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A service framework and roadmap for the development of care systems for heart attack and stroke in Kyrgyzstan

Prepared for the Ministry of Health of Kyrgyzstan

By the WHO Regional Office for Europe

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Abstract

Cardiovascular diseases (CVD) cause 50% of all deaths in Kyrgyzstan, and premature mortality from CVD is still high. Clinical care of CVD is costly and prolonged. The roadmap aims to create and transform existing networks, implement better clinical guidelines, use resources more effectively, improve infrastructure and improve performance management. Further, mapping the organization of regional centres for specialized care in acute myocardial infraction and stroke will improve the time indicators of specialized treatment. The roadmap outlines core acute care interventions in acute myocardial infraction and stroke with key design of services and proposes strategic directions to accelerate gains in CVD management.

Keywords
CARDIOVASCULAR DISEASES – PREVENTION AND CONTROL
STROKE – PREVENTION AND CONTROL
DELIVERY OF HEALTH CARE – METHODS
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Contents

Abbreviations and acronyms

ACS	acute coronary syndrome
ADL	activities of daily living
AMI	acute myocardial infarction
CHADSVASC	congestive heart failure, hypertension, age, diabetes, stroke/TIA and vascular disease (atrial fibrillation risk score calculator)
CT	computed tomography
CVD	cardiovascular disease
DALY	disability-adjusted life-year
ECG	electrocardiography
FAST	facial drooping, arm weakness, speech difficulties and time to call emergency services
IHD	ischaemic heart disease
IADL	instrumental activities of daily living
MRI	magnetic resonance imaging
NIHSS	United States National Institutes of Health stroke scale/score
NSTEMI	non-ST-elevated myocardial infarction
PCI	percutaneous coronary intervention
STEMI	ST-elevated acute myocardial infarction
TIA	transient ischaemic attack

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Executive summary

Cardiovascular diseases (CVD) cause more deaths than any other cause in Kyrgyzstan. Four of five CVD-related deaths are caused by heart attacks and strokes. CVD affects individuals in their peak mid-life years and undermines the development of countries by depriving valuable human resources in their most productive years.

Acute coronary syndrome and stroke have been the priority and the major theme of the national health reform programme Den Sooluk (2012–2016). In 2016, WHO reviewed acute and rehabilitative services for heart attack and stroke. It demonstrated fragmentation of the clinical pathways and lack of clear implementation of guideline recommendations, with most patients not being diagnosed or treated on time. Further, opportunities for better use of resources, health personnel, technology, equipment and drugs were observed.

In 2017, Kyrgyzstan's Ministry of Health established a working group to design a service framework and roadmap for the development of care systems for heart attack and stroke in Kyrgyzstan. Under the coordination of the WHO Regional Office for Europe and the WHO Country Office in Kyrgyzstan, guiding principles were defined and the service framework and roadmap of actions over the short, medium and longer term were developed, drawing on local data, documents and regulations.

The roadmap proposes ways to strengthen care for coronary heart disease and cerebrovascular disease through health system interventions:

- implementing evidence-informed, affordable and sustainable interventions (best buys) for preventing recurrences of myocardial infarction and stroke;
- identifying sustainable strategies for integrating a new model of care into existing health-care infrastructure; and
- building national capacity to meet people's health-care needs related to heart attack and stroke.

The document was presented to the Ministry of Health, the national working group and the regions in June 2018 and discussed again in September 2018. The latest version of the roadmap received input from recent consultations and letters from the National Centre for Cardiology and Internal Medicine and from the National Hospital for Neurological Care. The Kyrgyz Society of Cardiologists sent comments as well.

Many organizational changes will be required in existing health services to make them more receptive to the needs of people suffering from heart attack and stroke, working in partnership with families, health-care teams and the community, and more effective. This roadmap proposes a way forward for Kyrgyzstan.

Introduction

This roadmap is prepared to follow up the WHO *Review of acute care and rehabilitation services for hear attack and stroke in Kyrgyzstan (1)*, which was presented to the Ministry of Health in spring 2017. Ischaemic heart disease (IHD) and stroke are major causes of premature mortality and years of life lost in Kyrgyzstan, and the prevalence of cardiovascular risk factors is high. The review identified both strengths and weaknesses within the present services, with significant avoidable mortality and disability and lost opportunities for reducing the disease burden and costs. Its 16 recommendations were grouped into three key messages: manage the existing resources effectively; design the system and direct further investment; and demonstrate success.

The main audience for this document is policy-makers within Kyrgyzstan. Therefore, it seeks to be concise and to refer to other more detailed reports where necessary. It focuses on prehospital, hospital and post-hospital care for heart attacks (acute myocardial infarction (AMI)) and stroke (ischaemic and haemorrhagic).

The document was developed in conjunction with a CVD Working Group appointed by the Ministry of Health. Annex 1 presents the members of the Working Group and meeting dates. The process was led by WHO: the WHO Country Office in Kyrgyzstan, WHO Regional Office for Europe and WHO consultants.

Policy context

This is not a stand-alone document. It is prepared within (and benefits from) a broader policy context and dynamic process of change within the health sector of Kyrgyzstan. The national health reform programme 2012–2016 Den Sooluk (extended to 2018) will soon be replaced by the Health Sector Strategy for Kyrgyzstan (the Programme for Health System Development until 2030, currently in draft form). A service delivery master plan will be developed during 2018. The eHealth strategy was approved in 2016, and the eHealth architecture was developed in 2017. A ministerial decree on emergency care services, with an action plan, was approved in December 2017. National clinical guidelines for AMI (with ST-elevation (STEMI); without ST-elevation (NSTEMI)) and stroke were updated and approved in late 2017 *(2–4)*. Health system changes are also underway: a review of the State Guaranteed Benefit Package; broader consideration of performance- and results-based financing by the Mandatory Health Insurance Fund; improvement in pharmaceutical policies, including price regulation, pharmacovigilance and procurement practice to improve access to essential drugs, such as centralized procurement at the regional level through hospital or pharmacy chains; and improvements to the quality system and service delivery (recent WHO reviews for both are nearing completion).

Guiding principles

This document is consistent with guiding principles within relevant international and national policy documents, such as those within the draft Health Sector Strategy for Kyrgyzstan of universal health coverage, reducing inequalities in health and state guarantees ensuring quality-assured, safe and effective health care and population health services. In addition, specific guiding principles for this roadmap are:

- evidence-informed practice;
- improving quality, with data driving the improvement;
- consistency of services across the country, reducing variation in care;

- a unified model of care, common principles of organization and coordination, with emergency services, the hospital services, clinical networks and primary care teams planning services together;
- an integrated approach – effective collaboration between personnel providing assistance at different stages and effective communication of health-care providers across boundaries, with patients at the centre; and
- efficient use of resources: for example, sharing such facilities as an angiography suite, especially when resources are limited.

Core interventions

In conjunction with the Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013–2020, WHO has published a set of cost-effective ("best buys") and effective interventions, which was updated in May 2017 *(5)*. In addition to preventing risk factors such as tobacco and alcohol use, this contains a limited list of interventions for the acute care of acute coronary syndrome (ACS) and stroke and secondary prevention and rehabilitation following acute events:

- **drug therapy (including glycaemic control for diabetes mellitus and control of hypertension using a total risk approach) and counselling for individuals who have had a heart attack or stroke and to people with: high risk (≥30%) of a fatal or non-fatal cardiovascular event in the next 10 years or a moderate to high risk (≥20%) of a fatal or non-fatal cardiovascular event in the next 10 years;**
- treating new cases of AMI with either: acetylsalicylic acid; acetylsalicylic acid and clopidogrel; thrombolysis; or primary percutaneous coronary interventions (PCI);
- cardiac rehabilitation after myocardial infarction;
- anticoagulants for medium-and high-risk non-valvular atrial fibrillation and for mitral stenosis with atrial fibrillation;
- treating acute ischaemic stroke with intravenous thrombolytic therapy;
- low-dose acetylsalicylic acid (acetylsalicylic acid) for ischaemic stroke; and
- care of acute stroke and rehabilitation in stroke units.

Only one of these interventions is also a WHO best buy (shown in bold): that is, an effective intervention with cost–effectiveness analysis ≤100 international US dollars per disability-adjusted life-year (DALY) averted in low- and middle-income countries. The rest are WHO "effective interventions", with cost–effectiveness analysis >100 international dollars per DALY averted in low- and middle-income countries.

In support of the management of hypertension and other cardiovascular risk factors, WHO has issued a set of treatment protocols for use in primary health care *(6)*. WHO also publishes a Model List of Essential Medicines *(7)* that contains lists of drugs recommended for ACS and stroke care. WHO is also preparing a list of priority medical devices for cardiovascular disease, but it has not been published yet.

Other bodies, such as the European Society of Cardiology *(8)* (and its specific groups) and the European Stroke Organisation *(9)* have published evidence-informed clinical guidelines relevant to acute care of ACS and stroke, their secondary prevention and rehabilitation that are widely followed within many countries in the WHO European Region. Although not all follow WHO cost–effectiveness and effectiveness criteria, these clinical practice guidelines and scientific literature promote cornerstone interventions for acute care and rehabilitation. Stroke cornerstones in reducing death and disability are: comprehensive and multiprofessional clinical pathways within a stroke network *(10–12)*; endovascular thrombectomy *(11)*; hemicraniectomy *(13)* in selected cases; standardized nursing protocols such as the fever, sugar and swallowing protocol *(14)*; and comprehensive pharmaceutical and non-pharmaceutical control of vascular risk factors and rehabilitation *(11,15–*

18). ACS care cornerstone interventions in reducing death and disability are: coronary unit care; emergency reperfusion (PCI or fibrinolysis); treatment of acute complications; antithrombotic therapy; cardiac rehabilitation; and secondary prevention.

