FeSS	Fever, Sugar, Swallowing
GMF	Global Monitoring Framework (for NCDs)
GPS	global positioning system
ICD	International Statistical Classification of Diseases and related health problems
ICU	intensive care unit
IHD	ischaemic heart disease
IV	intravenous
LAPSS	Los Angeles Pre-hospital Stroke Screen
LE	life expectancy
MI	myocardial infarction
MOH	Ministry of Health
MoCA	Montreal Cognitive Assessment
MRI	magnetic resonance imaging
mRS	modified Rankin scale
NCD	noncommunicable disease
NIH	National Institutes of Health
NSTEMI	non-ST-segment elevation myocardial infarction
PEN	package of essential noncommunicable disease interventions
PCI	percutaneous coronary intervention
PHC	primary health care
RESQ	Registry of Stroke Care Quality
ROSIER	Recognition of Stroke in the Emergency Room
SITS	Safe Implementation of Treatments in Stroke
STEMI	ST-segment elevation myocardial infarction
TIA	transient ischaemic attack
tPA	tissue plasminogen activator
UNIATF	United Nations Interagency Task Force
WHO	World Health Organization
YLL	years of life lost

Executive summary

Cardiovascular diseases (CVD)[1] are responsible for half the mortalities in Kyrgyzstan and are a major theme of the national health reform programme 2012–2016 "Den Sooluk". To support implementation of "Den Sooluk", and with the agreement of the Ministry of Health, a WHO review of acute and rehabilitative services for heart attack[2] and stroke took place in October 2016. The review used a framework that considered common and distinctive features of care for acute coronary syndrome (ACS) and stroke. Together with other reviews of population-level prevention, and the assessment and management of cardiovascular risk factors in primary health care, it helped complete the picture of prevention and control of CVD in Kyrgyzstan.

Kyrgyzstan has the highest premature mortality rate from CVD in the WHO European Region, the second-highest death rate from cerebrovascular disease and the third-highest death rate from ischaemic heart disease. Significant gender differences exist for CVD mortality, with premature mortality among men being two- to threefold higher than that among women. Cardiovascular risk factors are high in the population: around half of the men smoke and over a third of adults (25–64 years) have three or more cardiovascular risk factors.

Policy and legislative frameworks to support prevention and control of noncommunicable diseases (NCDs) and CVDs are in place in Kyrgyzstan, although implementation is mixed. Through the WHO STEPS NCD risk survey, Kyrgyzstan has developed a baseline for risk factors in the country. There are services in place, within the public (and private) sector, for the acute care and rehabilitation of heart attack and stroke, more developed for the former than the latter. In particular, there are multiple gaps in secondary prevention and provision of cardiac rehabilitation for ACS and stroke patients. While resources are more concentrated in the capital, the structure of services does not follow a hub-and-spoke model.

Protocols and guidelines for the diagnosis and management of stroke and ACS are available, and appear to be evidence-based. Actions to support evidence-based practice are, nevertheless, limited and fragmented. Measurement of the quality of stroke and ACS care, as a part of a process of quality improvement, are scarce. Adherence to guidelines and recommended protocols remains poor, and there does not appear to be a clear implementation strategy. There was some indication of the practice of non-evidence-based medicine, which suggested opportunities for better use of resources, as such practices are not cost effective.

The components of evidence-based clinical pathways for stroke and ACS are partially in place in Kyrgyzstan. However, even if medical personnel are knowledgeable, the system lacks modern health-care technology, equipment and drugs. Timeliness of interventions remains an issue, with most of the patients not being diagnosed or treated on time, despite guideline recommendations. Access to the best treatment options in public hospitals is limited not only by lack of evidence-based treatment and diagnostic options but also by what patients can afford. Fragmentation of the clinical pathway and charges (formal and informal) place a heavy cost on the patient, both financially and in terms of clinical outcome.

Private health services offering diagnostics, consultations and residential care services are available for those who can afford them. There appears to be a growing gap between what is possible in the private sector and within the public sector, and a potential erosion of the latter as staff leave for better remuneration and conditions.

Nevertheless, there are some good and emerging practices, developing international networks, and investment opportunities. A more strategic approach and roadmap for the development of these services could capitalize on the strengths and upcoming opportunities for improving services for patients with stroke and ACS. Otherwise, as premature mortality from CVD reduces, failure to improve the acute care, rehabilitative services and clinical outcomes, particularly for stroke, could lead to an avoidable recurrence of acute events, and increased chronic disease and disability, with consequences for the quality of life, and health- and social-care costs.

A number of key messages are proposed, which are summarized as: manage the existing resources effectively; design the system and direct further investment; and demonstrate success. This report and its key messages were discussed with the Ministry of Health, relevant working groups and invited experts within consultative workshops held during 9–10 March 2017.

[1] Throughout this document, the term "cardiovascular diseases" refers to circulatory diseases and includes cerebrovascular disease.

[2] The term is used as shorthand for acute coronary syndrome.

1. Introduction

Cardiovascular diseases (CVDs) are one of the priority areas of the "Den Sooluk" National Health Reform Programme in the Kyrgyz Republic for 2012–2016, which aims for an expected annual decrease of 1% in the CVD mortality rate. Among noncommunicable diseases (NCDs), **CVDs are responsible for half of the mortalities in Kyrgyzstan:**[1] ischaemic heart disease (IHD) and stroke account for a large share of these, and are the top causes of premature death (Fig. 1).[2]

Fig. 1. Dynamics of the causes of premature mortality in Kyrgyzstan, 2005–2015

2005 ranking		2015 ranking		% change 2005 to 2015
Ischaemic heart disease	1	1	Ischaemic heart disease	Minus 10.1%
Cerebrovascular disease	2	2	Cerebovascular disease	Minus 23.4%
Lower respiratory infections	3	3	Lower respiratory infections	Minus 33.9%
Neonatal encephalopathy	4	4	Neonatal preterm birth	0.6%
Neonatal preterm birth	5	5	Neonatal encephalopathy	Minus 18.4%
Congenital defects	6	6	Congenital defects	7.4%
Road injuries	7	7	Road injuries	Minus 2.9%
COPD	8	8	Self-harm	Minus 15.1%
Self-harm	9	9	COPD	Minus 38.0%
Tuberculosis	10	10	Cirrhosis hepatitis B	Minus 3.9%
Cirrhosis hepatitis B	11	11	Tuberculosis	Minus 33.5%

COPD: chronic obstructive pulmonary disease
Source: Institute of Health Metrics and Evaluation (IHME), Kyrgyzstan [website] (http://www.healthdata.org/kyrgyzstan, accessed 7 February 2017). (http://www.healthdata.org/kyrgyzstan, accessed 7 February 2017).

In support of the implementation of "Den Sooluk" and with the agreement of the Ministry of Health (MoH), a **WHO mission took place during 6–9 October 2016 to review acute and rehabilitative services for heart attack and stroke.** The mission focused on acute and rehabilitation services for heart attack and stroke, given that population-level and individual-level prevention of CVDs had been the subjects of assessments already: for example, an in-depth assessment of tobacco control had taken place in August 2012[3] followed by a review of the tobacco taxation policy in 2015,[4] and an assessment of health systems strengthening for better NCD outcomes in 2013.[5] In the first half of 2016, the United Nations Interagency Task Force (UNIATF) on the Prevention and Control of Noncommunicable Diseases held a joint mission and a mid-term evaluation of the NCD strategy. Together with other reviews of population-level prevention, and the assessment and management of cardiovascular risk factors in primary health care, it helped complete the picture of prevention and control of CVD in Kyrgyzstan.

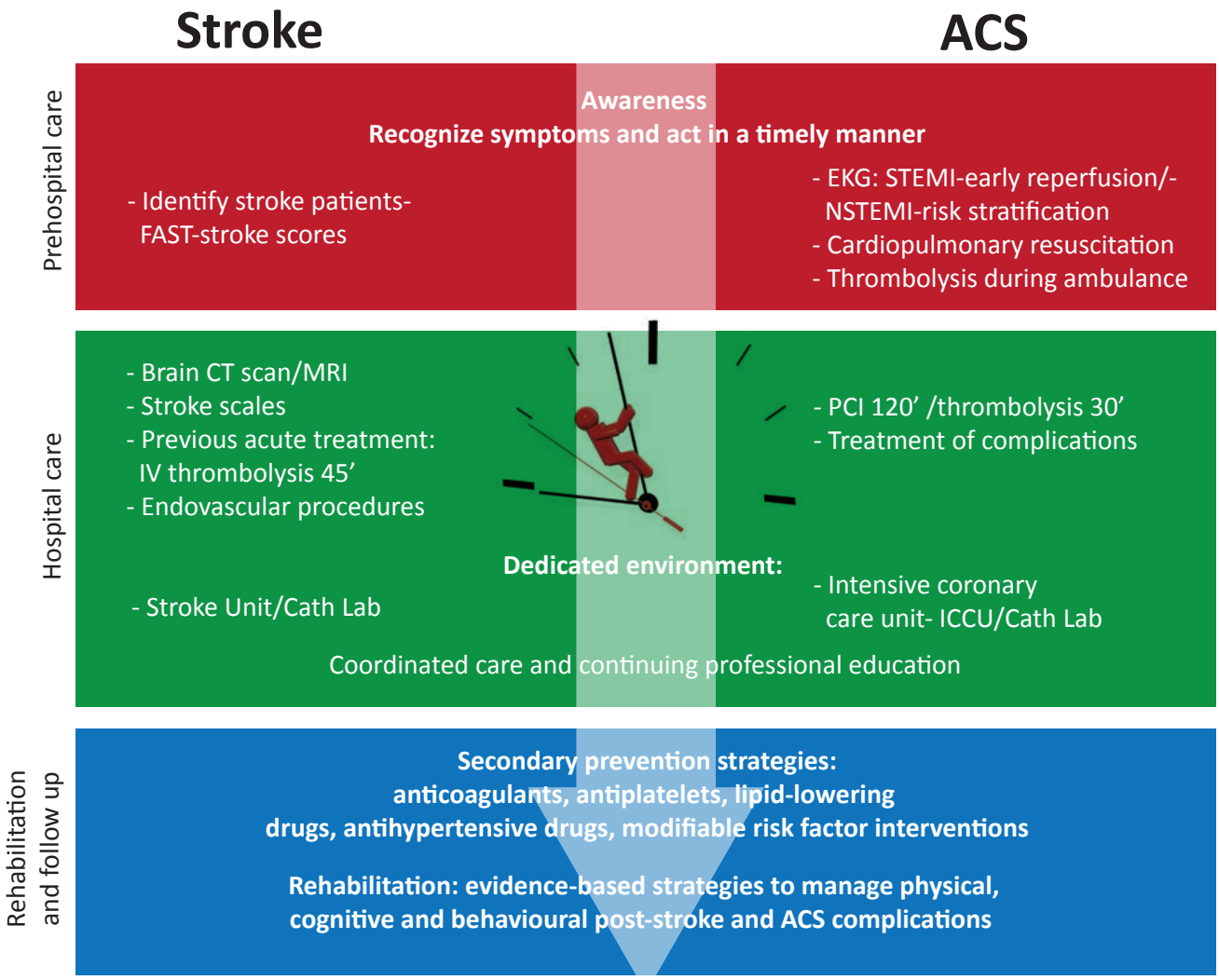
The mission was organized by the WHO Country Office for Kyrgyzstan and the WHO European Office for the Prevention and Control of Noncommunicable Diseases, based in Moscow, Russian Federation. The work forms part of the WHO NCD Project, which is financially supported by a grant from the MoH of the Russian Federation. The European Stroke Organisation (ESO) provided support 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 supported the work through technical experts.

A second mission took place during 9–10 March 2017 to present the draft report and consult with the Ministry of Health (MoH), CVD Thematic group, PEN Working Group and invited experts within workshops held during this time.

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 visits is given in Annex 1. Prior to the visit, a broad framework for analysis was developed and checklists were created of performance indicators for the care of acute coronary syndrome (ACS) and stroke, against which data were collected (*see* Annex 2). 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

According to this framework, evidence-based interventions for pre-hospital care, hospital care, rehabilitation and follow up are summarized within this report. The review assessed the strengths and gaps of the situation in Kyrgyzstan against this framework, and highlighted key messages. Preliminary findings were shared with the MoH at the end of the mission period.

3. Epidemiology

Life expectancy at birth in Kyrgyzstan is 75 years for women and 67 years for men.[6] NCDs are estimated to account for 80% of deaths overall, and half of these deaths are due to CVD. The probability of dying between the ages of 30 and 70 years from the four main NCDs is 28%: **among countries of the WHO European Region, Kyrgyzstan has the highest premature mortality rate from CVD, the second-highest death rate from cerebrovascular disease, and the third-highest death rate from IHD (Tables 1 and 2).** Nevertheless, there is a downward trend for premature mortality from NCDs (largely driven by reductions in CVD mortality) and the trajectory to 2025 suggests that Kyrgyzstan will reach the global NCD target of a 25% reduction in mortality by 2025.

According to national data, in recent years, there has been a trend for a stable reduction of the total mortality rate due to CVD (331.3 in 2012 to 300.9 in 2015 per 100 000 population).[7] A relative but stable reduction has also occurred in the mortality rate from stroke and acute myocardial infarction (AMI) in men and women, although the reduction in the AMI mortality rate was higher in women than men. Data on ischaemic stroke are apparently contrary to these trends: according to the National Statistics,[2] mortality for all ages due to ischaemic stroke has increased.

