# D3.1.1 – EVALUATION FRAMEWORK

## WP 3 – Benchmarking of Stroke care plans

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| **Deliverable description:** |
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| In this document, we describe the targets, indicators and the methodology used to evaluate the different levels of the stroke care delivered in each region.<br>The evaluation framework encompasses three parts: strategies for primary prevention, acute care, and follow-up and rehabilitation. |

| **Revision history** | | | |
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| **Version** | **Date** | **Comments** | **Partner** |
| | | | OE |
| V0 | Dec 2018 | AQuAS has to reconsider the structure and approach of the document<br>OE has | IACS |
| V1 | January 2019 | AQuAS considers to divide the document in three parts: strategies for primary prevention, acute care, and follow-up and rehabilitation. Each part should follow the same structure. The leader of the WP agrees with the new approach.<br>Submission of the Draft version within the First Project report. | IACS |
| V2 | February 2019 | AQuAS sends a second version to the leader of the WP | |
| V3 | March 2019 | Meeting between AQuAS, FIctus, OE and IACS to discuss the second version. A new version adding the comments and suggestions made by the partners was sent to IACS and OE by AQuAS. | AQuAS |
| V4 | May 2019 | Reception of the output from rehab specialists that preselected rehab indicators | AQuAS |

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# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| AF | Atrial Fibrillation |
| AQuAS | Agència de Qualitat i Avaluació Sanitàries de Catalunya |
| ARSN | Administração Regional de Saúde do Norte, I.P. |
| CEI-IB | Ethical Committee of Research of the Balearic Islands |
| CHA2DS2VASc | Congestive heart failure, Hypertension, Age ( ≥ 65 = 1 point, ≥ 75 = 2 points), Diabetes, and Stroke/TIA (2 points). VASc stands for vascular disease (peripheral arterial disease, previous MI, aortic atheroma) |
| CHUM | Centre hospitalier Universitaire de Montpellier |
| CHUT | Centre Hospitalier Universitaire de Toulouse |
| CICAT | Registry of "Codi Ictus Catalunya" |
| EC | European Commission |
| EEA | European Economic Area |
| ERDF | European Regional Development Fund |
| ESO | European Stroke Organization |
| EU | European Union |
| EVT | Endovascular treatment |
| FIctus | Fundació Ictus |
| FMS | Navarrabiomed- Fundación Miguel Servet |
| GCP | Good Clinical Practice |
| GDPR | General Data Protection Regulation |
| IACS | Instituto Aragonés de Ciencias de la Salud |
| ICTUSnet | Acronym of the Project *"Excellence network for the development and implementation of innovative models for Ictus integrated attention."* |
| IdISBa | Fundación Instituto de Investigación Sanitaria Illes Balears |
| IVT | Intravenous trhombolysis |
| NCDs | Non-Communicable Diseases |
| OE | Open Evidence |
| PADRIS | Public Data Analysis for Health Research and Innovation Program |
| SAFE | Stroke Alliance For Europe |
| WHO | World Health Organization |

# 1. Index

# EXECUTIVE SUMMARY

The present evaluation framework aims to guide different stakeholders related with stroke care in multiple levels in assessing their national/regional stroke plans.

The present deliverable has been structured into three main sections: 1) evaluation framework for primary prevention and awareness campaigns in stroke, 2) on the organisation of stroke services and management of acute stroke, and 3) on the follow-up and rehabilitation. Each main section is at the same time divided into different sections (Overview, Purpose, Audience, Structure, Background, Methodology and Definition of the specific selected strategies, their targets and indicators) to tackle specific aspects concerning the different settings of the stroke care.

As the aim of ICTUSnet project is to be aligned with the European Stroke Organization Action Plan, the main targets and indicators are based on the aforementioned document, besides other well-recognized health/stroke care institutions publications, such as the World Health Organization, the Stroke Alliance for Europe and the World Stroke Organization.

# 2. INTRODUCTION

Currently, there is still a huge burden of stroke in the world. It remains one of the leading causes of death and disability in Europe and stroke is the major contributor to neurological DALYs (1) .
Primary prevention interventions, development of stroke services, and particularly access to acute stroke care on a stroke unit, have resulted in improvements in incidence, mortality and disability outcomes post stroke. However many people who have a stroke will need long-term support to help them manage any difficulties they have, participate in society and regain their independence.
In this sense, the European Stroke Organization (ESO) together with Stroke Alliance for Europe (SAFE) have recently drawn up an Action Plan (2018-2030) which highlights the challenges and objectives of stroke in Europe.
ICTUSnet believe that stroke plans, among other factors, are entitled to contribute to improvements in the following main outcomes:

1. Incidence of stroke in adults
2. Mortality rates of adults who have a stroke
3. Long-term disability of adults who have a stroke

Thus, as part of ICTUSnet Work Package 3 (Analysis and benchmarking of Stroke plans in Southwestern regions), ICTUSnet members are entitled to develop the present evaluation framework that will try to guide, not only partners responsible of the associated tasks, but other stakeholders interested in evaluate their regional/national stroke plans.

The stroke quality outcome key indicators corresponding to this evaluation framework are depicted in Table 1.

Table 1. Outcome indicators

| Outcome indicators | Definition | Calculation | Metric |
|---|---|---|---|
| **Standardized Stroke incidence rates** | Stroke incidence rates adjusted for age and sex in the population | Numerator: Total number of stroke cases in a population (stratified by stroke type).<br>Denominator: Total population based on census information within a given time frame. | To reduce the absolute number of strokes by 10% |
| **Standardized stroke mortality rates** | Stroke mortality rates adjusted for age and sex in the population | Numerator: Total number of deaths from stroke (stratified by stroke type).<br>Denominator: Total population based on census information within a given time frame. | To be determined (region with best results as a reference) |
| **Prevalence of long-term disability** | Prevalence of patients with disability due to stroke at one year following index stroke symptom onset | Numerator: Total number of patients with stroke and mRS >2 at one year following index stroke symptom onset (stratified by stroke type).<br>Denominator: Total population based on census information within a given time frame. | To be determined (region with best results as a reference) |

To facilitate the evaluation process, this document is divided into 3 main sections: 1) evaluation framework for primary prevention and awareness campaigns in stroke, 2) on the organisation of stroke services and management of acute stroke, and 3) on the follow-up and rehabilitation. Each main section is at the same time divided into different sections: Overview, Purpose, Audience, Structure, Background, Methodology and Definition of the specific selected strategies, their targets and indicators.

# 3. EVALUATION FRAMEWORK FOR PRIMARY PREVENTION AND AWARENESS CAMPAIGNS IN STROKE

## 3.1. Overview

As ICTUSnet network, our vision is a South West European region free of the avoidable burden of stroke.

Our goal is to reduce the preventable burden of morbidity, mortality and disability due to stroke by means of multi-sectoral collaboration and cooperation across regional level.
Our **overarching objectives** are:

1) To address the prevention of stroke.
2) To reduce modifiable risk factors and raise stroke awareness.
3) To monitor the trends and determinants of stroke and evaluate progress in their prevention and control.

Our **targets** are aligned with the Action Plan for Stroke in Europe 2018-2030 (1), and we specially highlight :

1) Achieving universal access to primary preventive treatments based on improved and more personalised risk prediction.
2) Full implementation of national strategies for multi-sectoral public health interventions promoting and facilitating a healthy lifestyle, and reducing environmental, socioeconomic and educational factors that increase the risk of stroke.
3) Making available evidence-based screening and treatment programmes for stroke risk factors.
4) Having blood pressure detected and controlled in 80% of persons with hypertension.

## 3.2. Purpose

The purpose of the evaluation framework for prevention and awareness of stroke is to help and guide development of strategies addressed to reduce the burden of stroke.

## 3.3. Audience

This document is addressed mainly to stakeholders that contribute to the multi-sectoral approach of prevention and awareness of stroke for improving/developing plans/guidelines/ campaigns/etc. These stakeholders include:

1) policymakers;
2) public health technicians (health program managers);
3) primary healthcare services workers;
4) stroke patients organizations

### 3.4. Structure

Hereinafter, the following sections are structured as follows:

1) A background with information regarding the problem and its context.
2) The methodology used to develop this evaluation framework. The selection of the strategies, targets and indicators is based on the Action Plan for Stroke in Europe 2018-2030 (European Stroke Organization, ESO), the Burden of Stroke in Europe report (Stroke Alliance for Europe, SAFE) and the Global Action Plan for the prevention and control of non-communicable diseases 20-13-2020 report (World Health Organization, WHO).
3) The definition of the specific selected strategies, the targets and its indicators.

### 3.5. Background

Despite the reduction in the proportion of people having a stroke and the improvement of Stroke care in Europe, the numbers of strokes are set to rise because the proportion of Europeans aged 70 and over is increasing. The projections in the Burden of Stroke in Europe report (2) indicate there will be a 34% increase in total number of stroke events in the EU.

The increasing burden and costs associated with stroke care all point towards the pressing need for effective measures of stroke prevention. Besides, potentially modifiable risk factors cause more than 90% of the stroke burden and more than 75% of this burden could be reduced by controlling metabolic and behavioural risk factors (3).

Even though most European countries have guidelines management for risk factors such as high blood pressure and atrial fibrillation (4), there is significant under-treatment. Besides, less than 50% of all people treated for high blood pressure are actually on enough medication (either for insufficient dose or for lack of compliance) to get their blood pressure below the desired target level (Eurostat, 2008).

The **strategies for prevention** can be divided into three **categories** (5):

1) Primordial prevention**:** Activities that prevent the emergence of the risk factors via the establishment of environmental, economic, socio-behavioural, and cultural patterns of living. Important strategies that have revealed to be effective are those aim to tobacco control, adequate nutrition and development of healthy cities;
2) Primary prevention: Strategies for reducing the incidence of stroke, such as salt reduction;
3) Secondary prevention: Strategies for preventing the recurrence of stroke that require effective collaboration between various health-care sectors, policies and campaigns (not to be discussed in this part of the document, but in the last part “4. Evaluation framework on the follow-up and rehabilitation plans in stroke”.

## 3.6. METHODOLOGY

A scoping review of European and international action plans and recommendations related to prevention in stroke was performed. As the purpose of ICTUSnet is to be aligned with the aims and targets of European Stroke Action Plan 2018-2030 developed by ESO (1), and with the indicators proposed by SAFE (2), ICTUSnet members decided to include all of them in this section. Besides, as stroke prevention targets are the same as those involved in other cardiovascular diseases and other NCDs, the purpose is also to follow the WHO Global Action Plan for the Prevention and Control of NCDs 2013-2020 recommendations (6).
ICTUSnet members consider that the selection of all targets and indicators proposed in these official documents to be included in this evaluation framework have been thoroughly develop for official institutions, following good practices protocols and standard methods, and reached consensus between stakeholders in different countries and they needn't a systematic review on our behalf.