Kyrgyzstan has published several relevant evidence-informed clinical guidelines: STEMI *(2)*; NSTEMI *(3)*; and stroke *(4)*. Local recommendations do not describe the principles of organization of care and quality control. Some of the WHO cost-effective and effective interventions (listed above) and the proposed cornerstones for ACS and stroke are included, but not all. Otherwise, they appear to be evidence-informed and also reference the relevant European Society of Cardiology and European Stroke Organisation guidelines. Step-by-step introduction of the best interventions into practice should be supported by national recommendations, documents and instructions and orders of the Ministry of Health, and have implementation monitoring tools.

Model of care

Prehospital care

Summary of the current situation

The previous report *(1)* describes the current situation in more detail. In general, the public poorly recognizes the early symptoms and signs of AMI and stroke, and the knowledge and skills for appropriate responses are poor, even among health-care professionals.

The ambulance service does not meet modern standards or the population need. It was not planned countrywide according to important criteria such as population density and the location of emergency health facilities and transport routes, so there is unequal distribution of service and poor access in remote areas. Although some specialized cardiological ambulance teams exist that have been trained in acute cardiac care and have electrocardiography (ECG) equipment and defibrillators, generally vehicles are not equipped with life-saving drugs and equipment and ambulance crews are not trained to carry out key investigations such as ECG or to provide immediate emergency care for acute cardiovascular events.

Future situation

According to the national guidelines for stroke and transient ischaemic attack (TIA) and ACS, public information campaigns are needed to raise awareness among laypeople and health-care personnel of the early signs and symptoms of heart attack and stroke and what to do. These can be promoted by government and nongovernmental institutions such as patient and professional organizations such as the Kyrgyz Association of Neurologists and the Kyrgyz Association of Cardiologists. Some materials are already available and being used within the country, such as facial drooping, arm weakness, speech difficulties and time to call emergency services (FAST); other materials are available internationally and can be adapted.

A single emergency care number needs to be promoted so that members of the public call to get an ambulance. Dispatchers need to be trained to give immediate advice to people calling with symptoms of suspected ACS or stroke, maintaining telephone contact with the caller and providing advice on patient management and on cardiopulmonary resuscitation in the event of cardiac arrest until appropriately trained and equipped help arrives. Kyrgyzstan's stroke and TIA guidelines recommend establishing a stroke care service network, establishing a stroke code, a 15-minute prenotification system *(19)* and a protocol whereby people with suspected strokes are brought to the nearest hospitals that can provide specialized care.

Emergency funding mechanisms should be designed to stimulate the proper application of the best interventions with proven effect to discourage malpractice, providing support for the proper and high quality of health-care services.

In remote areas, where emergency care is difficult to access and the main health provider may be only a feldsher, the nurse needs to be trained and supported (with handbook and telemedicine support) to assess the patient, perform and interpret ECG and give appropriate first response (such as aspirin, pain relief and oxygen) before transporting the patient to an

emergency care centre. Kyrgyzstan's new clinical guideline on STEMI establishes a treatment window of 120 minutes from STEMI diagnosis to primary PCI. This could involve a prehospital setting with a tele-ECG network to select and direct the patient to effective treatment.

There are already plans to modernize emergency care services following adoption of the law, and it is also highlighted as an important topic for action within the draft health-care programme. Emergency services for trauma, ACS and stroke can be planned together. The ambulance response to out-of-hospital medical emergencies can provide basic life support or advanced life support. Basic life support emphasizes rapid transport to the hospital, so basic life support ambulance crews provide only minimal treatment at the scene ("scoop and run") *(20)*. Ambulance crews using advanced life support are trained and equipped to provide sophisticated care on site ("stay and play"). Apart from improving the ratio and distribution of ambulance to population, the ambulances need to be better equipped to respond to an acute event. Annex 2 lists the equipment and drugs to be included within the ambulance for care of heart attack and stroke.

The road map offers a justified plan of the development of emergency assistance systems for ACS and stroke, which should simultaneously be implemented in the regions for synchronous development and the absence of inequality. In terms of the roadmap, a short-term development (within one year) is to equip ambulances to be able to provide basic life support at a standard level (see Annex 2 for the list of supplies and equipment) and to train ground ambulance personnel to recognize suspected stroke (FAST test) and ACS and start the recommended clinical pathway. A standard ambulance equipped for basic life support seems to offer benefits for nonfatal and longer survival *(21)* of people with stroke, whereas a specialized cardiological team able to perform thrombolysis for STEMI patients <6 hours after symptom onset in a prehospital setting reduces mortality and disability among people with ACS (see Annex 2 for both the equipment and the medication standard recommended). Therefore, a medium-term development (1–3 years) is to equip ambulances to be able to perform thrombolysis remotely using specialist advanced life support ambulances supported by telemedicine.

A long-term development for stroke care in the prehospital setting would be to develop mobile stroke units if their cost–effectiveness can be demonstrated. A mobile stroke unit is an ambulance dedicated to treating people with acute stroke and similar time-sensitive brain ailments. It contains, in addition to the normal ambulance equipment, a device for brain imaging such as a computed tomography (CT) scanner, a point-of-care laboratory and telemedicine interaction between the ambulance and the hospital (videoconferencing, exchange of videos of patient examination and CT scans). Thus, this specialized ambulance includes all the tools necessary for hyperacute treatment of people with stroke and diagnosis-based triage directly at the emergency site. The use of stroke ambulances increases the percentage of people receiving thrombolysis within the golden hour *(22,23)*. The cost of building and fully equipping a functional mobile stroke unit is estimated to be between US$ 600 000 and US$ 2 million *(24)*. Although currently available cost–effectiveness studies suggest that the expenditure pays off in the long term *(25,26)*, conclusive evidence from clinical trials to support mobile stroke units as being cost effective and improving clinical outcomes is still needed.

Telemedicine support is provided as needed, with a recognized role especially in rural areas. There must be an agreed pre-admission protocol between appropriately trained emergency medical services and the specialist services, with algorithms on dispatch time, assessment, transport strategies within the catchment area and pre-notification that includes: onset time, symptom and sign recognition using a validated tool such as FAST and pre-alert systems. The ambulance crew should provide and record the delivery of appropriate prehospital treatment to people with suspected ACS or stroke and ensure that a defibrillator and someone trained in its use remain at the patient's side for the whole of the journey from the initial response to the handover in the hospital. Time is heart, time is brain, time is life. The person should be transported to hospital with acute specialist services as quickly as possible and always within a maximum of 1 hour for stroke and 120 minutes for ACS (for STEMI or NSTEMI from diagnosis to reperfusion with complications, for non-complicated NSTEMI 24 hours (time to angiography). The acute stroke service should immediately assess on arrival, enabling timely expert triage of people with acute stroke and the potential for thrombolysis *(27)*.

Hospital care

Summary of the current situation

There are resources (institutions, equipment, trained personnel, training opportunities etc.) that can be considered as the basis for the formation of the structure of regional networks of care in ACS and stroke. The possibilities are described in the WHO report *Review of acute care and rehabilitation of myocardial infarction and stroke in Kyrgyzstan (1)*. Table 1 gives an overview of the current facilities in the public sector for acute care.

Table 1. Hospital facilities (public sector) for acute care: current situation

Hospital	City	ACS care	PCI	Heart surgery	Stroke care	CT scan	Neurosurgery
National Centre for Cardiology and Therapy	Bishkek	+	+	–	–	–	–
Research Institute of Cardiac Surgery and Organ Transplantation	Bishkek	+	+	+	–	–	–
National Hospital	Bishkek	–	–	–	+	–	+
City Hospital No. 1	Bishkek	–	–	–	+	–	–
Chuy Joint Regional Hospital	Bishkek	–	–	–	+	–	–
Osh Regional Clinical Hospital	Osh	+	–	–	+	–	–
Southern Centre for Cardiovascular Surgery	Jalal–Abad	+	+	–	–	–	–
Naryn Regional Hospital	Naryn	+	–	–	+	–	–
Issyk–Kul Regional Hospital	Karakol	+	–	–	+	–	–
Talas Regional Hospital	Talas	+	–	–	+	–	–
Batken Regional Hospital	Batken	+	–	–	+	–	–

For PCI, currently a limited number of patients can be treated because of limited resources: that is, catheters and equipment and physician availability round the clock. Stroke unit care is only partly available, and stroke care pathways and multidisciplinary teams are not fully in place. Currently only a limited number of people with ACS can be treated because of limited resources and expertise.

Future situation

Both stroke and myocardial infarction (ACS) are time-dependent diseases that require an integrated care system approach based on a hospital network and protocols that enable rapid diagnosis and timely access to acute-phase therapy within a well-defined therapeutic window.

To optimize resources, both the ACS and stroke networks should be embedded within a broader emergency care system to homogenize their development, implementation and quality monitoring.

It is proposed that the provision of acute care be reorganized based on a hub-and-spoke arrangement *(28)* whereby the hub centres would have more advanced equipment, more personnel and more diversified and larger resources.

Multiprofessional collaboration and admission to a dedicated department is critical for clinical outcome related to mortality and disability for both ACS and stroke: patients who receives a package of organized inpatient care are more likely to survive, return home and regain independence than those who receive conventional care in general wards.

Where possible, the hubs for ACS and stroke care should be co-located to facilitate the sharing of staff and equipment and care of comorbidities. For stroke, the principle would be one hub (24/7) for 1.5 million population, with 3–4 spokes per hub depending on population density, geographical location and transport routes between centres, as stated by Kyrgyzstan's prehospital stroke guideline (2017). For ACS, it has been suggested that one PCI hub centre (24/7) is needed per 300 000 to 500 000 population, performing about 600 primary PCI per million population per year *(29)*.