Table 1. Cardiovascular and cerebrovascular morbidity (absolute numbers) in Kyrgyzstan, 2015[8]

Indicator of incidence	Kyrgyzstan	Bishkek
First-ever AMI	886	290
AMI recurrence	78	data not available
First-ever ischaemic stroke	1639	565
First-ever haemorrhagic stroke	603	171
First-ever stroke of unknown origin (CT scan not done)	280	23

Source: Centre for Medical Information, Kyrgyzstan

Table 2. Dynamics of cardiovascular and cerebrovascular mortality from 2011 to 2014 in Kyrgyzstan[2]

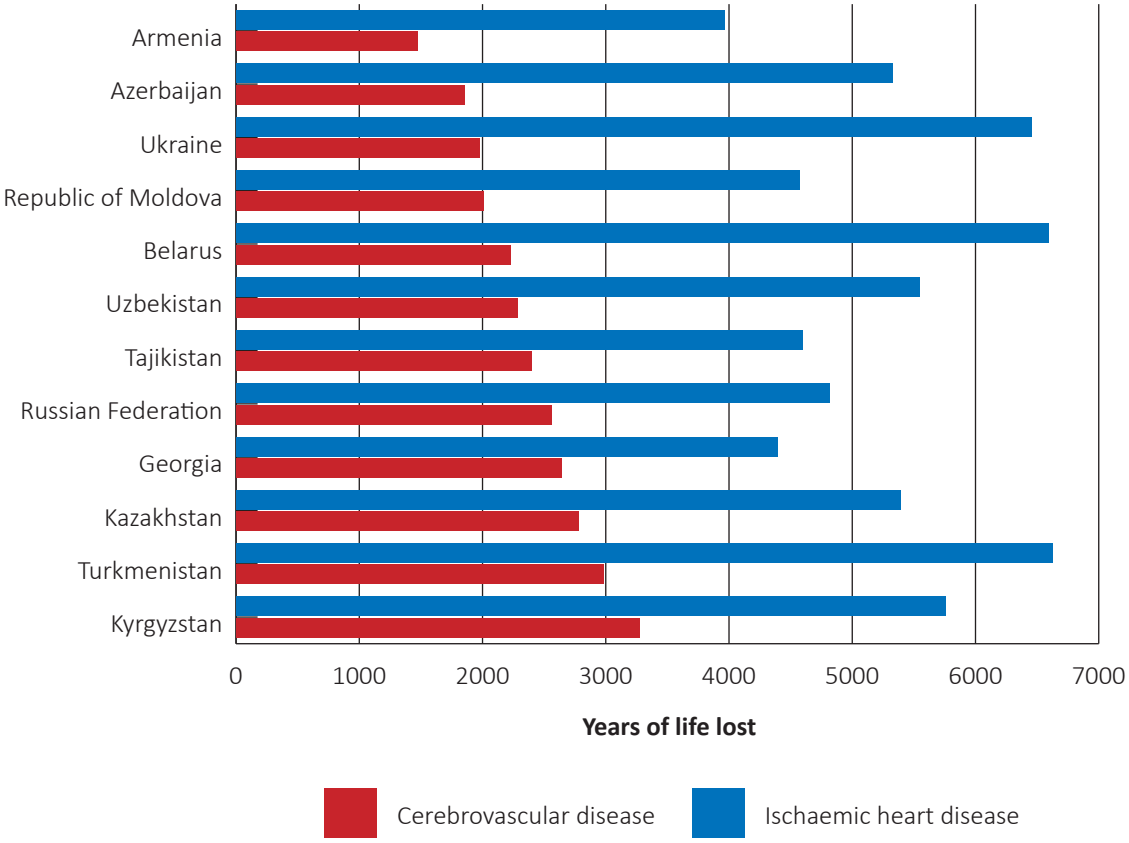
International Classification of Diseases (ICD)-10 code	2011 (per 100 000)	2014 (per 100 000)
ICD-10 61.0 haemorrhagic stroke	7.83	4.8
ICD-10 63.0 ischaemic stroke	2.46	5.1
ICD-10 64.0 stroke not specified	68.7	58.3
ICD-10 21.0 AMI	21.7	19.5
ICD-10 22.0 AMI recurrence	1.0	0.8

Source: Centre for Medical Information, Kyrgyzstan

Significant gender differences exist for CVD mortality. In the 0–64 years age group, mortality from diseases of the circulatory system is higher in men than women by a factor of 2.5, that from IHD by a factor of 3, and that from cerebrovascular disease by a factor of 1.9.[5] Apart from the risk factor prevalence, it has been suggested that other reasons for the higher mortality among men relate to lack of awareness of the signs, symptoms and consequences of raised blood pressure and low utilization of health-care services.[9]

The differences between similar countries should be emphasized: mortality from stroke was much higher in Kyrgyzstan than in other post-Soviet countries and moderately lower in cases of IHD (Fig. 3).

Fig. 3. Comparison of premature mortality (years of life lost) for cerebrovascular disease and ischaemic heart disease among selected post-Soviet countries, 2014



Source: Global Health Observatory, WHO 2017

This does not seem to be related to relative differences in funding for health care. Kyrgyzstan has a relatively low gross domestic product (GDP) compared with other post-Soviet countries and was categorized as a low-income country by the World Bank until 2014. Nevertheless, general government expenditure on health as a percentage of total government expenditure is relatively high compared with equivalent countries, and total expenditure on health as a percentage of GDP is close to the median for this same group of 12 post-Soviet countries.

The issue of timely and accurate diagnosis of stroke and the value of a stroke register is discussed in Section 6. While the quality of coding of cause of death may not be the best (although the proportion of deaths given the ICD-10 code R99 [ill-defined causes] is less than 5%) in general, it may be insufficient to explain on its own the high death rates from stroke. It is more likely to be related to the high cardiovascular risk factor levels, particularly for males. Another factor for consideration is the altitude and steepness of the terrain. Levels and trends of selected causes of death are similar to those in other post-Soviet countries but are slower to change, a matter that may be related to limited health-care capacity for early detection and treatment.

The prevalence of cardiovascular risk factors is high. The three risk factors that account for the greatest disease burden are dietary risk, high blood pressure and tobacco use.[2] A recent WHO study[10] describing the nutritional composition of the foods sold in the marketplaces in Bishkek found that the amounts of trans-fatty acids and salt in common foods are extremely high.

Around half the men smoke. The prevalence of current tobacco smoking among people in Kyrgyzstan 15 years and above in 2013 (latest year) was 3.7% for women, and 50.5% for men.[6] The total annual per capita alcohol consumption among people aged 15 years and above was 3.28 L of pure alcohol per year in 2011.[6] In 2014, the prevalence of overweight in males and females aged 18 years and above was, respectively, 45.2% and 49.1%.[6]

The WHO STEPS NCD survey[11] in 2013 found that 42.9% of adults aged 25–64 years had raised blood pressure (similar in males and females) and 23.6% had a raised total cholesterol level (females more than males). Almost one in five (17.4%) adults were identified as being at high cardiovascular risk, i.e. the probability of their having a cardiovascular event or death in the next ten years was 30% or more. **Over a third of adults (25–64 years) have three or more cardiovascular risk factors**, higher among men (39.5%) and older age groups.

4. Policy framework and NCD context

Policy and legislative frameworks to support the prevention and control of NCDs are in place in Kyrgyzstan. The National Public Health Programme 2020 aims to increase intersectoral actions through a whole-of-society approach. There is a national strategy on NCDs 2013–2020, recently evaluated mid-term, and the National Health Reform Program "Den Sooluk" 2012–2016[12] prioritizes cardiovascular health as one of its main themes. There is no roadmap for ACS and stroke. Regulatory and fiscal frameworks for tobacco and alcohol control are in place to a limited extent, but their scope and enforcement could be improved. **Through the WHO STEPS survey, Kyrgyzstan has developed a baseline on risk factors in the country.**

Among the five objectives of the national NCD strategy, two are particularly relevant for this review:

- improving the quality of health-care delivery in case of NCDs at all levels of the health sector using available interventions consistent with the principles of evidence-based medicine (EBM);
- reducing inequalities in accessibility to medical care by the population, regardless of geographical conditions, transport availability and income.

Funding of the NCD Action Plan includes a component for implementation of a package of essential NCD (PEN) interventions at the primary health-care level (PEN protocols), as well as provision to enable free access to insulin.

"Den Sooluk" was originally planned to end in 2016 but because of a delayed start, the Government of Kyrgyzstan and donor partners agreed to extend it until end-2018. A mid-term review of "Den Sooluk" documented achievements in health outcomes and outputs (25% of the 96 indicators achieved or exceeded) but also presented some mixed results.[13] These are described in Section 9 and Annex 4.

5. Evidence-based practice

Clinical guidelines

An EBM-oriented approach[14] characterized the "Manas National Program on Health Care Reforms 1996–2006" and it is now the backbone of the "Den Sooluk" Program.

Protocols and guidelines for the diagnosis and management of stroke and ACS exist, and appear to be evidence-based. The Evidence-based Medicine (EBM) unit that is responsible for developing guidelines and clinical protocols based on conscientious, explicit and judicious use of current best evidence is within the MoH. In the past five years, the EBM unit has revised clinical protocols on hypertension, stable angina, AMI; in 2015, it published, after approval of the Expert Council, clinical guidelines on atrial fibrillation and diabetes. In 2016, new clinical guidelines on acute stroke care were drafted. We noticed that these do not include some low-cost interventions such as the FeSS (Fever, Sugar, Swallowing) protocol (*see* the Hospital care section).

Guidelines and protocols are available on the MoH website in an EBM-dedicated space. Stroke guidelines and protocols that were obtained and reviewed for this report were found to be evidence-based, comprehensive and detailed, and included references and the strength of evidence for recommendations, even if they were not recently updated (*see* the section on Prehospital setting).

The European Society of Cardiology guidelines have been endorsed by the Kyrgyz Society of Cardiology, although the extent of their implementation, and relationship to national guidelines is unclear.[15] National guidelines are said to be based on the United States and European Society of Cardiology guidelines, and adapted for Kyrgyzstan, although many points cannot be incorporated because of low-cost practice.

As part of the implementation of "Den Sooluk", a "CVD Thematic Group" was established to support effective policies for CVD reduction, and coordinate and empower implementation and dissemination of CVD guidelines, protocols and clinical care best practices.

Professional education

The Kyrgyz Medical Institute of training and retraining organizes courses and workshops for professional development; educational opportunities on CVDs are available but mainly focus on primary care and CVDs, and less on stroke. In 2015, 201 physicians were trained in the provision of care for ACS, 139 in acute cerebrovascular events, 139 in AMI, 727 in CVD; 197 attended educational events on diagnosis and emergency management of stroke and AMI. We were informed at the consultation in March 2017 that some efforts had been made to address the gap in training by the end of 2016 and since our original visit. Courses and seminars were held for the training of workers in the health-care system (doctors, their assistants, paramedics and medical nurses) on the clinical protocols/clinical guidelines; these will be printed and disseminated throughout the country during 2017. Kyrgyz neurologists who have joined the ESO-EAST[16] project of the ESO in 2015 have planned a residential stroke nursing care course that will start in 2017.

Training opportunities on NCDs for family physicians and nurses are available: for example, as part of the implementation of a package of essential NCD (PEN) interventions in primary care, a training course has been developed to teach cardiovascular risk assessment and management, and lifestyle counselling (PEN protocols 1 and 2).[17] Initially aimed at health workers in the PEN project pilot districts, this has been extended to include other districts, community health workers, and teachers of the Kyrgyz Medical Institute of Training and Retraining, and Kyrgyz medical academy of I.K. Akhunbayev. It has also resulted in changes being made to the training programmes of family doctors in the Kyrgyz State Medical Institute of retraining and advanced training.

Over the past five years, there has been an increasing use of e-learning for the training of both medical personnel and nursing staff. Several development partners collaborated in implementing and disseminating this methodology. Since September 2016, webinars are also available, and a complete list of planned lectures is available on the website.[18]

The ambulance service provides for the retraining of ambulance personnel through internal activities (Fig. 4) and offers the possibility of participating in extramural courses (Kyrgyz State Medical Institute of retraining and advanced training).

Fig. 4. Equipment to retrain ambulance personnel

Actions to support evidence-based practice are, nevertheless, limited and fragmented, mainly focused on awareness, management and control of CVD risk factors, and less on stroke. Shortcomings in the implementation of clinical practice guidelines have already been noted.[5]

A list of possible EBM implementation strategies and their actual demonstration for both stroke and ACS in the country is summarized in Table 3.

Table 3. Implementation strategies for ACS and stroke in Kyrgyzstan observed by the mission team

Implementation strategy[19]	ACS	Stroke
Opinion leaders	YES	NO
Multiprofessional collaboration	NO	NO
Multifaceted interventions	NO	NO
Patient associations	NO	NO
National and regional policies		
● mandatory	YES	YES
● non-mandatory	NO	NO
Financial incentives		
● Public	NO	NO
● Private	YES	YES

Implementation strategy[19]	ACS	Stroke
Educational strategies		
● printed/electronic educational material	YES	YES
● educational meetings and workshops	YES	YES
● educational outreach visits	NO	NO
● educational campaigns	NO	NO
● guidelines	YES	YES
Audits and feedback	NO	NO
Reminders		
● electronic reminders	NO	NO
● written reminders	NO	NO
Computerized decision-support systems	NO	NO

Some explanatory notes to the table are as follows:

- The current Minister of Health is a cardiologist and acts as an opinion leader in his field, encouraging the establishment of private cardiological services, for example; there is no such equivalent in the area of stroke.
- There were some occasional observations of multiprofessional collaboration but this did not seem to be consistently present or to be part of an EBM or implementation strategy.
- Private incentives are the backbone of most implementation activities: development partners and drug companies finance different activities, and in some cases, influence them. This is the case with the guidelines on neuroprotective agents for stroke patients, for example. Private incentives may also influence professional education, driving medical attention to certain diseases and/or promoting the implementation of some evidence rather than others.
- Educational campaigns are generally not specific for stroke but instead focus on healthy lifestyles; there are no campaigns on the early signs and symptoms of stroke or AMI.
- Information collected by the ambulance registry is not used to provide feedback to clinicians.

6. Quality control and performance management

There is a substantial evidence base for interventions that are effective in improving outcomes after stroke. Ensuring that patients have timely access to evidence-based interventions is an essential component of good-quality care. **In Kyrgyzstan, measurement of the quality of stroke and ACS care as a part of a process of quality improvement is scarce**.

The ambulance is responsible for managing registries for all cases of stroke and myocardial infarction that the service receives (*see* the section on Prehospital setting for details). Admission cards include information on the ambulance care received, emergency room and discharge diagnoses, and outcome. Data are first collected by the ambulance operator on a hard copy module, while the section on outcome is forwarded to the service centres for updating their registry. Registry data are not used to provide feedback to clinicians, and their use by policy-makers for strategy planning in ACS and stroke care is unclear.