## 3.7. DEFINITION OF THE SPECIFIC SELECTED STRATEGIES, THEIR TARGETS AND INDICATORS

This section is focused on the evaluation of the following strategies:

1. Encourage healthy lifestyles and stroke awareness
2. Detection and treatment of hypertension
3. Detection and treatment of atrial fibrillation

As optimal targets of certain risk factors may differ between men and women (4) and the prevalence is associated with socioeconomic status (6), these strategies should tackle these aspects in every region.

### 3.7.1. Encourage healthy lifestyles and stroke awareness

Potentially modifiable risk factors for stroke are hypertension, poor dietary and physical activity habits, tobacco, alcohol, diabetes, obesity and dyslipidemia, cardiac causes, psychosocial stress, socioeconomic status, air pollution and rapid weather changes (7).

Most countries in Europe have undertaken regional or national educational campaigns aimed at raising awareness on stroke risk factors and healthy lifestyles often combined with campaigns to increase public knowledge of stroke symptoms and the appropriate response after symptoms onset. Although many campaigns have been undertaken, very few have been evaluated systematically, with varied success (8–10).

Innovative campaigning methods, such as the use of social media, apps; collaborative campaigns in co-operation with other medical specialties; risk factor education in schools; and risk-factor checks in places such as workplaces or pharmacies), should also be assessed.

#### 3.7.1.1. Targets and indicators for the evaluation of healthy lifestyles

According to WHO's Department for the prevention of Non-Communicable diseases (NCDs) campaigns, the main risk factors to be addressed and their targets list to be reached include:

- Tobacco control: A 30% relative reduction in prevalence of current tobacco use in persons aged 15+ years.
- Promoting a healthy diet: A 30% relative reduction in mean population intake of salt/sodium.
- Physical inactivity: A 10% relative reduction in prevalence of insufficient physical activity.
- Reducing the harmful use of alcohol: At least 10% relative reduction in the harmful use of alcohol, as appropriate, within the national context.

- The **final target** to accomplish is: A 25% relative reduction in risk of premature mortality from NCDs, including stroke.

To achieve these targets, a series of indicators has been developed (adapted from WHO's Department for the prevention of NCDs)

| Risk factor | Structural indicators | Output indicators |
|---|---|---|
| **Tobacco use** | ▪ Number of regional specific campaigns addressing risk factors (per year)<br>▪ Number of specific regional/national policies regulating risk factors<br>▪ Number of programs promoting healthy life style<br>▪ Number of programs that prevent and treat risk factors | ▪ Prevalence of current tobacco use among adolescents<br>▪ Age-standardized prevalence of current tobacco use among persons aged 18+ years |
| **Poor diet** | | ▪ Age-standardized mean population intake of salt (sodium chloride) per day in grams in persons aged 18+ years |
| **Physical inactivity** | | ▪ Prevalence of insufficiently physically active adolescents, defined as less than 60 minutes of moderate to vigorous intensity activity daily<br>▪ Age-standardized prevalence of insufficiently physically active persons aged 18+ years (defined as less than 150 minutes of moderate-intensity activity per week, or equivalent) |
| **Alcohol intake** | | ▪ Total (recorded and unrecorded) alcohol per capita (aged 15+years old) consumption within a calendar year in litres of pure alcohol, as appropriate, within the national context<br>▪ Age-standardized prevalence of heavy episodic drinking among adolescents and adults, as appropriate, within the national context<br>▪ Alcohol-related morbidity and mortality among |

| | | |
|---|---|---|
| | | adolescents and adults, as appropriate, within the national context |

#### 3.7.1.2. Targets and indicators for the evaluation of stroke awareness campaigns

The target of the public education campaigns designed to increase recognition of major stroke symptoms is to avoid delay in seeking medical attention, and consequently being potentially treated (8)(9).

| | **Structural indicators** | **Output indicators** |
|---|---|---|
| **Stroke awareness campaign** | Number of regional campaigns per year | ▪ Number of viewers/receptors<br>▪ Time from stroke onset to first seeking medical attention<br>▪ Nature of the first medical attention sought and recipient of initial alert (EMS, GP, etc.)<br>▪ Percentage of patients arriving before 4.5h symptoms onset |

### 3.7.2. Detection and treatment of hypertension

Hypertension is the single most important modifiable risk factor for stroke. Detection and adequate treatment is mandatory to modify the burden of the disease.
According to WHO, salt reduction initiatives can make a major contribution to prevention and control of high blood pressure. However, vertical programmes focusing on hypertension control alone are not cost effective.
Integrated non-communicable disease programmes implemented through a primary health care approach are an affordable and sustainable way for countries to tackle hypertension. Prevention and control of hypertension is complex, and demands multi-sectoral collaboration, including governments, civil society, academia and the food and beverage industry (10).
To detect hypertension, increase adherence to existing guidelines, compliance with prescribed medications, and regular blood pressure checks, both medical professionals and patients must be involved through shared decision-making (2) (11).

#### 3.7.2.1. Targets of hypertension

Targets to reach in hypertension nation-wide and primary health care settings campaigns are (10)(12) (1):

- A 25% relative reduction in the prevalence of raised blood pressure or contain the prevalence of raised blood pressure according to national circumstances.

- An 80% availability of the affordable basic technologies (blood pressure measurement devices) and essential medicines, including generic drugs, required to treat hypertension.
- Having blood pressure detected and controlled in 80% of persons with hypertension.

#### 3.7.2.2. Indicators for the evaluation of the detection of hypertension

The diagnosis of hypertension should be confirmed at 1 to 4 weeks after the first measurement. In general, hypertension is diagnosed if, on two visits on different days (11):

- systolic blood pressure (SBP) on both days is ≥140 mmHg and/or
- diastolic blood pressure (DBP) on both days is ≥90 mmHg.

| Risk factor | Structural indicators | Output indicators |
|---|---|---|
| **Hypertension** | ▪ Number of regional specific campaigns per year<br>▪ Number of programs promoting healthy lifestyle<br>▪ Number of programs that prevent and treat hypertension | ▪ Age-standardized prevalence of high blood pressure among persons aged 18+ years |

#### 3.7.2.3. Indicators for the evaluation of the treatment and control of hypertension

For most patients, blood pressure is considered controlled when SBP is under <140 mmHg and DBP is under <90 mmHg. However, for patients with diabetes or a high risk of cardiovascular disease, certain guidelines recommend lower targets: SBP <130 mmHg and DBP <80 mmHg.

| Risk factor | Structural indicators | Output indicators |
|---|---|---|
| **Hypertension** | Availability and affordability (independently) of quality, safe and efficacious essential hypertension medicines, including generics, and basic technologies in both public and private facilities | ▪ Percentage of patients with hypertension under lowering blood pressure medication<br>▪ Percentage of patients with controlled blood pressure<br>▪ Percentage of facilities where to measure blood pressure |

### 3.7.3. Detection and treatment of atrial fibrillation

Atrial fibrillation (AF) is increasing in incidence and prevalence and that may be related to better detection but also to ageing population. Approximately, 10% of ischemic strokes are associated

with AF first diagnosed at the time of stroke. Detecting asymptomatic AF would provide an opportunity to prevent stroke by initiating appropriate anticoagulation (13,14).

#### 3.7.3.1. Targets for AF

Targets for atrial fibrillation are not well-defined. Besides, the balance between benefits and harms of long-term anticoagulation as primary prevention is questionable in some AF patients, particularly those with very short episodes of AF or a low CHA2DS2VASc score (14).

Indicators of increased AF detection campaigns are related to the cost-effectiveness. For example, the ASERT screening study[1] primary hypothesis is that among elderly population with hypertension and a least one other risk factor for AF, they will detect AF in at least **10%** of patients who would be potential candidates for anticoagulant therapy.

#### 3.7.3.2. Indicators for the detection of AF

The value of wide screening for AF, and the clinical significance of short or paroxysmal AF episodes are currently under debate, particularly if it concerns primary prevention (13,14). Settings of screening varies (from annual events to pharmacies), being the primary care the ideal setting.

Following the key recommendation of the AF-SCREEN International Collaboration (14), campaigns should perform a single-timepoint screening of people ≥65 years of age in the clinic or community (justified based on yield of screening and likely cost- effectiveness). For those >75 years of age or in younger age groups at high risk of AF or stroke, 2 weeks of twice-daily intermittent AF screening may be warranted.

| Risk factor | Structural indicator | Output indicator |
|---|---|---|
| **Atrial fibrillation** | - Number of regional specific campaigns per year | - Age-standardized prevalence of detected AF among screened persons aged 65+ years |

#### 3.7.3.3. Indicators for the treatment of AF

In people with AF with an appropriate CHA2DS2VASc score, the beneficial effect of anticoagulation is evident. The goal is to treat the majority of patients with AF, avoiding overtreatment in low risk patients.

The indicator recommended by SAFE is:

[1] ASERT Screening study:
https://clinicaltrials.gov/ct2/show/NCT02401854?term=ASSERT+III&rank=1

| Risk factor | Output indicator |
|---|---|
| **Atrial fibrillation** | - Adults with atrial fibrillation at increased risk of stroke (according to CHA2DS2VASc score) are treated appropriately with anticoagulants |

# 4. EVALUATION FRAMEWORK ON THE ORGANISATION OF STROKE SERVICES AND MANAGEMENT OF ACUTE STROKE

## 4.1. Overview

As ICTUSnet network, our vision is that of a south-western European region free of the burden of disability and mortality after stroke.
Our goal is to provide the highest quality of stroke care to each and every inhabitant in the south-western European region by means of a multisectoral collaboration and cooperation across south-western European regions.
Our overarching objectives are:

1) To ensure equal access to high quality stroke care
2) To address the organization of acute stroke treatment services
3) To monitor the trends of reperfusion therapies and detect the most relevant barriers

Our targets, aligned with the Action Plan for Stroke in Europe 2018-2030 (1), are:

4) Have national plans for stroke encompassing the entire chain of care from primary prevention through to life after stroke
5) Treating 90% or more of all patients with stroke in Europe in a stroke unit as the first level of care.

## 4.2. Purpose

The purpose of the evaluation framework for stroke care plans on management of acute stroke is to help and guide the development of stroke care plans addressed to reduce the burden of disability and mortality after stroke by promoting adherence to best evidence-based guidance care.