For both ACS and stroke, telemedicine and phone consultation with brain imaging and ECG transmission should be used to empower spokes, triage patients and review cases (as established in Kyrgyzstan's stroke and TIA guidelines). Given the burden of CVD disease, a similar number of hubs and spokes for ACS as for stroke would be expected.

Final decisions about the distribution of services might be taken once the service delivery master plan is complete. The CVD Working Group initially thought that the proposed service model for delivering acute services should involve four main providers and the local ambulance service. These four main providers would be placed in Bishkek, Jalal-Abad, Osh and Karakol (Fig. 1). This will also need to fit with the Concept for the Development of the Regions of Kyrgyz Republic 2018–2022, which supposes economic development and employment growth in Chui, Jalal-Abad, Issyk-Kul, Osh and Bishkek in 2018–2019 and sees these regions as a priority for developing health care and emergency cardiovascular care.

Fig. 1. Perspective for development of ACS and stroke services: full implementation of hospital and ambulance master plan level

Legend: blue – ACS care; green – stroke care; red – ACS and stroke care.

Ideally, the four main centres and regional and local hospitals should be part of an ACS and/or stroke service network that has agreed protocols for acute patient triage, assessment, transport and possibly for the use of telemedicine to support the appropriateness of diagnosis, thrombolysis and other acute interventions if senior personnel are not available on site to conduct face-to-face assessment.

The principles of service development are that:

- PCI facilities should be available;
- health insurance models are developed with 100% coverage of emergency care in ACS and stroke including thrombolytic therapy and/or PCI (ACS) or thrombectomy (stroke) and models of payment;
- a programme is developed for educating and certifying health-care professionals for the ACS and stroke care system;

- prehospital care and logistical models are developed;
- a multilevel system of monitoring, quality control and operational management is created; and
- a public campaign supports early access to emergency specialized medical care.

The barriers to effective ACS care *(30)*, which are also likely to apply to stroke care *(31)*, are as follows:

- patient – social, personal, cultural, financial and religious barriers;
- insurance barrier: low penetration of insurance;
- transport barrier: lack of a centralized ambulance system;
- physician barriers: skills, 24/7 availability and ethics;
- technology barriers: lack of devices, drugs and infrastructure; and
- economic and legislative barriers: lack of legislation supporting infrastructure and resources and reimbursement policies to hospitals and providers.

Posthospital care

People with stroke and ACS need access to effective rehabilitation services. Stroke rehabilitation is a multidimensional process designed to facilitate the restoration of or adaptation to the loss of physical or mental function when reversal of the underlying pathological process is incomplete. Rehabilitation aims to enhance functional activities and participation in society and thus improve the quality of life. Key aspects of rehabilitation care include multidisciplinary assessment, identification of functional difficulties and their measurement, treatment planning through goal setting, delivery of interventions that may either effect change or support the person in managing persisting change and evaluation of effectiveness.

Summary of the current situation

In Kyrgyzstan, some components of the post-stroke and cardiac rehabilitation process are already in place, but these are limited to Bishkek city. Not all the available interventions are evidence informed. Cardiac rehabilitation facilities are even more limited, and neither post-stroke nor cardiac rehabilitation facilities are organized in a comprehensive clinical pathway.

Future situation

Rehabilitation services are the primary mechanism by which functional recovery and the achievement of independence are promoted among people with acute stroke and ACS. A full comprehensive evaluation (motor, swallowing, cognitive and mental aspects) should be done when the condition of the person with stroke is stable to plan discharge to the proper setting of post-acute care. It has been demonstrated that earlier admission to rehabilitation results in improved overall functional outcomes. People with stroke who are candidates for post-acute rehabilitation should receive organized, coordinated, interprofessional care. Early supported discharge services may be reasonable for people with mild to moderate disability who may attend a rehabilitation programme in outpatient or day service. Evidence indicates that the functional outcomes achieved through stroke rehabilitation are maintained and actually improve for up to one year; by five years after a stroke, functional outcomes plateau and may decline; by 10 years, overall functional outcome scores significantly decline, although it is unclear to what extent the natural ageing process and comorbidity may contribute to these declines. Nevertheless, stroke rehabilitation may be delivered in different settings and with different levels of intensity (see Annex 7 for a possible organization model of setting of care).

Cardiac rehabilitation is a medically supervised programme in which people who experienced heart attack, heart failure, angioplasty or heart surgery receive: exercise counselling and training, education for heart-healthy living to reduce vascular risk factor behaviour and empower cardiovascular-healthy habits. It may be delivered in different settings of care by multiprofessional teams. Primary health care has an important role to play in secondary prevention and preventing further

heart attacks and strokes. This requires good communication with specialist care on discharge and systematically identifying and following up patients to control CVD risk factors.

Drug therapy with the main groups of medicines (antiplatelets, statins, beta-blockers and angiotensin-converting enzyme inhibitors) for secondary prevention is a method of preventing recurrent myocardial infarction with proven efficacy and should be widely used for all patients. Measures need to be planned to increase the accessibility of therapy (registration, price regulation and benefits) and increase adherence to treatment.

Standards of care and quality indicators

Annex 3 suggests a list of evidence-informed standards of care for ACS and stroke together with a set of indicators that can be used for monitoring the achievement of these standards. These are listed alongside the indicators in Annex 3.

Several documents and agencies within Kyrgyzstan propose indicators for monitoring the quality of care for heart attacks and strokes within Kyrgyzstan. These include the Mandatory Health Insurance Fund (12 indicators drafted by 19 March 2018) and national clinical guidelines (eight suggested indicators for implementation). A roadmap for quality systems is also being prepared. A general concern is that the indicators suggested may be: difficult to collect routinely and/or may be open to manipulation; not very useful; too complex and comprehensive to be meaningful; or unclear (such as the indicator on door-to-brain CT: private facility CT? Public hospital neuroimaging service?).

Transforming services

Roadmap

Annex 4 outlines a roadmap for transforming services for ACS and stroke over the next five years, starting with immediate priorities for the first year, medium-term priorities (1–3 years) and then longer-term priorities by five years. Annex 5 summarizes the roadmap in one page, and Annex 6 contains infographics to overview the roadmap in pictorial format.

Roles and responsibilities

The list of stakeholders for agreeing and implementing the roadmap includes: the Ministry of Health; Mandatory Health Insurance Fund; regional and local health administrations; professional and scientific societies and academia; directors, managers and clinicians within public hospitals and health-care facilities; key opinion leaders in the cardiovascular and stroke field; health promotion and public health institutions; and patients, survivors and their families. Several of these are already represented within the CVD Working Group.

The system needs to be designed and implemented at the national, regional and local levels. National and subnational steering groups could comprise the Ministry of Health, the Mandatory Health Insurance Fund, the lead clinician, a hospital manager and public health and patient representatives. Clear lines of responsibility and accountability need to be designated.

Mechanisms

Policy and regulations

The broader policy context has already been described. There seems to be a real opportunity to link this work with that for developing the emergency systems, the service delivery master plan, eHealth system, performance monitoring and

the quality systems, so that the health system response is comprehensive and aligned with Ministry of Health instructions, orders, government decrees and decisions of the Coordination Council on optimizing care in AMI and stroke.

Structural investment

Bilateral donors have invested considerably recently in building hospitals and health facilities; some are in the private sector such as the Hospital of Kyrgyz-Turkish Friendship in Bishkek. There are likely to be multiple opportunities for investment, including in digital health solutions, but these need to be coordinated to achieve optimal outcomes. This should also fit with the regional development policy.

Training of personnel

A group of local experts appointed by the Ministry of Health has produced new stroke and ACS guidelines, and disseminating and implementing these is also part of this roadmap. Medical education reforms are underway. A Swiss-funded project produces distance-learning courses. Extending the use of telemedicine facilities is also a possibility. The CVD Working Group made the following suggestions: regular conferences presenting the results of work; educational programmes for postgraduate education, including distance and residential education; internships; international exchange programmes; participation in international projects – registries, clinical research and trials; advanced training (and education in the workplace) according to specialty, including for nurses; preparing emergency specialists and training specialties that are needed but absent such as neurorehabilitation physician, speech therapist and occupational therapist.

Materials that may need to be developed are: extension of the national clinical practice guidelines; clinical protocols on ACS and stroke for nurses (such as FeSS); pocket books and billboards with stroke and ACS protocols, clinical scales such as NIHSS, Rankin scale, CHADSVASC etc.; a pocket book for emergency ambulances; and a module for drivers, dispatchers and ambulances. The action plan for emergency services already includes suggestions regarding training for emergency ambulance crews and dispatchers.

Health-care funding

A comprehensive and aligned health system response also needs to ensure that system enablers are in place to facilitate this change. Health-care funding is a critical part of this and needs to consider how domestic funding can start to broaden the benefit package and coverage.

Next steps

This roadmap has been presented to the Ministry of Health and widely consulted with national and regional partners, including the medical profession. The document is intended to inform the Ministry of Health in taking the next steps in developing its own roadmap for improving services.

Important information in coming months will be the results of an exercise to test the feasibility of collecting the proposed indicators and costing of all the recommendations (one-time investment and concurrent costs). The analysis should also feed into the State Guaranteed Benefit Package discussion in the coming months.

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Annex 1. Members of the CVD Working Group

The Working Group was established in June 2017 and had 16 meetings by March 2018.

