

A Progressive Stroke Pathway

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1. Foreword



The [2019-20 Programme for Government](#) set out the Scottish Government's commitments on stroke care, including the ambition to scope and define a progressive model of stroke care.

As Chair of the National Advisory Committee for Stroke (NACS), I am pleased to have been able to lead this work. However, this document is the result of a huge amount of work by a large number of people who have committed their time during the COVID pandemic to describe The Progressive Stroke Pathway.

NACS is the national group which coordinates implementation of the [Stroke Improvement Plan](#) and aims to promote Scotland-wide collaboration, peer support and dissemination of best practice in the prevention, diagnosis, treatment and long-term management of stroke.

The Progressive Stroke Pathway draws on the expertise of a wide range of clinicians, as well as those with lived experience of stroke and the current treatment and rehabilitation pathway, to describe what we think progressive stroke care in Scotland should comprise. The pathway sets out an ambitious vision of a stroke service that fully meets the holistic needs of patients, as well as envisioning how future uses of novel technology and an evolving workforce can be incorporated into a progressive stroke service.

At every stage of the Progressive Stroke Pathway, we have outlined recommendations, based on best practice, clinical views and the experiences of stroke survivors.

Going forward, NACS will work with the Scottish Government, and continue to liaise with third sector organisations and those with lived experience, to support the delivery of the commitments in stroke care outlined in the Programme for Government.

A handwritten signature in black ink that reads "M.S. Dennis". The signature is written in a cursive, flowing style.

Professor Martin Dennis

Chair, National Advisory Committee for Stroke (NACS)

2. Introduction

Stroke develops as a result of problems with the blood vessels supplying blood to the brain.

There were 3,754 deaths in Scotland in 2019 where cerebrovascular disease, including stroke, was the underlying cause. While there has been a decrease in deaths due to stroke over the last decade, it is important to note that it remains a leading cause of death and the leading cause of disability in Scotland¹. This highlights that there is still work to do to improve prevention of, and outcomes from, stroke and to ensure that people across Scotland have equitable access to treatment and care.

Stroke remains a national clinical priority for Scottish Government. The [2019/20](#) and [2020/21](#) Programmes for Government made a number of commitments on stroke, including commitments to develop a national thrombectomy service and to '*scope out and define what a progressive stroke service looks like*'.

This document defines a progressive stroke pathway in the Scottish context and sets out a vision of stroke services in Scotland. It has been produced by the National Advisory Committee for Stroke (NACS) in collaboration with the groups and individuals outlined in [section 13 \(Acknowledgements\)](#). We are grateful to the many health care professionals who shared their expertise with us, and to the National Stroke Voices who shared their lived experience of stroke to support the development of this document. A refreshed Stroke Improvement Plan will follow to support in the delivery of this vision.

The infographic below depicts an overview of the 'Progressive stroke pathway' defined in this document. This pathway includes prevention, recognition of stroke, transfer to hospital, hyperacute and acute care through to rehabilitation and supported self-management.

Stroke symptoms appear:

1. Recognition by individual, prompting health-seeking behaviour.
2. Appropriate awareness and onward referral by Healthcare professionals.

Acute Stroke Suspected, transfer to hospital:

1. Improved pre-hospital assessments, enabled by better training and access to stroke specialists via technology and improved diagnostic tools.
2. Pre-alert including CHI number enabling quicker action upon arrival at hospital

TIA or Minor stroke suspected:

1. Early specialist assessment
2. Early access to investigations
3. Early initiation of treatment
4. Onward referral where necessary
5. Follow-up

Assessment/diagnosis (to determine diagnosis and assess eligibility for hyperacute stroke treatments):

1. Effective interface/collaboration with emergency department (as initial receivers)
2. Early access to investigations
3. Assessment for hyperacute treatment eligibility should take place immediately and by a stroke specialist.

Eligible for Thrombolysis:

1. Reduction in Door-to-Needle times across Scotland
2. Role of stroke nurse/interface with ED
3. Care in a stroke unit for post thrombolysis monitoring

Intracerebral Haemorrhage:

1. Care provided within Stroke Unit if no surgical intervention required
2. Engagement with local or regional neurosurgical teams where necessary

Eligible for Thrombectomy:

1. Timely transfer to Comprehensive Stroke Centre
2. Care delivered within a stroke unit enabling increased monitoring post intervention.
3. Specialist staff with recognised training experience
4. Repatriation protocols in place

Acute Care:

1. Delivery of stroke care bundle
2. Provision of care within stroke unit
3. End of life care where appropriate

Rehabilitation:

1. Started early in person's journey
2. Person-centred and holistic
3. Appropriate frequency and intensity
4. Provided by an interdisciplinary team
5. Delivered in appropriate setting
5. Appropriate follow-up
6. Supported self-management

There are number of principles underpinning delivery of a progressive stroke pathway. These include the principles of Realistic Medicine, the importance of good information technology (IT) and digital systems to facilitate seamless delivery of care, and an effective research environment.

2.1.1 Realistic Medicine and shared decision making

Delivery of a Realistic Medicine approach means ensuring that people who experience stroke are supported to take part in shared decision making about their treatment and care, to ensure that what matters to them is at the heart of the delivery of care throughout the whole pathway.

This should be incorporated into all aspects of the progressive stroke pathway. Specific shared decision-making tools, including those which facilitate sharing of individualised information about patients' diagnosis, prognosis and treatments and goal setting, can support such an approach.

Involvement of specific healthcare staff such as speech and language therapy for patients with communication difficulties, and clinical psychology for those with cognitive problems, can further enable communication and shared decision making.

2.1.2 Information technology (IT)

The delivery of a progressive stroke pathway is facilitated by digital health systems which facilitate networking between clinicians, the use of artificial intelligence (AI) in decision making, the ability to support the movement of patients across different NHS Boards and enable digital models of care to provide people with stroke access to remote care and self-management tools based on their needs and preferences.

In a progressive stroke pathway, stroke services should have access to systems which:

- Support shared electronic health record keeping, reduce duplication and allow information sharing across a network of care along the whole pathway.
- Plan, prompt and record important aspects of care digitally to optimise delivery whilst making best use of clinicians' time.
- Support secure communication (voice, video, text, shared documents and images) between clinicians working across networks.
- Alert a responsible clinician or team to referrals or abnormal investigations to maximise safety and minimise delays.
- Capture data in real-time for audit/quality improvement and monitoring as a by-product of clinical care.
- Support healthcare professionals in using "Tailored Talks". This is a tool which facilitates the provision of tailored digital information and/or signposting for patients, their relatives and carers.
- Establish electronic documentation for remote consultation outcomes (e.g. Clinical Portal) when cases are referred and discussed. An audit trail of

referrals, decisions and outcomes will help inform practice development and processes.

2.1.3 Research

Clinical research has an important function in delivering progressive stroke services. It helps to produce the knowledge on which to base more effective stroke services and ensures that healthcare staff are aware of the most up-to-date evidence and the latest developments in diagnostics and treatment. To facilitate continued clinical research activity, it is important to:

- Maintain the research infrastructures (e.g., University departments, NHS Research & Development, the Scottish Stroke Research Network (SRN) and Cochrane Stroke Review Group) which have helped make Scotland one of the leading countries for stroke research worldwide.
- Ensure that stroke patients and their families or carers can shape and participate in research in all parts of their pathway, wherever they are being cared for.

3. Governance

This vision document will be supported by a refreshed Stroke Improvement Plan, the delivery of which will be overseen by the National Advisory Committee on Stroke, and monitored through the Scottish Stroke Care Audit and Scottish Stroke Improvement Programme.

While Scottish Government sets the overall policy direction and vision, NHS Boards have a statutory responsibility for the delivery of health care within their area. It is therefore important that NHS Boards seek to deliver the vision outlined within this document, giving an equivalent level of prioritisation to stroke services as outlined by Scottish Government.

To achieve this requires that:

- NHS Boards have a clear management structure for stroke services relating to the whole patient pathway covering inpatients, outpatients and community services.
- Each NHS board should identify a member of their Senior Management Team to be accountable for the delivery of stroke services.
- Managed Clinical Networks (MCNs) should serve to coordinate professionals, services and organisations to ensure equitable, high quality clinical services.
- MCNs should operate with clear clinical and operational leadership to connect services via service pathways.
- Stroke services should coordinate across clinical, professional and service pathways, and be tailored to individual needs based on a range of personal, environmental and social factors.
- Stroke services should capture data which reflects performance in real-time, to support quality improvement activities.

- The NHS Board senior management team should take responsibility for ensuring that stroke services meet all important quality indicators within the Scottish Stroke Care Audit.
- NHS Boards should, where necessary, work collaboratively with other NHS Boards in the delivery of services. This is essential in the delivery of thrombectomy, which requires a national approach, and for thrombolysis, vascular surgery and sometimes TIA and rehabilitation services, which often require a regional approach.
- NHS Boards should work as part of integrated joint boards, alongside social care delivery partners and the third sector to deliver effective rehabilitation and supported self-management.

4. Primary Prevention

This refers to interventions aimed at reducing the risk of a stroke in people who have not yet had a stroke. This is distinct from secondary prevention which aims to reduce the risk of a recurrent stroke.

A progressive stroke pathway should focus preventative efforts on the identification and treatment of atrial fibrillation (AF) and raised blood pressure which are of specific importance to reduce the incidence of stroke. Secondary prevention (detection of AF or high blood pressure after stroke) is also important and more fully addressed within [Section 7.3: Access to imaging and other investigations](#).

Actions on other risk factors for cardiovascular disease, including stroke, such as obesity ([A Healthier Future: Scotland's Diet & Healthy Weight Delivery Plan 2018](#)), smoking ([Raising Scotland's Tobacco-Free Generation: Tobacco Control Action Plan 2018](#)) and alcohol consumption ([Alcohol Framework 2018: Preventing Harm](#)) are covered by other Scottish Government policy commitments and therefore are out of scope for this document.

Improving the primary identification and management of AF and blood pressure will involve a focus on improving data collection in primary care to better measure improvement, supporting community models of detection, and improving access to technology to support self-management.

4.1 Recommendations

1. Encourage improved detection, diagnosis and management of AF and high blood pressure, through quality improvement within primary care and community settings.
2. Support the development of pathways of care for AF which ensure prompt assessment and, where appropriate, treatments including anticoagulation, ablation and left atrial appendage occlusion to reduce the risk of future stroke.

3. Enable the use of proven technology to support detection, tele-monitoring and the provision of tailored self-management support for people with risk factors for stroke such as high blood pressure or AF.

5. Recognition and Referral

Raising and maintaining awareness of the symptoms of stroke and transient ischaemic attack (TIA) in the population, its recognition, and the need to immediately seek help are key to optimising treatment and outcomes.

5.1 Improving individual awareness and recognition of stroke

The FAST campaign is a UK wide awareness campaign designed to help detect and enhance responsiveness to the needs of a person having a stroke. The acronym stands for:

- **F**acial drooping
- **A**rm weakness
- **S**peech difficulties
- **T**ime to call emergency services

Awareness campaigns should be shaped by evidence about what methods (e.g. TV/radio advertising, social media) most effectively reach target populations. It is especially important to consider how best to reach people who may face inequalities in access to information, or awareness of stroke. This includes:

- People for whom English is not a first language
- People living in areas of deprivation
- Younger people who may not be aware of their risk of stroke

5.2 Improving referral pathways

Early assessment and triage for people with stroke or TIA is important because the time windows for delivering the most effective interventions, such as thrombolysis, thrombectomy & commencement of secondary prevention, are measured in hours. The earlier treatment is started the more effective it is.