## 4.3. Audience

This document is mainly addressed to stroke stakeholders that contribute to the multisectoral approach for the development of stroke care plans and management of acute stroke, including:

- Health policy makers
- Public health technicians (health program managers);

- Emergency medical services (EMS) personnel;
- Members of hospital stroke teams (including all disciplines required for acute stroke management)

### 4.4. Structure

Hereinafter, the following sections are structured as follows:

1. A background with information regarding the health problem and its context.
2. The methodology used to develop this evaluation framework. The selection of strategies, targets and indicators is based on the Action Plan for Stroke in Europe 2018-2030 (European Stroke Organization, ESO), the Burden of Stroke in Europe report (Stroke Alliance for Europe, SAFE) the results derived from stroke audits participating within European Implementation Score (EIS) project (15), and the Roadmap for Quality Stroke Care developed by the World Stroke Organization (WSO) (16)
3. The definition of the spectrum of care of the acute phase, the targets and its indicators.
4. The bibliography used to develop the document.

### 4.5. Background

Stroke is the leading cause of medically-acquired disability, and the second cause of mortality worldwide (17). The establishment of appropriate stroke services to support delivery of best practices ensuring patients have a timely access to evidence-based interventions, and the consideration of stroke as a medical emergency is fundamental to achieve good quality of care.

The Burden of Stroke in Europe report (2) pointed out that there is a need to revise and improve in-hospital emergency pathways to reduce Door-To-Needle times, and that efforts are required to increase the availability of stroke unit care and specialised personnel.

To achieve good quality of stroke care within the acute phase, this document focuses on two aspects:

- Organization of stroke services
- Management of acute stroke

### 4.6. Methodology

A scoping review of European and international action plans and guidelines related to organization of stroke services and management of acute stroke care, was performed. The purpose of ICTUSnet is to be aligned with the aims and targets of:

1) The European Stroke Action Plan 2018-2030 developed by ESO (1);
2) The indicators proposed by SAFE (2),
3) The performance measures developed as part of the EIS project (a European Union funded project aiming at developing a European methodology to assess the

implementation of research evidence into practice) (15),

4) and the Roadmap for Quality Stroke Care developed by the World Stroke Organization (WSO) (16).

In 2015, a multinational European working group (stroke physicians, neurologists, and public health academics) developed and published a harmonized set of healthcare performance measures for cross-national comparisons of the quality of acute stroke care as part of the EIS project. These indicators encompass these domains: coordination of care (stroke unit-based care), diagnosis, preservation of neural tissue, prevention of complications, initiation of secondary prevention, survival and functional outcomes, and are used in different European countries currently. These indicators are consistent with the Roadmap for Quality Stroke Care develop by the WSO, which published consensus guidelines that take into account the level of resource available in different health economies.
ICTUSnet members consider that these official documents have been thoroughly develop for official institutions, following good practices protocols and standard methods, and reached consensus between stakeholders in different countries and they needn't a systematic review on our behalf.

## 4.7. Definition of the specific settings of care, their targets and indicators

This section focuses on the evaluation of the following settings:

1. Pre-hospital
2. Hyperacute stroke care
3. Acute inpatient care

### 4.7.1. Targets of the pre-hospital setting

Training of emergency medical services (EMS) personnel in detecting code stroke patients increases the number of patients with timely arrival at hospital. Besides, pre-hospital identification of patients with stroke by use of validated tools and scales has been recognised as being important for prompt treatment, although they have suboptimal specificity (19). Furthermore, pre-notification of patient's arrival by EMS personnel has shown to shorten delays and speed up medical management.
Thus, the targets proposed in this phase are:

- All regions have to have a clear transportation routing to the closest suitable hospital (that is, a defined code stroke system or protocol)
- EMS personnel have to use pre-hospital validated scales in >75% of code stroke cases
- EMS personnel have to pre-notify arrival of code stroke cases to the stroke team at the destination hospital in >90% of code stroke cases

### 4.7.2. Targets of the hyperacute stroke care setting

The hyperacute stroke care is defined as the immediate care in the first hours, particularly in the

short time window after stroke onset when revascularization is most effective.
Systems of stroke care should minimise time to assessment and initiation of treatment in both patients with acute ischemic stroke (AIS) and intracranial haemorrhage (ICH).
Among the different strategies in the hyperacute phase described to have a direct impact on stroke outcomes are:

- Admission to centralised facilities for acute hospital care, since it increases the likelihood of receiving intravascular thrombolysis (IVT) for patients with AIS; (20)
- Admission to hospitals with greater use of IVT (leading to shorter delays in administering rtPA after arrival; with currently limited data supporting this statement for endovascular treatment (EVT) (21)
- Rapid access to brain imaging, including vascular imaging at all times (immediate brain imaging is the most cost-effective approach in stroke) (22)

Thus, the targets propose in this phase are:

- Guaranteeing access to recanalization therapies to 95% of eligible patients
- Decreasing median onset-to-needle times to <120 minutes for IVT and onset-to-reperfusion times to <200 minutes for EVT
- Achieving IVT rates above 15% and EVT rates above 5% (of all ischemic strokes)

**NOTE:** The specific targets corresponding to EVT are described in the Deliverable 1.1.1.

### 4.7.3. Targets of the acute care setting

This phase of care usually starts from about 24 hours after stroke onset through the first 5 to 7 days, when the patient becomes medically stable and care goals shift to ongoing stroke assessment, determining aetiology, management of persistent symptoms, initiating recovery, early rehabilitation, and prevention of acute complications.
Among the different strategies in the acute phase described to have a direct impact on stroke outcomes are:

- Admission to dedicated stroke units ~~to avoid poor outcomes~~
- Access to nurses and physicians with stroke expertise (stroke team)
- Protocols to guide acute stroke care based on best practice guidelines
- Data collection strategy/registry to monitor key performance indicators
- Programs to certify stroke units and stroke centres.

Thus, the targets proposed in this phase are (1,23,24):

- Treating 90% or more of all stroke patients in a stroke unit as the first level of care
- Decreasing first-month case-fatality rates to <25% for ICH and increasing the rate of good functional outcomes (mRS 0-2 at three months) to >50%
- Decreasing pulmonary embolism from deep venous thrombosis (DVT) death rates after stroke to <10%
- Decreasing the rate of early stroke recurrence during hospitalisation

- Reducing the length of stay in stroke units for patients with mild to moderate stroke
- Decreasing aspiration pneumonia rates.

#### 4.7.4. Indicators of organisation of stroke services and management of acute stroke

NOTE: to assure accurate metrics and to facilitate comparisons between different regions, the following indicators should be stratified by clinical and sociodemographic variables (a priori selected by the ICTUSnet partners involved in the analysis tasks).

| Structural indicators | Definition | Calculation | Metric | Setting |
|---|---|---|---|---|
| The region has a defined transportation route (code stroke system) | Descriptive list of transportation routes that covers all the territory | | At least one route that covers the whole territory | **Pre-hospital** |
| EMS personnel properly trained in code stroke recognition and in the use of pre-hospital stroke scales | Percentage of EMS personnel properly trained in code stroke recognition and in the use of pre-hospital stroke scales | Numerator 1: total number of EMS members properly trained in code stroke recognition<br>Numerator 2: total number of EMS members properly trained in the use of pre-hospital stroke scales<br>Denominator: total number of EMS members | All EMS personnel should be trained to recognize the warning signs and symptoms of stroke and in the use of pre-hospital stroke scales.<br><br>Protocols should be in place to emergency call centres to mobilize EMS personnel to respond to stroke call with high urgency | **Pre-hospital** |
| Stroke teams rate per 1.000,000 inhabitants | Rate of multi-professional team (physicians with stroke expertise, stroke nurses, radiologists, therapy staff (1)) per region | Numerator: Total number of Stroke teams in a region<br>Denominator: Total population based on census information within a given time frame | To be defined | **Hyperacute** |

| | | | | |
|---|---|---|---|---|
| Stroke Units per 1.000,000 inhabitants | Rate of Stroke Units (defined as A dedicated geographically clearly defined area or ward in a hospital, where stroke patients are admitted and cared for a multi-professional team (medical, nursing and therapy staff) who have specialist knowledge of cerebral function, training and skills in stroke care with well-defined individual tasks, regular interaction with other disciplines and stroke leadership). | Numerator: Total number of Stroke Units in a region.<br>Denominator: Total population based on census information within a given time frame | According to results of a recent survey of national scientific societies and stroke experts in 44 European Countries (including France, Portugal and Spain), the maximum rate was 2.4 (corresponding to Portugal)(25) | **Hyperacute** |
| Stroke Unit beds rate per 1.000,000 inhabitants | Rate of stroke unit beds | Numerator: Total number of Stroke Units beds in a region.<br>Denominator: Total population based on census information within a given time frame | To be defined | **Hyperacute/ Acute** |

| | | | | |
|---|---|---|---|---|
| Stroke Centres rate per 1.000,000 inhabitants | Rate of Stroke Centres (defined as A hospital infrastructure and related processes of care that provide the full pathway of stroke unit care. Provides stroke unit services for the population of its own catchment area and serves as a referral centre for peripheral hospitals with stroke units) | Numerator 1 (for IVT Centres): Total number of IVT Centres in a region.<br>Numerator 2 (for EVT Centres): Total number of EVT Centres in a region.<br>Denominator: Total population based on census information within a given time frame | According to results of a recent survey of national scientific societies and stroke experts in 44 European Countries (including France, Portugal and Spain), the maximum rate for IVT Centres was 2.4 and for EVT 0.9 (both rates corresponding to Portugal) (25) | **Hyperacute/ Acute** |
| The region participates in a quality register or routine and standardized clinical audits for monitoring stroke care | Descriptive list of each facility within a region where routine and standardized data collection occurs, describing type of episodes, variables and coverage. | | At least one stroke registry that collects information regarding reperfusion treatments in all the region | **Hyperacute/ Acute** |

| Process indicators | Definition | Calculation | Metric | Setting |
|---|---|---|---|---|
| Meaningful Data entered in the registry | Percentage of patients in whom information has been entered in the all the mandatory set of variables | Numerator: number of patients in whom mandatory variables are filled in<br>Denominator: number of patients entered in the registry | 100% of the patients have all the required data entered in the registry. | **Hyperacute/ Acute** |
| Symptoms to door time | Time from symptoms onset (or last time seen well) to Stroke Centre arrival. | ddmmyyyy/ hh:mm arrival (= hospital admission) – ddmmyyyy/ hh:mm symptoms onset (or last time seen well) | To achieve median times from stroke onset to Stroke Centre arrival of 180 minutes. | **Hyperacute** |
| Door-to-needle (DTN) time | Time from arrival at the IVT treating Center to needle (bolus of alteplase/ tenecteplase). | ddmmyyyy/HH: MM bolus onset - ddmmyyyy/HH: MM hospital admission (result in minutes) | Decreasing median onset-to-needle times to <120 minutes for IVT.<br>75% of patients who underwent bridging treatment should have a DTN < or = 40 minutes.<br>In those Centres with a large | **Hyperacute** |