In 1997, a stroke registry was established for the capital city of Bishkek and oblast of Osh. At present, this registry is functioning only in the capital and is managed by the same emergency agency that manages the ambulance system. The neurologist responsible for the Stroke Registry Center is required to adhere to the standards set out for the Physician Stroke Registry by WHO.[20] Moreover, according to the Normative Act Stroke Registry in Bishkek, the registry manager must record every case of acute stroke and death from stroke in Bishkek. The following data are recorded:

- Any type of stroke at the polyclinics and hospitals in Bishkek is recorded.
- Information pertaining to the diagnosis via statistical forms forwarded by family physicians or hospital personnel is recorded.
- Stroke physicians are advised to send patients to a specialized stroke care unit, and in the case of refusal, treatment is administered at the patient's home.
- Physicians are supposed to visit and register stroke patients within 7 days to monitor the patient's condition and to clarify the cause of possible death. Patients who refuse hospitalization should receive a home visit after 7 days.

The stroke registry is responsible for:

- registering all new and recurrent cases of strokes. Strokes occurring repeatedly over the 28 days from the first event are considered a single event;
- noting the stroke type (ischaemic/haemorrhagic or transient ischaemic attack [TIA]) without defining a subtype classification;
- noting the system of the affected artery (for ischaemic stroke) and hemisphere (for haemorrhagic stroke);
- noting the cause of death from stroke, and its type (ischaemic, haemorrhagic).

In 2014, a publication[21] presented the results of the activity and performance of the registry. According to it, the stroke registry physician examines the major proportion of patients with such a diagnosis. In 2011, 86.8% of stroke patients were enrolled in the registry and in 2012, the percentage increased to 94.1%. Reliable sources of information on stroke epidemiology in the rest of the country are lacking. New facilities for stroke patients have been recently added in Narin and Osh (quarter four 2016) but at the moment, there is no expertise or infrastructure to establish a stroke registry. The Bishkek Stroke Registry offers an interesting analysis of stroke trends and epidemiology. It also gives a unique insight into the diagnostic power of the care pathway as it has been in existence for the past 5 years: according to the previously mentioned publication that examined the activities in 2011–12, a correct diagnosis of stroke was made within the first 24 hours from stroke onset only in 58.2% of patients. The rest were diagnosed within 1–3 days (29.63%) and a small percentage after 10 days of onset (2.3%). These figures show that before (or together with) any programme to implement acute therapies, there is a need for a cultural and organizational intervention to empower timely and accurate diagnosis of stroke.

In addition to the previously mentioned Bishkek Stroke Registry, a single stroke centre based in the capital (City Clinical Hospital N°1) is actively recruiting patients for the Safe Implementation of Treatments in Stroke (SITS) General Stroke registry.[22] This international registry records any case of stroke and TIA **not treated** with intravenous (IV) thrombolysis or thrombectomy and, to date, more than 100 patients have been enrolled. These two experiences differ for many reasons. The Bishkek Stroke Registry is mandatory and managed by a local agency; the results are not used to provide feedback to clinicians on a regular basis, whereas the SITS registry relies on the voluntary work of vascular neurologists of the Stroke Centre. It provides information on the performance of the participating centre over time and compares this with other countries. Participation in a second international stroke registry is also on the cards: two stroke centres in Bishkek have recently joined the Registry of Stroke care Quality (RES-Q), which has been developed as an ESO initiative and targeted primarily at supporting countries of Eastern Europe.[23] To date, Kyrgyzstan has not started recruiting patients to this registry.

7. Clinical pathway

An effective system for CVD needs to coordinate and manage patient access to a full range of services and activities for prevention, treatment and rehabilitation of stroke and ACS. The main components of the pre-hospital phase of care within the full stroke and ACS clinical pathway include the pre-hospital system and hospital facilities. The pre-hospital system consists of community-based elements: ambulance service, stroke and ACS awareness campaigns focused on recognition

of stroke symptoms, timely recognition of acute stroke and ACS and ambulance dispatch, screening of potential stroke patients, prehospital diagnosis of ACS (by ambulance ECG and/or tele-ECG), and hospital notification. A timely clinical pathway for stroke and ACS, in order to be most effective, needs to be coordinated by a multidisciplinary team that places the highest priority on minimizing the transfer time of the patient to the most equipped stroke care facility**. In Kyrgyzstan, these components are partially in place; however, even if medical personnel are knowledgeable, the system lacks modern health-care technology, equipment and modern drugs.** There is no well-organized referral and re-referral system for patients with ACS.

Prehospital setting

Evidence-based interventions

Stroke

Stroke is a clinical emergency and its outcome is strongly dependent on both timely assessment and timely treatment. Specifically, narrowing the times to diagnosis and treatment have been proven to significantly lower both mortality and disability in patients with acute stroke. Ambulance services play a leading role in this by identifying acute stroke symptoms and providing transport to qualified stroke treatment centres that are best prepared to administer effective treatment (tissue plasminogen activator [tPA] or endovascular therapy when appropriate and if available). Ambulance personnel who are unable or lack the ability to identify acute stroke symptoms can contribute to delayed and missed diagnoses of stroke.[24]

Prehospital stroke scales screen for stroke in patients with acute neurological deficits and differentiate it from sepsis, hypo- or hyperglycaemia, seizure, tumour, intracranial haemorrhage, migraine and syncope, which may also cause acute neurological disorders. When ambulance providers do not use a stroke scale, they are more likely to miss the diagnosis.[25]

Several scoring systems are currently available for identifying an acute ischaemic stroke in the field. Of these, the most popular are: the FAST test (Facial drooping, Arm weakness, Speech difficulties and Time to call emergency services), the Cincinnati Prehospital Stroke Scale (CPSS) and the Los Angeles Prehospital Stroke Screen (LAPSS). These scores are considered to be more accurate in predicting anterior circulation strokes. To date, no practical prehospital scale is able to accurately predict strokes outside of the middle cerebral artery distribution. FAST and CPSS are easy to use and have shown good reproducibility between physicians and paramedics.[26,27] Regarding their sensitivity and specificity, the FAST score has a reported sensitivity of between 79% and 85%, and specificity of 68%, while CPSS has a reported sensitivity of between 44% and 95% and a specificity of between 23% and 96%.[28] A score of two on the CPSS has been reported to reliably identify patients for thrombolytic therapy with a 96% sensitivity and 65% specificity.[29]

Hypo- or hyperglycaemia can mimic stroke. In fact, hypoglycaemia may cause symptoms such as hemiparesis, hemiplegia, speech or visual disturbances, confusion, and poor coordination; hence, it is critical to measure blood glucose levels when there is concern of a possible stroke.[30] In this regard, the prehospital ROSIER (Recognition of Stroke in the Emergency Room) score assesses facial, arm and leg weakness, speech and visual field deficits, as well as blood glucose levels. The ROSIER score has been reported to have a sensitivity of 80–89% and a specificity of 79–83%.[31] Physicians have confirmed that 64% of strokes and 78% of non-strokes had been previously suspected by ambulance attendants with ROSIER.[32]

Moreover, it is known that cardiac abnormalities can cause or manifest concurrently with stroke. Thus, when stroke is suspected, cardiac monitoring is recommended in the prehospital setting and throughout the first 24 hours of care.[33]

The two most effective therapies to reduce both mortality and disability from ischaemic stroke – IV tPA and endovascular thrombectomy – have restricted windows of delivery;[34] therefore, timely transport of a stroke patient to a stroke centre contributes to limiting cerebral damage.

The American Heart Association (AHA) recommends an ambulance-call-to-dispatch time of less than 90 seconds, an ambulance-response time of less than 8 minutes, and an on-scene ambulance time of no more than 15 minutes.[35] Moreover, AHA guidelines recommend that ambulance personnel document the time “last seen normal” to best define the therapeutic window. It has been demonstrated that greater efficiency in the dispatch and hospital notification of a stroke leads to shorter times for: (1) ambulance call to arrival; (2) assessment by physician; (3) door-to-needle time; (4) door-to-

imaging time. Moreover, when adhering to these parameters, patients were more likely to receive tPA. Finally, authors have reported that patients admitted to stroke units, instead of community hospitals, were more likely to receive tPA and have a lower risk of mortality at 30 days.[36]

Acute coronary syndrome

During the prehospital stage of acute care, the early identification of ACS is very important. The first evaluation should be based on clinical symptoms, which requires at least a basic knowledge of the clinical differential diagnosis of chest pain. An early ECG is essential for the triage and selection of an appropriate treatment strategy. Current international guidelines strongly recommend that an ECG be done within 10 minutes of the first medical contact.[37,38] For patients with a recognized stable ST-segment elevation myocardial infarction (STEMI) on ECG, the time from symptom onset, availability of primary percutaneous coronary intervention (PCI) and suspected time of transport to a PCI centre should be evaluated before making any decision regarding reperfusion strategy. The administration of thrombolysis (within 30 minutes from the first medical contact in the absence of contraindications) is recommended if primary PCI is not available, with a possible delay of up to 90–120 minutes; otherwise, thrombolytics of a second generation are preferable.[38]

Patients without ST-segment elevation on ECG should be transferred to a hospital with a PCI facility for stratification of risk, evaluation of cardiac biomarkers and angiography within the next 24–48 hours.[37]

A patient with ACS complicated by recurrent chest pain, arrhythmia, acute heart failure and/or cardiogenic shock should receive symptomatic treatment for stabilization of the vital functions and thereafter be immediately transferred to a PCI centre.

According to international guidelines, recommended medication during the prehospital stage includes analgesics, antiplatelet drugs, parenteral anticoagulants and, in some cases, vasodilators, diuretics and inotropes.

The most common causes of mortality during the prehospital stage of care in patients with ACS include ventricular tachycardia and ventricular fibrillation. The treatment of these complications requires high-quality cardiopulmonary resuscitation (basic level) and early defibrillation.[39] In order to create a strong and effective link between prehospital and hospital care for ACS patients, a regional ACS network needs to be set up considering local factors.

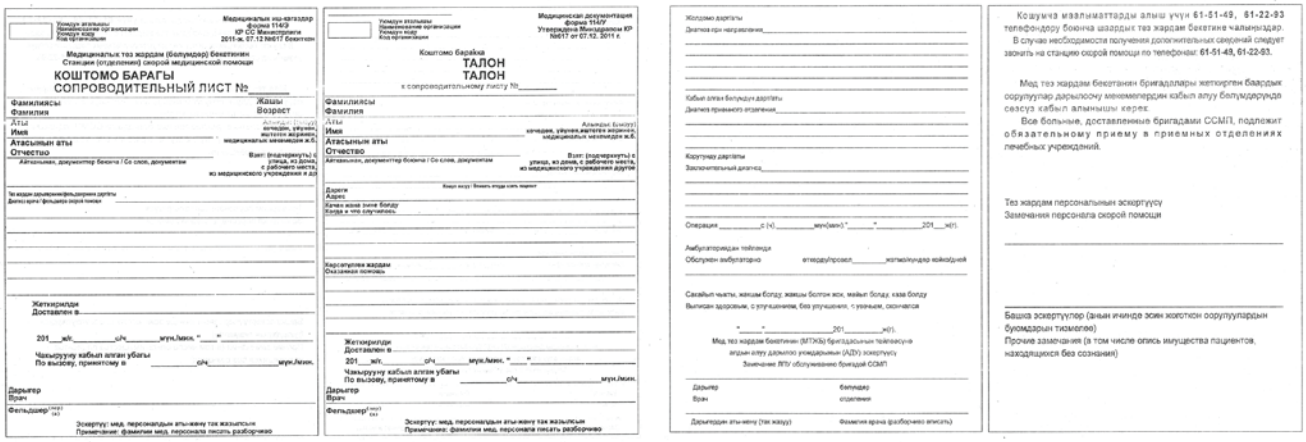
Strengths

In Kyrgyzstan, the ambulance service covers both urban and rural regions, and call centres are open 24/7. Global positioning system (GPS) mapping (Fig. 5) tracks the ambulances and there are 692 emergency service teams, 102 with at least one on-duty physician. Specialized cardiological teams (29 ambulances) have been trained in acute cardiac care, and have both defibrillators and ECG devices at their disposal. There is constant radio communication between the call centres and the ambulances, and the delivery of prehospital care is arranged on a territorial basis, in accordance with hospital schedules. The ambulance service is organized in accordance with the directives of the MoH, which also establishes the general standards of intervention: 4 minutes for ambulance dispatch, whereas the time to reach the patient and take the patient to the nearest hospital facility is up to 110 minutes in Bishkek and Osh, and 130 minutes in the other regions of the Kyrgyz Republic.

Fig. 5. GPS tracking of ambulances

All incoming and outgoing calls, along with their related outcomes, are recorded on both an electronic file and a hard copy (Fig. 6). Ambulance cards, written in both Russian and Kyrgyz, include information on the patient's medical history, diagnosis, time of intervention, and outcome.

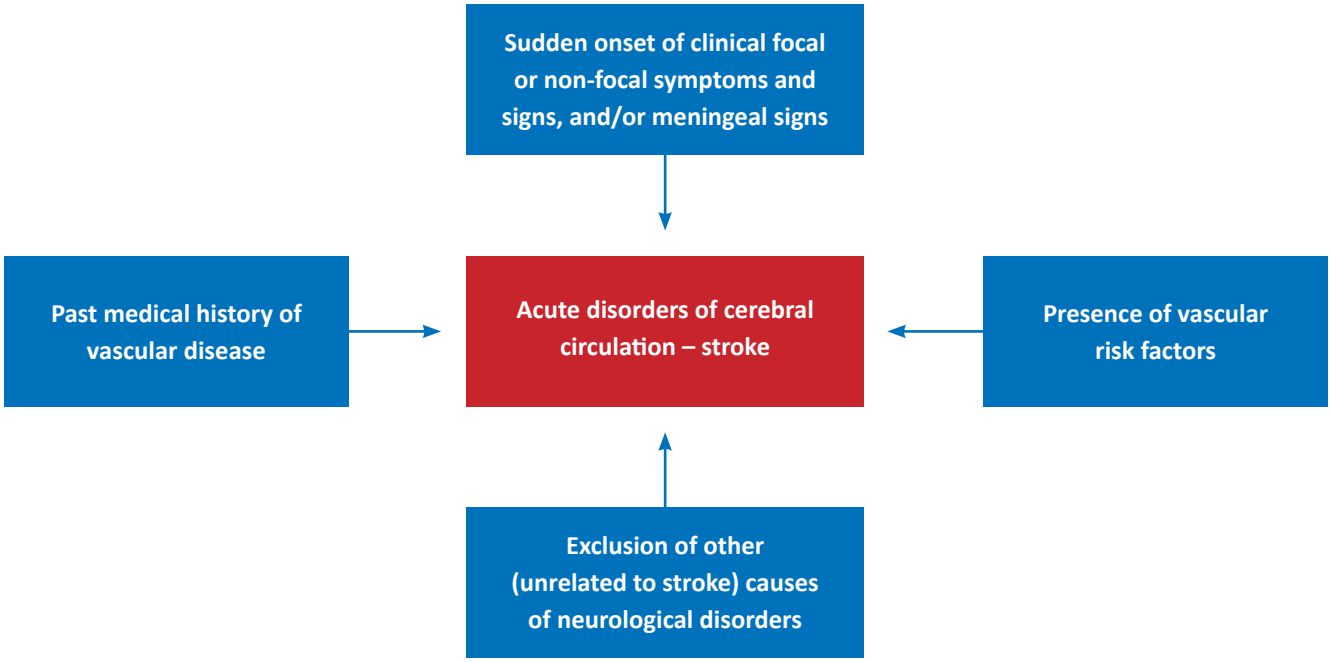
Fig. 6. Admission cards include information on the ambulance care received, emergency room and discharge diagnoses, and outcome



Ground ambulance services operate at a basic life-support level and furnish both emergency and non-emergency transportation. Specialized cardiology teams (17) are trained to resuscitate, defibrillate and gain experience in administering prehospital thrombolysis with streptokinase.