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Annex 2. Recommendations for ambulances

2.1. Equipment for ambulances

Table A2-1 shows the suggested core equipment for an ambulance providing prehospital basic life support that is relevant for ACS and stroke, in addition to any other standard basic life support equipment the ambulance contains for other conditions (see the section on model of care).

Table A2-1. Suggested equipment to be in all ambulances to support basic care of ACS and stroke

Availability requirements	Equipment	Current availability for ambulances
Required	Ventilation and airway equipment (suction apparatus; oxygen supply; manual resuscitator and mask)	No
Required	Pulse oximetry monitor	Yes
Required	ECG recorder and monitor	Yes
Required (in the absence of doctor) Recommended (when there is a team of doctors)	The device for transmitting ECG results (telemedicine)	Not in ambulances Yes, in some tertiary-level hospitals
Required	External cardioverter (defibrillator)	Yes

In addition to the basic equipment, an ambulance that provides more advanced life support for ACS would need additional equipment as shown in Table A2-2 *(1)*.

Table A2-2. Suggested equipment to be in specialized ambulances providing more advanced care for ACS

Availability requirements	Equipment	Current availability for ambulances
Required (in the absence of doctor) Recommended (when there is a team of doctors)	The device for transmission of ECG (telemedicine)	Not in ambulances Yes, in some tertiary-level hospitals
Strongly recommended	External electrocardiostimulator (pacemaker)	No
Recommended	Invasive ventilation	No
Recommended	Portable ultrasound diagnostic device	No
May be considered	Chest compression device	No
May be considered	Point-of-care biomarker systems (troponin test)	No

Source: Beygui et al. *(2).* Key: the priorities are: (1) required; (2) strongly recommended; (3) recommended; and (4) may be considered.

2.2. Medicines for ambulances

These are the suggested core medicines for an ambulance with a doctor onboard that provide prehospital care *(3)* for ACS and stroke (see the section on model of care). Kyrgyzstan's prehospital clinical guidelines do not list any specific medicines, but these suggestions come from international evidence-informed guidelines and the WHO essential medicines list.

Table A2-3. Suggested medicines for ambulances providing prehospital care for ACS and stroke in ambulances

Requirements	Medicines for ACS and stroke	Presence in WHO essential medicines list	Presence in national formulary	Current availability for ambulances
Required	Morphine	Yes	Yes	Yes
	Furosemide	Yes	Yes	Yes
	Adrenaline	Yes	Yes	Yes
	Diazepam	Yes	Yes	Yes
Strongly recommended	Amiodarone	Yes	Yes	Yes
	Atropine	Yes	Yes	Yes
	Blood pressure–lowering drugs	Bisoprolol Amlodipine Enalapril	Bisoprolol Amlodipine Enalapril	Yes
Recommended	Nitroglycerin	Yes	Yes	Yes
	Lidocaine	Yes	Yes	Yes
	Dobutamine	Yes	Yes	Yes
	Magnesium sulfate	Yes	Yes	Yes

As described in the section on model of care, a specialized ambulance for ACS would be able to perform thrombolysis. Table A2-4 lists the additional medicines that would be needed.

Table A2-4. Additional medicines needed for performing thrombolysis

Medicines to support prehospital thrombolysis	Presence in WHO essential medicines list	Presence in national Formulary	Current availability for ambulances
Alteplase[a]	No	No	No
Unfractionated heparins and/or enoxaparin	Yes	Yes	Not
Acetylsalicylic acid (aspirin)	Yes	Yes	Yes
Clopidogrel	Yes	Yes	Yes
Beta-blockers	Yes	Bisoprolol Carvediol Metoprolol	Yes

Source: Beygui et al. *(2)*. [a]Streptokinase is currently available in hospitals but not ambulances. Currently, only streptokinase is available, this drug is not recommended by international guidelines anymore. Within international guidelines *(2)*, alteplase may be considered and tenecteplase is recommended but the latter is not in the WHO essential medicines list.

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Annex 3. Standards and performance indicators

3.1. Prehospital care: acute coronary syndrome (ACS)

Standard of care	Implementation phase	Indicators	Implementation tools	Level (hospital, regional or national)
Availability of basic level of care at the prehospital stage: cardiopulmonary resuscitation, defibrillation, analgesics, antithrombotic drugs (heparin, antiplatelets), diuretics, catecholamines *(1)*	1 year	• % of ambulance teams equipped with ECG machine, defibrillator and set of medications • % of ambulance teams certified in basic and advanced life support • % of resuscitation cases successfully resuscitated • % of ambulances equipped with both ECG and defibrillator (ambulances equipped with defibrillator/all ambulances times 100) • % of need covered (actual number of available devices/total devices needed to cover the population times 100)	Plan for developing emergency care Ambulance annual reports Training programmes Ambulance staff certification programme	Regional
Patients with suspected ACS requiring ambulance intervention should receive it as soon as possible (ideally within 20 minutes) from calling, ECG should be registered within the next 10 minutes after clinical assessment and, if indicated, patients should receive antithrombolytic drugs in the prehospital setting if available	1–3 years	• % of patients with ACS receiving ambulance help within 20 minutes from calling (ACS patients receiving ambulance help within 20 minutes/all ACS patients calling ambulance times 100) • % of patients receiving EKG in a prehospital setting (all patients receiving EKG in prehospital settings/all patients with clinically diagnosed ACS times 100) • % of patients with ACS receiving thrombolysis in a prehospital setting[a] (patients receiving thrombolysis/all patients with clinical diagnosis of ACS times 100)[b]	Ambulance registry and ACS registry • Availability of thrombolytic drugs • EKG and defibrillator availability • Checklist and ACS prehospital treatment protocol • Ambulance personnel training	Regional and national

3.1. Prehospital care: acute coronary syndrome (ACS) *continued*

Standard of care	Implementation phase	Indicators	Implementation tools	Level (hospital, regional or national)
The prehospital care of people with suspected ACS should include an ACS pre-alert by ambulance crews to the receiving emergency department or intensive care unit if the patient is ECG positive or ACS is suspected to expedite specialist assessment and treatment. These patients should be hospitalized directly in an intensive care unit	1–3 years	• % of patients with prehospital suspected ACS (EKG done) hospitalized directly to intensive care unit/all ACS patients admitted to hospital times 100)	Protocol of regional coordination of ACS care Ambulance connection with hospital (direct call or call through ambulance dispatcher) Prehospital ACS protocol and checklist Ambulance and emergency services training Ambulance registry and ACS or hospital registry	Hospital
Defibrillation at the prehospital stage; ECG at the prehospital stage should be available	1–3 years	• % of ambulances equipped with both ECG and defibrillator (ambulances equipped with defibrillator/all ambulances times 100) • % of need covered (actual number of available devices/total devices needed to cover the population times 100)		Regional
Tele-ECG should be available, especially in rural areas where primary PCI reperfusion is not reachable	1–3 years	• % of ambulance non-physician teams equipped with tele-ECG • Number of tele-ECG consultations • Number of times thrombolysis performed in prehospital settings	Establishment of tele-ECG in regions Ambulance and emergency services training	Regional or hospital

[a] This indicator is especially useful in rural areas.
[b] Prehospital thrombolysis is especially important in rural areas and has a well-proven effect in reducing mortality and disability. It requires ECG and defibrillator availability and well-trained ambulance personnel, updated protocol and checklist. All this may be allocated into one standard defined as "availability of stroke thrombolysis for selected patients" measured with the absolute number of times prehospital thrombolysis was performed per region and the percentage of actual thrombolysis procedures/patients with ACS admitted to hospital times 100.

3.2. Prehospital care: stroke

Standard of care	Implementation phase	Indicators	Implementation tools	Level
A person with suspected stroke or TIA should be immediately assessed at first contact using a validated stroke screening tool, such as the FAST (face, arm, speech and time) test *(2)*	1–3 years	● % of stroke patients receiving a telephone assessment for suspected stroke (number of patients receiving a telephone assessment for suspected stroke/stroke patients admitted to hospital times 100)	FAST ambulance training Ambulance registry Regional stroke registry[a]	Regional or national
Transport to hospital with acute specialist stroke services should be achieved as quickly as possible and always within a maximum of one hour from ambulance alert *(3)*	1–3 years	● % of patients with prehospital suspected stroke reaching hospital within a maximum of one hour from ambulance (patients reaching hospital within one hour from ambulance alert/all stroke patients admitted to hospital times 100)	Prehospital stroke protocol and checklist Ambulance and emergency services training Ambulance registry and stroke and hospital registry	Hospital or regional
The prehospital care of people with suspected stroke should include a 15-minute pre-alert by ambulance crews to the receiving emergency department or stroke unit where the patient is FAST positive or stroke is suspected to expedite specialist assessment and treatment *(2)*	1–3 years	● % of stroke patients admitted to hospital with a stroke pre-alert (stroke patients admitted to hospital with a 15-minute stroke pre-alert/all stroke patients admitted to hospital times 100) ● Timing to admission to hospital of stroke patients — Timing to admission to hospital of stroke patients with pre-alert stroke code — Timing to admission to hospital of stroke patients without pre-alert stroke code	Pre-alert stroke protocol Ambulance and emergency physician and neurologist training Stroke and ambulance registry Pre-notification protocol dissemination Ambulance training on pre-notification protocol	Regional

[a]This is already in place in Bishkek but needs to be redesigned in a user-friendly and more meaningful way.