| | | | | |
|---|---|---|---|---|
| | | | volume of patients and with a well-established infrastructure, the time should be less than 30 minutes. | |
| Imaging-to-needle time | Time from 1st neuroimaging to needle for the IVT | ddmmyyyy/HH: MM bolus onset - ddmmyyyy/HH: MM 1st neuroimaging | To be defined | **Hyperacute** |
| Door to puncture time | Time from a EVT Centre arrival to groin puncture | ddmmyyyy/hh:mm groin puncture - ddmmyyyy/hh:mm EVT Centre arrival | For all patients undergoing EVT at the EVT Centre: 50% of patients should have a door to puncture < or = 90 minutes.<br>For transferred-in patients without 2nd neuroimaging at EVT Centres: 75% of patients should have a EVT Centre door to puncture time < or = | **Hyperacute** |

| | | | | |
|---|---|---|---|---|
| | | | 80 minutes. | |
| Imaging to puncture time | Time from 1st neuroimaging to arterial puncture for the EVT. | ddmmyyyy/HH: MM arterial puncture - ddmmyyyy/HH: MM 1st neuroimaging (result in minutes) | 75% of EVT patients should have a 1st neuroimaging to puncture time < or = 110 minutes. | **Hyperacute** |
| Puncture time to reperfusion | Time from the arterial puncture that initiates the EVT to the achievement of a successful revascularization defined as the time in which a mTICI> = 2b is reached for the first time | ddmmyyyy/HH: MM mTICI> = 2b - ddmmyyyy/HH: MM arterial puncture (result in minutes) | 70% of EVT patients reach an mTICI >= 2b in the first 60 minutes. | **Hyperacute** |

| | | | | |
|---|---|---|---|---|
| Imaging test after EVT | percentage of patients who undergo an imaging test in the 36 hours after the completion of EVT | Numerator: number of patients who undergo an imaging test within 36 hours after the completion of the EVT<br>Denominator: number of patients receiving EVT within a given frame time | 100% of alive patients should have a follow-up neuroimaging < = 36 hours after EVT. | **Acute** |
| Symptomatic intracerebral haemorrhage (SICH) | Percentage of patients with SICH (as per the SITS MOST definition) after IVT and EVT | Numerator: number of patients with SICH after EVT<br>Denominator: number of patients receiving EVT within a given frame time | Less than 2% of patients receiving IVT (only) should develop a SICH*<br>Less than 10% of patients receiving EVT should develop a SICH | **Acute** |
| Embolizations in new territories | Percentage of patients presenting embolizations in territories not initially affected as a result of thrombus fragmentation during EVT | Numerator: number of patients presenting with embolizations in territories not affected initially as a result of thrombus fragmentation during EVT<br>Denominator: number of patients receiving EVT | Less than 10% of patients should have an embolization in a new territory | **Hyperacute** |

| | | | | |
|---|---|---|---|---|
| | | within a given frame time | | |
| Stroke patients treated in a stroke unit | Percentage of stroke patients that meet criteria to be admitted in a stroke unit and are treated in a stroke unit | Numerator: number of stroke patients that meet criteria to be admitted in a stroke unit<br>Denominator: number of stroke patients admitted within a given frame time | 100% of stroke patients that meet criteria to be admitted in a stroke unit and are treated in a stroke unit | **Hyperacute/ Acute** |
| Length of stay in stroke units | Length of stay in stroke units, according to stroke severity | Median number of days of stay (p25-p75), stratified by stroke severity (mild, moderate, severe) | To be determined (either the median number of days and the stratification of severity) | **Acute** |

| | | | | |
|---|---|---|---|---|
| Early supported discharge | Percentage of patients with mild to moderate stroke that received early supported discharge | Numerator: Number of patients with mild to moderate stroke that received early supported discharge<br>Denominator: Total number of patients with mild to moderate stroke admitted within a given frame time | To be determined | **Acute** |
| Venous thromboembolism (VTE) prophylaxis on hospital day during the first 48h | Percentage of stroke patients prescribed VTE prophylaxis on hospital day during the first 48h | Numerator: number of stroke patients prescribed VTE prophylaxis on hospital day during the first 48h<br>Denominator: total number of stroke patients admitted within a given frame time | To be determined | **Acute** |

| | | | | |
|---|---|---|---|---|
| Dysphagia screening within 24h | Percentage of patients with a diagnosis of stroke for whom there is documentation that a dysphagia screening was performed within 24 h of admission using a dysphagia screening tool approved by the institution in which the patient is receiving care | Numerator: patients with a diagnosis of stroke for whom there is documentation that a dysphagia screening was performed within 24 h of admission using a dysphagia screening tool approved by the institution in which the patient is receiving care.<br>Denominator: total number of patients with stroke admitted within a given frame time | To be determined | **Acute** |
| Passed dysphagia screen before first oral intake of fluids, nutrition, or medications | Percentage of patients with passed dysphagia screen before first oral intake of fluids, nutrition, or medications | Numerator: patients with a diagnosis of stroke who were documented to have passed the most recent dysphagia screen before oral intake. Denominator: total number of patients | To be determined | **Acute** |

| | | | | |
|---|---|---|---|---|
| | | with stroke admitted within a given frame time | | |

| Output indicators | Definition | Calculation | Metric | Setting |
|---|---|---|---|---|
| IVT percentage | Percentage of AIS patients who are treated with IVT | Numerator: Number of all AIS who receive IVT<br>Denominator: total number of AIS admitted | >= 15% | **Hyperacute** |
| IVT population rate | Rate of IVT in the region per 1.000,000 inhabitants -year | Numerator: number of IVTs<br>Denominator: Total population based on census information within a given time frame | According to results of a recent survey of national scientific societies and stroke experts in 44 European Countries (including France, Portugal and Spain), the maximum rate for IVT was 146.5 per million-year (rate corresponding to Portugal) (25) | **Hyperacute** |

| | | | | |
|---|---|---|---|---|
| EVT percentage | Percentage of AIS patients who are treated with EVT | Numerator: Number of all AIS who receive EVT<br>Denominator: total number of AIS admitted | >= 5% | **Hyperacute** |
| EVT population rate | Rate of EVT in the region per 1.000,000 inhabitants -year | Numerator: number of IVTs<br>Denominator: Total population based on census information within a given time frame | According to results of a recent survey of national scientific societies and stroke experts in 44 European Countries (including France, Portugal and Spain), the maximum rate for IVT was 81.6 per million-year (rate corresponding to Portugal) (25) | **Hyperacute** |
| Successful revascularization after EVT | Percentage of patients receiving EVT that achieve a >=2b mTICI score immediately after removal of the thrombus that produces the occlusion of the affected vessel. | Numerator: number of patients receiving EVT that achieve a >=2b mTICI score after removal of the thrombus that produces occlusion of the affected vessel<br>Denominator: number of | At least 70% of patients must have a >=2b mTICI score at the end of the EVT (for all anterior circulation locations) | **Hyperacute** |

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|---|---|---|---|---|
| | | patients receiving EVT within a given frame time. | | |
| Pulmonary embolism from deep venous thrombosis death rates | Pulmonary embolism from deep venous thrombosis death rates after stroke (period to be determined) | Numerator: number of dead patients of pulmonary embolism from deep venous thrombosis after stroke.<br>Denominator: total of patients with stroke admitted within a given frame time. | To be determined | **Acute** |
| Aspiration pneumonia rates | Aspiration pneumonia rates during stroke hospitalisation | Numerator: number of patients with aspiration pneumonia during hospitalization<br>Denominator: total of patients with stroke admitted within a given | To be determined | **Acute** |

| | | | | |
|---|---|---|---|---|
| | | frame time | | |
| Case fatality (mortality) rates | Case fatality (mortality) rates at 7-, 30-days post-stroke by stroke subtype, adjusted for age, gender, comorbidities and stroke severity | Numerator: Number of people with stroke who have in-hospital mortality within 7 days, 30 days following index stroke symptom onset.<br>Denominator: Total number of stroke cases admitted within a given frame time. | To be determined for AIS<br>For ICH, decreasing first-month case-fatality rates to <25% | **Acute** |
| Functional status after stroke | Functional status measured using the modified Rankin Score at 3 months following stroke. Good outcome is defined as patients with a mRS 0-2 score 90 days after the IVT or EVT. | For IVT<br>Numerator: number of patients with a mRS score 0-2 at 90 days of the IVT<br>Denominator: total number of patients receiving IVT | To be determined for IVT<br>For EVT<br>at least 30% are independent at 3 months. Includes posterior circulation strokes as well as patients with | **Acute** |

| | | | | |
|---|---|---|---|---|
| | | within a given frame time<br>For EVT:<br>Numerator: number of patients with a mRS score 0-2 at 90 days of the EVT<br>Denominator: total number of patients receiving EVT within a given frame time | premorbid mRS = > 3 | |

*According to recent SITS-MOST results http://www.sitsinternational.org/registries/sits-thrombolysis/
AIS: Acute ischemic stroke

# 5. EVALUATION FRAMEWORK ON THE FOLLOW-UP AND REHABILITATION PLANS IN STROKE

## 5.1. Overview

As ICTUSnet network, our vision is that of a south-western European region where all stroke patients achieve and maintain optimal functioning in interaction with their environments.
Our goal is to ensure access to all stroke patients to a continuum of care, including the appropriate stroke secondary prevention, rehabilitation and addressing the needs of life after stroke.
Our overarching goals are:

1) To ensure equal access to the continuum of care in stroke.
2) To address the organization of stroke rehabilitation services.
3) To improve and monitor the provision of secondary prevention services.
4) To address the long-term unmet needs in life after stroke.

Our **targets** are aligned with the Action Plan for Stroke in Europe 2018-2030 (1), and we specially highlight:

1) Guarantee that at least 90% of the stroke population has access to early rehabilitation within the stroke unit.
2) Provide early supported discharge to at least 20% of the stroke population in all countries.
3) Ensure all stroke patients and caregivers have a review of their rehabilitation and other needs at three to six months after stroke, and annually thereafter.
4) Ensure that 90% of the stroke population should be seen by a stroke specialist and have access to secondary prevention management (investigation and treatment).
5) Set out, through national stroke plans, the support that will be provided to stroke survivors regardless of their place of residence and socio-economic status.

## 5.2. Purpose

The purpose of the evaluation framework for follow-up and rehabilitation stroke plans is to help and guide the development of stroke care plans addressed to ensure the continuum of stroke care, beyond the acute management, by promoting adherence to evidence-based care and address the unmet needs in life after stroke.

### 5.3. Audience

This document is mainly addressed to stroke stakeholders, including rehabilitation experts, primary care physicians, patients and caregivers, that contribute to this multi-sectoral approach, to improve rehab care. These stakeholders include:

- Policy makers
- Public health technicians (health program managers);
- Members of in-hospital stroke rehabilitation teams;
- Primary and social care professionals
- Stroke patients and caregivers

### 5.4. Structure

The present document is structured as follows:

1. A background with information regarding the health problem and its context.
2. The methodology used to develop this evaluation framework.
3. The definition of the spectrum of continuum of care after the acute phase.
4. The bibliography used to develop the document.