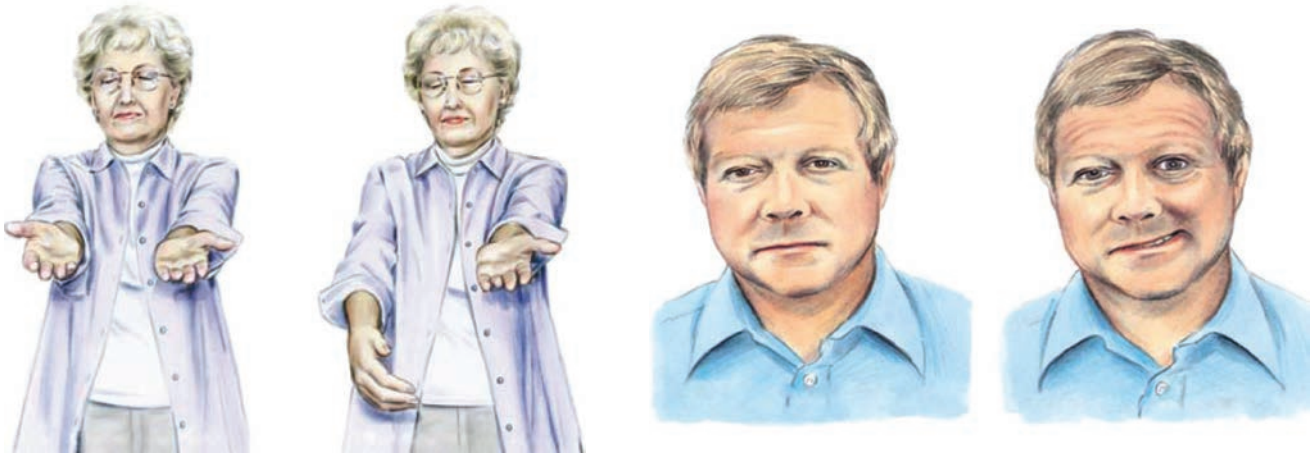
Since 2011, specific evidence-based recommendations have been formulated for prehospital stroke care dealing with the timeliness of interventions and the use of prehospital stroke scales and scores; the actions are summarized in algorithms (Fig. 7).

Fig. 7. Diagnostic stroke algorithm



Guidelines offer evidence-based recommendations for ambulance personnel on how to best identify stroke symptoms in the field. As a diagnosis of stroke is solely clinical, no available tests are able to confirm stroke in a prehospital setting. Thus, the FAST test (Fig. 8) can be utilized only as a screening tool.

Fig. 8. FAST test



Locally developed prehospital stroke care guidelines recommend the following:

- All patients with a diagnosis of stroke/identifiable stroke symptoms should be hospitalized.
- Prior notification to a hospital is recommended for suspected stroke patients.
- Home treatment of patients with suspected stroke is futile and is usually associated with high mortality rates.
- The gold standard regarding time to hospital admission is 1–3 hours from stroke onset.

The guidelines also state absolute contraindications for hospitalization (agonal state) and relative contraindications for hospitalization (end-stage cancer and other chronic somatic diseases, chronic disabling mental disorders [severe dementia] prior to stroke onset).

Guidelines cite telemedicine as an effective strategy for improving the quality of stroke care. In terms of prehospital treatment, critical points such as assessment and management of ABC (airways–breathing–circulation) are addressed, as well as the management of hypertension.

These clinical guidelines have been drafted based on the results of a systematic review and a thorough evaluation of the published literature. A methodological assessment was conducted for each study and the results obtained were used as a reference for the guidelines, indicating the level of evidence according to a standard scale.

Guidelines and algorithms are also available for the diagnosis and treatment of ACS with ST-segment elevation and without ST-segment elevation on ECG, covering diagnostics, triage and treatment (including thrombolysis) at the prehospital stage of care.

Gaps

Currently, services for emergency care and rehabilitation of cases of ACS and stroke are more developed in the capital than in the other regions, i.e. there is inequality in access to medical care of the population, regardless of geographical conditions and accessibility of transport.

In Kyrgyzstan, improvements in prehospital organization specific to the ACS pathway are ongoing, as the existing network does not yet allow each patient with STEMI to receive the best reperfusion treatment. In fact, a part of the patient population with ACS is still referred to private clinics and hospitals where life-saving primary PCI is more readily available.

The implementation of timely interventions recommended by local (such as those cited in the previous paragraph) and international guidelines is gravely hindered by a low ambulance-to-population ratio; at present, the service can cover only 30% of calls effectively due to a shortage of staff and vehicles. In fact, in both Kazakhstan and the Russian Federation, the ambulance services provide, on average, one ambulance for every 10 000 inhabitants: Almaty, with a population of 1.5 million has 156 cars, for example. In contrast, Bishkek, with a registered population of 1.2 million, has 39 working cars. Furthermore, staff have left since the Eurasian Economic Union allowed free movement of workers in 2015: there are 59 vacancies for doctors (out of 168 posts) and 56 vacancies for nurses.

Public ambulance services are free from home to the first hospital. If the patient needs to be transferred to private services or other facilities or back home, the public ambulance (if available) could be hired at a charge (around 260 sum or US$ 3). Prices are listed on the MoH website. Private ambulance services are available in Bishkek.

Likewise, regarding stroke care pathways in the prehospital setting, we found that stroke scores were rarely used. The ability to provide prehospital care to ACS patients is further limited by an insufficient number of ambulance teams. Moreover, most of these ambulance teams are not equipped with ECG devices and defibrillators, and no tele-ECG or prehospital thrombolysis protocol is available. Finally, medications, including second-generation thrombolytics such as tenecteplase and low molecular-weight heparin (LMWH) for the early treatment of ACS, are not available in Kyrgyzstan.

We found anecdotal evidence of ambulance staff offering stroke patients neuroprotective agents for an informal payment (200–300 sum) in the recent past. This practice has been strongly opposed by the competent health authorities,[40] as has the expensive use of non-evidence-based drugs (listed on the MoH website) and non-defined forms of alternative medicine. We learnt at the consultation in March 2017 that during 2017, the national expert group together with leading experts in the MoH, clinical pharmacologists, academic and educational representatives together with WHO experts have reviewed the list of essential medicines in Kyrgyzstan. They found that the list contained medicines that were not on the WHO essential medicines list, do not meet the selection criteria because of lack of evidence of effectiveness, and are obsolete and irrational. This is currently being rectified.

There may also be other issues that prevent patients from seeking early hospitalization, as illustrated by the case of a patient interviewed in one of the stroke units (Box 1). Not seeking early admission to hospital could be due to a range of issues: cultural; lack of awareness or belief that it will improve outcomes; financial considerations. The perceived likelihood of high cost has been identified as a barrier to health-care-seeking behaviour already.[11]

Box 1. Clinical case of patient in a stroke unit in Bishkek

A woman, aged 72 years, had a history of hypertension. She experienced a sudden onset of weakness in the left arm and leg. She waited one day and then called her general practitioner (GP). The GP saw her within one hour and initially tried to reduce her blood pressure at home.

The GP called a neurologist. The patient waited 3 hours for a consultation with the neurologist. The neurologist referred her to a public sector hospital and the patient's daughter took her in her own car. The patient needed to organize and pay for her own MRI to be done in a private diagnostic centre for 3000 sum. The MRI showed left hemisphere ischaemic stroke. Carotid sonography was not done because it was not available.

Note that, although the patient paid a significant amount of money for a diagnostic test, it was unnecessary because the time delays meant that she was already outside the therapeutic window and it did not alter the clinical management.

Hospital care

Evidence-based interventions

Acute coronary syndrome

This section draws on international guidelines.[41,42] Effective organization of care for patients with ACS requires provision of care at different levels. These may be available according to service provider capability. Hospitals with intensive care units (ICUs, monitored beds) and capability for immediate defibrillation and administration of thrombolytics provide basic treatment that reduces mortality from ACS.

Early diagnostic and management protocols guide early risk stratification to determine whether a patient should be managed with either an early invasive strategy or an initial conservative strategy, and can help determine which recommended pharmacological therapies should be used. Patients presenting with chest pain should follow a diagnostic protocol for ACS as soon as possible. The protocol entry point is a 12-lead ECG, and the results should be interpreted within 10 minutes of the first emergency clinical contact. This may involve facilitating referral to a clinician experienced in performing and/or interpreting an ECG. Based on the ECG, the patient should be classified into one of two groups for further management: those with acute chest pain and persistent ST-segment elevation (ST-segment elevation ACS), and those with acute chest pain but no persistent ST-segment elevation.

ST-segment elevation ACS generally reflects an acute total coronary occlusion and most patients will ultimately develop a STEMI. A patient with a STEMI, for whom emergency reperfusion is clinically appropriate, is offered timely PCI or thrombolysis in accordance with the time frames recommended in the current European/national guidelines. In general, according to the European guidelines, primary PCI is recommended if the time from first medical contact to balloon inflation is anticipated to be less than 90 minutes; otherwise, the patient is offered thrombolysis. In patients with AMI, the time from first medical contact to balloon inflation should be 60 minutes if less than 3 hours from symptom onset. For patients presenting in hospitals without a PCI facility, the maximum delay to reperfusion is 120 minutes with a "door-in-door-out" time of less than 30 minutes. The time frame for reperfusion in STEMI is 12 hours, both for thrombolytic therapy and primary PCI, and up to 24 hours for primary PCI in patients with symptoms of ischaemia. Recanalization of a totally occluded artery more than 24 hours from symptom onset in stable patients is not recommended.

Patients with acute chest pain but no persistent ST-segment elevation should be managed according to an assessment of their risk of an adverse event. If patients are identified to be at intermediate or high risk of an adverse cardiac event,

clinicians should discuss with them and/or their carer the risks and benefits of coronary angiography and appropriate revascularization.

Testing serially for biochemical markers of myocardial damage such as troponin during evaluation for ACS adds diagnostic value.

Antithrombotic agents, such as acetylsalicylic acid (aspirin), which reduce the risk of thrombosis by interfering with platelet release and aggregation, are a cornerstone of ACS management and part of WHO "best buys"[43] (acetylsalicylic acid, atenolol and thrombolytic therapy [streptokinase] have also been recommended by WHO for AMI in the current version of Appendix 3,[43] but this is being updated at World Health Assembly 2017). For treatment of AMI, aspirin, a combination of aspirin and anticoagulant therapy, and a combination of aspirin, beta-blockers, angiotensin-converting enzyme (ACE) inhibitors and streptokinase have all been proposed as highly cost-effective measures for Kyrgyzstan.[44]

Stroke

Specialized care in a stroke unit,[45–47] and thrombolytic therapy given within 4.5 hours from the onset of ischaemic stroke[48] and intra-arterial thrombolysis[34] have been demonstrated to improve mortality and disability rates in stroke patients. The primary goal of any stroke care model needs to be that of providing timely access to thrombolysis (systemic or intra-arterial treatment) for eligible stroke patients, and the most rapid transfer to specialized care for all suspected stroke patients.

Coordinated care along the clinical pathway, with effective interaction between the prehospital and the hospital stages of medical and stroke care is critical, reduces delays in diagnosis and treatment and, in turn, improves the long-term clinical outcome of the patient. The prenotification strategy for potential stroke patients has been shown to be effective, though it is still underused even in some Western countries.[49] This strategy initiates a chain of actions: triage priority, and the timely evaluation of patients according to the following recommended time frames for acute stroke algorithm:[40]

- General assessment by a certified stroke team, an emergency physician, or other recognized experts within 10 minutes of arrival at the emergency room (ER), which includes carrying out a computerized tomography (CT) scan;
- ER door-to-stroke team notification ≤15 minutes
- ER door-to-CT scan time ≤25 minutes
- Interpretation of the CT scan within 45 minutes of arrival in the ER;
- ER door-to-fibrinolytic therapy needle time ≤1 hour, or ≤90 minutes from symptom onset;
- ER door-to-monitored bed ≤3 hours for all patients.

To achieve these time frames, an organized protocol must be put into place that prioritizes the emergency evaluation of all potential stroke patients. Any such protocol needs to be tailored to the availability of local resources and the limitations of infrastructure.