Most services in Scotland have a system in place to allow urgent patient referral for rapid specialist assessment, though unwarranted variation should be identified and addressed.

The National Stroke Voices highlighted the importance of raising awareness about recognition of stroke and TIA within primary care, and identified emergency departments as a key area for improvement. Targeted education on FAST and clear referral guidelines could support health care professionals to recognise symptoms and signs of stroke, including in circumstances where presentation may not be typical (for example where the FAST test might be negative, or where the person experiencing stroke is young).

5.2.1 Referral to TIA services

In instances where the symptoms of stroke have resolved rapidly and an acute stroke is not suspected, then the person should be referred into TIA services. Key aspects of these services are outlined in detail in [Section 5: TIA Services](#). The most common sources of referral to TIA services will be from primary care, emergency departments, ophthalmology/optometry services, medical wards and Scottish Ambulance Service. Clear pathways should be in place for all referrers.

In some locations TIA telephone hotlines are in place which allow paramedics, primary care clinicians and emergency department professionals to talk directly to a stroke physician at the time of the patient first accessing healthcare. This enables early specialist intervention and treatment whilst the patient is waiting to have the diagnosis and treatment refined.

All patients referred to TIA services should be told that they must not drive for one month - as per [Driver and Vehicle Licensing Agency \(DVLA\) recommendations](#) - and should be advised regarding current regulations around resuming driving. This should be supported by a robust and rapid electronic referral system e.g., SCI gateway or TRAK workbench, which should prompt driving advice and secondary prevention prescription. These referrals should be monitored, or have notification systems, to ensure prompt appointing to specialist review.

5.2.2 Suspected acute stroke – taking prompt action

In instances where symptoms of stroke persist and an acute stroke is suspected, the patient should be transferred by ambulance to the nearest ‘stroke ready’ hospital – that is a hospital with facilities to scan patients, offer hyperacute treatment with thrombolysis and provide assessment of eligibility for thrombectomy.

There are 25 such hospitals across Scotland, 22 of these are Acute Stroke Centres (ASCs). The remaining three are Comprehensive Stroke Centres (CSCs), which in addition to the facilities described above, can also deliver thrombectomy and neurosurgical interventions.

All stroke centres will have stroke units unless they serve a very small population (such as occurs in remote and rural areas where the essential features of a stroke unit are delivered within a single ward area). This is [described in more detail in Section 9.2](#).

In a progressive stroke pathway, it will be important to ensure ambulance response times are as short as possible, through appropriate assessment and prioritisation of emergency calls².

NHS 24 or 999 call handlers use algorithms to assess the urgency of calls and the likelihood that the person has had a stroke. Improved algorithms based on analysis of linked data about triage and resulting actual diagnoses could help reduce delays to effective treatments. Such an approach would be maximised by targeted training for call handlers in awareness and identification of stroke.

Ambulance crews should be supported with continued training in the most up-to date tools to improve diagnosis and assessment of the patients' need for hyperacute treatments and early secondary prevention.

Once the ambulance crew has made an assessment it is necessary to consider robust and transparent algorithms for the prioritisation of SAS resources, including air transfers, which take account of availability, the benefits and risks to the patient, the time urgency of the interventions and the cost effectiveness to ensure that the optimum improvement in outcomes from the available resources can be achieved. These should be developed through analysis of linked data from SAS and the Scottish Stroke Care Audit.

5.3 Recommendations

1. Effective campaigns to raise awareness of stroke and TIA, their impact on people who experience them, and tools for timely recognition should consider how best to reach people who may face inequalities in access to information, or awareness of stroke.
2. Support the use of FAST and work to embed other pre-hospital stroke tools - particularly those which support assessment for hyperacute treatment - in a standardised way across NHS 24, primary care and SAS.
3. Improved algorithms and training for NHS 24 or SAS call handlers and crews should be deployed to support the assessment of the urgency of calls and the likelihood that the patient has had a stroke, and enable effective prioritisation of SAS resources, including air transfers.
4. Ensure appropriate referral of people with all stroke events, including those with acute ongoing symptoms, acute but resolved symptoms and other stroke-like events.
5. Referral systems should prompt driving advice and secondary prevention prescription.
6. All patients referred to TIA services should be told not to drive for one month (as per DVLA recommendations) at the point of referral and advised on current regulations for resuming driving.

6. TIA Services

Many people who develop mild or transient symptoms which might represent a TIA or mild stroke do not require immediate admission to hospital but do need specialist assessment by a clinician experienced in stroke care, early access to investigations and same day initiation of treatment to reduce the risk of a disabling stroke.

TIA services aim to offer these functions flexibly and provide access to support to reduce long-term risks and optimise the person's physical, psychological and social outcomes.

These services may be delivered in a variety of settings including, but not limited to, specialist TIA outpatients' clinics. However, people with suspected TIA can also be supported effectively through the provision of services within ambulatory care units, stroke units, or through rapid inpatient ward reviews. A proportion of patients with TIA are seen in an Emergency Department. These models of care, so long as they are supported by stroke specialists and have early access to investigations, or backup from a TIA clinic, can provide excellent care which minimises the risk of further stroke.

The Scottish Stroke Care Audit does not fully capture or monitor routinely activity which takes place outside of TIA clinics as it has proven challenging to capture data in these more varied settings. This should be addressed to enable us to understand and compare all models of care for people with TIA.

The performance of TIA clinics is currently monitored by the Scottish Stroke Care Audit which measures the proportion of patients seen in the TIA clinics within 4 days of referral. Whilst the majority of services meet the standard of 80%, there remain opportunities for improvement and to address variation.

As the risk of recurrent stroke is higher in the first day or two following a TIA, the faster a person can be seen the better. Therefore, the Scottish Stroke Improvement Programme will work with services across Scotland to minimise delays.

At present, the Scottish Stroke Care Audit measures the referral time to TIA services, but there is an opportunity to look in more detail at the care for people who have experienced a TIA. Therefore, development of a TIA bundle including times to important investigations and treatments should be included within the audit.

6.1 Specialist assessment

Specialist assessment for people with suspected TIA helps to expedite additional imaging where this is necessary and ensure that a diagnosis and treatment plan is refined and tailored to the individual's needs. This should take place in a timely manner, as specified by relevant clinical guidelines.

Where in-person specialist assessment cannot always be rapidly available, TIA services should consider how targeted access to local or remote stroke specialists (for patients meeting agreed criteria) can minimise delay to time-sensitive interventions.

Due to the Covid-19 pandemic many NHS boards had started to incorporate virtual assessments using telephone and Near Me into their assessments. This more flexible approach has led to reduced waiting times for specialist input in some areas. It is important to ensure that where virtual assessments are performed, patients should have the same access to rapid investigations and immediate secondary prevention as those who are seen face-to-face.

6.2 Investigations

People with suspected TIA or minor ischaemic stroke require timely access to investigations to confirm a diagnosis and guide treatment.

High risk TIAs and patients with uncertain presentations may be assessed as inpatients, and so rapid access to necessary radiology and cardiac investigations should be available in both outpatient and inpatient settings. There should be a robust system in place to ensure that the results of radiology and cardiac investigation results are available rapidly and are flagged to the responsible clinicians.

Full details of access to investigations for people with suspected TIA or stroke is outlined in [Section 7.3: Access to imaging and other investigations](#).

6.3 Treatment and care

Where necessary, people seen in TIA services should be able to rapidly access appropriate support from a Multi-Disciplinary Team including speech and language therapy, occupational therapy, clinical psychology, orthotics, ophthalmology and orthoptics.

Some patients seen in TIA services turn out not to have had a TIA or stroke. Alternative pathways should be available if input is required from another specialist service. There should also be a system for rapid feedback to referrers when a person would not benefit from attendance at a TIA service, and clear communication of an alternative pathway or approach.

For people who are identified as having had a TIA, treatment involves access to secondary prevention medication and advice. All NHS Boards should therefore have accessible pathways and secondary prevention guidelines for TIA patient management, which should be up-to-date and responsive to change in the evidence base. These should ensure that:

- For TIA (with full recovery) antiplatelet agents and a statin should be commenced immediately (as per local guidance, including any necessary investigations) pending specialist review, unless specialist review is immediate.
- Guidelines should recommend which secondary prevention medication to prescribe but should also have a plan for situations where medication should not be stopped (e.g., for some cases - anticoagulants after TIA).
- Secondary preventative medications should be immediately available e.g., from ward stock, hospital pharmacy or written prescription to take straight to a 24/7 chemist.

People who have experienced a TIA or minor stroke may also require advice or onward referral to support them in their longer-term self-management. The following should be available from the TIA service:

- Referral to addiction support teams
- Ongoing driving advice and referral to the Scottish Driving Assessment Service when needed
- Recommendations to optimise physical activity and reduce sedentary behaviour, including referral to exercise services where appropriate
- Referral to Dietetics
- Vocational advice and support
- Recommendations to support emotional and psychological wellbeing including referral to psychological services where appropriate

Communication between health professionals following TIA assessment is important. There should be a rapid electronic communication system back to the referrer following assessment in a TIA service. If using a traditional dictated letter system, then the letter should be sent electronically and within 48 hours of the specialist assessment.

It is important that referrers are made aware of individual treatment targets:

- Remote blood pressure monitoring should be available where required e.g., FLORENCE programme or 24-hour ambulatory monitoring
- Selected patients may benefit from more aggressive lipid management aiming for lower LDL targets - where appropriate, pathways should be in place for this e.g., a pharmacist led stroke lipid clinic, primary care follow up system.
- Furthermore, any request to referrer to make urgent prescribing changes or other key changes to management should be transmitted immediately.

Following discharge from TIA services, patients who have experienced TIA or minor stroke should receive lifelong follow-up in primary care and long-term conditions monitoring. This will require ongoing education to support primary care professionals with:

- Current best practice for longer-term care of TIA or stroke survivors
- Managing stroke in people with co-existing conditions

- Current guidance and pathways for referring a person back to stroke services

Follow up appointments for people who have experienced TIA should be available when needed, potentially through the TIA clinic or a stroke liaison nurse team.

6.4 Recommendations

1. People with suspected TIA should have specialist assessment by a clinician experienced in stroke care, early access to investigations and same day initiation of treatment to reduce the risk of further stroke.
2. Where in-person specialist review cannot always be rapidly available, TIA services should consider how to enable access to local or remote stroke specialists for patients meeting agreed criteria.
3. There should be appropriate pathways in place for onward referral of people who have had neither stroke nor TIA but require input from another specialist service.
4. All NHS Boards should have accessible pathways and secondary prevention guidelines for TIA patient management.
5. TIA services should support the following, where required:
 - Referral to addiction support teams
 - Ongoing driving advice and referral to the Scottish Driving Assessment Service when needed
 - Recommendations to optimise physical activity and reduce sedentary behaviour, including referral to exercise services where appropriate.
 - Referral to Dietetics
 - Recommendations to support emotional and psychological wellbeing including referral to psychological services where appropriate
 - Vocational advice and support
6. The Scottish Stroke Care Audit should develop a TIA bundle which takes account of the varied models of providing care for people with TIA.

7. Transfer to Hospital

Most patients with symptoms of acute stroke will be transferred to hospital by the Scottish Ambulance Service (SAS). In general, SAS transport patients with suspected hyperacute stroke to the nearest hospital which can provide thrombolysis (Acute Stroke Centre).