### 5.5. Background

Among adults, stroke is the most common cause of new disability leading to more than one impairment that could affect daily activities (distributed in motor function, cognition and communication deficits). Specialist rehabilitation is one of the core aspects of a comprehensive stroke unit, and treatment in such facilities has been shown to reduce mortality and disability.
On the other hand, secondary prevention encompasses the reduction of further stroke and transient ischemic attack (TIA), any other vascular disease, and other complications including cognitive decline and dementia, mood disturbances or anxiety, fatigue and poor quality of life. Besides, secondary prevention applies to almost all patients with stroke or TIA and can reduce stroke recurrence by 80%.
Furthermore, it is important to recognise that improvement can continue for a long time after stroke, and that the patient's needs will vary over time and they have to be met.

### 5.6. Methodology

A scoping review of academic literature and other relevant documents related to stroke rehabilitation was performed. This had the goal of collecting **indicators** used in the evaluation of stroke rehabilitation and follow-up, including:

a) Indicators to measure the state of stroke patients when they leave acute care, and indicators to measure recovery
b) Indicators related to resources used by health organisations to treat stroke patients in the rehabilitation phase

Based on this objective, and on a first screening of relevant articles (ESO & SAFE, 2018; Richards, Malouin, & Nadeau, 2015; Stevens, Emmett, Wang, McKevitt, & Wolfe, 2017), some key words were identified (see Table 1).

*Table 1 Key words related to stroke rehabilitation*

| Dimension | Words |
|---|---|
| **Disease** | Stroke |
| **Phase** | Rehabilitation, Long-term, discharge, follow-up, post-stroke, "after stroke", recovery, post-hospital, survivor, reintegration |
| **Rehabilitation Services** | therapy, treatment, programme, services, care, support, training, pathway, plan, intervention, strategy, guidelines, review, protocol, "early supported discharge" "secondary prevention" |
| **Sequelae** | Sequelae, limitations, restrictions, disability, handicap, disorders, deficits, impairment, function, independence, ADLs/Activities of Daily Living/daily activities, Disability Adjusted Life Years lost/DALYs lost/ DALY, morbidity, consequences, problems |
| **Resources** | "health professionals", personnel/staff, beds, equipment, budget, resources |
| **Evaluation** | Indicators, evaluation, impact, effect, assessment |
| **Economic impact** | Costs, burden, economic, financial, productivity, earnings, income, work |
| **Societal impact** | Socio-economic impact, societal/social, emotional problems, depression, anxiety, relationships, quality of life, leisure, community, caregivers/carers, informal care/unpaid care |

*Source: authors' elaboration*

These words were combined in order to form the search strings that were used to find the relevant documents. The search for academic articles was conducted in PubMed, Scopus and Google Scholar. Moreover, additional documents were obtained through Google search. Moreover, some of the articles provided new sources that were also relevant and were included in the selection.

Due to the elevate number of studies on stroke rehabilitation, we mainly focused on multi-country studies, documents on ICTUSNET countries (France, Portugal, Spain) and regions (Occitanie, Norte, Aragon, Navarra, Balearic Islands, Catalonia), and systematic reviews, literature reviews and meta-analysis. Moreover, some key words were translated to the languages of ICTUSNET regions (French, Portuguese, Spanish, Catalan), which provided additional articles.
The first selection contained 305 documents. The most relevant articles were identified by reading the titles and the abstract. A total of 70 articles were screened.

### 5.7. Selection of indicators

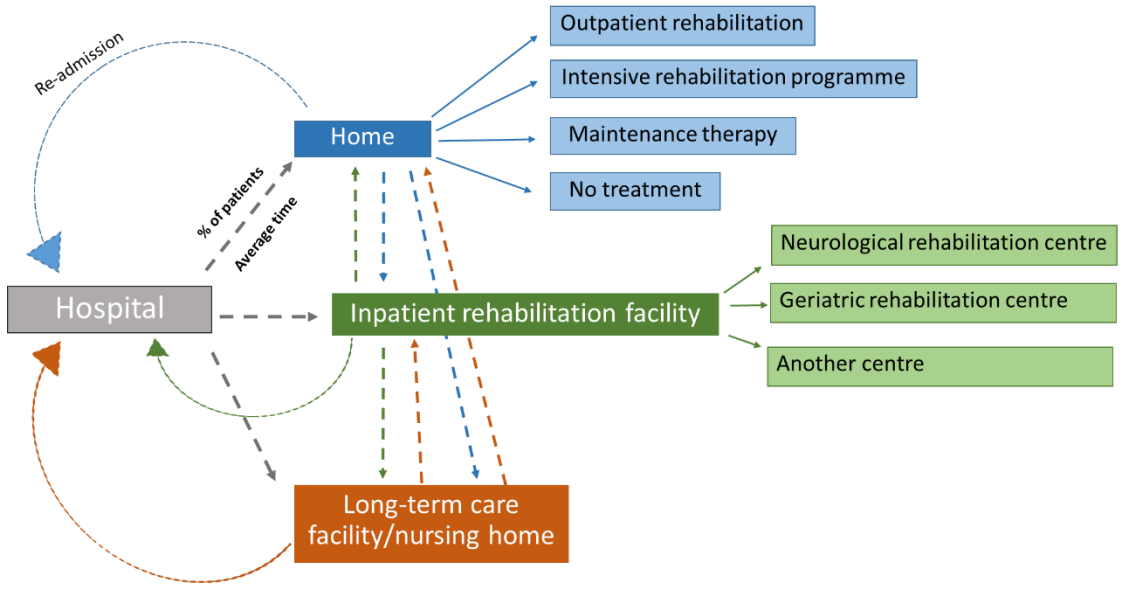
A set of 324 indicators were obtained from the screened articles, 185 of which were considered to be more relevant **(displayed in Table 2, Table 3, Table 4 and Table 5 in Annexes)**. They can be divided in four dimensions:

1) Pathway
2) Follow-up
3) Resources
4) Secondary prevention

These dimensions include indicators of different nature, which has been specified in the tables below (Table 2, Table 3, Table 4 and Table 5). It must be noted that these tables aim at presenting a preliminary collection of indicators found in the literature, not a list of standardised indicators.

The dimension '**pathway'** includes indicators that describe the different trajectories available (a mix of resources and processes) for stroke patients. An example including the main pathways is depicted in Figure 1.

*Figure 1 Stroke rehabilitation pathways*




Source: Authors elaboration based on Richards et al (2015)

The dimension '**follow-up'** refers to whether the status and level of recovery of stroke survivors is assessed when they leave acute care and at different points of time, and to the sequelae that are assessed. These comprises the health condition, indicators related to patients' and informal caregivers' quality of life and mental wellbeing, and to economic consequences (e.g. derived from the impossibility to return to work). It includes a mix of processes and outcomes.

The dimension '**resources'** includes the rehabilitation services and therapies offered (related to the patient's physical and mental wellbeing, as well as to support for caregivers) and also the level of use and cost of these services and the associated personnel.

**Secondary prevention** has the aim to prevent a second stroke. This dimension includes how secondary prevention is managed, whether patients are assessed for risk factors and for adherence to the secondary prevention treatment, and the interventions that are implemented in this domain (e.g. educational interventions, interventions to modify lifestyle, interventions to address clinical variables).

A second selection of indicators was made. For this selection, the list of 185 indicators was sent to experts with long experience in rehab and home care in stroke in Catalonia (ED and CC) that collaborate with the Catalan Stroke Programme. Secondary prevention indicators were not revised for selection.

The final selection is listed below:

*Table 2 Selection of indicators. Pathway*

| | Sub-dimension | Indicator description | Type |
|---|---|---|---|
| 1 | Trajectory | Whether the hospital provides on-site in-patient rehabilitation services for stroke patients prior to discharge | Output |
| 2 | Trajectory | % of stroke survivors who return **home** and do not follow outpatient rehabilitation | Output |
| 3 | Trajectory | % of stroke survivors who return **home** and follow **outpatient** rehabilitation (e.g. Day Hospital, visits with a therapist) | Output |
| 4 | Trajectory | % of stroke survivors who return **home** and follow an **intensive** rehabilitation **program at home** | Output |
| 5 | Trajectory | % of stroke survivors who return **home** and follow **maintenance therapy** offered by home care services | Output |
| 6 | Trajectory | % of stroke survivors who follow a rehabilitation program at an **inpatient rehabilitation** facility (e.g. SSR institution in France) | Output |
| 7 | Trajectory | % of stroke survivors who are referred to a **long-term care facility** (e.g. USLD in France)/nursing home | Output |
| 8 | Trajectory | % of stroke survivors transferred to inpatient rehabilitation facility specialised in neurological issues | Output |
| 9 | Trajectory | % of stroke survivors transferred to inpatient rehabilitation facility specialised in geriatrics | Output |
| 11 | Trajectory | Early discharge from acute care (to inpatient rehabilitation unit or to community) is supported for medically stable patients with mild or moderate impairment | Output |
| 16 | Trajectory | Duration of the rehabilitation treatment/services (in number of appointments, or in weeks/months) | Output |
| 20 | Management | Whether a coordinated plan for rehabilitation is established between the different health professionals who treat the patient | Input |

| | | | |
|---|---|---|---|
| 22 | Management | Whether there are set criteria to determine the patient pathway (and if yes, mention which ones) (e.g. Disability level, age, physical/occupational/speech/psychology therapy services available) | Input |
| 25 | Management | Whether the hospital refers discharged stroke patients to community rehabilitation services | Input |