3.3. Hospital acute care: ACS

Standard of care	Implementation phase	Indicators	Implementation tools	Level
Availability of PCI, intensive care unit service, monitored beds 24/7/365	3–5 years (?)	● Number of STEMI patients treated with PCI — Primary PCI — PCI after thrombolysis ● STEMI patients: % of STEMI patients receiving reperfusion in the first 12 hours from symptom onset[a] ● Non-STEMI patients: % of patients with medium, high and very high risk of NSTEMI undergoing coronary angiography during hospital stay	Intensive care unit and catheterization laboratory availability in strategic centres Staff (cardiologist, nurse, technician) training Quality monitoring, local ACS registry and case review	Hospital and regional
Availability of laboratory diagnostic facilities (preferably high-sensitivity troponin over quantity standard troponin or MB-CK)		% of patients with suspected ACS with troponin test performed at admission	Hospital ACS registry Insurance company audit	
All patients with ACS of intermediate and high risk, especially with complications, should be admitted to the intensive care unit and treated on a monitored bed until stabilization	1–3 years	In-hospital mortality for acute myocardial infarction Rates of death within 30 days following hospital admissions for acute myocardial infarction	Establishment of intensive care unit Defining and implementing ACS clinical pathways Auditing regional insurance company Staff training, standardization of protocols and checklist in the country, update of available drugs (including statins, beta-blockers and anti-thrombotic therapy)	National, regional and hospital
Comprehensive cardiovascular surgery (coronary artery bypass graft surgery; surgical management of acute disorder of the aorta, valves and any other cardiovascular structure) should be available in selected cases[b]	3–5 years	Cardiac surgery consultations availability: ● Number of consultations ● Number of cardiac surgery operations performed during hospital admission[c]	Technical and educational update of staff and structures	National, regional and hospital

3.3. Hospital acute care: ACS *continued*

Standard of care	Implementation phase	Indicators	Implementation tools	Level
Availability of echocardiography for all patients during hospitalization (in complicated cases, within the first 24 hours)	3–5 years	% of patients with assessed LVEF and other echo parameters during hospitalization	Hospital ACS registry Insurance company audit	
All ACS patients without contraindications should be treated with dual antiplatelet therapy, ACE inhibitors, beta-blockers and high-dose statin	1 year	% of eligible patients receiving required medications	Hospital ACS registry Insurance company audit	

[a] Reperfusion could be PCI or thrombolytic therapy.
[b] This point is very general but an important consideration for the future vision and development of services.
[c] To be defined.

3.4. Hospital acute care: stroke

Standard of care	Implementation phase	Indicators	Implementation tools	Level
All patients with suspected stroke should have immediate access to CT scanning if required to plan urgent treatment. All other patients with suspected stroke to be scanned within 12 hours of presentation[a] *(1)*	1-3 years (?)	• Door-to-CT scan timing • % of brain imaging by CT in every suspected stroke where CT scanning is available • % of acute stroke patients reaching hospital within 4.5 hours from symptom onset receiving brain CT scanning within 30 minutes from admission (patients reaching hospital within 4.5 hours from symptom onset undergoing CT within 30 minutes from admission/patients reaching hospital within 4.5 hours from symptom onset undergoing CT after 30 minutes from admission times 100) • % of acute stroke patients undergoing CT scanning within 12 hours from admission (acute stroke patients undergoing CT scan within 12 hours from admission/all admitted stroke patients times 100)	CT scan establishment programme in public hospital Emergency and stroke registry	Hospital and regional
Alteplase should only be delivered by specialist personnel embedded within a hyperacute stroke service who are trained and experienced in providing stroke thrombolysis and recognizing complications. The earlier the thrombolytic treatment is delivered, the better the outcome, particularly if delivered within 90 minutes of symptom onset. The licence supports the use of alteplase up to 4.5 hours. Once IV thrombolysis is available in the centre, door-to-needle time for those appropriate for in-licence use of IV thrombolysis as soon as possible <60 minutes *(3,4)*	3–5 years	• Absolute number of thrombolysis procedures performed • Door-to-needle time • % of eligible patients receiving intravenous thrombolytic therapy • % of eligible patients receiving intravenous thrombolytic therapy within 60 minutes from hospital admission	Acute stroke protocol Alteplase availability Emergency, ambulance and neurology staff training	Hospital and regional

3.4. Hospital acute care: stroke *continued*

Standard of care	Implementation phase	Indicators	Implementation tools	Level
Stroke patients should be managed in a stroke unit unless other conditions requiring immediate specialist care dominate. Stroke patients are managed by a multiprofessional team and receive a multiprofessional evaluation within 24 hours from stroke unit admission *(3)*	1–3 years	• Rates of death within 30 days following hospital admissions for ischaemic stroke • Rates of death within 30 days following hospital admissions for haemorrhagic stroke • % of all patients with acute stroke as the predominant pathology admitted to the hospital treated in the stroke unit (or the intensive care unit, if appropriate) • % of patients with a final diagnosis of stroke with a documented physiotherapy assessment within 24–48 hours of admission to hospital • % of patients with a documented swallowing evaluation within 24–48 hours of admission to hospital	Stroke centres already exist; improving stroke care in existing stroke units requires four types of intervention: • Quality monitoring and case review with stroke team (RES-Q registry already in place offers a monthly report) • Staff training (speech therapist, rehabilitation etc.) • Equipment (sonography, multiparametric monitoring) • Essential drugs	National, regional and hospital

[a]This standard depends on the availability of CT scanning equipment in public hospitals, which is now lacking. The implementation phase therefore also depends on the technological investment plan and strategy. CT scanning is required to plan the treatment of people with stroke and to establish prognosis.

3.5. Post-hospital care: ACS and stroke

Standard of care	Implementation phase	Indicators	Implementation tools	Level
Stroke: all patients with stroke should have access to specialized neurorehabilitation services and to a designated stroke rehabilitation programme in a dedicated appropriate setting (rehabilitation inpatient unit, nursing facility, day service, outpatient clinic, home rehabilitation) according to the patients' needs and rehabilitation prognosis (established and standardized by using stroke scales such as NIHSS, Rankin, ADL, IADL, Barthel Index and Mobility Index) *(3,4)*	1–3 years	Number of patients referred to specialized neurorehabilitation services at hospital discharge[a]	Stroke registry Stroke scales Staff training Definition of stroke rehabilitation interventions avoiding procedures with no or poor evidence	Hospital and regional
Stroke: all stroke patients should receive a comprehensive review after 6–12 months *(5)*	1–3 years	Distribution of disability scores across the stroke population using the modified Rankin scale score at discharge from acute care and at 3, 6 and 12 months after stroke[b]		
ACS: all ACS patients should be assessed for eligibility, referral, clinical assessment and core delivery of cardiac rehabilitation before progressing to long-term management	3–5 years	● % of patients with myocardial infarction referred to cardiac rehabilitation ● cardiovascular mortality at 12 months after myocardial infarction	Adoption of standardized protocols for cardiac rehabilitation Adoption of accreditation criteria for cardiac rehabilitation centres	Hospital and regional

[a]Individual indicators may be used depending on the rehabilitation setting.
[b]This indicator can also be added to the acute care table, to stress the importance of using clinical scales in everyday practice. Clinical scales that are essential for stroke are NIHSS, modified Rankin scale and, for rehabilitation purposes, Barthel Index and ADL and IADL.

3.6. Posthospital care: secondary prevention for ACS and stroke

Standard of care	Implementation phase	Indicators	Implementation tools	Level
Standard secondary prevention prescription at discharge according to cardiovascular acute event: ACS, TIA, ischemic stroke *(3,4)*	1–3 years	• % of patients with ACS without contraindications discharged on high-dose statins • % of patients with ACS (with LVEF 40%) discharged on beta-blockers and ACE inhibitors • % with ACS, TIA or stroke on antithrombotic treatment (acetylsalicylic acid, clopidogrel or acetylsalicylic acid plus clopidogrel if indicated) • % of patients with atrial fibrillation and ischaemic stroke or TIA discharged on anticoagulants	ACS registry with follow-up Free and/or affordable medication for secondary prophylaxis (at least one year after ACS and stroke or TIA)	Regional
Comorbidity (diabetes, overweight, smoking)		• % of patients with ACS, TIA or stroke who receive smoking-cessation counselling • % of patients with ACS, TIA or stroke who receive lifestyle (such as dietary modification) counselling		Regional and national
Health behaviour consultation, patient education and medication adherence programmes	3–5 years	• % of patients on dispensary observation • % of eligible patients participating in free-of-charge medication supplementation or co-payment programmes	Policy of dispensary observation Policy of free-of-charge medication supply	

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Annex 4. Priorities for interventions

4.1. Priorities for 2018 or the first 12 months with existing or limited resources

	Stroke	ACS
System issues	• Emergency department network and master plan • Create teams (Ministry of Health, Mandatory Health Insurance Fund, eHealth, lead cardiologists and stroke clinicians, providers) at the national and subnational levels responsible for implementing the roadmap, monitoring standards of care and achieving indicators • Disseminate the new national clinical guidelines for ACS and stroke and train and support clinicians to use them with the support of telemedicine facilities • Agree on indicators to be used for monitoring the quality of ACS and stroke care and the performance of providers	
Prehospital care	• Raise awareness among the general public of the signs and symptoms of stroke and ACS and an appropriate and timely response • Train primary health care doctors, nurses and feldshers on the signs and symptoms of stroke and ACS and the appropriate and timely response • Roll out tele-ECG, equipping primary health care workers and supporting through telemedicine • Equip ambulances with the most essential equipment and drugs for ACS and stroke	
	• Train ambulance crews to recognize stroke signs using FAST mnemonic and in immediate care	• Train ambulance crews to recognize STEMI and NSTEMI and in immediate care
Hospital care	• Deliver a hospital master plan that includes the design of services for ACS and stroke with a hub-and-spoke model embedded in the emergency network • Develop acute care networks for stroke and ACS using existing resources and scale up • Review telemedicine and eHealth opportunities – design a system to facilitate access to physicians with acute stroke and ACS expertise and to support the interpretation of diagnostic tests and imaging • Increase access to angiography by improving the use of existing resources and/or commissioning provision • Review the list of essentials drugs for ACS and stroke and cardiovascular and cerebrovascular prevention • Start implementation of stroke (RES-Q) and ACS registry	
	• Start to organize stroke networks • Organize multidisciplinary stroke teams • Review neurosurgery service and protocols for haemorrhagic stroke and subarachnoid haemorrhage • Train nurses to use fever, sugar and swallowing protocol and in nutrition assessment, scale-up implementation and monitor performance • Train emergency and neurology physicians and nurses to use clinical scales and scores: NIHSS, modified Rankin scale, Barthel Index, ADL, IADL, scale up implementation and monitor performance • Increase access to immediate CT scans by improving the use of existing resources and/or commissioning provision	• Start to organize ACS networks • Pilot audit of AMI using indicators • Train cardiologists and nurses to use scales and scores: modified Rankin scale, ADL, IADL