Transfer to hospital is a vital part of a progressive stroke pathway. There are important opportunities to:

- Improve pre-hospital diagnostic accuracy including assessment of eligibility for hyperacute treatments, enabling possible bypass of the local Acute Stroke Centre (sometimes referred to as a spoke hospital in the thrombectomy pathway) to a Comprehensive Stroke Centre (sometimes referred to as a thrombectomy hub).
- Provide receiving clinicians with information to enable quick decision making upon arrival at hospital.

7.1 Improving pre-hospital assessment

It is important to continue providing training and support to ambulance crews in the use of pre-hospital clinical assessment tools and to explore the use of more detailed tools or technologies which might improve diagnostic accuracy and triage for stroke, TIA and the identification of people potentially suitable for thrombolysis and thrombectomy.

Improving pre-hospital assessment of people who would benefit from hyperacute treatment will reduce time to treatment by ensuring that they can be quickly placed on the pathway for the most appropriate treatment.

It is also important that ambulance crews have the capacity to seek advice from stroke specialists to support with triage and diagnosis while a patient is being transferred. This can be provided via telestroke services. For example, there have been pilot projects indicating that providing ambulance crews with access to specialist support via a Professional to Professional audio and/or video call can enhance the pre hospital diagnostic accuracy and decision making with respect to TIA and stroke.

7.2 Pre-Alert

Ensuring that appropriate information is available to clinicians receiving the patient at the hospital enables quicker decision making and enables timely access to imaging and treatment upon arrival.

Pre-alert refers to the sharing of information about a patient with the hospital during transfer by an ambulance crew. Through our review process, hospital clinicians highlighted the vital importance of the pre-alert including patient identifiers such as the CHI number, name and date of birth. Despite this, the reviews identified that there is variation in appropriate pre-alerting of patients with stroke, and of the information included with the pre-alert.

At present, there is a lack of timely data available from NHS boards and sites, concerning the number of patients with suspected hyperacute stroke that are pre-alerted by SAS. This in turn means that there is no robust measure to ensure the correct patients are being taken to the most suitable hospital, and then placed on the most appropriate pathway. It is therefore important to have access to better

information about pre-alerting across Scotland, to address variation and to improve pre-alerting in general.

7.3 Recommendations

1. To improve pre-hospital assessment ambulance crews should continue to be trained and supported in the use of pre-hospital clinical assessment tools.
2. The use of more detailed tools or technologies, which might improve diagnostic accuracy and triage for stroke, TIA and the identification of people potentially suitable for thrombolysis and thrombectomy, should be explored.
3. Telestroke systems should be available for use in ambulances and air transport to enable professional-to-professional calls to support ambulance crews in decision making regarding hyperacute stroke.
4. A single communication platform should facilitate voice, data and video communication between paramedics, ambulance control, stroke physicians in ASCs and CSCs, stroke nurses and interventional radiologists.
5. Communication of patient identifiers during pre-alert should be enabled to support timely decision making and improve time to treatment upon arrival at hospital.
6. A mechanism should be developed to provide routine feedback of confirmed diagnosis and treatment pathway to SAS to support staff development and improve performance and patient pathways.

8. Assessment and diagnostics

Early assessment and diagnosis are vital to ensuring that people can receive prompt and appropriate treatment, thus improving their chances of positive outcomes.

8.1 Interface between stroke services and emergency departments

Seamless joint working between stroke services and emergency departments is paramount for optimal patient care and outcomes in the acute stage of the stroke pathway.

To minimise delays to assessment and treatment for people with stroke, emergency department services should include:

- Systems supporting pre-registered imaging requests from the stroke team clinicians.

- Staff competent in acute stroke management and familiar with thrombolysis and thrombectomy eligibility criteria and pre-transfer procedures, checklists and processes.
- Video links for optimal virtual communication between the emergency department and stroke teams, where required.
- Senior stroke decision maker and senior leadership involvement at the front door to minimise door-to-needle times for thrombolysis e.g., straight to CT protocols.
- Systems and resources agreed with SAS to minimise door in, door out times for patients eligible for thrombectomy.
- Goal of minimising inappropriate or futile transfers to the CSC for thrombectomy.
- “Straight to MRI protocols” for some strokes where this is the most appropriate imaging modality.
- Agreed stroke mimic pathways where non stroke patients are cared for out with the stroke service, when possible, enabling efficient use of stroke beds and workforce.

Performance and protocols should be audited, and cases reviewed.

8.2 Assessment of eligibility for hyperacute treatment

People with suspected acute stroke should be assessed immediately to determine the best approach to treatment. This is particularly important for identifying people who would benefit from specific hyperacute stroke treatments such as thrombolysis and/or thrombectomy.

Assessment for emergency hyperacute stroke treatments should be undertaken by a stroke specialist clinician without delay. In locations where that specialist clinician is not available on site then telestroke services should provide access to specialist assessment and decision making.

Telestroke involves the use of mobile technologies to provide audio and/or video calls between patients and local and remote healthcare professionals. It has a major role in improving access to hyperacute specialist care, decision making and the safe delivery of hyperacute treatments.

Electronic documentation for remote consultation outcomes (e.g., Clinical Portal) should be established. An audit trail of referrals, decisions and outcomes will help inform practice development and processes.

Telestroke can be used to support filtering and triage of referrals from remote sites into designated stroke units and reduce delays in time critical decisions, including on the delivery of appropriate treatments and identification of patients not suitable for specific interventions or transfer to another site.

Eligibility for thrombolysis should be guided by available clinical support tools. Further information on thrombolysis is included in [Section 8.1: Intravenous Thrombolysis](#).

Eligibility for thrombectomy should be guided by available clinical support tools. Patients who are identified as eligible for thrombectomy should be transferred to the relevant CSC for further assessment to confirm eligibility and to receive this intervention. They should then be admitted to a stroke unit to receive appropriate post intervention monitoring and care. Further detail on the core components of the delivery of thrombectomy are outlined in [Section 8.2: Thrombectomy](#)

The majority of patients with acute stroke will not be eligible for thrombolysis or thrombectomy. The key focus for these patients is ensuring access to the stroke bundle, including care within a designated stroke unit. Full information on this is included in [Section 9: Acute Stroke Care](#).

8.3 Access to brain and vascular imaging and cardiac investigations

The role of diagnostic imaging and other investigations in stroke management is integral to achieving the best outcomes by supporting time critical decision making.

8.3.1 Brain imaging

For people with acute stroke Computed Tomography (CT) of the brain is a useful tool in detecting recent bleeding in and around the brain and can sometimes detect ischaemic changes present as a result of thrombotic stroke. CT Angiography (CTA) and CT Perfusion (CTP) are important in identifying large vessel occlusion, collateral circulation and salvageable tissue for reperfusion interventions. Magnetic Resonance Imaging (MRI) is particularly useful in detecting early or minor ischaemic changes, previous bleeding and can also be used to assess the blood vessels and salvageable brain tissue³.

Decision support systems based on Artificial Intelligence (AI) can provide clinicians and radiologists with very early access to the results of imaging, on laptops or even mobile phones. These platforms support them in the immediate interpretation of the images to confirm the diagnosis and identify a large vessel occlusion and thus speed up the appropriate decision making to refer a patient for hyperacute treatment or not^{4,5}.

However, it is important to recognise that AI is not a standalone decision-making technology and therefore, the process of using AI for decision support should be closely supported by radiology professionals. Formal reporting of images within 24 hours is important as a governance and learning tool.

The additional logistical link in delivering thrombectomy (patients are transferred to a CSC for this treatment) requires a clear plan between the ASC (spoke) and CSC (hub) regarding investigations to avoid duplication and minimise time to treatment. It also requires effective acquisition, transfer and interpretation of images between the ASC and CSCs.

There is also a need to ensure adequate imaging resources in ASCs and CSCs to cope with increasing numbers of patients needing assessments to determine

eligibility for thrombolysis or thrombectomy. Improved access to advanced imaging will maximise the number of patients who present on waking, or present late, to receive thrombolysis and/or thrombectomy⁶.

8.3.2 Vascular imaging

Imaging of the arteries and veins supplying the brain is not only important to determine suitability for thrombectomy but also guides the use of medication, interventional neuro radiology and surgery to reduce risks of stroke recurrence.

All ASCs and CSCs should have a pathway for carotid vascular imaging (using Carotid Doppler and/or CTA or MRA), enabling early identification of vascular pathology and rapid access to the vascular Multi-Disciplinary Team (MDT) to inform secondary prevention strategies where indicated.

- Carotid Ultrasound +/- CTA or MRA should be used for carotid imaging when required
- Where carotid stenosis is detected, there should be rapid access to a vascular MDT
- Carotid intervention should be performed within the standard time as recommended and monitored by the Scottish Stroke Care Audit – a Carotid Co-ordinator role may help this process

8.3.3 Cardiac investigations

Post-stroke cardiac investigations are important for identifying an underlying cardiac cause of stroke, such as AF or Patent Foramen Ovale (PFO). When judged to be required by the stroke specialist there should be early access to prolonged cardiac monitoring to detect paroxysmal AF. Prolonged cardiac monitoring should be carried out and reported within two weeks.

Cardiac rhythm monitoring systems should, where technically possible, have real-time reporting of paroxysmal AF with immediate notification of the service to allow verification of the diagnosis and, if appropriate, immediate anticoagulation. Where patients need anticoagulation, there should be a pathway in place for early anticoagulation with counselling and monitoring systems.

For patient work up for PFO, there should be 'soon' access to contrast transthoracic echocardiography or transcranial doppler and transoesophageal echocardiography with a pathway in place ensuring that PFO closure is carried out within six months of the index stroke.

Monitoring of Boards' ability to perform cardiac investigations for people with stroke within these time frames will be via the Stroke Action Plan and Scottish Stroke Improvement Programme team.

8.4 Recommendations

1. People with suspected acute stroke should be assessed for hyperacute stroke treatments by a specialist clinician without delay.
2. Where telemedicine is used for the rapid assessment of people with suspected stroke, the system should include the option of a high-quality video link.
3. Staff providing care via telemedicine should be appropriately trained in hyperacute stroke assessment, the delivery of thrombolysis and the use of this approach and technology.
4. All stroke services should have access to CT, CTA, and CTP on a 24/7 basis whether the patient is an inpatient or outpatient.
5. Departments offering CT, CTA, CTP and MRI should have systems in place which ensure that patients with stroke or TIA are prioritised appropriately in order to enable rapid access to these time-sensitive investigations.
6. When the stroke specialist feels that brain imaging is required in patients attending the TIA service, there should be same day access to this. MRI will usually be the preferred imaging modality in TIA/minor stroke patients who require a brain scan.
7. Where the above investigations are not delivered within one location, stroke services should have a clear plan for a) assessing the gain in outcome if a transfer takes place, and b) enabling a transfer for investigations where the outcome would be improved.
8. Where AI is used to support interpretation of imaging and enable timely decisions around transfer for thrombectomy, formal reporting of all radiology investigations should take place the following working day after the investigation is conducted.
9. Each stroke service should have a pathway in place enabling same day access to MRI in instances where this would be the most appropriate imaging modality.
10. There should be nationally agreed imaging protocols to be followed by ASCs and CSCs for non-contrast CT, CT Angiography (CTA) and CT perfusion (CTP) to avoid duplication.