*Source: own elaboration based on the results of the literature review*

*Table 3 Selection of indicators. Follow-up*

| | Sub-dimension | Indicator description | Type |
|---|---|---|---|
| 26 | Assessment | Whether patients' situation is assessed at the point of discharge/Whether the organisation or the region performs an initial stroke rehabilitation assessment | Output |
| 29 | Assessment | Patients are assessed for rehabilitation needs within the first three days after admission and provided with rehabilitation by multidisciplinary staff on the basis of need | Output |
| 32 | Assessment | Whether patients are assessed 3 months after starting rehabilitation therapy | Outcome/impact |
| 34 | Assessment | Whether 6-month reviews are performed | Outcome/impact |
| 39 | Recovery | % of stroke patients who are returned to the community after their stroke and then within six-months or one-year require admission to a long-term care facility | Outcome/impact |
| 42 | Sequelae | Stroke severity computed using the National Institutes of Health Stroke Scale (NIHSS) | Outcome/impact |
| 47 | Sequelae | Fugl-Meyer Assessment Scale (FMAS) | Outcome/impact |
| 48 | Sequelae | Barthel Index (BI) | Outcome/impact |
| 50 | Sequelae | Modified Rankin Scale (mRS) | Outcome/impact |

| | | | |
|---|---|---|---|
| 55 | Sequelae | IADL (Instrumental. Activities of Daily Living) | Outcome/impact |
| 59 | Sequelae | Charlson score of co-morbidities | Outcome/impact |
| 60 | Sequelae | Orpington Prognostic Scale (OPS) | Outcome/impact |
| 63 | Sequelae | Gait speed | Outcome/impact |
| 67 | Sequelae | % of patients with speech and language impairments/ communication problems | Outcome/impact |
| 68 | Sequelae | % of patients with swallowing impairments | Outcome/impact |
| 70 | Sequelae | % of patients with cognitive impairments | Outcome/impact |
| 72 | Economic consequences | % of patients who were employed before the stroke that do not return to work | Outcome/impact |
| 73 | Economic consequences | Average time to work re-entry | Outcome/impact |
| 76 | Economic consequences | % of patients who return to work but in different conditions (e.g. a permanent change of job or employer, reduction of working hours, the survivor is officially accredited as a handicapped worker) | Outcome/impact |
| 79 | QoL sequelae | Health-related quality of Life | Outcome/impact |
| 81 | QoL sequelae | Frenchay activities index (FAI) | Outcome/impact |

| | | | |
|---|---|---|---|
| 83 | QoL sequelae | % of patients who suffer depression | Outcome/impact |
| 84 | QoL sequelae | Level of social participation of stroke patients | Outcome/impact |
| 86 | Caregivers sequelae | % of caregivers who have emotional problems after one year of caring for a stroke victim | Outcome/impact |
| 87 | Caregivers sequelae | % of informal caregivers (relatives) who are experiencing an important burden | Outcome/impact |

*Source: own elaboration based on the results of the literature review*

*Table 4 Selection of indicators. Resources*

| | Sub-dimension | Indicator description | Type |
|---|---|---|---|
| 96 | General | Number of stroke rehabilitation units in the region | Input |
| 97 | General | Number of rehabilitation beds available (e.g. rehabilitation beds per million population) | Input |
| 98 | Therapies | % of patients who follow a task-specific therapeutic approach | Output |
| 101 | Therapies | Whether the patient follows an **exercising** programme/ aerobic exercise training/ fitness training | Output |
| 102 | Therapies | % of patients who follow **occupational** therapy | Output |
| 107 | Therapies | Whether the organisation/the region provides stroke rehabilitation to improve **cognition** | Output |
| 108 | Therapies | Whether the organisation/the region provides stroke rehabilitation of **swallowing and dysphagia** | Output |
| 109 | Therapies | Whether the organisation/the region provides stroke rehabilitation to improve **communication and aphasia** | Output |
| 110 | Therapies | % of patients who use telemedicine service/ **tele-rehabilitation** | Output |
| 111 | Therapies | % of patients who use **virtual reality** in their treatment | Output |

| | | | |
|---|---|---|---|
| 116 | QoL services | Whether the organisation/the region offers services to assist the person to reintegrate into the **community** (e.g. services that encourage stroke survivors to socialize, to exercise, and to participate in meaningful activities) | Output |
| 117 | Services for caregivers | Whether the organisation/the region offers caregiver assessment and training | Output |
| 121 | Use and cost of rehabilitation services | Average total hours of therapy (average number of weeks * sessions per week * length of session in minutes). Calculated for each type of therapy (physical, occupational, speech) and for each setting (primary care, community day hospital, residential rehabilitation, outpatient rehabilitation, nursing home, community team rehabilitation, community stroke team) | Input |
| 122 | Use and cost of rehabilitation services | Total cost of in-patient rehabilitation care | Input |
| 124 | Use and cost of rehabilitation services | Days spent in a rehabilitative care facility (i.e. in-patient care) | Input |
| 126 | Use and cost of rehabilitation services | National Average Hours of Physiotherapy for Stroke Survivors in a nursing home (the same but for occupation therapy and speech and language therapy) | Input |
| 127 | Use and cost of rehabilitation services | National Average Hours of Physiotherapy for Stroke Survivors in outpatient rehabilitation (non-acute) (the same but for occupation therapy and speech and language therapy) | Input |
| 131 | Use and cost of rehabilitation services | Cost of providing community services for stroke survivors | Input |
| 136 | Use and cost of rehabilitation services | Number of physical therapy sessions /visits with a physiotherapist (* unit cost) | Input |

| | | | |
|---|---|---|---|
| 141 | Personnel | The regions' Stroke Rehabilitation Program counts with an **interdisciplinary team of professionals** experienced in and dedicated to the care of the patient with stroke | Input |
| 142 | Personnel | Number of medical doctors specialising in rehabilitation in the health centre who mainly focus on stroke patients | Input |
| 143 | Personnel | Number of physical therapists in the health centre/region/rehabilitation unit (e.g. Divided by the number of stroke survivors discharged with disability) | Input |
| 144 | Personnel | Number of occupational therapists in the health centre/region/rehabilitation unit (e.g. Divided by the number of stroke survivors discharged with disability) | Input |
| 145 | Personnel | Number of speech and language therapists in the health centre/region/rehabilitation unit (e.g. Divided by the number of stroke survivors discharged with disability) | Input |
| 146 | Personnel | Number of clinical psychologists in the health centre/region/rehabilitation unit | Input |
| 147 | Personnel | Number of geriatricians in the health centre/region/rehabilitation unit | Input |
| 148 | Personnel | Number of social workers in the health centre/region/rehabilitation unit | Input |
| 149 | Personnel | Number of orthotists in the health centre/region/rehabilitation unit | Input |
| 150 | Personnel | Number of nurses in the rehabilitation unit | Input |

*Source: own elaboration based on the results of the literature review*

*Table 1 Selection of indicators. Secondary prevention.*

| | Sub-dimension | Indicator description | Type |
|---|---|---|---|
| 155 | Management | Whether regions have set a plan and targets for secondary prevention | Input |
| 156 | Management | Whether there is collaboration between multi-disciplinary teams for implementing secondary stroke prevention strategies on modifiable risk factor control | Output |
| 157 | Management | Whether there are integrated care services/ continuum of care for secondary stroke prevention | Output |

| | Sub-dimension | Indicator description | Type |
|---|---|---|---|
| 158 | Management | % of stroke survivors who are discharged from acute care with a personalised plan for secondary prevention (i.e. with an appropriate prescription, addressing risk factors) | Output |
| 159 | Assessment | % of stroke survivors who are evaluated for cardiovascular and stroke risk factors (at discharge, during a follow-up consultation) | Output |
| 160 | Assessment | Whether patients' adherence and tolerance to treatment (either medical treatment or re-education) is assessed | Output |
| 161 | Assessment | % of stroke survivors who are re-evaluated after a recurrent stroke | Output |
| 162 | Intervention | % of stroke survivors who engage in secondary prevention | Output |
| 163 | Intervention | % of stroke survivors who receive secondary prevention advice/ educational intervention (i.e. advice on changes to lifestyle or medications for preventing another stroke) | Output |
| 164 | Intervention | % of stroke survivors who are informed about stroke symptoms and the need to call emergency services if they have these symptoms | Output |
| 165 | Intervention | % of stroke survivors' caregivers who receive training on secondary prevention (e.g. risk factors, control measures, etc.) | Output |
| 166 | Clinical factors | % of stroke survivors who follow a medical treatment to prevent a second stroke | Output |
| 167 | Clinical factors | % of stroke survivors who are prescribed aspirin one year after discharge | Output |
| 168 | Clinical factors | % of stroke survivors discharged with a prescription of an antiplatelet agent / antiaggregant | Output |
| 169 | Clinical factors | % of stroke survivors who are offered oral anticoagulation (and under which criteria) | Output |
| 170 | Clinical factors | % of stroke survivors discharged with a blood pressure lowering therapy | Output |
| 171 | Clinical factors | % of stroke survivors who are prescribed anti-hypertensives for secondary prevention | Output |
| 172 | Clinical factors | % of stroke survivors who follow Statin therapy (lipid modification therapy) | Output |
| 173 | Clinical factors | % of stroke survivors who receive antithrombotic therapy | Output |
| 174 | Clinical factors | % of stroke survivors with diabetes who have their haemoglobin under control | Outcome/impact |
| 175 | Clinical factors | % of stroke survivors who have their glucose levels under control | Outcome/impact |
| 176 | Clinical factors | % of stroke survivors who have their levels of LDL-cholesterol under control | Outcome/impact |

| | Sub-dimension | Indicator description | Type |
|---|---|---|---|
| 177 | Clinical factors | Whether patients with 70–99% stenosis have Carotid endarterectomy (CEA) (+ when does this take place) | Output |
| 178 | Clinical factors | Whether patients with less than 50% stenosis have Carotid endarterectomy (CEA) (not recommended) | Output |
| 179 | Clinical factors | Whether patients have carotid percutaneous transluminal angioplasty and/or stenting (CAS)(only recommended in selected patients) | Output |
| 180 | Clinical factors | % of stroke survivors who are examined to detect atrial fibrillation | Output |
| 181 | Lifestyle | % of stroke survivors who stop smoking | Outcome/impact |
| 182 | Lifestyle | % of stroke survivors who limit their alcohol consumption | Outcome/impact |
| 183 | Lifestyle | % of stroke survivors who have a diet low in salt and saturated fat, high in fruit and vegetables, and rich in fibre | Outcome/impact |
| 184 | Lifestyle | % of stroke survivors with an elevated body mass index that adopt a weight- reducing diet | Output |
| 185 | Lifestyle | % of stroke survivors who do regular physical activity | Outcome/impact |