4.1. Priorities for 2018 or the first 12 months with existing or limited resources *continued*

	Stroke	ACS
Posthospital care	● Education, skills training and involvement in care planning for stroke survivors and their caregivers and families ● Train stroke and ACS teams in discharge planning, including in coordinating care with primary health care providers ● Train primary health care providers in identifying high-risk patients (history of stroke or ACS) and in secondary prevention ● Increase access to medication	
	● Review available post-stroke rehabilitation services and available guidelines, use existing resources to deliver evidence-informed rehabilitation protocols	● Review available cardiac rehabilitation services and guidelines and design new services

Sources: Brandler et al. *(1)*, Mattsson et al. *(2)*, European Society of Cardiology Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation 2017 *(3)*, European Stroke Organisation Stroke Unit Certification Committee *(4)*, Middleton et al. *(5)*, Quinn et al. *(6)*, Dalal Hasnain et al. *(7)*, Hartwell et al. *(8)*, Elgendy et al. *(9)*, Penaloza-Ramos et al. *(10)*.

4.2. Priorities during the next 1–3 years

	Stroke	ACS
System issues	● Continue to monitor the performance of indicators and hold lead clinicians and providers accountable ● Continue training clinicians with support from telemedicine facilities ● Implement stroke and ACS registries ● Support the development of associations of stroke patients	
Prehospital care	● Continue to raise awareness among the general public and train clinicians ● Continue equipping ambulances for ACS or stroke and develop further the specialist ambulances capable of thrombolysis for ACS ● Continue training ambulance crews in stroke and ACS	
Hospital care	● Implement the hub-and-spoke model for stroke and ACS ● Refine acute care networks for stroke and ACS using existing resources ● Increase access to angiography by improving the use of existing resources and/or commissioning provision ● Continue training nurses and feldshers in basic stroke care ● Strengthen the use of clinical scales to tailor care, target efforts and monitor progress and outcomes ● Expand access to basic diagnostic services ● Design and plan the implementation of critical care services for patients with severe stroke, ACS and subarachnoid haemorrhage	
	● Pilot and evaluate systemic thrombolysis in centres once immediate CT scanning possible ● Implement early rehabilitation and mobilization protocols	● Expand thrombolysis (in hubs and spokes) and PCI (in hubs)

4.2. Priorities during the next 1–3 years *continued*

	Stroke	ACS
Posthospital care	● Continue the support to stroke and myocardial infarction survivors and their caregivers and families with ongoing education and skills training ● Increase access to medication and lifestyles counselling for secondary prevention ● Organize comprehensive re-evaluation for all patients with cardiovascular and cerebrovascular disorders six months after the event	
		● Implement cardiac rehabilitation services
	● Expand post-stroke rehabilitation services and measure functional outcome (using botulinum toxin injection to reduce severe hypertonicity in hemiplegic muscles)	

4.3. Priorities during the next 3–5 years

	Stroke	ACS
System issues	● Continue to monitor the performance of indicators and hold lead clinicians and providers accountable ● Continue training clinicians with support from telemedicine facilities ● Review stroke and ACS registries and indicators and produce an annual report ● Update the implementation strategy in response to the report	
Prehospital care	● Continue to raise awareness among the general public and train clinicians and ambulance crews ● Put ambulance bypass agreements in place ● Consider using mobile stroke units for rural areas	
Hospital care	● Review the progress and success of the hub-and-spoke model for stroke and ACS ● Implement critical care service for stroke and ACS ● Refine acute care networks for stroke and ACS using existing resources ● Develop acute inpatient stroke and ACS regional databases ● Develop coordinated regional referral systems ● Provide telestroke consultations for smaller and more rural centres ● Put repatriation agreements in place to transfer patients back to home communities	
	● Pilot and evaluate advanced stroke services rationalized to a small number of centres (hubs) ● Access to advanced diagnostics (hubs): magnetic resonance imaging (MRI), CT angiography ● Access to advanced interventions and critical care services (hubs): endovascular thrombectomy; hemicraniectomy for ischaemic stroke ● Increase basic diagnostics (spokes): CT scans and CT angiography; echocardiography; Doppler ultrasound; Holter monitors	● Develop advanced surgical and endovascular services ● Hypothermia ● Comprehensive cardiovascular surgery ● Interventional vascular radiology ● Percutaneous structural heart intervention

4.3. Priorities during the next 3–5 years *continued*

	Stroke	ACS
	● Continue supporting stroke survivors and their caregivers and families with ongoing education and skills training ● Increase access to medication and lifestyles counselling for secondary prevention ● Extend the availability of secondary prevention drugs and counselling	
Posthospital care	● Organized prevention clinics and experts ● Post-stroke epilepsy assessment and management ● Cognition assessment and management ● Depression assessment and management ● Implement prolonged ECG monitoring devices	● Strengthen cardiac rehabilitation services

Sources: Rodrigues et al. *(11)*, Suarez et al. *(12)*, Daou et al. *(13)*, Cortez et al. *(14)*, Jeon et al. *(15)*, Sterne et al. *(16)*, Pan Y et al. *(17)*, Tan Tanny et al. *(18)*.

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Annex 5. Summary of the roadmap

1	Infrastructure	Hospitals with 24/7 catheterization laboratory and CT scanning facility, with intensive care unit and availability of thrombolysis and thromboextraction in stroke, PCI in ACS, endovascular treatment for subarachnoid haemorrhage Availability of cardiac surgery and neurosurgery (on-site or regional plan of transfer) Availability of post-acute rehabilitation and long-term care structures													
2	Policies	CVD and emergency care government programme, local guidelines and clinical pathways protocol, established payment model (DRGs?), continuing medical education													
3	Insurance and funding	Total volume of care planning and funding, coverage of all expenses for whole case													
4	Patient flow	First contact		Ambulance		Emergency/intensive care unit		Intervention		Hospital		Rehabilitation		Secondary prevention	
		ACS	Stroke	ACS	Stroke	ACS	Stroke	ACS	Stroke	ACS	Stroke	ACS	Stroke	ACS	Stroke
5	Goals First	ACS awareness and assessment	Stroke awareness FAST assessment	ACS pre-alert by ambulance crews EKG Defibrillation	Basic life support ambulance equipment FAST validation Stroke pre-alert	Troponin Medication No delays in emergency or intensive care unit admission	CT scan 24/7 Carotid sonography No delays in emergency assessment	Thrombolysis	Fever, sugar and swallowing protocol Thrombolysis 24/7 Neurosurgical protocols	Intensive care unit critical care (monitored bed) ACS clinical pathways according to the vascular risk Medication guidelines adherence	Stroke unit care (monitored beds) Multiprofessional evaluation Clinical pathways National stroke guideline adherence	Review current cardiac rehabilitation protocol, GL and facilities	Early in-hospital rehabilitation (occupational therapist, ST, FKT) Use EB rehabilitation protocols Review, reorganize existing resources and services Measure functional outcome	Coordinated discharge planning with primary health care providers Medication availability Lifestyle counselling	EBM medication availability Anticoagulation in post-stroke atrial fibrillation Caregiver and patient involvement in lifestyle counselling
	Second	Time checking	Time checking	Tele-ECG to assist thrombolysis in prehospital setting	Stroke ambulance network establishment	Echo and comprehensive cardiac diagnostic work-up for all patients	Angio CT scan 24/7 advanced neuroimaging (MRI, perfusion CT) 24/7	PCI 24/7	Endovascular thrombectomy 24/7 Endovascular procedures (aneurysm embolization) 24/7 Neurosurgery	Quality control programme: ACS registry Audit	Quality control programme: Stroke registry Audit	Establish cardiac rehabilitation services, implement cardiac rehabilitation national EB guidelines	Expand post-stroke rehabilitation Implement cognitive rehabilitation	Dispensary observation 12 months after ACS	Comprehensive re-evaluation six months after the event
6	Perspective	Countrywide dispatching, coordinated and flexible ACS network	Countrywide dispatching protocols Coordinated stroke network and ambulance protocol	Prehospital triage, countrywide availability of prehospital basic treatment with specialist ambulances capable of thrombolysis for ACS Ambulance bypass agreements in place with direct transfer from home to remote PCI centre, skipping local non-PCI hospital	Stroke network Implementation Prehospital triage, ambulance bypass to transfer patient from home to nearest stroke centre (spoke or hub), skipping local non-stroke ready hospital Consider mobile stroke units for rural areas	ECMO Hypothermia Shock treatment protocol	Improve timeliness of stroke care emergency assessment and intervention at all levels	PCI + CABG on site	Expand access to advanced interventions and neurocritical care services: Thrombolysis Endovascular procedures Hemicraniectomy	Heart team Total ACS registry	Quality accreditation and benchmarking of stroke centres	Strengthen cardiac rehabilitation culture and services such as in primary health care, and in inpatient and outpatient departments countrywide		Preferential medication supply / adherence control programmes	Management of post-stroke depression, epilepsy, cognitive disorders Increase access to patient caregiver education and evidence-informed drugs
7	Monitoring and quality control	Monitoring, national registries, indicators													