Over the past 25 years, the model of organized inpatient care, the so-called "**stroke unit**", for stroke patients has been largely debated. The debate is on whether improving the organization of inpatient stroke care can significantly and cost-effectively improve patient outcome and, if so, whether these benefits are shared across different patient groups. In general, at present, stroke patients are admitted to hospital where they receive care from a range of health-care professionals working in different settings: care of stroke patients is often provided by general/internal medicine and/or neurology geriatric departments where they would be managed alongside a range of other patient groups. In contrast, stroke units are led by multidisciplinary teams, made up of specialized nursing staff and therapists who care and treat only patients with stroke. It has been proven that patients receiving stroke unit care are more likely to survive, regain independence and return home than those receiving a less organized service, irrespective of patient age, sex, stroke severity and subtype.[45–47] Care of acute stroke and rehabilitation in stroke units is one of the effective recommendations by WHO.[43]

Thrombolytic therapy restores cerebral blood flow in patients with acute ischaemic stroke and may lead to an improvement or resolution of neurological deficits. Thrombolytic therapy has been shown to substantially benefit clinical outcomes in selected patients with acute cerebral ischaemia;[48] there is strong evidence to demonstrate that intravenous thrombolytic therapy at the dose used to treat ischaemic stroke within the first 3 hours of onset of ischaemic stroke offers substantial net benefits for virtually all patients with potentially disabling deficits and, within 3–4.5 hours, possible moderate net benefits.[34,48] WHO's "best buy" recommendations on thrombolytic therapy in acute stroke are currently being updated.[43]

Finally, intra-arterial treatment is highly effective for emergency revascularization, and has been demonstrated to be safe and effective in patients with acute ischaemic stroke caused by a proximal intracranial occlusion of the anterior circulation.[34] To perform these treatments, an adequate environment and infrastructure meeting current guideline standards are necessary, as well as a trained and expert dedicated staff. Moreover, it is critical to monitor performance of the care system with adequate indicators and registries (*see* section 6: Quality control and performance management).

The FeSS is a multidisciplinary, supported evidence-based nursing protocol for the management of fever, hyperglycaemia and swallowing dysfunction, and has been demonstrated to significantly improve patient outcomes after discharge from stroke units.[50] A specific educational training programme is available with the protocol; its implementation would not be expensive, would positively impact on the majority of patients admitted to stroke centres, and does not require complex technology.

Strengths

ACS

The model of service delivery in Kyrgyzstan has been rated as a major barrier to the acute management of AMI and stroke.[5]

Basic equipment and basic drugs are available in the public hospital setting for ACS patients. The National Centre of Cardiology in Bishkek is equipped with a CT scanner for CT angiography (12 hours/day) and catheterization laboratory (cath-lab); nevertheless, the cath-lab is not used to its full potential because of the limited availability of catheters and human resources. The cath-lab is used not only for ACS patients but also for other vascular procedures. In the private sector, the medical competence of health professionals and equipment is almost on a par with European Union (EU)-15 countries.

National clinical guidelines, protocols and algorithms for ACS are produced by the MoH, and those reviewed during the mission were found to be evidence-based and updated, although their dissemination (through printed materials) is limited and their implementation in rural areas is still inadequate. Campaigns and actions to empower self-education are conducted, and mainly consist of dissemination of posters and publications focusing on the control and prevention of CVD risk factors.

Stroke

In Kyrgyzstan, dedicated environments with specialized physicians (neurologist) and availability of therapists (physiotherapist and, in some cases, speech therapist) for acute stroke patients are available at four stroke centres: two in Bishkek, the capital city, and one each in the regions of Naryn (Fig. 9–12) and Osh (Fig. 13). The number of stroke patients admitted to hospital wards in Bishkek has been increasing over time; in 2011, it was 70.6% of all stroke patients enrolled in the Bishkek registry, in 2012, it was 79.9%, in 2016 it was above 90%. Data from other regions are not available yet.

Fig. 9–11. Naryn Stroke Unit, dedicated infrastructure and new equipment (opened on 8 September 2016)

Since 2012, a programme to establish stroke units has been led by the MoH within the Den Sooluk National Health Strategy. Nevertheless, some infrastructure and organizational gaps remain that need to be addressed: neuroimaging is not available at all public health facilities with a stroke centre, and stroke patients, once admitted, are for the most part personally responsible for obtaining imaging and other instrumental diagnostic test services through private clinics (and paying for the ambulance to get there).

Fig. 12. Monitored bed in Naryn Stroke Unit

Access to specialists such as a cardiologist or angiologist is possible, and patients may benefit from early neurorehabilitation that includes physiotherapy and, in some cases, a speech therapist. The four stroke centres admitting acute patients are intended to be "intensive" models of care that should have continuous monitoring, high levels of nursing staff and the potential for provision of life support.

The stroke centre at the Naryn Regional Hospital was opened in September 2016 and is equipped with 20 beds, 6 of which are meant to be the ICU; however, neuroimaging is not available and the diagnosis of stroke is done on a clinical basis. To date, one monitor and one ventilator are available (Fig. 9–12). A similar situation can be found at the stroke centre of the Regional Hospital in Osh, where 25 beds are available for stroke patients: no neuroimaging facilities are available and patients who are in a stable condition are referred to a private centre, such as "Yurfaà" (Fig. 13, 14) where, at the price of 3000–4000 sum (US$ 43–58) they can undergo a CT scan or MRI. At both of these stroke centres, multi-professional teams are not employed, though we were told that early rehabilitation strategies in the form of nursing mobilization are available.

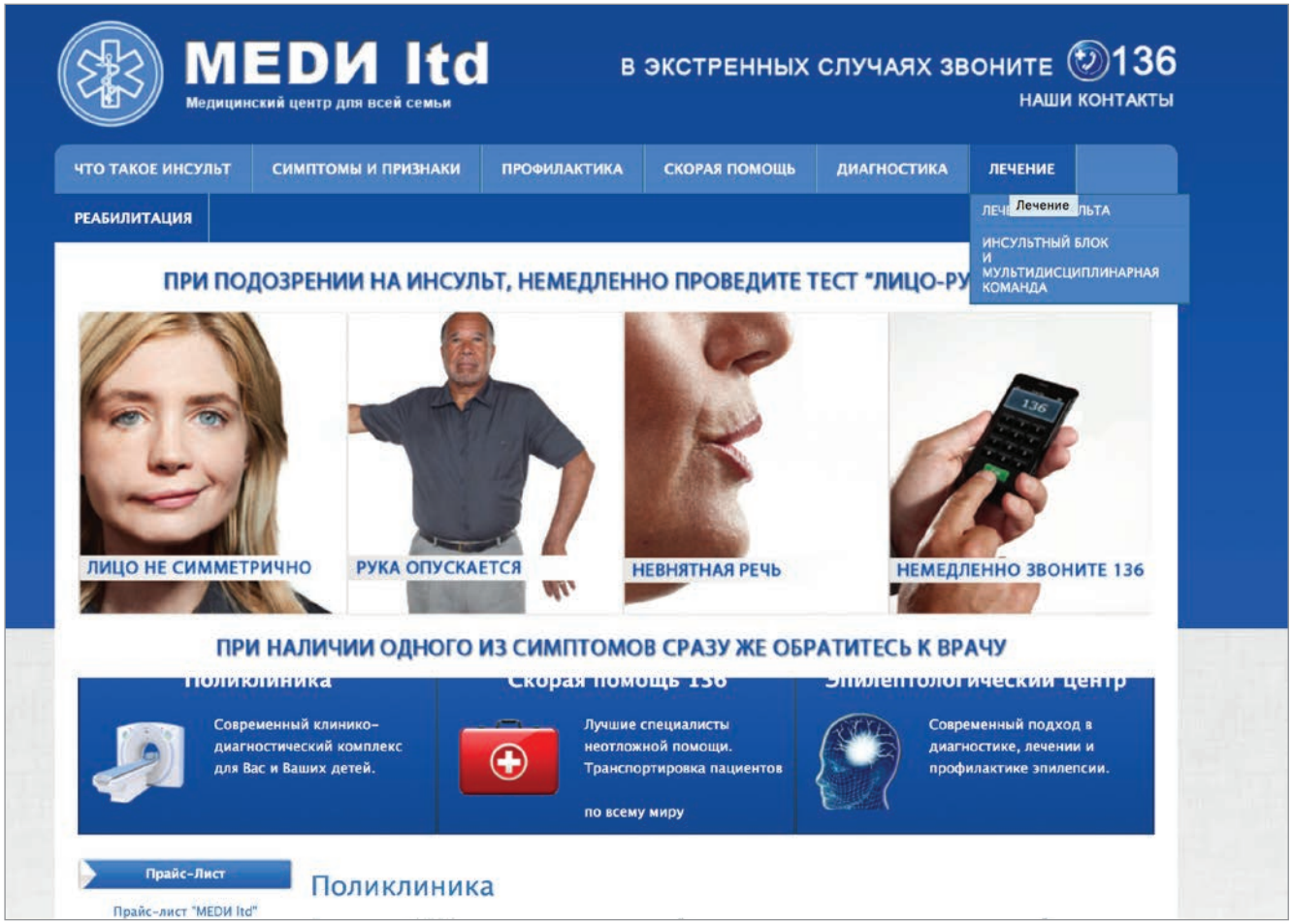
Multi-professional teams are in place in the Bishkek Stroke Centres, where 20–30 beds are available. Patients are usually discharged after 12–18 days, either home or to a rehabilitation facility.

As in the case of ACS, private providers are available for stroke care as well (Fig. 14 and 15), offering neuroimaging and diagnostic work-up and in-hospital care comparable to a stroke unit care.

Fig. 13. Osh Stroke Unit

Fig. 14. Yurfaà Centre offers a wide variety of private medical specialist consultations and diagnostics

Fig. 15. Medi Center offers a stroke-focused website that presents high-tech facilities and a full range of services for stroke patients, ranging from ambulance, dedicated emergency pathways, "stroke hospital", diagnostics and rehabilitation services



Gaps

ACS

Equipment, infrastructure and drugs for ACS treatment are lacking, even if the level of care for ACS is more advanced and widely available in the country compared with stroke. Hospitals do not truly offer the various levels of intensive care: there are no true emergency departments, and no true ICUs structured and equipped as per international standards. As a consequence, categorizing the patient according to the severity of the clinical picture is not possible; an in-hospital protocol to manage patient flow would be meaningless. Some wards are equipped with monitoring and potential for life-support (*see* the section on stroke strengths and gaps) where most critically ill patients are taken, stabilized and managed. Even in the National Centre of Cardiology, certain treatment and diagnostic options are not available, such as

- device for intra-aortic balloon pump counterpulsation
- equipment for hypothermia
- certain drugs (dobutamine, noradrenaline, antiarrhythmic drugs, enoxaparine, fondaparineaux, antithrombotic drugs such as ticagrerol and prasugrel)
- troponin testing
- invasive monitoring
- mobile echocardiography and vessel echo-sonography equipment.

Streptokinase is the only drug available to perform thrombolysis; both alteplase and tenekteplase are not available. There have been problems even with streptokinase registration and, for some months, thrombolytics were not available. Catheters for angiography and coronary stents are not free of charge (1000 sum per stent, including insertion; 2500 sum for 3 stents), so access to the best treatment options in public hospitals is limited not only by lack of EBM treatment and diagnostic options but also by the financial resources of patients. At the consultation in March 2017, we learnt that the MoH has issued an order to provide high-tech care to patients with ACS in the country. The tender was conducted and stents and supplies were purchased to provide free-of-charge PCIs for patients with ACS in different regions of the country.

Availability of human resources is limited, and there is a salary issue; professionals' income in private practice is three to four times higher (average salary in the private sector 45 000–50 000 sum per month) than that in public hospitals (average salary in the public sector 16 000 sum per month) so, once trained, some clinicians may leave the public sector for the private sector.

There is no national or regional registry for ACS other than that of the emergency service. Local experience in some centres such as the National Centre of Cardiology observed that 80% of treatable patients did not receive appropriate treatment (PCI). Timeliness of interventions remains an issue, with most of the patients not being diagnosed or treated on time, despite guideline recommendations.

Stroke

Technology and infrastructure for stroke care are lacking. In 2007 in Bishkek, only 16% of stroke patients were reported to have had access to neuroimaging at their own expense. Even now in the newly opened stroke centres, imaging and diagnostic instrumental procedures are not available, hence obsolete practices such as lumbar puncture (70% of patients undergo this procedure) and echoencephaloscopy are in use. Monitoring and the potential for life support are not available for all beds, and other equipment critical for treating severely impaired patients, including anti-decubitus mattresses, is missing. Moreover, nurse staffing levels do not fulfil the criteria for average intensive stroke care.[47]

Since the basic components of the current diagnostic work-up of stroke patients, such as neuroimaging, Doppler sonography and other investigations, are not available in all public hospitals, private health services offering diagnostics, consultations and residential care services are available for persons who can afford them. A simple brain CT scan can cost 3000–4000 sum (US$ 43–58). All private health facilities must be authorized by the MoH but, especially in rural areas, inappropriate remedies may be purchased in local areas from unauthorized retailers. At the consultation in March 2017, we learnt that the MoH has initiated a project for installation of CT scanners in public health organizations on the basis of a public–private partnership. A feasibility study for this has begun.

The national formulary still lists poor or non-evidence-based drugs such as neuroprotective agents, which are used by physicians, contrary to recommendations by local and international guidelines. Other drugs such as new oral anticoagulants are not available. Even though the MoH is actively investing in developing evidence-based solutions for stroke patients, adherence to guidelines and recommended protocols remains poor, and there does not appear to be a clear implementation strategy regarding evidence-based care interventions for stroke. We met many highly trained physicians with PhDs, who had limited opportunities for scientific and clinical cooperation internationally.

Some initiatives have been taken to improve facilities for stroke care. A Credit Agreement between the Kyrgyz Republic and the Kuwait Fund for Arab Economic Development was ratified and signed in March 2016 for a project for constructing and equipping the neurosurgical centre of the National Hospital in Bishkek. The centre will provide medical care for patients with stroke in accordance with international standards.

Secondary prevention and rehabilitation

Drug therapy plays a crucial role in improving outcomes in patients with ACS and stroke.[43] Drug therapy (including glycaemic control for diabetes mellitus and control of hypertension) and counselling to individuals who have had a heart attack or stroke is one of the NCD "best buys" or cost-effective measures recommended by WHO.

The continuous education of patients regarding lifestyle risk factors and early rehabilitation are essential for better results of care. Yet, the EUROASPIRE IV study[51] found that most coronary patients in Europe are not meeting their lifestyle, therapeutic and risk factor targets after hospitalization. Despite evidence of effectiveness, evidence-based cardiac rehabilitation is one of the most underused evidence-based interventions/therapies in cardiac care in Europe.

Effective interaction between the prehospital and hospital stages of medical care has been proven to lead to shorter delays in onset of treatment and thus better outcomes.