*Source: own elaboration based on the results of the literature review*

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# ANNEXES

*Table 2 Selection of indicators. Pathway*

| | Sub-dimension | Indicator description | Type |
|---|---|---|---|
| 1 | Trajectory | Whether the hospital provides on-site in-patient rehabilitation services for stroke patients prior to discharge | Output |
| 2 | Trajectory | % of stroke survivors who return **home** and do not follow outpatient rehabilitation | Output |
| 3 | Trajectory | % of stroke survivors who return **home** and follow **outpatient** rehabilitation (e.g. Day Hospital, visits with a therapist) | Output |
| 4 | Trajectory | % of stroke survivors who return **home** and follow an **intensive** rehabilitation **program at home** | Output |
| 5 | Trajectory | % of stroke survivors who return **home** and follow **maintenance therapy** offered by home care services | Output |
| 6 | Trajectory | % of stroke survivors who follow a rehabilitation program at an **inpatient rehabilitation** facility (e.g. SSR institution in France) | Output |
| 7 | Trajectory | % of stroke survivors who are referred to a **long-term care facility** (e.g. USLD in France)/nursing home | Output |
| 8 | Trajectory | % of stroke survivors transferred to inpatient rehabilitation facility specialised in neurological issues | Output |
| 9 | Trajectory | % of stroke survivors transferred to inpatient rehabilitation facility specialised in geriatrics | Output |
| 10 | Trajectory | Time between discharge or referral and when the service started to treat the patient | Output |
| 11 | Trajectory | Early discharge from acute care (to inpatient rehabilitation unit or to community) is supported for medically stable patients with mild or moderate impairment | Output |
| 12 | Trajectory | Number of patients with early admission to rehabilitation (approx. first 30 days) | Output |
| 13 | Trajectory | Number of patients with very early admission to rehabilitation (approx. first hours) | Output |
| 14 | Trajectory | Whether stroke patients can transfer among the trajectories | Output |
| 15 | Trajectory | Whether stroke patients can be re-referred back to a service (after the patient has been discharged by the same service for the same condition at the same location) | Output |

| | | | |
|---|---|---|---|
| 16 | Trajectory | Duration of the rehabilitation treatment/services (in number of appointments, or in weeks/months) | Output |
| 17 | Trajectory | % of patients who have access to ongoing rehabilitation therapy beyond 3–6 months | Output |
| 18 | Management | Whether the regional stroke plan covers the rehabilitation phase | Input |
| 19 | Management | Whether the national stroke plan covers the rehabilitation phase | Input |
| 20 | Management | Whether a coordinated plan for rehabilitation is established between the different health professionals who treat the patient | Input |
| 21 | Management | Whether there are set discharge criteria (and if yes, mention which ones) | Input |
| 22 | Management | Whether there are set criteria to determine the patient pathway (and if yes, mention which ones) (e.g. Disability level, age, physical/occupational/speech/psychology therapy services available) | Input |
| 23 | Management | Whether the hospital refers discharged stroke patients for off-site in-patient rehabilitation services (to nursing homes, geriatric hospitals, rehabilitation hospitals, psychiatric hospitals, non-acute hospitals) | Input |
| 24 | Management | Whether the hospital refers discharged stroke patients to other institutions for outpatient rehabilitation | Input |
| 25 | Management | Whether the hospital refers discharged stroke patients to community rehabilitation services | Input |

*Source: own elaboration based on the results of the literature review*

***Table 3 Selection of indicators. Follow-up***

| | Sub-dimension | Indicator description | Type |
|---|---|---|---|
| 26 | Assessment | Whether patients' situation is assessed at the point of discharge/Whether the organisation or the region performs an initial stroke rehabilitation assessment | Output |
| 27 | Assessment | Whether a rehabilitation assessment is performed in the first 24h/Whether the patient situation is assessed by a specialist in rehabilitation the first day after admission | Output |
| 28 | Assessment | Whether a rehabilitation assessment is performed in the first 48h | Output |

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|---|---|---|---|
| 29 | Assessment | Patients are assessed for rehabilitation needs within the first three days after admission and provided with rehabilitation by multidisciplinary staff on the basis of need | Output |
| 30 | Assessment | % of rehabilitation assessments that are performed later than 48h | Output |
| 31 | Assessment | Patients are offered a review after the stroke for assessment of medical and rehabilitation needs: 'n. of patients with follow-up / total n. of patients treated' | Outcome/impact |
| 32 | Assessment | Whether patients are assessed 3 months after starting rehabilitation therapy | Outcome/impact |
| 33 | Assessment | Whether patients' situation is assessed when the rehabilitation phase finishes | Outcome/impact |
| 34 | Assessment | Whether 6-month reviews are performed | Outcome/impact |
| 35 | Recovery | Amount (degree) of recovery (at different points of time, % of recovery after rehabilitation) for stroke survivors (average) | Outcome/impact |
| 36 | Recovery | Average number of weeks to 80% Best Recovery as measured by the Barthel Index (BI) or the Scandinavian Stroke Scale (SSS) (Speed of recovery ) | Outcome/impact |
| 37 | Recovery | Average number of weeks to 95% Best Recovery as measured by the Barthel Index (BI) or the Scandinavian Stroke Scale (SSS) (Speed of recovery ) | Outcome/impact |
| 38 | Recovery | 3-month re-hospitalisation rate | Outcome/impact |
| 39 | Recovery | % of stroke patients who are returned to the community after their stroke and then within six-months or one-year require admission to a long-term care facility | Outcome/impact |
| 40 | Recovery | % of deaths during rehabilitation | Outcome/impact |
| 41 | Sequelae | International Classification of Functioning, Disability and Health (ICF). Values for stroke survivors (when leaving acute care; after a specific period: 1 month, 6 months, 1 year, 5 years, etc.) | Outcome/impact |

| | | | |
|---|---|---|---|
| 42 | Sequelae | Stroke severity computed using the National Institutes of Health Stroke Scale (NIHSS) | Outcome/impact |
| 43 | Sequelae | Stroke severity computed using the Canadian Neurological Stroke Scale (CNSS) | Outcome/impact |
| 44 | Sequelae | Stroke severity computed on the basis of functional independence measure (FIM) scores | Outcome/impact |
| 45 | Sequelae | Stroke severity computed on the basis of the AlphaFIM (an abbreviated 6-item version of the 18-item FIM instrument) | Outcome/impact |
| 46 | Sequelae | Système de mesure d'autonomie fonctionnelle (SMAF) as a measure of functional independence | Outcome/impact |
| 47 | Sequelae | Fugl-Meyer Assessment Scale (FMAS) | Outcome/impact |
| 48 | Sequelae | Barthel Index (BI) | Outcome/impact |
| 49 | Sequelae | SAFE score (shoulder abduction finger extension, range 0–10) to predict the potential for upper limb recovery in individual patients | Outcome/impact |
| 50 | Sequelae | Modified Rankin Scale (mRS) | Outcome/impact |
| 51 | Sequelae | Berg scale | Outcome/impact |
| 52 | Sequelae | Motor Index Score (MIS) | Outcome/impact |
| 53 | Sequelae | Trunk control test | Outcome/impact |
| 54 | Sequelae | ADL scale to assess patients' autonomy or disabilities | Outcome/impact |

| | | | |
|---|---|---|---|
| 55 | Sequelae | IADL (Instrumental. Activities of Daily Living) | Outcome/impact |
| 56 | Sequelae | SOFMER scale to assess patients' autonomy or disabilities | Outcome/impact |
| 57 | Sequelae | AGGIR scale to assess patients' autonomy or disabilities | Outcome/impact |
| 58 | Sequelae | Glasgow Coma Score (CGS) | Outcome/impact |
| 59 | Sequelae | Charlson score of co-morbidities | Outcome/impact |
| 60 | Sequelae | Orpington Prognostic Scale (OPS) | Outcome/impact |
| 61 | Sequelae | Scandinavian Stroke Scale (SSS) | Outcome/impact |
| 62 | Sequelae | Score of physical dependency (dressing, displacement and locomotion, eating, incontinence) | Outcome/impact |
| 63 | Sequelae | Gait speed | Outcome/impact |
| 64 | Sequelae | % of patients who suffer loss of arm function | Outcome/impact |
| 65 | Sequelae | % of patients who suffer spasticity | Outcome/impact |
| 66 | Sequelae | % of patients with motor impairment | Outcome/impact |
| 67 | Sequelae | % of patients with speech and language impairments/ communication problems | Outcome/impact |

| | | | |
|---|---|---|---|
| 68 | Sequelae | % of patients with swallowing impairments | Outcome/impact |
| 69 | Sequelae | % of patients with vision impairments | Outcome/impact |
| 70 | Sequelae | % of patients with cognitive impairments | Outcome/impact |
| 71 | Sequelae | % of patients with post-stroke fatigue | Outcome/impact |
| 72 | Economic consequences | % of patients who were employed before the stroke that do not return to work | Outcome/impact |
| 73 | Economic consequences | Average time to work re-entry | Outcome/impact |
| 74 | Economic consequences | Income loss from stroke- related morbidity (e.g. annual number of certified days off work from stroke * mean daily earnings) | Outcome/impact |
| 75 | Economic consequences | Direct income payments that stroke survivors receive related to stroke morbidity | Outcome/impact |
| 76 | Economic consequences | % of patients who return to work but in different conditions (e.g. a permanent change of job or employer, reduction of working hours, the survivor is officially accredited as a handicapped worker) | Outcome/impact |
| 77 | QoL sequelae | DALYs | Outcome/impact |
| 78 | QoL sequelae | Quality-Adjusted Life Year (QALY) | Outcome/impact |
| 79 | QoL sequelae | Health-related quality of Life | Outcome/impact |
| 80 | QoL sequelae | Patients' Mental Health-related quality of Life | Outcome/impact |

| | | | |
|---|---|---|---|
| 81 | QoL sequelae | Frenchay activities index (FAI) | Outcome/impact |
| 82 | QoL sequelae | Satisfaction With Life Scale (SWLS) (for patients) | Outcome/impact |
| 83 | QoL sequelae | % of patients who suffer depression | Outcome/impact |
| 84 | QoL sequelae | Level of social participation of stroke patients | Outcome/impact |
| 85 | QoL sequelae | Score of psychic dependency (behaviour and social relations, communication) | Outcome/impact |
| 86 | Caregivers sequelae | % of caregivers who have emotional problems after one year of caring for a stroke victim | Outcome/impact |
| 87 | Caregivers sequelae | % of informal caregivers (relatives) who are experiencing an important burden | Outcome/impact |
| 88 | Caregivers sequelae | % of informal caregivers who return to work (or % who need to leave their job/reduce their working hours) | Outcome/impact |
| 89 | Caregivers sequelae | Satisfaction With Life Scale (SWLS) (for caregivers) | Outcome/impact |
| 90 | Caregivers sequelae | Daily Caregiving Diary (DCD) | Outcome/impact |
| 91 | Caregivers sequelae | Carers' Assessment of Satisfactions Index (CASI) | Outcome/impact |
| 92 | Caregivers sequelae | Carers 'Assessment of Managing Index (CAMI) | Outcome/impact |
| 93 | Caregivers sequelae | % of caregivers who suffer depression | Outcome/impact |

| | | | |
|---|---|---|---|
| 94 | Caregivers sequelae | caregivers' Health-related quality of Life | Outcome/impact |
| 95 | Caregivers sequelae | caregivers' Mental Health-related quality of Life | Outcome/impact |