Annex 6. Summary diagrams of the roadmap

Fig. A6-1. Possible model of ACS care for Kyrgyzstan: phase 1 – next 1–3 years

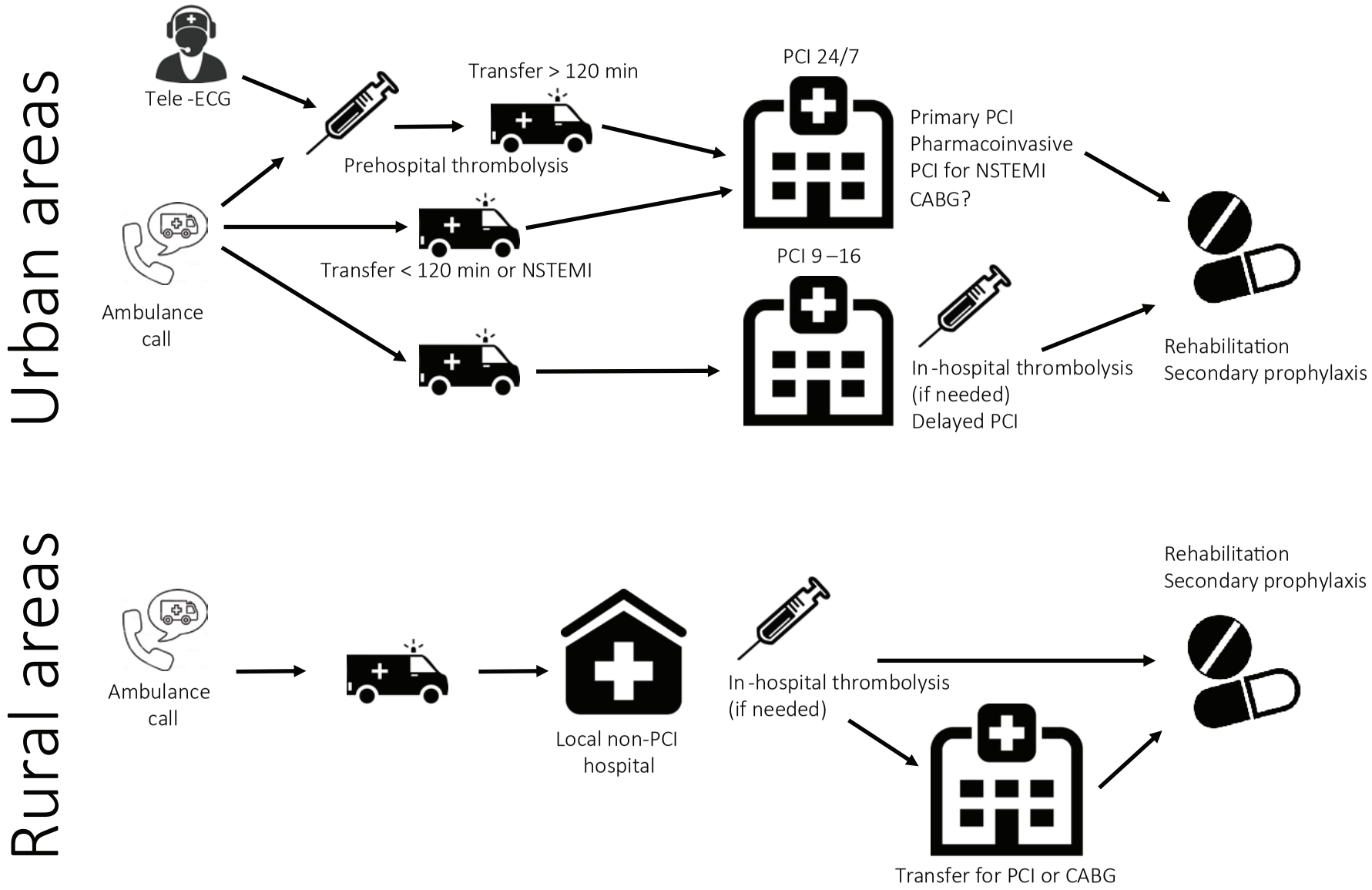


Fig. A6-2. Possible model of ACS care for Kyrgyzstan: phase 2 – next 3–5 years

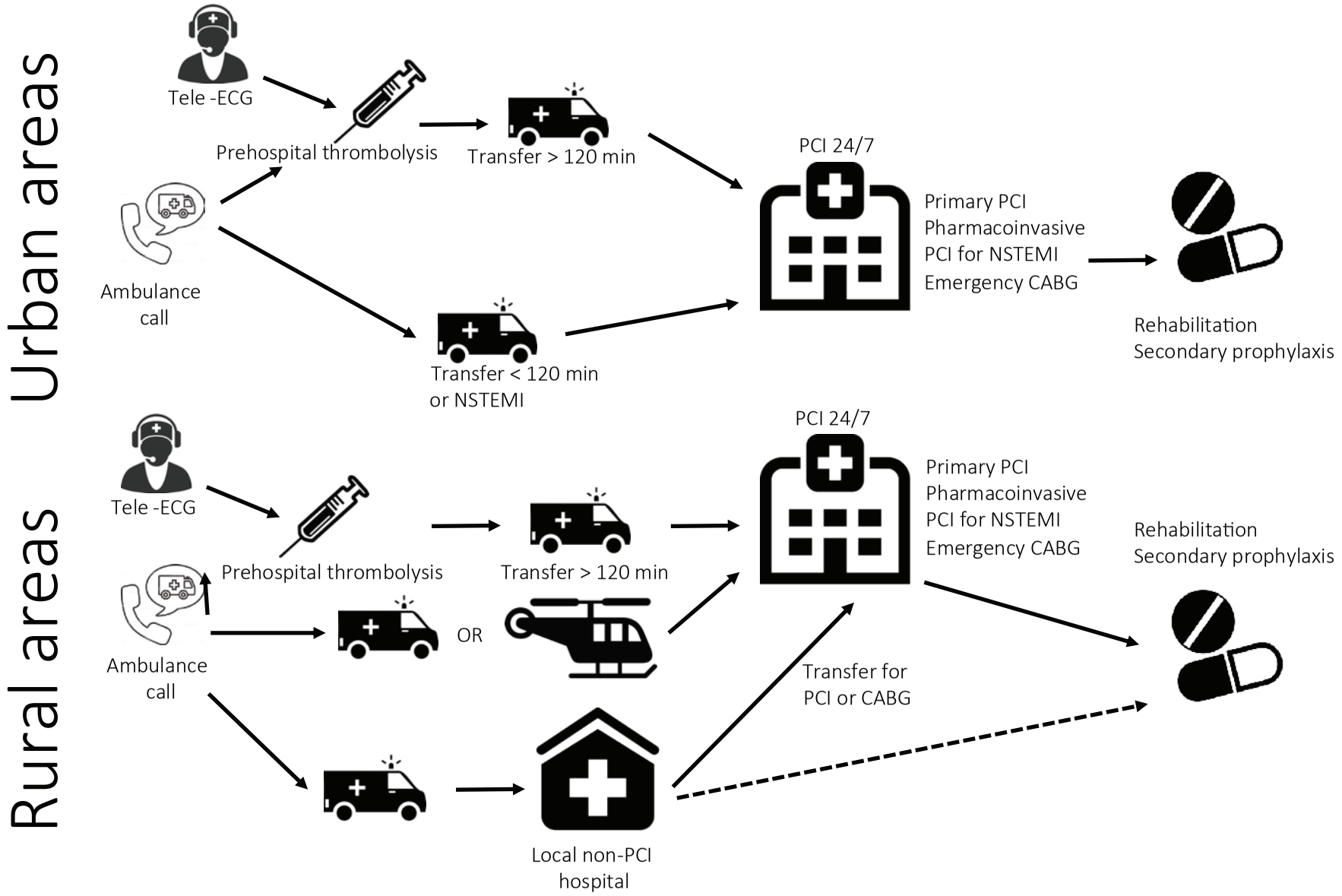


Fig. A6-3. Possible model of stroke care for Kyrgyzstan: phase 1 – next 1–3 years