Evidence-based interventions

ACS

Evidence suggests that one of the biggest opportunities for outcome improvement and impact is reducing gaps in the delivery of high-quality patient care for the secondary prevention of CVD after hospital discharge for ACS. The general EBM guidelines for post-ACS care consist of:

- lifestyle therapy, including physical activity and weight management;
- CVD risk factor control, including smoking cessation (for current smokers), blood pressure control, and lipid and diabetes mellitus management;
- preventive medications, according to indications;
- post-discharge follow up;
- patient education;
- cardiac rehabilitation.

Cardiac rehabilitation consists of a multidimensional, multidisciplinary, systematic and standardized approach, both in outpatient and inpatient settings. Exercise-based cardiac rehabilitation has been shown to have important benefits, including a reduction in the risk of death due to a cardiovascular cause and hospital admission, and improvements in the health-related quality of life, compared with not undertaking exercise. There is also some economic evidence indicating that exercise-based cardiac rehabilitation is cost effective.[52] Cardiac rehabilitation post- myocardial infarction is one of the WHO effective care recommendations.[43] Providing post-acute AMI treatment and secondary prevention through cardiac rehabilitation and drug treatment (beta-blockers, aspirin and ACE inhibitors) have been proposed as highly cost-effective measures for Kyrgyzstan.[44]

Successful CVD prevention relies on GPs providing risk factor evaluation, intervention and patient education. Such intensive and structured interventions in general practice contribute to the prevention of recurrent cardiovascular events and reduce hospital admissions in patients with coronary artery disease.[53]

Clinicians should develop an individualized care plan for each patient with an ACS and/or their carer before they leave the hospital. The plan should identify lifestyle changes and drug options (e.g. antithrombotic drugs, high-dose statins, beta-blockers, renin–angiotensin system inhibitors, aldosterone blockers), address their psychosocial needs, and include a referral to an appropriate cardiac rehabilitation or another secondary prevention programme. A copy of the plan should be provided to the patient and their GP or outpatient clinic within 48 hours of discharge.

Stroke

Treatment with aspirin for post-acute ischaemic stroke, a combination of ACE inhibitor and diuretics, beta-blockers and statins for secondary prevention have all been proposed as highly cost-effective measures for Kyrgyzstan.[44]

Rehabilitation therapies are the cornerstone of stroke patients' recovery and functional improvement, and allow stroke survivors to regain possible autonomy and ability for self-care.[54] Evidence-based rehabilitation therapies are of many forms,[55] and these allow tailoring of post-acute interventions according to patient need and features. Stroke rehabilitation programmes are characterized by an interdisciplinary team working cohesively and closely to provide a comprehensive

rehabilitation programme for each patient. These programmes may vary in terms of the types of therapies offered as well as their intensity and duration.[56]

The optimal window for initiating rehabilitation therapies has yet to be determined. Clinical studies have indicated that there is an association between earlier admission to rehabilitation and better outcomes. Likewise, strong evidence suggests that early mobilization (within the first 24 hours), consisting of frequent short sessions, can contribute to better outcomes.[57] Clinically, there is strong evidence that rehabilitation provided in the subacute phase can improve functional outcome. This being the case, it seems advisable that eligible stroke patients be engaged in rehabilitation as soon as they are able. Age is not considered to be a strong predictor of functional recovery after stroke, whereas stroke severity and initial neurological deficit are.

Rehabilitation services are provided at acute care and rehabilitation hospitals; long-term care facilities; at home, with the assistance of public and/or private health services; and in outpatient facilities. Thus far, evidence suggesting the superiority of either home-based or hospital-based outpatient stroke rehabilitation is conflicting. Mild stroke patients can be/have been/are regularly rehabilitated with success in an outpatient setting when treated by a qualified interdisciplinary stroke rehabilitation team. Based on best evidence, patients with moderately severe stroke should receive rehabilitation at stroke-specific rehabilitation units. Other factors may also be important for all stroke survivors, such as continuity of care. Finally, patients with severe stroke are best managed at long-term, less intensive stroke rehabilitation units.

All stroke survivors need care, support and education, but not all require formal rehabilitation. Approximately 20% of stroke survivors recover full functional independence by 2 weeks following a stroke.[58] It is estimated that another 20% have such severe functional deficits that they are expected to remain non-ambulatory and continue to require assistance with activities of daily living (ADLs), irrespective of rehabilitation efforts.[59]

An effective triage system allows stroke patients to be quickly matched with the appropriate intensity of resources, or easily moved to different levels of rehabilitation intensity according to their needs. This is critical for any well-functioning stroke clinical pathway. Before an objective and transparent triage system can be set up, there must be consistent objective measures of functional abilities and outcomes. Clinical scales such as the National Institutes of Health (NIH) stroke scale to measure neurological deficit, modified Rankin Scale (mRS), Montreal Cognitive Assessment (MOCA), and Barthel Index are tools that could be adopted at different times of the stroke clinical pathway to direct patients to suitable facilities, hypothesize a prognosis and inform families about what to expect.

Strengths and gaps

ACS

There are multiple gaps in the provision of secondary prevention and cardiac rehabilitation for ACS patients. Drug availability for secondary prevention of stroke and ACS is limited, as well as public sector cardiac rehabilitation facilities. High out-of-pocket payments for outpatient medicines are the main cause of catastrophic and impoverishing expenditure.[60] Studies have highlighted financial barriers as reasons why patients may not take medication, particularly those required over a long period, such as for hypertension.[9,61] These also found that statins are relatively high priced with limited availability, and not on the reimbursement list, contributing to low countrywide consumption. While the majority of post-MI patients receive long-term therapy with aspirin and beta-blockers (albeit with considerable regional variation), very few receive statins or effective interventions to promote tobacco cessation.[5]

Post-discharge follow up and patient education mainly relies on polyclinic and primary care services. Yet, as has been highlighted elsewhere, although high levels of avoidable hospitalizations for CVD could have been addressed at the primary care level, cardiovascular risk factors are not considered or well controlled by doctors; there is also the largest number of health-care staff vacancies at the primary health-care level.[62] Recurrence of AMI is high in several oblasts, particularly Osh, which is 1.7 times higher than the national average.

There are no national guidelines on cardiac rehabilitation, and it is not clear if the interventions that are present in private practice facilities are consistent with EU-15 standards.

Stroke

Ineffective drugs are widely used for stroke patients, both in the acute phase and for secondary prevention. These drugs are supposed to have a neuroprotective effect and are paid for by patients.

Limited early rehabilitation is in place in public hospital stroke centres but stroke scales and scores that are critical in realizing an objective triage to direct patients along the stroke clinical pathway are not routinely used. Additionally, rehabilitation services are available within rehabilitation hospitals and outpatient clinics at the polyclinics. A wide range of rehabilitation interventions have been proposed, not all of which are evidenced-based, and patients are offered these activities that are added to their global rehabilitation schedule as extra paid activities.

Long-term care facilities and nursing homes are lacking, and patients with severe disabilities are apparently left at home under the care of families and/or social service programmes.

8. Patient involvement

Patient involvement and advocacy for stroke patients is a relatively new phenomenon in Kyrgyzstan. In 2016, for the first time, a number of activities were organized for World Stroke Day in Bishkek; hypertension and peripheral blood glucose screening, information on stroke prevention and early signs of recognition of stroke were presented during a one-day workshop. The materials were obtained by the World Stroke Organization, and the event was conducted by medical students and local stroke neurologists. A video was recorded and published on YouTube.[63]

To our knowledge, heart and stroke patient organizations are not in place, and patients are not consulted on the development of clinical guidelines or service design/stroke strategy planning. Stroke specialists and stroke experts are apparently only occasionally consulted by the guideline and evidence-based implementation unit of the MoH.

9. Monitoring and evaluation

The "Den Sooluk" programme established 96 indicators to track progress.[64] The mid-term evaluation of "Den Sooluk" found key data to be missing for some of the indicators, and inconsistency of data when these are available.

Of the indicators for the category of CVDs in "Den Sooluk", the mid-term evaluation considered that three were achieved or exceeded, eight not achieved, and data were missing for two. The indicators are shown in the table in Annex 4 alongside the results.

The mid-term evaluation of the NCD Strategy found that, for the two most relevant indicators in the Global Monitoring Framework (GMF) for NCDs, one cannot be easily measured yet, and one is close to achievement (Table 4).

Table 4. Relevant indicators within the WHO Global Monitoring Framework and their achievement in Kyrgyzstan

A 25% relative reduction in the prevalence of raised blood pressure or contain the prevalence of raised blood pressure, according to national circumstances	This indicator requires periodic measurement through a population-level survey such as STEPS for ascertainment. The STEPS survey last done in 2013 is due to be repeated in 2017 so trends will be possible then.
At least 50% of eligible people receive drug therapy and counselling (including glycaemic control) to prevent heart attacks and strokes	Proxy measurement is possible through the STEPS survey. The 2013 survey indicated that Kyrgyzstan was close to achieving this target with 49% of eligible people receiving drug therapy and counselling.

10. Conclusions and key messages

NCDs, and particularly CVD, present a challenge for Kyrgyzstan. IHD and stroke are major causes of premature mortality and years of life lost, and the prevalence of cardiovascular risk factors is high within the population. The government has committed itself to tackling the problem, as evidenced by the policy framework and some of the measures already in place. Given that NCD prevention, management of cardiovascular risk factors, and health systems barriers to better NCD outcomes have been covered by other reports,[5,65] this review focused on services for acute care and rehabilitation for heart attacks (ACS) and stroke. In so doing, together with the other reports, it aimed to provide a comprehensive picture of the prevention and control of CVD from population- and individual-level prevention through treatment to rehabilitation, and to view prevention along its continuum of primary, secondary and tertiary prevention. Taking such a disease-specific approach, an in-depth look at the course of one of the major NCDs, and the opportunities and interventions available for impacting on it, is intended to add depth to the broader, more integrated NCD approach. As such, improvements to the CVD or perhaps, more specifically, ACS or stroke pathways, can be seen and used as a means to benefit other diseases through health system change. This report aims to supplement rather than repeat what has already been said in other reports; nevertheless, it does take the opportunity to reiterate the need to continue to strengthen population-level prevention, and assess and manage cardiovascular risk well within primary health care. Such measures will prevent future morbidity and support efforts to prevent recurrence and disability following acute events; they have been shown to be cost effective in Kyrgyzstan.[44]

To review how to better manage today's morbidity, the review used a framework that considered common and distinctive features of care for ACS and stroke. Strengths and gaps were highlighted throughout the report. In summary, there are services in place, within the public (and private) sector for the acute care and rehabilitation of heart attacks and strokes, more developed for the former than the latter, and more concentrated in the capital. Clinical guidelines exist and are largely evidence-based, but their implementation is impeded by gaps in resources and infrastructure, design of services, fragmented clinical pathways and networks, and limited performance management. There was some evidence of the practice of non-EBM, and thus potential opportunities for diverting the resources used up by such practices and put to better use. There appears to be a growing gap between what is possible in the private sector and within the public sector, and a potential erosion of the latter as staff leave for better remuneration and conditions. Fragmentation of the clinical pathway and charges (formal and informal) place a heavy cost on the patient, both financially and in terms of clinical outcome. Nevertheless, there are both good practices and ones in development, international networks are being formed, and there are investment opportunities. A more strategic approach and roadmap for development of these services could capitalize on the strengths and upcoming opportunities. As premature mortality from CVD reduces, failure to improve acute care and rehabilitative services and clinical outcomes, particularly for stroke, could lead to an avoidable recurrence of acute events, increased chronic diseases and disability, with consequences for the quality of life, and health and social care costs.

The key messages that were presented to the MoH at the end of the mission are summarized as follows:

1. Manage the existing resources effectively

- *Rationalize the existing infrastructure and resources*. Existing infrastructure should be rationalized according to the CVD roadmap (*see* the next section on Design the system and direct further investment), which triages resources according to the national and regional CVD epidemiology. Existing practices and services could be reviewed to remove waste. For example, there are a number of ineffective treatments and/or investigations that do not alter clinical management, and contribute to national health expenditures and affect citizens directly or indirectly – these could be removed. A review of the national formulary and practice is critical to exclude drugs (such as neuroprotective agents) that are not evidence-based, and include new treatment options that would reduce significantly the risk of recurrence of both ACS and stroke. EBM implementation and dissemination strategies are needed to increase routine use of clinical guidelines/protocols. More specifically, in settings without physicians routinely working in the prehospital field, it might be more pragmatic to develop advanced prehospital management along with procedures that can be carried out by paramedics.
- *Develop human resources for health*. Suggestions would be to connect highly trained people with postdoctoral education within the country (public and private sectors and higher education), and to capitalize on existing training opportunities (such as twinning, distance learning, telemedicine, secondment), which may be available through international links. A number of clinicians that we met already had good international contacts with institutions and clinicians in other countries (e.g. in the Russian Federation, Turkey, South Korea).
- *Capitalize on existing professional networks* and peer support. The Kyrgyz Society of Cardiology is a member of the European Society of Cardiology and there are links with the ESO. Both of these, and the institutions mentioned above, could potentially provide peer support and opportunities for training, as well as exploring telemedicine support.
- *Develop further the multi-professional training approach*. There are already some good examples within the country, such as training of primary health-care workers, doctors and nurses, together with the PEN training. For stroke care and cardiac rehabilitation, where multidisciplinary collaboration is so crucial, team training could be beneficial.
- *Triage resources*. In a situation with limited resources, triage and targeting of resources may lead to better outcomes overall. One (potentially controversial) option may be to consider reserving scarce resources such as stents for use in working-age people. Better use of clinical scales could help predict and monitor clinical outcomes and direct patients along more tailored pathways.
- *Protect the patient from catastrophic health expenditure.* There has been longstanding work done already in Kyrgyzstan to improve health financing and universal health coverage, and to explore ways of reducing out-of-pocket expenditure.[60] Almost half the population find it difficult to afford health care. This is a problem for ACS and stroke care, as it is for other diseases, and care for ACS and stroke will also benefit from these broader initiatives. Specific examples that we came across were the high costs related to neuroimaging and PCI, and for some drugs, and the cost and inconvenience to patients of having to move between public and private sector facilities for their clinical pathway. Placing facilities such as CT scanners within some key public sector facilities could reduce the costs for patients, and shorten time along the clinical pathway, thus protecting the patient financially and leading to better health outcomes.