11. All stroke centres should have a clear pathway ensuring that carotid imaging and intervention is performed within the standard time as recommended and monitored by the Scottish Stroke Care Audit. A Carotid Co-ordinator role is recommended to support delivery of this pathway.
12. People who have experienced stroke should have access to cardiac investigations including:
 - Prolonged cardiac monitoring to identify paroxysmal AF (within two weeks)
 - Access to contrast transthoracic echocardiography or transcranial doppler and transoesophageal echocardiography with a pathway in place ensuring that PFO closure is carried out within six months of the index stroke.
13. IT systems should be in place which highlight that the results of tests are available to the referring clinician. This enables prompt action to be taken on the results of the investigation.

9. Hyperacute Stroke Treatment

For some people, treatment of stroke within the first few hours can include treatments such as thrombolysis and thrombectomy. These are aimed at unblocking the artery. Both have the potential to greatly reduce the brain damage caused, and thus improve functional outcomes and probably survival.

Early blood pressure lowering, in some cases of intracerebral haemorrhage (ICH) may be beneficial and continues to be researched.

The earlier these treatments are given, the more chance the person will have of an improved outcome. Therefore, stroke services need to be configured to minimise any delays and maximise the proportion of patients suitable.

Patients receiving these treatments require more intensive observation and monitoring to minimise risks and identify complications early when they can be most effectively treated. Therefore, post intervention, they should be cared for in a stroke unit enabling close, non-invasive monitoring of physiological parameters to detect the early complications of treatment and of their stroke.

Assessment to determine eligibility for these treatments is outlined in [Section 7.2: Assessment of eligibility for hyperacute treatments](#). This section will therefore focus on the logistics of delivering these treatments as quickly as possible once a patient has been identified as eligible.

9.1 Intravenous thrombolysis

Outcomes from ischaemic stroke treated with thrombolysis are time critical and can be improved by minimising the delay from stroke onset to thrombolysis treatment. There are a number of performance measures within the Scottish Stroke Care Audit

relating to the delivery of thrombolysis, and performance measures for thrombectomy are in development.

Thrombolysis is carried out at 22 ASCs and 3 CSCs in Scotland. There is variation in the proportions of patients receiving thrombolysis and variation in door-to-needle time between hospitals.

In most hospitals offering thrombolysis the door-to-needle times are much shorter during normal working hours than at other times. However, in services where a stroke nurse is involved in “pulling” the patient through the pathway, or where specialist stroke doctors are available in person out of hours, door-to-needle times tend to be shorter overall, and the difference between in and out of hours is minimised. This reinforces the importance of adequate stroke specific staffing, including the important role played by stroke nurses⁷.

9.2 Thrombectomy

The most severe 10-20% of acute ischaemic strokes are due to a large vessel occlusion (LVO). Restoring blood flow with early thrombectomy, sometimes referred to as clot retrieval, significantly reduces dependency^{8,9}. In some cases, thrombolysis is given prior to the thrombectomy procedure.

Approximately 800 cases per annum in Scotland, 10% of all stroke presentations, could be treated by a 24/7, Scotland wide, thrombectomy service¹⁰.

Geographical modelling recommends three CSCs (sometimes called Thrombectomy hubs) serving 22 ASCs (sometimes referred to as spoke hospitals) where patients are first taken to their nearest ASC to be diagnosed, scanned, receive thrombolysis if appropriate, and then be transferred to a CSC for thrombectomy. This is known as the ‘drip and ship model’¹¹.

There is a planned incremental development of services across the three CSCs (Queen Elizabeth University Hospital, Glasgow, Royal Infirmary of Edinburgh and Ninewells Hospital, Dundee) aiming for 24/7 availability across Scotland by 2023.

It will be important, as the service develops, that monitoring of referrals to the service is followed closely and accounted for in future service planning. This is because the number of people eligible for thrombectomy may increase due to advances in imaging, technology and research.

9.2.1 Transfer from ASC to CSC for thrombectomy

The transfer of patients between hospitals is an aspect of the thrombectomy pathway which can introduce delays to this time critical treatment. Therefore, it is important that safe, efficient and timely transfers take place.

An important aspect of transfer is ensuring agreed and robust communication processes and modalities for discussing cases between ASC, CSCs and the interventional neuro radiologists (INRs) /interventional radiologists (IRs) who will be

carrying out the procedure. It is vital that adequate infrastructure is in place for effective and reliable communications between all relevant teams and health boards.

Utilisation of electronic devices (using 4G/5G), capable of real time information sharing between the thrombectomy nurse escort (based at the ASC hospital), the ASC and CSC stroke physicians and INR/IR which integrate with patients' electronic health records would improve workflows and patient safety. Back-up systems (such as airwave radio systems) should be in place for when primary modes of communication fail or become unreliable due to connectivity or unplanned downtime.

The use of a mobile communication platform is currently being explored by the Thrombectomy Advisory Group (TAG)¹.

9.2.2 Repatriation

People who receive thrombectomy initially require intensive monitoring and support after the intervention in a stroke unit in the CSC until they are deemed to require less intensive care and are suitable for transfer to a stroke unit in the ASC. This is known as repatriation. Repatriation enables patients to receive as much of their care near their own home as possible. Prompt repatriation is vital to maintain flow and for CSCs to continue to take incoming referrals from ASCs.

It is important that there are shared protocols between CSCs, ASCs and the SAS for the delivery of agreed, safe and efficient repatriation. Decisions around repatriation after thrombectomy should be guided by the readiness for repatriation checklist, developed by TAG.

9.2.3 Interventional neuroradiology

Imaginative and flexible workforce solutions will be essential in a globally competitive employment market due to a shortage of specialist trained INRs. Incentivising rotas and job plans may be a partial solution if Scotland is to be an attractive workplace for specialist trained staff. Features of a sustainable interventional neuroradiology/radiology service for thrombectomy will include^{12,13,14}:

- A volume of work at CSCs that satisfies the agreed numbers for maintaining competency and training¹⁵ - training may involve remote mentoring and simulation technology-based teaching.
- Credentialing, supported by interventional neuroradiologists (INRs), may be necessary to train sufficient operators to populate 24/7 rotas across Scotland and enable cover of non- stroke INR work e.g., aneurysm coiling.
- Workforce planning futureproofed for the anticipated increase in workload once a service has commenced and the inevitable effect of extending time windows for intervention as advancements in therapies emerge.

¹ The Thrombectomy Advisory Group is a national group tasked with overseeing the delivery of a national thrombectomy service in Scotland.

- Cognisance that 60% of potential cases will present out of hours - work patterns, job plans and rotas will need to reflect this in order to provide equity of access and avoid the “weekend effect”.
- Adoption of cutting-edge technological innovation including advancements in AI and neurointerventional robotic solutions.
- Opportunities to participate in research and teaching.

9.3 Management of intracerebral haemorrhage (ICH)

Strokes due to intracerebral haemorrhage (ICH) represented 12% of stroke admissions in Scotland in 2019. Mortality rates and disability remain disproportionately high within this group worldwide¹⁶.

A progressive stroke service should aim to improve outcomes for this group of patients. Hyperacute stroke services for ICH should include^{17,18,19,20}:

- Expert supportive care on a stroke unit, aiming for consistent and optimal care and close observation for signs of deterioration.
- Care that reflects emerging best evidence for reducing secondary brain injury
- Consideration of the adoption of care bundles to help consistency and reduce variation by standardising processes of care.
- Incorporate evidence-based interventions where available.
- Early communication with local or regional neurosurgical teams where the patient is at risk of developing hydrocephalus or other complications amenable to neurosurgical intervention.
- Rapid anticoagulant reversal protocols responsive to emerging evidence as up to 20% of ICH cases occur in patients taking anticoagulant medication.
- If required, the delivery of appropriate end of life care, consistent with the approach outlined in [Section 9.3: End of Life Care](#), and the avoidance of harm and unintended limitations of care by ensuring timely senior level decision making regarding advanced care planning.

9.4 Recommendations

1. All patients eligible for thrombolysis should receive the intervention with the minimum delay. Therefore, there should be a sustained drive to improve door-to-needle times across Scotland.
2. Telestroke networks should be developed to support hospitals in achieving optimal thrombolysis treatment numbers and door-to-needle times.
3. There should be time efficient pathways and agreed processes for thrombectomy in place at all ASCs and CSCs to optimise patient outcomes and limit patient exclusions in those with ischaemic stroke due to LVO.

4. The provision of mobile communication platforms and adequate mobile technology will enable stroke physicians and INR/IRs to interpret hyperacute imaging remotely.
5. There should be nationally agreed pathway documentation, in digital and paper format, to facilitate movement of patients between NHS Boards and regions and to reduce duplication of imaging and investigations.
6. For patients referred for thrombectomy the door in, door out time in ASCs should be minimised.
7. Patients eligible for thrombectomy should be transferred to the CSC via the quickest and safest transport means available as determined by SAS.
8. Staff carrying out thrombectomies unsupervised should have completed recognised training and should perform a sufficient number of interventional procedures per annum to maintain their competencies.
9. The door-to-puncture time at thrombectomy hubs should be as short as is safely possible.
10. There should be agreed and sustainable rotas for anaesthetic staff, INRs/IRs, stroke physicians and theatre staff supporting the thrombectomy service.
11. There should be agreed, safe and efficient repatriation protocols in place between the CSCs and ASCs to ensure optimal patient flow.
12. There should be continuous review of the thrombectomy service model, processes of care and referral criteria as the evidence base grows. Regular multi-professional governance meetings should take place across Scotland with the intent of optimising learning for all involved in the process and embracing a culture of quality improvement.
13. Stroke services should have protocols for the monitoring, referral and urgent transfer of patients to regional neurosurgical centres.
14. A focus should be placed on improving outcomes for people with intracerebral haemorrhage. This may be achieved by the adoption of care bundles to help consistency and reduce variation by standardising processes of care.

10. Acute stroke care

10.1 Provision of 'the bundle' of care.

The majority of people who experience a stroke will not be eligible to receive hyperacute treatments such as thrombolysis or thrombectomy. The emphasis of care for the majority of stroke patients, is therefore to deliver the stroke bundle.

There are four components to the bundle:

- Swallow screen (100% within 4 hours of arrival, and before any food, fluids or oral medication is administered)²¹, - we believe this reduces the risk of pneumonia, dehydration, malnutrition and death.
- Brain imaging (90% within 12 hours accepting that hyperacute patients require a scan as soon as possible after arrival), since confirmation of the stroke diagnosis and distinguishing strokes due to ischaemic and bleeding has wide-reaching effects on management from the earliest stages.
- Aspirin for those with ischaemic stroke (95% on day of admission or following day) – which is a very simple and almost universally applicable treatment which improves patients outcome.
- Admission to stroke unit (90% on day of admission or following day) which reliably provides a wide range of targeted interventions. This reduces the risks of complications, improves the patients' experience and is known to improve functional outcomes and reduce mortality.

In general, brain imaging and aspirin standards are met across Scotland. However, there remains significant challenges in swallow screen and access to stroke units. Consequently, the overall adherence to the stroke bundle performance remains low.

Where patients are at risk of post stroke complications (e.g., infection, venous thromboembolism, dehydration, malnutrition, pressure sores), and depending on the established aims of treatment, patients should receive evidence-based interventions such as parenteral fluids, early tube feeding, intermittent pneumatic compression and antibiotics. At present, delivery of these important aspects of stroke care is assessed through sprint audits within the Scottish Stroke Care Audit or local audits. These have demonstrated variable delivery. Such audits had to rely on review of paper or electronic health records which identifies issues in delivery only in retrospect.