*Source: own elaboration based on the results of the literature review*

*Table 4 Selection of indicators. Resources*

| | Sub-dimension | Indicator description | Type |
|---|---|---|---|
| 96 | General | Number of stroke rehabilitation units in the region | Input |
| 97 | General | Number of rehabilitation beds available (e.g. rehabilitation beds per million population) | Input |
| 98 | Therapies | % of patients who follow a task-specific therapeutic approach | Output |
| 99 | Therapies | % of patients who follow high-intensity therapy | Output |
| 100 | Therapies | % of patients who follow repetitive-task training | Output |
| 101 | Therapies | Whether the patient follows an **exercising** programme/ aerobic exercise training/ fitness training | Output |
| 102 | Therapies | % of patients who follow **occupational** therapy | Output |
| 103 | Therapies | Whether patients follow **adaptive** support programs (e.g. Teaching of compensatory and adaptive techniques) | Output |
| 104 | Therapies | % of patients who follow **device-based and adjunctive therapies** (e.g.robotic arms, body-weight support treadmills) | Output |
| 105 | Therapies | % of patients who follow a **constraint-induced movement therapy** (CIMT) | Output |
| 106 | Therapies | % of patients who follow a **functional electrostimulation** | Output |
| 107 | Therapies | Whether the organisation/the region provides stroke rehabilitation to improve **cognition** | Output |
| 108 | Therapies | Whether the organisation/the region provides stroke rehabilitation of **swallowing and dysphagia** | Output |
| 109 | Therapies | Whether the organisation/the region provides stroke rehabilitation to improve **communication and aphasia** | Output |

| | | | |
|---|---|---|---|
| 110 | Therapies | % of patients who use telemedicine service/ **tele-rehabilitation** | Output |
| 111 | Therapies | % of patients who use **virtual reality** in their treatment | Output |
| 112 | Therapies | % of patients who follow a **pharmacological** treatment | Output |
| 113 | QoL services | Patients and their family/carers have access to practical and **emotional** support | Output |
| 114 | QoL services | Whether patients are offered equipment to help them in **daily activities** such as cooking, entering the shower/bath, moving outside their home, driving, etc. | Output |
| 115 | QoL services | Whether the patient receives support for **work re-entry** (training, occupational therapy, professional orientation, vocational rehabilitation programmes, etc.) | Output |
| 116 | QoL services | Whether the organisation/the region offers services to assist the person to reintegrate into the **community** (e.g. services that encourage stroke survivors to socialize, to exercise, and to participate in meaningful activities) | Output |
| 117 | Services for caregivers | Whether the organisation/the region offers caregiver assessment and training | Output |
| 118 | Services for caregivers | Whether the organisation/the region offers respite services to caregivers | Output |
| 119 | Use and cost of rehabilitation services | Average amount of direct therapy received from each rehabilitation discipline each day (Min/Day) | Input |
| 120 | Use and cost of rehabilitation services | Hours of rehabilitation therapy per week | Input |
| 121 | Use and cost of rehabilitation services | Average total hours of therapy (average number of weeks * sessions per week * length of session in minutes). Calculated for each type of therapy (physical, occupational, speech) and for each setting (primary care, community day hospital, residential rehabilitation, outpatient rehabilitation, nursing home, community team rehabilitation, community stroke team) | Input |

| | | | |
|---|---|---|---|
| 122 | Use and cost of rehabilitation services | Total cost of in-patient rehabilitation care | Input |
| 123 | Use and cost of rehabilitation services | Annual hospital beds for stroke rehabilitation spent in the region | Input |
| 124 | Use and cost of rehabilitation services | Days spent in a rehabilitative care facility (i.e. in-patient care) | Input |
| 125 | Use and cost of rehabilitation services | Days spent in a long-term care facility or nursing home / Cost of stay in a nursing home/residential home/sheltered home (mean length of stay in days & unit cost per week) | Input |
| 126 | Use and cost of rehabilitation services | National Average Hours of Physiotherapy for Stroke Survivors in a nursing home (the same but for occupation therapy and speech and language therapy) | Input |
| 127 | Use and cost of rehabilitation services | National Average Hours of Physiotherapy for Stroke Survivors in outpatient rehabilitation (non-acute) (the same but for occupation therapy and speech and language therapy) | Input |
| 128 | Use and cost of rehabilitation services | hours of paid home nursing | Input |
| 129 | Use and cost of rehabilitation services | hours of paid home help/ use of paid home help * national mean hourly wage rate | Input |
| 130 | Use and cost of rehabilitation services | unpaid home caregiving hours (+ converted to money, e.g. Using the hourly gross cost of social care)/ use of unpaid home care * hourly wage for over 65 years of age, unemployed or economically inactive carers | Input |

| | | | |
|---|---|---|---|
| 131 | Use and cost of rehabilitation services | Cost of providing community services for stroke survivors | Input |
| 132 | Use and cost of rehabilitation services | Number of meals on wheels received by stroke patients discharged home at 90 days | Input |
| 133 | Use and cost of rehabilitation services | Number of medical consultations | Input |
| 134 | Use and cost of rehabilitation services | Number of follow-up visits with a neurologist | Input |
| 135 | Use and cost of rehabilitation services | Number of visits with a GP/ visits * unit cost | Input |
| 136 | Use and cost of rehabilitation services | Number of physical therapy sessions /visits with a physiotherapist (* unit cost) | Input |
| 137 | Use and cost of rehabilitation services | Visits with an occupational therapist * unit cost | Input |
| 138 | Use and cost of rehabilitation services | Number of speech therapy sessions/visits with a speech therapist (* unit cost) | Input |
| 139 | Use and cost of rehabilitation services | Number of visits with a nurse | Input |

| | | | |
|---|---|---|---|
| 140 | Use and cost of rehabilitation services | Cost of drug consumption (Antihypertensive, Antithrombotic, antidepressant, etc.) | Input |
| 141 | Personnel | The regions' Stroke Rehabilitation Program counts with an **interdisciplinary team of professionals** experienced in and dedicated to the care of the patient with stroke | Input |
| 142 | Personnel | Number of medical doctors specialising in rehabilitation in the health centre who mainly focus on stroke patients | Input |
| 143 | Personnel | Number of physical therapists in the health centre/region/rehabilitation unit (e.g. Divided by the number of stroke survivors discharged with disability) | Input |
| 144 | Personnel | Number of occupational therapists in the health centre/region/rehabilitation unit (e.g. Divided by the number of stroke survivors discharged with disability) | Input |
| 145 | Personnel | Number of speech and language therapists in the health centre/region/rehabilitation unit (e.g. Divided by the number of stroke survivors discharged with disability) | Input |
| 146 | Personnel | Number of clinical psychologists in the health centre/region/rehabilitation unit | Input |
| 147 | Personnel | Number of geriatricians in the health centre/region/rehabilitation unit | Input |
| 148 | Personnel | Number of social workers in the health centre/region/rehabilitation unit | Input |
| 149 | Personnel | Number of orthotists in the health centre/region/rehabilitation unit | Input |
| 150 | Personnel | Number of nurses in the rehabilitation unit | Input |
| 151 | Personnel | Total cost of rehabilitation personnel in the region | Input |
| 152 | Personnel | Total Whole Time Equivalent (WTE) for each staff disciplines within each service type | Input |
| 153 | Personnel | Whole Time Equivalent per 10 stroke beds (in-patient care) | Input |
| 154 | Personnel | Whole Time Equivalent per 100 stroke patients (outpatient care, domiciliary services) | Input |

*Source: own elaboration based on the results of the literature review*

*Table 2 Selection of indicators. Secondary prevention.*

| | Sub-dimension | Indicator description | Type |
|---|---|---|---|
| 155 | Management | Whether regions have set a plan and targets for secondary prevention | Input |
| 156 | Management | Whether there is collaboration between multi-disciplinary teams for implementing secondary stroke prevention strategies on modifiable risk factor control | Output |
| 157 | Management | Whether there are integrated care services/ continuum of care for secondary stroke prevention | Output |
| 158 | Management | % of stroke survivors who are discharged from acute care with a personalised plan for secondary prevention (i.e. with an appropriate prescription, addressing risk factors) | Output |
| 159 | Assessment | % of stroke survivors who are evaluated for cardiovascular and stroke risk factors (at discharge, during a follow-up consultation) | Output |
| 160 | Assessment | Whether patients' adherence and tolerance to treatment (either medical treatment or re-education) is assessed | Output |
| 161 | Assessment | % of stroke survivors who are re-evaluated after a recurrent stroke | Output |
| 162 | Intervention | % of stroke survivors who engage in secondary prevention | Output |
| 163 | Intervention | % of stroke survivors who receive secondary prevention advice/ educational intervention (i.e. advice on changes to lifestyle or medications for preventing another stroke) | Output |
| 164 | Intervention | % of stroke survivors who are informed about stroke symptoms and the need to call emergency services if they have these symptoms | Output |
| 165 | Intervention | % of stroke survivors' caregivers who receive training on secondary prevention (e.g. risk factors, control measures, etc.) | Output |
| 166 | Clinical factors | % of stroke survivors who follow a medical treatment to prevent a second stroke | Output |
| 167 | Clinical factors | % of stroke survivors who are prescribed aspirin one year after discharge | Output |
| 168 | Clinical factors | % of stroke survivors discharged with a prescription of an antiplatelet agent / antiaggregant | Output |
| 169 | Clinical factors | % of stroke survivors who are offered oral anticoagulation (and under which criteria) | Output |
| 170 | Clinical factors | % of stroke survivors discharged with a blood pressure lowering therapy | Output |
| 171 | Clinical factors | % of stroke survivors who are prescribed anti-hypertensives for secondary prevention | Output |

| | Sub-dimension | Indicator description | Type |
|---|---|---|---|
| 172 | Clinical factors | % of stroke survivors who follow Statin therapy (lipid modification therapy) | Output |
| 173 | Clinical factors | % of stroke survivors who receive antithrombotic therapy | Output |
| 174 | Clinical factors | % of stroke survivors with diabetes who have their haemoglobin under control | Outcome/impact |
| 175 | Clinical factors | % of stroke survivors who have their glucose levels under control | Outcome/impact |
| 176 | Clinical factors | % of stroke survivors who have their levels of LDL-cholesterol under control | Outcome/impact |
| 177 | Clinical factors | Whether patients with 70–99% stenosis have Carotid endarterectomy (CEA) (+ when does this take place) | Output |
| 178 | Clinical factors | Whether patients with less than 50% stenosis have Carotid endarterectomy (CEA) (not recommended) | Output |
| 179 | Clinical factors | Whether patients have carotid percutaneous transluminal angioplasty and/or stenting (CAS)(only recommended in selected patients) | Output |
| 180 | Clinical factors | % of stroke survivors who are examined to detect atrial fibrillation | Output |
| 181 | Lifestyle | % of stroke survivors who stop smoking | Outcome/impact |
| 182 | Lifestyle | % of stroke survivors who limit their alcohol consumption | Outcome/impact |
| 183 | Lifestyle | % of stroke survivors who have a diet low in salt and saturated fat, high in fruit and vegetables, and rich in fibre | Outcome/impact |
| 184 | Lifestyle | % of stroke survivors with an elevated body mass index that adopt a weight- reducing diet | Output |
| 185 | Lifestyle | % of stroke survivors who do regular physical activity | Outcome/impact |

*Source: own elaboration based on the results of the literature review*