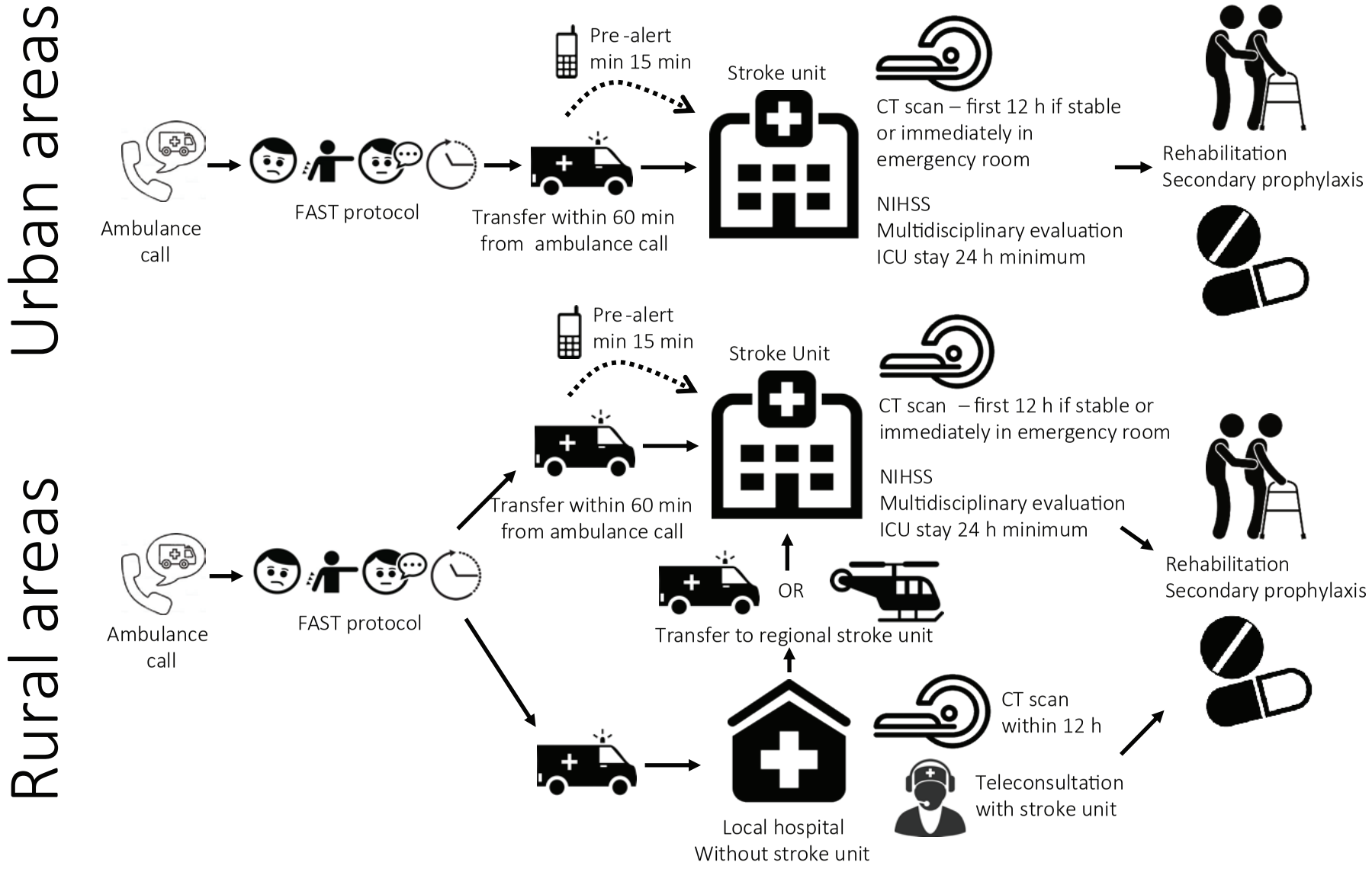
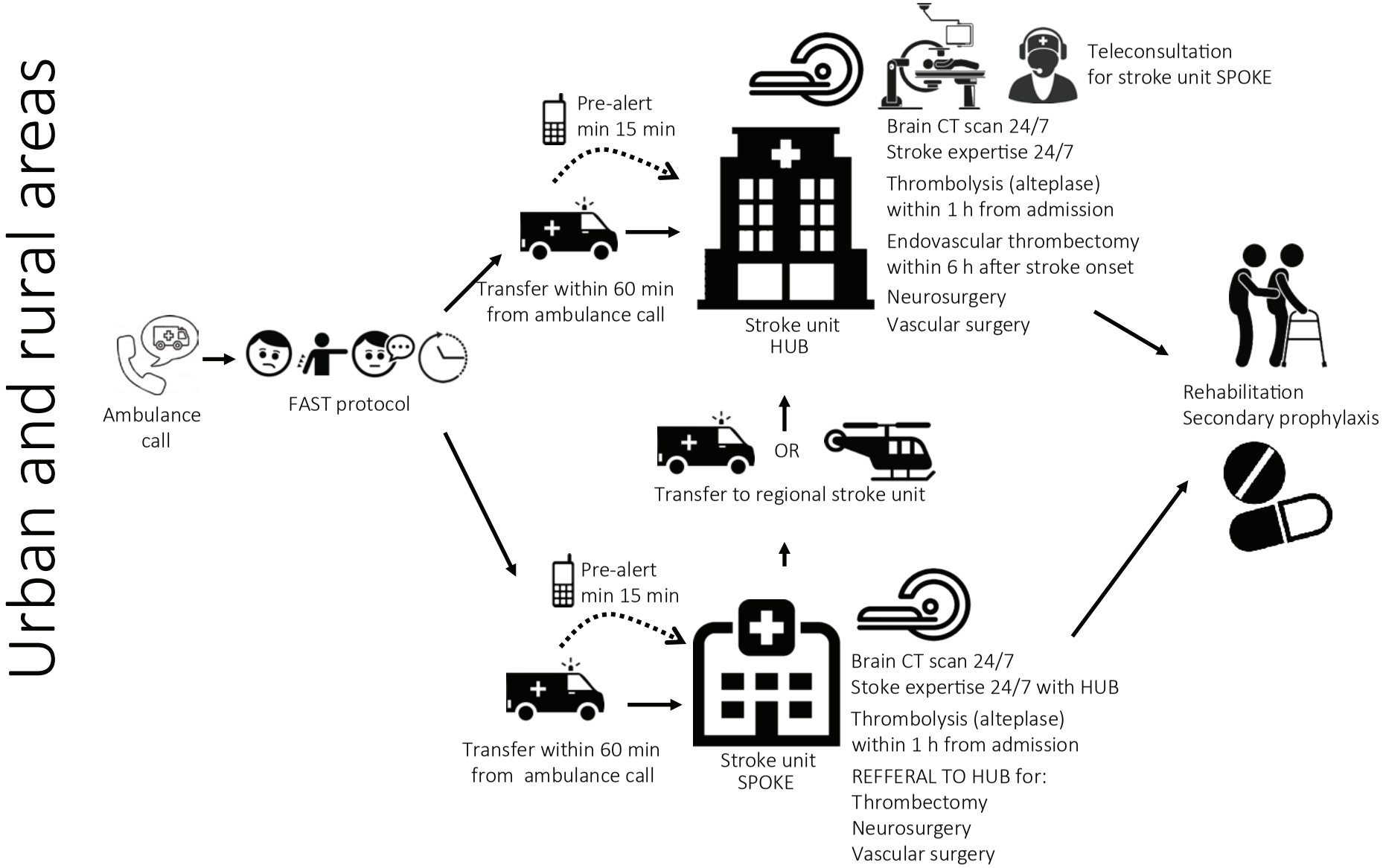


Fig. A6-4. Possible model of stroke care for Kyrgyzstan: phase 2 – the next 3–5 years



Annex 7. Possible model of stroke care rehabilitation

The following table presents a possible organization model for settings of care *(1)*. The guiding principle is that rehabilitation starts in the acute phase (early rehabilitation) and continues in the post-acute phase in a proper environment. The current trend is to separate the two things (acute care and rehabilitation), even for financial reasons: the hospitals are reimbursed with a DRG-based system, whereas rehabilitation is reimbursed through a daily rate calculated based on the level of intensity of care provided. The level of intensity of care provided is decided based on patient condition, level of stroke severity (here the Barthel index, NIH stroke scale and other measures are very useful). For example, to be admitted to inpatient rehabilitation, a patient's Barthel index score must be below 49 and able to do three hours of rehabilitation per day. The number of rehabilitation beds for each region should be calculated based on demographic and epidemiological data.

Setting	Admission	Length of stay	Specialist involvement	Features
Inpatient rehabilitation facility[a]	5–7 days after stroke	8–45 days	MD: physical medicine and rehabilitation (physiatry) or trained neurologists; allied health personnel: specialized stroke nurse, speech therapist, physiotherapist, occupational therapist, social worker, psychologist	General rehabilitation in patient facility with rehabilitation programme suitable for stroke patients and access to neurorehabilitation services. Able to deliver services seven days a week.
Stroke inpatient rehabilitation facility[b]	5–7 days after stroke	8–45 days	MD: physical medicine and rehabilitation (physiatry) or trained neurologists; allied health personnel: specialized stroke nurse, speech therapist, physiotherapist, occupational therapist, social worker, psychologist	Defined geographical area with suitable facilities, with clinical practice showing evidence of multidisciplinary teamwork: structured team meetings at least weekly, regular programmes of stroke education tailored to the needs of staff and patients, multidisciplinary notes, involvement of family and caregivers in treatment programmes and regular goal planning meetings. Able to deliver services seven days a week.
Nursing home	Variable	Prolonged and highly variable	MD: geriatrician, internal medicine; nurse, physiotherapist, occupational therapist	Defined geographical area to admit patients objectively assessed as failing to respond to a tailored programme of stroke rehabilitation or in case the prognosis of other comorbidities does not allow time for a trial of rehabilitation
Outpatient rehabilitation facility	Variable (typically 5–30 days)	Variable	MD: physical medicine and rehabilitation (physiatry) or trained neurologists, specialized stroke nurse, speech therapist, physiotherapist, occupational therapist, social worker, psychologist	Outpatient neurorehabilitation services offering different level of rehabilitation intensity, with rehabilitation programme suitable for stroke patients. Able to deliver services seven days a week

[a]This is a post-acute level of care. A rehabilitation facility could be part of a hospital or placed outside in a dedicated rehabilitation facility.
[b]Stroke inpatient rehabilitation is an inpatient residential rehabilitation facility that is dedicated to stroke care.

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