TRAKcare, the electronic health record used across Scotland does not support the sort of data capture, extraction and analysis to provide real-time data on delivery of important aspects of stroke unit care. An improved approach is required where failures of delivery are identified in real time, when they can be rectified to avoid patient harm. However, IT systems which are available to do this for only certain aspects of care (e.g. delivery of the National Early Warning System (NEWS) of observations to avoid in hospital deterioration and cardiac arrest) are not currently

used to provide improvements in delivering specialty specific aspects of care, such as those in a stroke unit.

10.2 Access to stroke unit care

Stroke unit care is the central feature of a modern stroke service. As it can benefit most stroke patients, even those who also undergo hyperacute treatments, it is important that the important role of stroke unit care within hospitals is recognized and supported²².

Through engagement with the National Stroke Voices, we heard that receiving care in a stroke unit was important to people.

“My treatment was much better and much more focused when I was placed in the Stroke Unit” – National Stroke Voices participant.

Every stroke patient should receive the core service characteristics of stroke unit care²³ from initial assessment to discharge from hospital²⁴. Key features of a stroke unit in a progressive stroke pathway should include:

- A geographically-defined unit
- A co-ordinated multi-disciplinary team that meets at least once a week for the exchange of information about in-patients with stroke.
- Information, advice and support for people with stroke and their family/carers.
- Management protocols for common problems, based upon the best available evidence.
- Close links and protocols for the transfer of care with other in-patient stroke services, early supported discharge teams and community services.
- Training for healthcare professionals in the specialty of stroke.
- The provision of holistic assessment of need for every patient which incorporates the views of patients and their families, which informs decisions about care.
- All interactions and interventions are carried out under a person-centred approach.

Although the core features are well described, services have sought to deliver stroke unit care in a variety of different ways. The size and configuration of stroke units depends on factors such as rurality and the other services and resources available within the local area.

Of the 22 ASCs, the seven smallest general hospitals in Scotland define stroke unit admission as entering the appropriate acute medical ward. While this means that the hospitals do not meet the first criteria of a geographically defined unit, they should meet all other criteria outlined above. In some instances, this may mean that remote stroke specialist support is required to provide early specialist assessments and a coordinated, regular multi-disciplinary team meeting. This is an appropriate response

to maintaining local services, and reduced time to thrombolysis, for people with stroke in these areas.

The Scottish Stroke Care Audit 'bundle' reflects access to stroke unit care and shows that this is currently variable between health boards and sites. There are marked variations in the size of stroke units, their staffing levels (medical, nursing, allied health professionals, clinical and neuropsychologists and social work staff) and the training of those staff.

While every stroke patient should have access to stroke unit care as defined above, in some instances, patients may require more intensive care. This is the case for those who undergo thrombectomy. In such instances, those people should receive care within a stroke unit which can also provide:

- Specialist staffing and technology that provide close clinical and continuous physiological monitoring for all, and especially those at higher risk of early deterioration or complications.
- Seamless working with intensive care units and high dependency units where required.
- Continuous access to a consultant with expertise in stroke medicine, with consultant review seven days per week.
- Immediate access to specialist medical, nursing, rehabilitation, and diagnostic staff trained in the hyperacute management of people with stroke, plus tertiary services for endovascular therapy, neurosurgery and vascular surgery.

These features are often available within a hyperacute stroke unit (HASU) where patients often stay for just the first couple of days, or a hyperacute bay within a stroke unit.

All stroke services should have protocols for the monitoring, referral and urgent transfer of patients, where there is a risk of patients requiring neurosurgical intervention, to regional neurosurgical centres.

Systems of joint working should be developed to establish broadly agreed referral criteria for carefully selected cases, e.g., those patients who might benefit from decompressive hemicraniectomy for malignant middle cerebral artery (MCA) syndrome.

As outlined in the introduction of this paper, supporting shared decision making helps to ensure treatments are delivered which are most likely to deliver the outcome valued by the patient and/or family. This remains important in the acute and hyperacute phases and is likely to be optimised by early involvement of senior clinicians with access to systems to share tailored information with patients and their family.

10.3 End of Life Care

About one in 20 people with acute stroke will be receiving end-of-life care within 72 hours of onset, and one in seven people with acute stroke will die in hospital²⁵.

Therefore, providing high quality end-of-life care should be a core activity for the multi-disciplinary stroke team. The key aim is to appropriately and holistically manage distress associated with the end-of-life experience for the person and the family/carers, in line with guideline advice²⁶.

Patients with severe stroke resulting in a high risk of death or poor functional outcome, should be involved at an early stage in shared decision making about the aims of treatments including cardiopulmonary resuscitation, critical care, hemispherectomy, and treatments to reduce the risk of serious complications. Where the patient lacks capacity then next of kin or advocate should be involved.

Advanced care planning should take place for those people who may survive the acute stroke with limited life expectancy, to facilitate timely referral to specialist palliative care services, where required²⁷.

10.4 Recommendations

1. Patients with acute stroke should have their clinical status monitored closely and managed according to clinical guidelines.
2. Stroke services should deliver the stroke bundle, meeting the Scottish Stroke Care Audit Standards for:
 - Swallow screen
 - Brain imaging
 - Provision of aspirin for those with ischaemic stroke
 - Admission to stroke unit
3. Healthcare professionals responsible for the assessment and management of patients with acute stroke should be trained in how to position and mobilise patients in a way that is safe and consistent with clinical guidelines.
4. Acute stroke patients should be managed in a stroke unit that meets the core requirements outlined in Section 9.2.
5. A stroke unit should have continuous access to a consultant with expertise in stroke medicine, with consultant review 5 days per week.
6. Staff working in stroke units should have completed the necessary training as outlined in the national educational template and should follow standardised management protocols for the assessment & management of acute stroke according to clinical guidelines.
7. Staff working in stroke units should have access to IT systems which optimise the reliability of assessments and treatment delivery.

8. People with rehabilitation needs should be assessed by a therapist and ongoing management planned according to clinical guidelines and in line with the progressive vision of rehabilitation outlined in Section 10.
9. Services providing acute and ongoing care for people with stroke should provide high quality end-of-life care for those who need it, including advanced care planning and timely access to specialist palliative care if required.
10. All stroke services should have protocols for the monitoring, referral and urgent transfer of patients, where there is a risk of patients requiring neurosurgical intervention, to regional neurosurgical centres.
11. In addition, for patients who require closer monitoring:
 - A so called hyperacute stroke unit or area which is providing close monitoring of patients post thrombectomy should have continuous access to a consultant with expertise in stroke medicine, with consultant review 7 days per week.
 - These units should in addition have immediate access to specialist medical, nursing, rehabilitation, and diagnostic staff trained in the management of people with stroke, plus tertiary services for endovascular therapy, neurosurgery and vascular surgery.

11. Rehabilitation and long-term support

11.1 Stroke Rehabilitation

People who have had a stroke should have access to high quality, evidence-based, person-centred stroke rehabilitation which reflects their needs and preferences. Stroke rehabilitation aims to optimise function, reduce disability, promote independence and work alongside people and their families to achieve meaningful outcomes²⁸. It helps people to be as independent as possible in everyday activities and enables participation in education, work, recreation and meaningful life roles. An inter-disciplinary team approach to stroke rehabilitation is essential, with the individual and their family or carers at the centre and given the opportunity to see the right professional at the right time to support their needs.

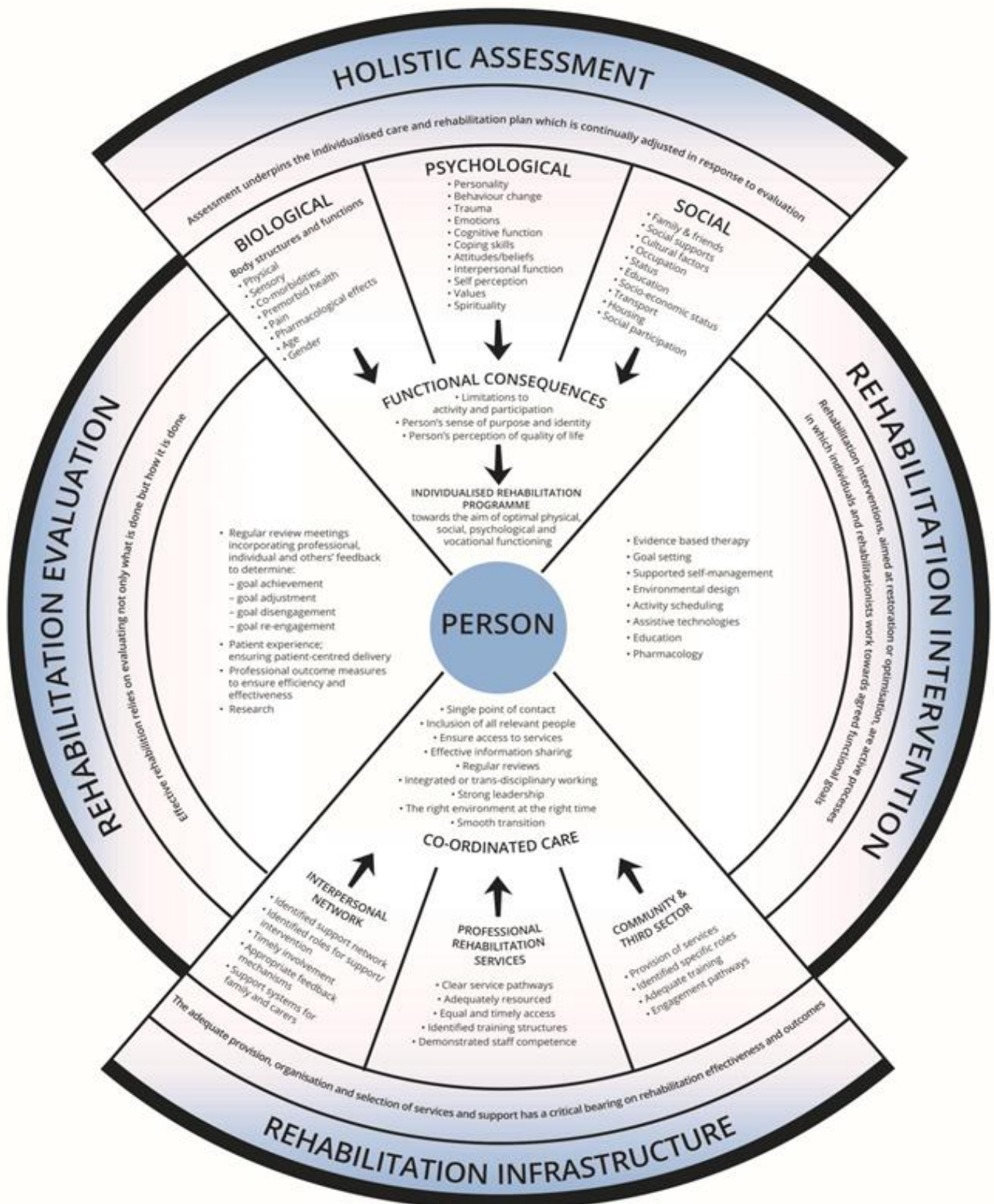
The United Nations has set out the right of people with disabilities to have access to rehabilitation to achieve participation and inclusion in all aspects of life²⁹. The World Health Organisation Rehabilitation in Health Framework highlights a tiered approach to rehabilitation which should be community based and focussed on the needs of the population³⁰.

Access to rehabilitation should be equally available to those in urban and remote and rural areas and across socio-demographic areas, using technology to deliver when appropriate.