2. Design the system and direct further investment

- *Develop a roadmap and coordinate implementation, positioning new investments (buildings, equipment) for maximum benefit*. At present, there is no comprehensive ACS or stroke strategy, or roadmap in Kyrgyzstan. Various interventions and programmes were conducted or are in progress to improve stroke care, but do not appear to be coordinated. Development partners have planned interventions in both infrastructure and technological equipment. However, these investments do not appear to be implemented in a coordinated way and not in the framework of a balanced care development plan. Therefore, there is a high risk of fragmentation: if the care pathway components are not coordinated, there is a chance that less effective and efficacious actions to manage patients will be put in place, which would be a waste of resources. Investments in infrastructure and complex technological equipment should be directed through a roadmap leading to maximum benefit.

- *Review the membership, functioning and objectives of the CVD thematic group*. In order to realize a roadmap for CVD care, we recommend that a country-level strategy be organized involving all the key players (i.e. the MoH, CVD thematic group, regional authorities, hospitals and professionals, and primary care services) and development partners. The CVD thematic group for "Den Sooluk" could play a convening, development and monitoring role. This might require a review of membership, functioning and objectives.
- *Concentrate expertise*. This links to the previous section and to planning of new services. A hub-and-spoke model, supported by telemedicine, could make better use of existing resources in achieving countrywide coverage and help direct future investments.
- *Develop a culture of acute care*. Timeliness of care is critical for the treatment of ACS, stroke and emergencies, and for achieving the best possible outcomes. Awareness of its importance needs to be raised among the public and professionals, and measuring timed indicators, monitoring performance and sharing good practices could help ensure it.
- *Raise the quality of ICU care* and patient placement flow for better outcomes.
- *Bring together the care of heart attack and stroke*. Removing physical and professional barriers between the work of those caring for cardiovascular and cerebrovascular events could improve efficiency and effectiveness, sharing resources where feasible. This may also lead to the proposal and adoption of joint care strategies, developed by cardiology and stroke experts, e.g. of stroke patients with myocardial infarction, of better cardiovascular risk assessment and management of stroke patients.

3. Demonstrate success

- *Identify and share good practices and empower*. Good practice examples existed throughout the system, e.g. within the emergency service and stroke unit.
- *Continue/expand thrombolysis registries*. Registries and indicators should be used as an opportunity to identify, share and empower good practice, provide feedback to health professionals and health policy-makers, and monitor performance and management for improved outcomes.
- *Benchmark performance against international standards*. Opportunities for benchmarking practices exist internationally such as the Safe Implementation of Thrombolysis in Stroke (SITS), Registry of Stroke Care Quality (RES-Q) through the European Stroke Organisation (ESO), and EURObservational Research Programme (EROP) through the European Society of Cardiology (ESC) and are at the early stages of being taken up.
- *Review the indicator set* to more effectively monitor and manage performance for improved outcomes. A few well-chosen indicators, well measured and monitored, may be more beneficial than a larger number of indicators.

Annex 1: Mission programme

Thursday 6 October 2016

Date/Time	Meetings	Venue
08.30–09.30	Briefing meeting with Jarno Habicht, WR	WHO Office
10.00–11.30	Meeting with Saidumar Makhmudkhodjaev, MoH consultant on CVDs	UN House
14.30–15.30	Meeting with M. Kaliev, Director MHIF, database, hospitalization, coverage of patients with acute coronary syndrome, purchasing, remuneration	Mandatory Insurance Fund 122, Chui av.
16.00–17.30	Visit to National Hospital meeting with head of department of stroke N. Omorov and head of department of neurology J. Turgunbaev	National Hospital
18.00–18.40	Meeting with Ha Thi Hong Nguyen, Senior Health Economist, Health, Nutrition and Population, WB	WB Office

Friday 7 October 2016

Date/Time	Meetings	Venue
09.00–10. 00	Meeting with Director of National Center of Cardiology and Therapy A. Djumagulova, Professor Dadabaev, Dr R. Kadyralieva, Deputy Director of the Centre, Professor Beishenov	National Centre of Cardiology and Therapy 3, Togolok Moldo str.
10.15–11.15	Meeting with K. Jooshev Deputy Director of Institute of Heart Surgery and Organ transplantation; A. Jumakadyrov/ Deputy Director of health care, T. Kudaiberdiev, head of the consultative unit; I. Bebezov, head of the unit of heart failure and transplantation; I. Abdyldaev, head of the unit of endovascular surgery	-/-
11.30–12.30	Visit to the emergency medical centre in Bishek to see the register of acute myocardial infarction and stroke. Head of Center, Dr Isken Shayhmetov	105, Isanov str.
14.45–16.00	Visit to Kyrgyz Institute of Rehabilitation (Tash-Dobo village) Department of Rehabilitation Heart Attack and Stroke, Director M. Sultanmuratov	Tash-Dobo village
17.00	Interview with Dr Kudabai Koshumbaev, Head of Angioneurological unit, Naryn Oblast Hospital	UN House
17.30	Interview with Dr Jenish Mamytov, Head of Angioneurological unit, Osh Oblast Hospital	UN House

Saturday 8 October 2016

Date/Time	Meetings	Venue
09.00–10.30	Visit to the private clinic "Bicarb"	Tynystanov street
10.30–11.00	Meeting with rector of Institute training and retraining Chubakov T.	Meeting room, ground floor
11.00–11.30	Meeting with specialist on evidence-based medicine B. Barktabasova; B. Kambaralieva, Coordinator on PHC	Meeting room, ground floor
12.00–13.00	Visit to the Angiography unit, Hospital N1, Bishkek	Hospital N1

Monday 9 October 2016

Date/Time	Meetings	Venue
09.00–10.00	Debriefing with WR	WHO Office
15.15–16.00	Debriefing in MoH (Minister, or Deputy Minister Murzaliev, A. Jumagulova, N. Omorov, R. Jakypova, K. Jooshev, M. Sultanmuratov, MHIF, R. Kadyralieva, L. Murzakarimova)	MoH

Annex 2: Checklist of performance indicators for stroke care

No values were obtained during or after the mission concerning the following indicators.

Acute care performance indicators		Value
Access of stroke patients: number of accesses in accident and emergency (A&E)	Percentage of patients who received a diagnosis of stroke in the emergency room among overall number of accesses at the A&E	
IV tPA 3.5 h	Intravenous recombinant tissue plasminogen activator (IV tPA) in patients who arrive within 3.5 h of symptom onset and treated within 4.5 h of symptom onset (IV tPA 3.5 h) (ischaemic stroke only)	
Door-to-needle time	Time for access to IV tPA	
Door-to-CT time	Time for access to brain CT imaging	
Antithrombotic therapy–antiplatelet medication within ≤48 h after stroke onset	Percentage of patients after ischaemic stroke or TIA treated with antiplatelets ≤48 h after stroke onset if intracranial haemorrhage and contraindications against use of antiplatelets 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 h after admission) who were seen or treated by a physiotherapist or occupational therapist within the first 2 days of admission	
Brain imaging in stroke patients	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 receive 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 5 components: modifiable risk factors, stroke warning signs and symptoms, how to activate emergency medical services, need for follow up, medications prescribed (stroke education)	
Discharge indicators		
Discharge destination (%)	Percentage of stroke patients discharged: 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 without 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 discharged 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, 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 mRankin scale)	Disability at 3, 6, 12 months (proportion of patients dependent – mRankin 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

№	Indicator	Value
1	The population of the country	
2	The urban population	
3	The rural population	
4	Administrative division	
5	All-cause mortality	
6	The all-cause mortality rate per 100 000 inhabitants	
7	Mortality from CVD	
8	The mortality rate from CVD per 100 000 inhabitants	
9	The number of reported cases of ACS	
10	The number of reported cases of AMI	
11	The number of deaths from ACS (I20–I22)	
12	The number of fatal outcomes in ACS in the first 24 h of the disease	
13	The number of fatal outcomes in ACS in hospitals	
14	The number of autopsies in fatal outcomes in ACS	
15	The number of divergences of diagnoses by autopsy	
16	The number of deaths from AMI (I21–I22)	
17	The rate of mortality from AMI per 100 000 inhabitants	
18	The number of registered cases of ACS with ST-segment elevation on ECG	
19	The number of ambulance crews	
20	The number of ambulance physician teams	
21	The number of specialized ambulance teams (resuscitation/intensive care)	
22	A single call number for ambulance	
23	A system for routing of ACS patients (policies, regulatory documents, dispatchers)	
24	The availability of ECG in the prehospital setting	
25	Remote transmission of the ECG	
26	The availability of thrombolysis in the prehospital setting	
27	The availability of defibrillation in the prehospital setting	
28	The availability of antithrombotic therapy in the prehospital setting	
29	The number of cases of prehospital thrombolysis per year	
30	The number of hospitals providing care for ACS	
31	The number of monitored beds for the management of ACS	
32	The number of doctors assisting in ACS care	

№	Indicator	Value
33	The number of nurses assisting in ACS care	
34	The number of hospitals with the possibility of thrombolysis, but without PCI facility	
35	The number of hospitals with on-site PCI facility during working hours	
36	The number of hospitals with 24/7 on-site PCI facility	
37	The number of hospitals with PCI and surgery (coronary artery bypass graft surgery [CABG]) on-site facility	
38	The number of cases of thrombolysis in hospitals per year	
39	The number of cases of thrombolysis + PCI per year	
40	The number of primary PCIs per year	
41	The population in areas with available primary PCI	
42	The number of CABG for ACS per year	
43	The frequency of use of drug-eluting stents in PCI in ACS	
44	The frequency of use of radial access in PCI in ACS	
45	Presence of national registry of ACS	
46	Presence of regional registers of ACS	
47	A system for assessment/monitoring of quality of care in ACS	
48	The number of cases in which quality of care control was carried out, per year	
49	Time delay “symptom – call to ambulance”	
50	Ambulance arrival time	
51	“Door-to-needle” time for thrombolysis	
52	“The door-to-balloon” time for primary PCI	
53	The use of double antiplatelet therapy	
54	The use of parenteral anticoagulants in acute phase of ACS	
55	The use of ACE inhibitors	
56	The use of statins	
57	The availability of rehabilitation programmes	
58	Presence of a programme for the development of a regional network for ACS management	
59	Presence of programmes for preferential provision of medicines	
60	Presence of programmes that inform the population about the symptoms of AMI and about early treatment	

Annex 4: Achievement of "Den Sooluk" CVD indicators

Indicator	Result
1. Index of CVD mortality (age 30–39 / 40–59 years, per 100 000 population) ● Index of CVD mortality, females (age 30–39 / 40–59 years, per 100 000 population) ● Index of CVD mortality, males (age 30–39 / 40–59, per 100 000 population)	ACHIEVED 2015 target by 2014 Target indicator to be changed (from 2014 baseline) Annual decline of 1%
2. Index of mortality from stroke (age up to 65 years; 65 years and above) ● Index of mortality from stroke, females (age up to 65 years; 65 years and above) ● Index of mortality from stroke, males (age up to 65 years; 65 years and above)	NOT ACHIEVED 2015 target Targets remain unchanged in order to stabilize the index.
3. Indicator of the efficacy of the health system to control hypertension	NOT ABLE TO MEASURE Propose to remove the indicator
4. Identification of cases of smoking in the general population (adults and adolescents, %)	NOT ACHIEVED 2015 target *Note:* this indicator seems to be measured as case identification from health systems data rather than population-level survey of prevalence. It is proposed to establish that the purpose is not to reduce smoking prevalence but have an increased detection rate of 2% to improve registration.
5. Mortality rate from acute myocardial infarction (up to 65 years) per 100 000 population ● Mortality rate from acute myocardial infarction, females (up to 65 years) per 100 000 population ● Mortality rate from acute myocardial infarction, males (up to 65 years) per 100 000 population	ACHIEVED 2015 target by 2014 Target indicator to be changed (from 2014 baseline) Annual decline of 1%
6. The proportion (%) of patients with recurrent myocardial infarction from total number of patients with myocardial infarction	NOT ACHIEVED 2015 target Targets remain unchanged in order to stabilize the index.
7. Hospital mortality from acute myocardial infarction (%)	NOT ACHIEVED 2015 target Since 2011, there has been a growth rate so the goal remains the same – stabilization of index.
8. Incidence of myocardial infarction in patients with diabetes type 2 (per 100 patients)	NOT ACHIEVED 2015 target Since 2011, there has been a growth rate so the goal remains the same – stabilization of index.

Indicator	Result
9. The incidence of stroke in patients with diabetes type 2 (per 100 patients)	NOT ACHIEVED 2015 target Since 2011, there has been a growth rate so the goal remains the same – stabilization of index.
10. The number of identified cases of hypertension at the primary level of health care ● Females ● Males	NOT ACHIEVED 2015 target Targets remain unchanged in order to stabilize the index.
11. The proportion of patients (%) with acute myocardial infarction who received a standard package of services in the hospital (aspirin, beta-blocker, heparin)	NO TARGETS SET & NOT ABLE TO MEASURE The study was conducted. The appropriateness of the indicator is questioned.
12. The level of excise taxes on tobacco products (%)	NO TARGETS SET Unchanged

References

1 Noncommunicable diseases country profiles: Kyrgyzstan. Geneva: World Health Organization; 2014.

2 Institute of Health Metrics and Evaluation (IHME), Kyrgyzstan [website] (http://www.healthdata.org/kyrgyzstan, accessed 7 February 2017).

3 Convention Secretariat. Needs assessment for implementation of the WHO Framework Convention on Tobacco Control in the Kyrgyz Republic. August 2012.

4 Krasovsky K. Tobacco taxation policy in Kyrgyzstan. Copenhagen: WHO Regional Office for Europe; 2015.

5 Jakab M, Hawkins L, Loring B, Tello J, Ergüder T, Kontas M. Better noncommunicable disease outcomes: challenges and opportunities for health systems. Kyrgyzstan country assessment. Copenhagen: WHO Regional Office for Europe: 2014.

6 European Health Information Gateway. In: WHO Regional Office for Europe [website]. Copenhagen: WHO; 2016 (http://gateway.euro.who.int/en/country-profiles/kyrgyzstan/#h2020_target1, accessed 7 February 2017).

7 Den Sooluk National Health Reform Program of the Kyrgyz Republic for 2012–2016 [Mid-term review report]. Bishkek: Den Sooluk; 2016.