Stroke rehabilitation should be based on a holistic biopsychosocial approach which seeks to understand the interactions of a diverse range of factors in a person's presentation (i.e. biological, psychological and social factors). This is essential for defining the aims of rehabilitation and to ensure that interventions are appropriate for, and meet the needs and preferences of, the individual. This shared understanding promotes interdisciplinary working between health and social care professionals to support effective and efficient stroke rehabilitation services³¹.

The foundations of a progressive stroke rehabilitation service are underpinned by a holistic rehabilitation model³² and appropriate service infrastructure, leadership and expertise, as depicted in the infographic below. This model outlines the requirements of holistic patient assessment, interventions where individuals and practitioners work towards agreed goals, the importance of appropriate evaluation and an underpinning rehabilitation infrastructure that supports the provision of co-ordinated care.

Holistic Model of Stroke Rehabilitation (Williams, Hamilton & Evans, 2021)



The core elements of rehabilitation include person-centred care, the setting of personal goals, and supported self-management. Personalised and evidence based therapeutic interventions delivered by stroke specialists should be offered to support recovery, adaptation to new functional status, and to support self-management and longer-term health and wellbeing.

11.1.1 Key principles of stroke rehabilitation

Person-centred - Person-centred care is about treating people as individuals and working with them to develop the knowledge skills and confidence to manage and make decisions about their own health and social care needs. Rehabilitation should be personalised, co-ordinated and enabling, and above all ensure that people are treated with dignity, compassion and respect³³. Person-centred rehabilitation considers the person's needs, capacity, preferences, wishes, values, lifestyle, environment, family and social circumstances. The rehabilitation team works in partnership with them to understand their priorities and to develop solutions.

Personal goals - Goal setting is the process by which the person with stroke (and their family or carers if they wish) and members of the stroke team identify individual goals which are meaningful, challenging and have personal value³⁴.

Supported Self-management - A person-centred approach in which the individual is empowered and has ownership over the management of their life and condition.

Co-ordinated Services- Areas in which Managed Clinical Networks (MCN's) operate with clear clinical and operational leadership are more able to connect services via clear service pathways. Stroke rehabilitation services should co-ordinate across clinical and service pathways and be tailored to individual needs based on a range of personal, environmental and social factors.

Rehabilitation team - Expertise from an interdisciplinary team who work in partnership with the person who has had a stroke and who collectively tailor rehabilitation input towards the person's goals. Where appropriate, this partnership should include family and carers.

Clinical Leadership - Clinical and service leadership should be provided by senior allied health professionals, medical, psychology and nursing staff, ensuring an equal focus on hospital and community rehabilitation pathways.

Appropriate care setting - In-patient rehabilitation is required for people with complex physical, cognitive, psychological and/or social needs, who could not be supported in a community setting. Rehabilitation of stroke patients in hospital should occur in an integrated stroke unit (a mixed acute and rehabilitation ward) or a specialist rehabilitation area. Early supported discharge (ESD) and community stroke

rehabilitation services should be offered in a community setting whenever that best meets the needs and wishes of the patient.

Evaluation - Data on service delivery, patient outcomes and experiences should be collected systematically³⁵. Outcome measures used should be standardised, valid and reliable³⁶ as well as being focused on what matters to patients^{37,38}. The effectiveness of progressive stroke rehabilitation services will be reviewed via the Scottish Stroke Improvement Programme utilising rehabilitation data from the Scottish Stroke Care Audit and by at least one annual review.

11.1.2 Stroke Rehabilitation Service Provision

Stroke rehabilitation services should include inpatient rehabilitation, ESD and community stroke or neuro rehabilitation teams who work closely to ensure services are delivered in the most appropriate setting for each person's needs. This relies on having the right infrastructures in place, including sufficient access to rehabilitation professionals and close links with social care and the voluntary sector as part of an MCN.

Rehabilitation for people with stroke in all settings should ensure:

- That people receive a holistic assessment to determine their rehabilitation needs as quickly as possible.
- That the delivery of rehabilitation takes place in the most appropriate setting and at the right time for that person's needs.

To achieve this, stroke rehabilitation plans should be agreed and initiated in the acute phase and be available, according to need, along the entire stroke pathway.

The duration of stroke rehabilitation services should be led by the needs of the person who has had a stroke and be defined by their goals and should not be time limited. A clear life-long pathway for people to be able to re-engage with stroke rehabilitation services and to re-access specialist support should be available to patients and families³⁹.

It is important that families and carers are included in rehabilitation planning and goal setting, if agreed by the person who has had the stroke. If agreed, then carers should be

- Included in assessments to identify needs.
- Provided with tailored information about stroke and the caring role.
- Provided with advice, access to emotional support to adjust to their caring role and maintain their wellbeing.
- Signposted to peer support to reduce the impact of loneliness and social isolation if required.

Evidence supports increased frequency and intensity of therapy especially in the first six months post-stroke which can improve recovery rate and outcome. Provision of greater amounts of stroke therapy is associated with higher therapy and nursing

staffing levels, a weekend therapy service and specialist stroke rehabilitation teams⁴⁰. Stroke rehabilitation services should therefore be available as required across the pathway seven days per week at an appropriate intensity with appropriate workforce skill mix.

Factors which impede the amount of therapy provision include time spent in information exchange and administration. Patient focussed reorganisation of working practices including shared documentation, and individual patient therapy timetabling is recommended to enable therapy provision in line with clinical guideline recommendations⁴¹.

11.1.3 The Rehabilitation Team

Stroke rehabilitation services must include regular access to an inter-disciplinary team who work in a co-ordinated manner and collaborate towards common goals.

The inpatient stroke rehabilitation team should include stroke specialists in medicine, nursing, occupational therapy, physiotherapy, speech and language therapy, and dietetics. It should also ensure timely access to other specialist clinical services as required, such as orthotics, pharmacy, orthoptics, and social work. The psychological, emotional and cognitive effects of stroke should be understood and supported by the whole team. Specialist input from clinical psychology and neuropsychology should also be part of the core team and service provision throughout the patient journey from acute to longer term.

ESD and community stroke/neuro rehabilitation teams should include occupational therapy, physiotherapy, speech and language therapy, nursing and neuro/psychology, with easy access to other professionals as required.

Rehabilitation and recovery should be embedded within all aspects of stroke rehabilitation by all team members on a 24/7 basis. Teams should work to engage people in as much therapeutic activity (including specialist therapy interventions and self-practice) as required at a frequency and intensity that enables them to reach their rehabilitation goals.

The stroke rehabilitation environment should facilitate patient engagement in a range of physical, cognitive and social activities out with formal therapy time. This can be supported by staff, carers and volunteers. This whole system approach to stroke rehabilitation should be promoted to improve recovery and rehabilitation outcomes⁴².

11.1.4 Rehabilitation settings

Inpatient stroke rehabilitation is required for those who have complex physical, cognitive and psychological needs which are unable to be managed in a community setting.

Community stroke rehabilitation can be offered by a range of services including ESD and community stroke/neuro rehabilitation teams, with varying intensity for up to seven days per week depending on the individual's needs.

All hospital in-patients with stroke who have mild to moderate disability should have the opportunity for early supported discharge⁴³ which enables rehabilitation to commence in their home environment within one working day of hospital discharge and at an intensity and frequency that would be provided if they remained in hospital. To enable this, strong links are required between the inpatient and community rehabilitation teams^{44,45}.

Regardless of the health board in which the patient receives acute stroke care, it is important that rehabilitation is provided in their local area. This should be facilitated by effective communication and clear referral pathways between health boards.

To ensure equitable access to ongoing support and self-management resources, all those who have had a stroke or TIA should be provided with high quality, tailored information at the point of discharge from outpatient clinic, emergency department or hospital and be followed up as soon after discharge as possible and thereafter, as indicated by the individual's needs, by a community stroke nurse or other stroke specialist healthcare professional to provide further specialist advice and support.

Everyone with residual difficulties following a stroke on discharge from hospital should be provided with a documented plan for community rehabilitation and self-management support.

In addition, everyone who has experienced a stroke should receive a review by a stroke specialist health care professional within six months of their event.

11.1.5 Key interventions delivered by a progressive stroke rehabilitation service

Many aspects of stroke rehabilitation require a tiered approach whereby aspects of care are the responsibility of the whole interdisciplinary team with specialists within the team focusing on more complex presentations. Each stroke rehabilitation network should have clearly defined pathways about how these services are provided.

Activities of Daily Living

Activities of daily living (ADL) include personal activities, e.g., washing and dressing; domestic activities, e.g., cooking and housework, and extended activities, e.g., work, driving and leisure. People experiencing difficulty with ADLs should be seen by an occupational therapist for assessment and the implementation of a personalised intervention programme. Evidence supports continued ADL training from occupational therapy and interventions can include direct training in an activity, training in adapted methods of performing an activity and the training in the use of adaptive equipment, assistive technology and environmental adaptation to maintain independence⁴⁶.

Arm function

Rehabilitation interventions that comprise intensive, graded practice of tasks and activities that focus on an individual's goals have been shown to be effective⁴⁷.

Progressive arm rehabilitation, usually provided by occupational therapists and physiotherapists, comprises comprehensive assessment, person-centred goal setting and the provision of a structured, goal-orientated programme of intensive practice. This may include assistive technologies (e.g., functional electrical stimulation, mirror-box therapy and virtual reality⁴⁸) as well as involving their affected arm in activities of daily living as much as possible in order to increase the intensity of meaningful practice and to improve outcomes.

Bowel and Bladder rehabilitation

Bladder and bowel dysfunction (including urinary incontinence, faecal incontinence, constipation and nocturia) are common and can be persistent following stroke but are amenable to rehabilitation intervention. Progressive rehabilitation will feature structured assessment by a nurse to identify the type of bladder/bowel dysfunction, agreement of individual goals and a programme of mainly behavioural interventions targeted to the type of dysfunction, to support active recovery of bladder/bowel function and use of the toilet. Regular review of the rehabilitation programme and avoidance of containment approaches (including indwelling catheters) are key to recovery of independent bladder/bowel functioning and toilet use⁴⁹.

Balance, walking and mobility

Problems with balance, walking and mobility are likely to increase the risk of falls, deconditioning, becoming housebound and social isolation. People who have had a stroke should have their mobilisation needs assessed and once medically stable, they should be assisted to mobilise, overseen by a physiotherapist. Walking training should be task specific and include a cardiovascular component. Treadmill training with or without body weight support can improve walking and should be available for those who are able to walk independently⁵⁰. For those who are not able to walk independently after stroke, electromechanical-assisted gait training devices (i.e. automated electromechanical gait machines) together with physiotherapy can improve the ability to walk independently⁵¹ and this technology should be made available. Early access to orthotic assessment for the provision of an ankle foot orthosis (AFO) should be available, with reassessment when necessary, in order to facilitate walking and prevent falls. Functional electrical stimulation (FES) should be available to facilitate gait and prevent falls in those with persistent mild lower limb weakness.

Communication

Post-stroke communication disorders occur frequently. Aphasia and dysarthria each affect around a third of people following a stroke. People who are identified as having a communication disorder after a stroke should be assessed by a speech and language therapist and provided with an individualised rehabilitation programme using evidence-based interventions⁵² to reduce the impairment and/or support functional improvement and long-term adaptation. Such interventions may include

group work, computer-based therapy, assistive technology and conversation partner training⁵³.

Cognition

Cognitive impairment is common following a stroke and can have a significant impact on social recovery and re-integration with overall poorer rehabilitation outcomes. Services should have a documented pathway for the identification and assessment of cognitive problems. Cognitive rehabilitation should be integrated into the broader rehabilitation programme and goals should include cognitive rehabilitation interventions with the aim of restoring, compensating or adapting for reduced cognitive ability.

Driving

A documented pathway should be available to advise on national and local services for further assessment and advice about resuming driving or alternative mobility options. Stroke service should ensure that driver status and intention to return to driving should be ascertained and advice and tailored information is made available.

Fatigue

Fatigue is commonly reported following stroke and can impact on longer term recovery and wellbeing. A range of physical and mental factors may contribute to fatigue and a documented pathway for the identification and assessment of fatigue and its impact on activity and participation should be available. Rehabilitation programmes should include strategies to anticipate and manage fatigue as well as education for patients and families/carers.

Pain management

Pain following stroke can be due to several causes including neuropathic pain, musculoskeletal pain and shoulder pain and subluxation. Each element requires specialised assessment and a range of evidence-based interventions which should be available in documented pathway.

Physical activity, exercise and fitness training

Physical activity, exercise and fitness training should be provided through partnerships between health and exercise professionals, the third sector and local authority services. Exercise and fitness training should begin, as appropriate, in hospital and continue in the community⁵⁴. It should be provided by therapists or exercise professionals who have evidence of stroke specific knowledge and skills to adapt and tailor exercise programmes for people after stroke.

Physical activity should also be encouraged. Many people who have had a stroke experience barriers to becoming more active and sedentary behaviour tends to persist after stroke^{55,56}. Evidence-based counselling strategies are effective to

encourage stroke survivors to engage and maintain physical activity after stroke⁵⁷ and these should be provided as required along the entire stroke pathway.

Posture and movement – spasticity services

Stroke services should implement a systematic approach to identify all those who need specialist spasticity assessment and treatment. Stroke services should also implement a documented programme for prevention and management, including self-management, of post stroke spasticity. All those who need it will have access to a specialist spasticity service which may include Botulinum toxin injections, electromyography (EMG) or ultrasound guided approach, appropriate clinical expertise to deliver, and co-ordinated multidisciplinary community follow up including occupational therapy, orthotics and physiotherapy.

Positioning and seating

Following stroke, many people will find it challenging to control their position when in bed and when sitting in a chair. Effective positioning and seating is essential for reducing the risk of aspiration, falls, skin breakdown, and contracture development in addition to providing maximum comfort and supporting participation in ADL. All staff from statutory and voluntary sector organisations and carers involved along the whole pathway should be aware of correct positioning. People with stroke, their carers, and all services should have access to clinicians with training in postural management. Appropriate beds, specialist chairs and positioning equipment should be available from inpatient and community rehabilitation services when required.

Psychological Care (cognitive and emotional)

In the aftermath of stroke, patients and families experience a wide range of psychological, cognitive and emotional difficulties which impact profoundly on function and rehabilitation.

Stroke services should implement a documented programme for promoting awareness of, screening for and treatment of psychological consequences of stroke, led by a specialist clinical/neuropsychologist as detailed in the National Model of Psychological care for stroke⁵⁸. Psychological care should be available to all patients in line with local delivery plans.

Relationships and sexuality

Sexuality includes physical and psychosocial aspects of intimacy. Approximately 50% of individuals experience sexual dysfunction following stroke⁵⁹, however it is not commonly included as part of a rehabilitation programme⁶⁰. Services to address these aspects of life after stroke are variable and professional education is lacking. Education with regards to sexuality following stroke should be provided to the stroke rehabilitation team and specialised support should be made available to those who require it.

Swallowing

Post-stroke swallowing difficulties (dysphagia) are common and can persist long-term. Management of such difficulties should be led by a dysphagia specialist, such as a trained speech and language therapist (SLT), and should include evidence-based rehabilitation and restorative strategies which aim to improve oropharyngeal function. Management of swallowing difficulties will additionally include compensatory strategies, swallowing manoeuvres, sensory modification and texture modification of food and fluids as appropriate. All interventions should take into consideration the factors which may limit ability to participate, such as physical and cognitive impairment, as well as encompass shared decision-making and a shared responsibility for management of risk. There should be access to instrumental assessments such as videofluoroscopy and flexible endoscopic evaluation of swallowing (FEES) to determine the specific rehabilitation programme/management approach. There should also be pathways for people with long-term dysphagia to re-access services for review.

Technology and tele rehabilitation

Stroke rehabilitation services should include the use of robotics and software programmes which support rehabilitation interventions as appropriate.

Vision

Comprehensive assessment and rehabilitation services should be provided to all those with visual problems due to their stroke including:

- Comprehensive visual screening completed before discharge.
- Direct referral to appropriate professionals for assessment of suspected visual problems.
- Follow up to determine the level of spontaneous recovery of visual problems.
- Provision of treatment and rehabilitation, tailored to the specific visual problems by the most suitable profession in that locality (this may vary across NHS and Social Care areas).
- Provision of tailored information and clear explanation of visual problems, and their possible impact, at each possible opportunity.
- Ensuring individuals have knowledge of, and access to, relevant low vision services initiating direct referral if required⁶¹.

Vocational rehabilitation

Stroke rehabilitation services should identify work status and offer advice, signposting and referral for specialised return to work support as appropriate. A documented pathway should identify local and regional access to specialised vocational rehabilitation services.

11.2 Supported Self-Management and Longer-term support

Supported self-management and longer-term care & support should be an integral element of stroke rehabilitation pathway⁶² and should be provided in partnership with health, social care and the voluntary sector.

Supported self-management is a core component of person-centred care and is an interdisciplinary approach which supports people to develop skills, knowledge, and confidence to manage the impact of stroke and to maintain an ability to engage in meaningful activities and life roles.

Not everyone who experiences a stroke or TIA will have ongoing rehabilitation needs identified at the time of their discharge. However, feedback from people with lived experience was that often, this meant that there was a missed opportunity to identify routes to access support.

Everyone who experiences a stroke or TIA should receive tailored information provision and be signposted to community-based support and advice. It is important that people who have had a stroke or TIA are provided with the necessary skills, resources and support to continue self-management in the longer term along with management of other long-term conditions they may have⁶³.

There is considerable variation across the country in the longer-term support for people who have had a stroke. This may comprise nurse or other healthcare professional follow up, peer support groups and exercise classes. In some places these aspects of care are provided directly by NHS stroke services, in others they are commissioned from charities including Chest Heart and Stroke Scotland (CHSS) and the Stroke Association.

Primary care services are the main source of medical care for stroke survivors in the longer-term after their stroke. It is common practice that routine annual reviews for people with stroke take place alongside reviews of other long-term conditions. In addition, people who have had a stroke identify health issues that arise and contact primary care services for assessment.

Primary and secondary care services should communicate effectively to enable the provision of patient-centred care, for example primary care may identify a further rehabilitation need and refer the person back to the community rehabilitation team.

People with lived experience of stroke highlighted that a key issue was the lack of a 'joined up' approach, and outlined how important it would be to have a person who could support them by signposting to advice and support services, and act as a point of return for when issues arose further down the line in their journey.

“One of the big aspects is going to be having someone who is responsible for ensuring that the service is joined up. I think that’s what’s missing” – National Stroke Voices participant.

It is therefore important that people who experience stroke are provided with clear and easily accessible contact information once discharged from community services,

enabling the provision of continued advice, support and signposting. A clear life-long pathway for people to be able to re-engage with stroke services and re-access specialist support should be available to patients and families⁶⁴.

To ensure equitable access to ongoing support and self-management resources every person who has had a stroke should be contacted by a community stroke nurse or other appropriate stroke professional as soon as possible following their discharge from outpatient clinic, emergency department or hospital to provide review and an opportunity to access specialist advice and support⁶⁵.

11.3 Recommendations

1. Stroke rehabilitation services should be underpinned by a holistic rehabilitation model, appropriate service infrastructure, clinical leadership and expertise.
2. Stroke rehabilitation in all settings should be person-centred and optimise outcomes with evidence-based interventions, enabling appropriate long-term support and self-management.
3. Rehabilitation should be a process that begins as soon as a stroke is diagnosed and continues as long as required. The duration of stroke rehabilitation should be needs led and not time limited.
4. An early holistic assessment of a person's rehabilitation needs should be provided by specialist stroke teams and a personalised, documented rehabilitation and self-management plan agreed with the person who has had a stroke and, if they wish, their family/carers.
5. Stroke rehabilitation services must include a specialised and coordinated team who work in an interdisciplinary manner and collaborate towards common, person-centred goals.
6. The psychological, emotional, cognitive effects of stroke should be understood and supported by the whole team. Specialist input from clinical psychology and neuropsychology should be part of the core team and service provision throughout the patient journey from acute to longer term.
7. Evidence based stroke rehabilitation services should be available in inpatient and community settings seven days per week at an appropriate intensity, with an appropriate workforce skill mix.

8. Each stroke rehabilitation network should have clearly defined pathways about how key stroke rehabilitation interventions and services are provided.
9. Stroke rehabilitation services should be provided as part of a managed clinical network which includes inpatient rehabilitation services, ESD and community stroke or neuro rehabilitation teams who work closely with social care and the voluntary sector to ensure services are delivered in the most appropriate setting for each person's needs and ensure equity of service provision across all geographical and socio demographic areas.
10. Inpatient stroke rehabilitation is required for those who have complex physical, cognitive and psychological needs which are unable to be managed in a community setting.
11. Community stroke rehabilitation can be offered by a range of services with a range of intensities according to individual needs, including Early Supported Discharge and community stroke / neuro rehabilitation teams.
12. Clinical and service leadership should be provided by senior allied health professionals, medical, nursing and neuropsychology staff, ensuring an equal focus on hospital and community rehabilitation pathways
13. Every person who has had a stroke should be followed up by a community stroke nurse or other appropriate healthcare professional, as soon as possible following discharge from hospital and thereafter, as indicated by the individual's needs, ideally in their own home.
14. A clear lifelong pathway for people to re-engage with stroke rehabilitation services and re-access specialist support should be available to patients and families
15. A formal review should also be carried out for everyone who has experienced a stroke, six months post event, to provide another opportunity to access specialist advice and support, regardless of the rehabilitation needs identified at the time of their discharge from hospital.
16. People who have had a stroke should be signposted to relevant resources and support to continue self-management in the longer term along with management of other long-term conditions they may have.
17. Demonstration of a person-centred approach should be evaluated via the approach used by stroke rehabilitation services to deliver activities which are deemed to be central to person centred care e.g., regular holistic assessment of need; goal setting; supported self-management and family/carer involvement, as well as the patient experience of these activities and the

treatment and communication they experience with the professionals working with them.

12. Workforce

The quality of stroke services provided is hugely dependent on the availability of knowledgeable, skilled and experienced healthcare professionals. This is influenced by access to high quality education and supported learning, and staff turnover.

Stroke services should provide specialist medical, nursing, allied health professional neuropsychology, and other rehabilitation staffing levels matching the Royal College of Physicians⁶⁶ and British Association of Stroke Physicians Guidelines⁶⁷.

It is recognised that there is significant attrition of stroke trained staff from acute stroke rotas and services and retention of trained staff remains a challenge for future service provision. It is imperative that burnout risk is minimised in a speciality with unpredictable intensity and requiring complex decision making. To support this, it will be necessary to:

- Ensure that working patterns and staffing levels, especially for healthcare staff contributing to out of hours care, are sustainable to attract and retain staff.
- Consider novel remuneration rates for unsociable hours which may save on external locum costs for rota gaps.
- Ensure that there are adequate levels of support staff and access to IT to optimise the efficiency of clinical staff and optimise patient facing time.