8 Epidemiological data from Demographic Book (national statistical data 2015). Bishkek: Centre for Medical Information; 2015.

9 Abdraimova A, Iliasova A, Zurdinova A. Underlying reasons for low levels of seeking medical care in men. Policy research document. Bishkek: Health Policy Analysis Center; 2015.

10 Salt and trans-fats assessed in Kyrgyz Republic with WHO support. Copenhagen: WHO Regional Office for Europe; 2016 (http://www.euro.who.int/en/countries/kyrgyzstan/news/news/2016/11/salt-and-trans-fats-assessed-in-kyrgyz-republic-with-who-support, accessed 11 February 2017).

11 Kyrgyzstan STEPS survey 2013: fact sheet. Copenhagen: WHO Regional Office for Europe; 2015.

12 Den Sooluk National Health Reform Program in the Kyrgyz Republic for 2012–2016. Bishkek: Government of Kyrgyzstan; 2011.

13 Anderson I, Buga M, Obermann K, Temirov A, Ibragimova G. Independent review of Den Sooluk and project in support of the mid-term review. Oxford: Oxford Policy Management; 2016.

14 Sackett DL, Rosenberg WMC, Gray JAM, Haynes RB, Richardson WS. Evidence based medicine: what it is and what it isn't. BMJ. 1996;312:71.

15 Kyrgyz Society of Cardiology. In: European Society of Cardiology [website] (http://www.escardio.org/The-ESC/Member-National-Cardiac-Societies/Kyrgyz-Society-of-Cardiology, accessed 7 February 2017).

16 ESO-EAST "Enhancing and Accelerating Stroke Treatment. In: European Society of Cardiology [website] (http://eso-stroke.org/eso-east, accessed 7 February 2017). The project consists of a 5-year collaboration with physicians from Eastern European countries to improve the management of stroke in Europe through medical education to health-care professionals and the lay public, implementation of evidence-based and best practice approaches, and mutual collaboration. Kyrgyzstan joined the ESO-EAST project in 2015.

17 Package of essential noncommunicable (PEN) disease interventions for primary health care in low-resource settings. Geneva: World Health Organization; 2010.

18 Kyrgyz State Medical Institute of retraining and advanced training [website] (http://www.ksmi.kg/do-v-kgmipipk.html, accessed 7 February 2017).

19 Boaz A, Baeza J, Fraser A; European Implementation Score Collaborative Group (EIS). Effective implementation of research into practice: an overview of systematic reviews of the health literature. BMC Res Notes. 2011;4:212.

20 STEPS-Stroke manual (version 1.2). The WHO STEPwise approach to stroke surveillance. Geneva; WHO (http://www.who.int/ncd_surveillance/en/steps_stroke_manual_v1.2.pdf, accessed 7 February 2017).

21 Turgunbayev DD, Artykbayev ASh, Kadyrova N, Abdraimova A, Urmanbetova A. Analysis of stroke diagnosis verification in patients that died at home [Policy Research Paper No. 82]. Bishkek: Health Policy Analysis Centre; 2014.

22 SITS – General Stroke (All patients) registry. In: SITS [website]. SITS International, Department of Neurology, Sweden (http://www.sitsinternational.org/registries/sits-general-stroke-all-patients-registry/, accessed 8 February 2017).

23 Registry of Stroke Care Quality (RES-Q) [website] (http://www.qualityregistry.eu/index.php/en/, accessed 8 February 2017).

24 Mosley I, Nicol M, Donnan G, Patrick I, Kerr F, Dewey H. The impact of ambulance practice on acute stroke care. Stroke. 2007;38:2765–70.

25 Oostema JA, Konen J, Chassee T, Nasiri M, Reeves MJ. Clinical predictors of accurate prehospital stroke recognition. Stroke. 2015;46(6):1513–7.

26 Nor AM, McAllister C, Louw SJ, Dyker AG, Davis M, Jenkinson D. et al.Agreement between ambulance paramedic- and physician-recorded neurological signs with Face Arm Speech Test (FAST) in acute stroke patients. Stroke. 2004;35:1355–9.

27 Kothari RU, Pancioli A, Liu T. Cincinnati Prehospital Stroke Scale: reproducibility and validity. Ann Emerg Med. 1999;33:373–8.

28 Studnek JR, Asimos A, Dodds J, Swanson D. Assessing the validity of the Cincinnati prehospital stroke scale and the medic prehospital assessment for code stroke in an urban emergency medical services agency. Prehosp Emerg Care. 2013;17:348–5.

29 You S, Chung SP, Chung HS, Lee HS, Park JW, Kim HJ et al. Predictive value of the Cincinnati prehospital stroke scale for identifying thrombolytic candidates in acute ischemic stroke. Am J Emerg Med. 2013;31:1699–702.

30 Abarbanell NR. Is prehospital blood glucose measurement necessary in suspected cerebrovascular accident patients? Am J Emerg Med. 2005;23(7):823–7.

31 Purrucker JC, Hametner C, Engelbrecht A, Bruckner T, Popp E, Poli S. Comparison of stroke recognition and stroke severity scores for stroke detection in a single cohort. J Neurol Neurosurg Psychiatry. 2015;86(9):1021–8.

32 Fothergill RT, Williams J, Edwards MJ, Russell IT, Gompertz P. Does use of the recognition of stroke in the emergency room stroke assessment tool enhance stroke recognition by ambulance clinicians? Stroke. 2013; 44(11):3007–12.

33 Jauch EC, Saver JL, Adams HP Jr, Bruno A, Connors JJ, Demaerschalk BM et al., American Heart Association Stroke Council, Council on Cardiovascular Nursing, Council on Peripheral Vascular Disease, Council on Clinical Cardiology. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2013;44(3):870–947.

34 Powers WJ, Derdeyn CP, Biller J, Coffey CS, Hoh BL, Jauch EC et al.; American Heart Association Stroke Council. 2015 American Heart Association/American Stroke Association focused update of the 2013 Guidelines for the early management of patients with acute ischemic stroke regarding endovascular treatment: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2015;46(10):3020–35.

35 Mosley I, Nicol M, Donnan G, Patrick I, Kerr F, Dewey H. The impact of ambulance practice on acute stroke care. Stroke. 2007;38:2765–70.

36 Xian Y, Holloway RG, Chan PS, Noyes K, Shah MN, Ting HH et al. Association between stroke center hospitalization for acute ischemic stroke and mortality. JAMA. 2011;305(4):373–80.

37 Task Force on the management of ST-segment elevation acute myocardial infarction of the European Society of Cardiology (ESC), Steg PG, James SK, Atar D, Badano LP, Blömstrom-Lundqvist C, Borger MA et al. ESC guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Eur Heart J. 2012;33(20):2569–619.

38 Roffi M, Patrono C, Collet JP, Mueller C, Valgimigli M, Andreotti F et al. 2015 ESC guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation: Task Force for the Management of Acute Coronary Syndromes in Patients Presenting without Persistent ST-Segment Elevation of the European Society of Cardiology (ESC). Eur Heart J. 2016;37(3):267–315.

39 Perkins GD, Handley AJ, Koster RW, Castrén M, Smyth MA, Olasveengen T et al., on behalf of the Adult basic life support and automated external defibrillation section collaborators. European Resuscitation Council Guidelines for Resuscitation 2015: section 2. Adult basic life support and automated external defibrillation. Resuscitation. 2015;95:81–99.

40 http://www.med.kg/index.php/ru/ - accessed 20 February 2017.

41 O'Gara PT, Kushner FG, Ascheim DD, Casey DE, Chung MK, de Lemos JA et al. American College of Emergency Physicians; Society for Cardiovascular Angiography and Interventions. 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol. 2013;61(4):e78–140.

42 Clinical practice guidelines. In: European Society of Cardiology [website] (http://www.escardio.org/Guidelines/Clinical-Practice-Guidelines, accessed 5 February 2017).

43 Global action plan for the prevention and control of noncommunicable diseases 2013–2020. Geneva: World Health Organization; 2013:65–72 (Appendix 3).

44 Akkazieva B, Chisholm D, Akunov N, Jakab M. The health effects and costs of the interventions to control cardiovascular diseases in Kyrgyzstan. Policy Research Paper no. 60. Bishkek: Health Policy Analysis Center; 2009.

45 Langhorne P, Fearon P, Ronning OM, Kaste M, Palomaki H, Vemmos K et al.; Stroke Unit Trialists' Collaboration Stroke unit care benefits patients with intracerebral hemorrhage: systematic review and meta-analysis. Stroke. 2013;44(11):3044–9.

46 Stroke Unit Trialists Collaboration. How do stroke units improve patient outcomes? A collaborative systematic review of the randomized trials. Stroke. 1997;28(11):2139–44.

47 Stroke Unit Trialists' Collaboration. Organised inpatient (stroke unit) care for stroke. Cochrane Database Syst Rev. 2013;(9):CD000197.

48 Hacke W, Kaste M, Bluhmki E, Brozman M, Dávalos A, Guidetti D et al.; for the ECASS Investigators. Thrombolysis with alteplase 3 to 4.5 hours after acute ischemic stroke. N Engl J Med. 2008;359(13):1317–29.

49 Lin CB, Peterson ED, Smith EE, Saver JL, Liang L, Xian Y et al. Emergency medical service hospital prenotification is associated with improved evaluation and treatment of acute ischemic stroke. Circ Cardiovasc Qual Outcomes. 2012;5(4):514–22.

50 Middleton S, Levi C, Ward J, Grimshaw J, Griffiths R, D'Este C et al. Fever, hyperglycaemia and swallowing dysfunction management in acute stroke: a cluster randomised controlled trial of knowledge transfer. Implement Sci. 2009;4:16.

51 Kotseva K, Wood D, De Bacquer D, De Backer G, Rydén L, Jennings C et al.; EUROASPIRE Investigators. EUROASPIRE IV: a European Society of Cardiology survey on the lifestyle, risk factor and therapeutic management of coronary patients from 24 European countries. Eur J Prev Cardiol. 2016;23(6):636–48.

52 Anderson L, Thompson DR, Oldridge N, Zwisler AD, Rees K, Martin N et al. Exercise-based cardiac rehabilitation for coronary heart disease. Cochrane Database Syst Rev. 2016;(1):CD001800.

53 Piepoli MF, Hoes AW, Agewall S, Albus C, Brotons C, Catapano AL et al.; Authors/Task Force Members. 2016 European Guidelines on cardiovascular disease prevention in clinical practice: the Sixth Joint Task Force of the European Society of Cardiology and other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of 10 societies and by invited experts) developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR). Eur Heart J. 2016;37(29):2315–81.

54 Dobkin BH. Clinical practice. Rehabilitation after stroke. N Engl J Med. 2005;352(16):1677–84.

55 Langhorne P, Bernhardt J, Kwakkel G. Stroke rehabilitation. Lancet. 2011;377(9778):1693–702.

56 Di Lauro A, Pellegrino L, Savastano G, Ferraro C, Fusco M, Balzarano F et al. A randomized trial on the efficacy of intensive rehabilitation in the acute phase of ischemic stroke. J Neurol. 2003;250(10):1206–8.

57 Bernhardt J, Churilov L, Ellery F, Collier J, Chamberlain J, Langhorne P et al., on behalf of the AVERT Collaboration Group, G. Prespecified dose-response analysis for A Very Early Rehabilitation Trial (AVERT). Neurology. 2016;86(23):2138–45.

58 Kelly-Hayes M, Wolf PA, Kannel WB, Sytkowski P, D'Agostino RB, Gresham GE. Factors influencing survival and need for institutionalisation following stroke: the Framingham study. Arch Phys Med Rehabil. 1988;69(6):415–8.

59 Pfeffer MM, Reding MJ. Stroke rehabilitation. In: Lazar RB, editor. Principles of neurological rehabilitation. New York: McGraw Hill; 1998:105–19.

60 Akkazieva B, Jakab M, Temirov A. Long-term trends in the financial burden of health-care seeking in Kyrgyzstan, 2000–2014. Health Financing Policy Papers. Copenhagen: WHO Regional Office for Europe; 2016.

61 Abdraimova A, Urmanbetova A, Borchubaeva G, Azizbekova J. Cost-estimation of medicinal treatment of hypertension in the Kyrgyz Republic with the view of creating possible drug supply mechanisms ensuring free-of-charge HTN treatment. Policy Research Paper no. 83. Bishkek: Health Policy Analysis Center; 2014.

62 Comparative analysis of cardiovascular patient hospitalization by regions. Policy Research Report no. 86. Bishkek: Health Policy Analysis Center; 2014.

63 World Stroke Organization. World Stroke Day in Kyrgyzstan, 2016 (https://www.youtube.com/watch?v=ZtwXHF9DQy8, accessed 8 February 2017).

64 Government of Kyrgyzstan. Package of indicators for monitoring the national health care reform program "Den Sooluk" 2012–2016, 2012 (http://densooluk.med.kg/en/monitoring-and-evaluation-2, accessed 8 February 2017).

65 Pharmaceutical pricing and reimbursement reform in Kyrgyzstan. Copenhagen: WHO Regional Office for Europe; 2016 (http://www.euro.who.int/__data/assets/pdf_file/0005/325823/Pharmaceutical-pricing-reimbursement-reform-Kyrgyzstan.pdf?ua=1, accessed 8 February 2017).

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

Member States
Albania
Andorra
Armenia
Austria
Azerbaijan
Belarus
Belgium
Bosnia and Herzegovina
Bulgaria
Croatia
Cyprus
Czech Republic
Denmark
Estonia
Finland
France
Georgia
Germany
Greece
Hungary
Iceland
Ireland
Israel
Italy
Kazakhstan
Kyrgyzstan
Latvia
Lithuania
Luxembourg
Malta
Monaco
Montenegro
Netherlands
Norway
Poland
Portugal
Republic of Moldova
Romania
Russian Federation
San Marino
Serbia
Slovakia
Slovenia
Spain
Sweden
Switzerland
Tajikistan
The former Yugoslav Republic of Macedonia
Turkey
Turkmenistan
Ukraine
United Kingdom
Uzbekistan

World Health Organization Regional Office for Europe
UN City, Marmorvej 51, DK-2100 Copenhagen Ø, Denmark
Tel.: +45 45 33 70 00 Fax: +45 45 33 70 01 Email: euwhocontact@who.int
Website: www.euro.who.int