Through the review process for this document, staffing available to deliver equitable rehabilitation services was raised as a concern, with particular reference to limited access to psychology & neuropsychology services across the country.

The rehabilitation workforce challenges mean that in practice, few stroke rehabilitation services are able to offer a seven-day service with appropriate intensity. To be able to provide a progressive stroke rehabilitation service these workforce challenges should be addressed.

12.1.1 Education and training

Stroke services should have an education programme for all staff providing acute, hyperacute stroke care and rehabilitation.

There is currently a national education template which outlines the training required for staff involved in the care of stroke patients. It is important that all NHS boards enable staff involved in delivery stroke care to undertake the education outlined by this template. Dedicated trainers can support this.

- All professional groups potentially dealing with hyperacute patients should have been trained in core stroke competencies, STAT+, STARS Advanced Modules and Hyperacute stroke treatment decision making for clinicians.
- Stroke physicians and radiologists should have up to date training in advanced imaging for stroke.
- Training should be supported by rolling educational plans with blended learning, web based and simulation-based training.
- Training should include a focus on supporting staff with having difficult conversations.
- Regular national educational sessions will support shared learning amongst professional groups.
- Education development framework with clear career progression opportunities important for retaining staff.
- Mentoring for junior staff, opportunities to rotate into other parts of the stroke pathway or undertake secondments and gain wider knowledge and appreciation of their role within the entire system.

To support health boards to deliver effective training and education, at a national level, there will be a continued:

- Investment in developing and maintaining interactive online training which can be accessed at the convenience of the learner.
- Delivery of live training sessions which can be delivered remotely via an appropriate online platform (e.g., MS Teams) to a large live audience across many NHS Boards, and also be recorded for others to access later.
- Coordinated national training programmes tailored to each group of healthcare staff involved in stroke services.

NHS Boards should keep records of the staff working within stroke services, their training needs and training received. When new staff join a stroke service their training needs should be identified and a plan made to meet those needs promptly.

13. Glossary

ACTATS (Acute CTA for Thrombectomy in Stroke): An online training package aimed at stroke clinicians and radiologists to help them interpret CT (see computerized tomography) & CTA (see computed tomography angiography) in the context of thrombectomy.

Acute Stroke Centre: A hospital which has staffing and facilities to acute assess acute stroke patients, carry out an early CT brain scan and deliver thrombolysis. They will also have a stroke unit, or equivalent facility for ongoing care of stroke patients.

AF: Atrial Fibrillation is an irregular and often very rapid heart rhythm (arrhythmia) that can lead to blood clots in the heart. AF increases the risk of stroke.

AFO: Ankle Foot Orthoses are external biomechanical devices utilized on lower limbs to stabilize the joints, improve the gait and physical functioning of the affected lower limb.

AI: Artificial intelligence: In the context of stroke services this term refers to digital systems which provide a rapid interpretation of brain imaging, and communication of the images and its interpretation to those involved in delivering time sensitive stroke treatments.

Aneurysm coiling: a procedure performed to block blood flow into an aneurysm (a weakened area in the wall of an artery).

Aphasia: a disorder of language which can affect speech, reading and writing. It's usually caused by damage to the left side of the brain.

Botulinum toxin injections: Botulinum toxin can help to relax overactive muscles for a short period of time. During this time a therapy programme can be implemented to stretch shortened muscles and stiff joints. This may help improve function e.g., walking or grip, or could help care staff manage personal hygiene.

Carotid endarterectomy: An operation to remove the narrowing in a carotid artery to reduce the risk of future stroke.

Carotid Ultrasound: Carotid ultrasound is an imaging test that uses high-frequency sound waves to create pictures of the inside of carotid arteries. It is used to identify patients who may benefit from carotid endarterectomy or angioplasty and stenting

CHI number: Community Health Index number is a unique patient identifier used across Scotland. The first 6 digits include the patient's date of birth.

CSC: A Comprehensive Stroke Centre is a hospital which in addition to the facilities of the ASC can also provide thrombectomy and neurosurgery with associated critical care support.

CT: A computerized tomography (CT) scan combines a series of X-ray images taken from different angles around your body and uses computer processing to create cross-sectional images (slices) of the inside of the body.

CTA: Computed tomography angiography (CTA) uses an injection of contrast material into your blood vessels and CT scanning to help diagnose and evaluate blood vessel disease or related conditions.

CTP: Computed tomographic perfusion (CTP) imaging is an advanced modality that can aid in diagnosis, management, and prognosis of acute stroke patients by clarifying acute cerebral physiology.

Decompressive hemicraniectomy: A surgical treatment for cerebral oedema (when the brain swells, causing an increase in pressure). Has been performed for several different pathologies, including malignant middle cerebral artery syndrome, one of the most widely recognized large vessel strokes.

Door In, Door Out time: The delay between a patient's arrival at an Acute Stroke Centre (ASC) and their departure from that hospital to go to a Comprehensive Stroke Centre (CSC) for thrombectomy.

DTN: Door-to-Needle Time is the delay between arrival at a hospital and the administration of a bolus of thrombolysis medication.

Dysarthria: Slurred speech caused by disturbance of muscular control.

Dysphagia: Medical term for swallowing difficulties.

Endovascular therapy: Minimally invasive procedures that are done inside the blood vessels.

ESD: Early supported discharge services comprise a stroke specific interdisciplinary team and sufficient care staff to allow hospital admitted stroke patients to be discharged home earlier than otherwise to continue their rehabilitation in the community

Flexible endoscopic evaluation of swallowing (FEES): FEES is a procedure designed to assess swallowing function through visualization of the pharyngeal and laryngeal (throat) structures.

FLORENCE: Flo or Florence is a simple telehealth system that uses text messages to support patients to manage their high blood pressure and related aspects of health.

FES: Functional Electrical Stimulation is a treatment that uses small electrical charges to produce muscle activity or a muscle contraction.

Hydrocephalus: a build-up of fluid around the brain, which increases pressure and can cause brain damage.

Integrated Joint Boards: Bodies that lead the planning of health and social care services. IJB's commissions the local authority and health board to deliver services in line with a strategic plan.

Interdisciplinary team: a group of professionals from a range of disciplines who work in a coordinated manner toward the same goal for the patient

Intermittent pneumatic compression comprises sleeves wrapped around the legs which are inflated regularly to squeeze the legs, increasing blood flow to reduce the risk of blood clots in the legs).

Interventional Neuroradiologists: doctors who specialise in minimally invasive treatment of neurovascular disease including thrombectomy

Interventional Radiologists: Doctors who performs image guided procedures, fully interpret the imaging required to guide and monitor response of those procedures, as well as provides the pre and post procedural care for those patients receiving procedures including thrombectomy.

LDL: Low density lipoprotein (LDL) cholesterol is often referred to as “bad cholesterol” because too much is unhealthy.

Large Vessel Occlusion a blockage in one of the major arteries of the brain which may be opened up with thrombectomy.

Managed Clinical Networks: linked groups of health professionals and organisations from primary, secondary and tertiary care, working in a co-ordinated manner to ensure equitable provision of clinically effective services throughout Scotland.

MRA: Magnetic resonance angiography (MRA) uses a powerful magnetic field, radio waves and a computer to evaluate blood vessels and help identify abnormalities.

MRI: Magnetic resonance imaging (MRI) is a type of scan that uses strong magnetic fields and radio waves to produce detailed images of the inside of the body.

Musculoskeletal pain is pain which affects the muscles, ligaments, tendons, and bones.

Mirror-box therapy: a rehabilitation therapy in which a mirror is placed between the arms or legs so that the image of a moving non-affected limb gives the illusion of normal movement in the affected limb.

Multi-disciplinary team: a group of professionals from one or more clinical disciplines who together make decisions regarding recommended treatment of individual

Near Me: A secure form of video consulting approved for use by the Scottish Government and NHS Scotland.

Neuropathic pain: Neuropathic pain is often described as a shooting or burning pain. It often is the result of nerve damage or a malfunctioning nervous system.

Neurosurgery: Specialty concerned with the diagnosis and treatment of patients with injury to, or diseases/disorders of the brain, spinal cord and spinal column, and peripheral nerves within all parts of the body.

Nocturia: The medical term for excessive urination at night.

Orthoptics: Allied health professionals who specialise in the diagnosis and non-surgical management of eye problems that affect eye movement and the development of vision.

Orthotics: Allied health professionals who make and fit braces and splints (orthoses) for people who need added support for body parts that have been weakened by injury, disease, or disorders of the nerves, muscles, or bones.

Patent Foramen Ovale: A hole in the heart that didn't close the way it should after

Post stroke spasticity: Following stroke, muscles may become stiff, tighten up and resist stretching. This is called spasticity.

SCI Gateway: Scottish Care Information (SCI) Gateway is a national system that integrates primary and secondary care systems using highly secure Internet technology. SCI Gateway enables GPs to access SCI services on-line.

Scottish Stroke Care Audit: An audit coordinated by Public Health Scotland. Measures the performance of stroke services against national standards

STAT+, STARS Advanced Modules: Professional training:

STAT+: Stroke and Transient Ischaemic Attack (TIA) Assessment Training (STAT) and STAT+. Training incorporates simulated scenarios to improve the emergency response to stroke and TIA.

STARS: Stroke Training and Awareness Resources. An e-learning resource providing a learning tool for health and social care staff to enable them to become more knowledgeable and skilful in the area of stroke care.

Stroke: Occurs when the blood supply to part of the brain is interrupted and brain cells are starved of oxygen. **Ischaemic strokes** occur when a blood clot blocks the flow of blood. A **haemorrhagic stroke** can happen when blood from an artery begins bleeding into the brain after a blood vessel bursts.

Subluxation: Shoulder subluxation happens when the upper arm bone, called the humerus, becomes partially dislocated from the shoulder socket. This condition starts when the muscles around the shoulder become weak or paralyzed after stroke.

Telestroke: A service which uses telephone, video conferencing and access to Picture Archiving and Communication System (PACS) to allow clinicians to remotely assess patients to enable the clinician to advise on management.

Thrombectomy: The physical removal of a thrombus (clot) which is blocking an artery causing a stroke.

Thrombolysis: The use of medicine which dissolves blood clots and restores blood flow to the brain.

Transient Ischaemic Attack (TIA): A temporary disruption in the blood supply to part of the brain. The symptoms last only minutes or hours.

TRAKCare: An electronic health record management system which is available in all NHS Boards.

Treadmill training: Used to aid walking rehabilitation with or without the use of body weight support

Transthoracic echocardiogram: The most common type of echocardiogram, which provides a moving image of the internal parts of the heart using ultrasound.

Transoesophageal Echocardiography: A type of echocardiogram where a small probe is passed down the throat into the gullet and stomach.

Transcranial Doppler: A test that uses sound waves to detect medical problems that affect blood flow in the brain.

Triage: The assignment of degrees of urgency to illnesses to decide the order of treatment of a large number of patients.

Vascular surgery: Vascular surgeons are trained in the diagnosis and management of conditions affecting the circulation, including disease of the arteries, veins and lymphatic vessels.

Venous thromboembolism: Blood clots that can develop in the deep veins in the legs or pelvis and can travel to the lungs to cause pulmonary embolism.

Videofluoroscopy: Assesses swallowing ability. It takes place in the X-ray department and provides a moving image of swallowing in real time.

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